INTEGRAL SYSTEMS


# Manager of Managers Architectures: Providing Enterprise Situational Awareness to the User

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*GSAW March 2009*

# Overview

- Motivation for Manager of Manager (MoM) Architectures
- Advantages
- Guidelines and Case Studies
- Situational Awareness via Enterprise-Level Integration

# Manager of Mangers: Motivation

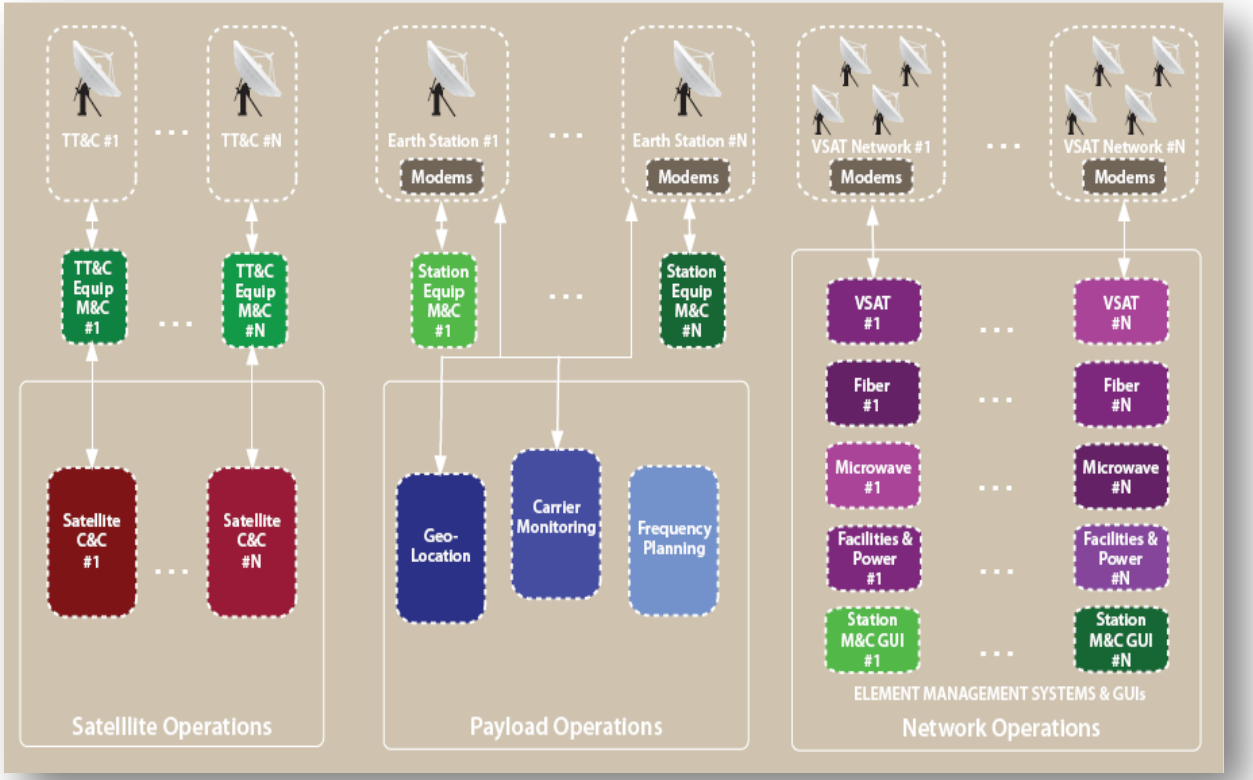
- Early ground system Monitor and Control (M&C) goal
  - Deliver an interface offering end-to-end control of disparate ground system subsystems and hardware
- Modern enterprise M&C goals
  - Provide users with a single interface for end-to-end monitoring and control of the entire enterprise
  - Extensible systems that integrate data from multiple new and legacy systems (without hardware/software replacement)

# Before Manager of Managers

- Divergent hardware protocols made large scale data integration impossible
  - Serial equipment, switches, other ground system devices had different interfaces
- The advent of the Simple Network Management Protocol (SNMP) over standard Ethernet connections helped, but
  - Practical applications were initially limited because replacing existing legacy equipment was cost prohibitive
  - Well respected products such as HP OpenView and NetBoss have no native capacity to communicate with non-SNMP equipment

# Inability to Integrate Resulted in Stovepipe Ground Systems

- **Stovepipe Systems**
  - TT&C antenna/RF, with M&C
  - Teleports/ communication networks
  - M&C systems
  - Network management
  - C&C systems
  - CSM system
  - Geolocation

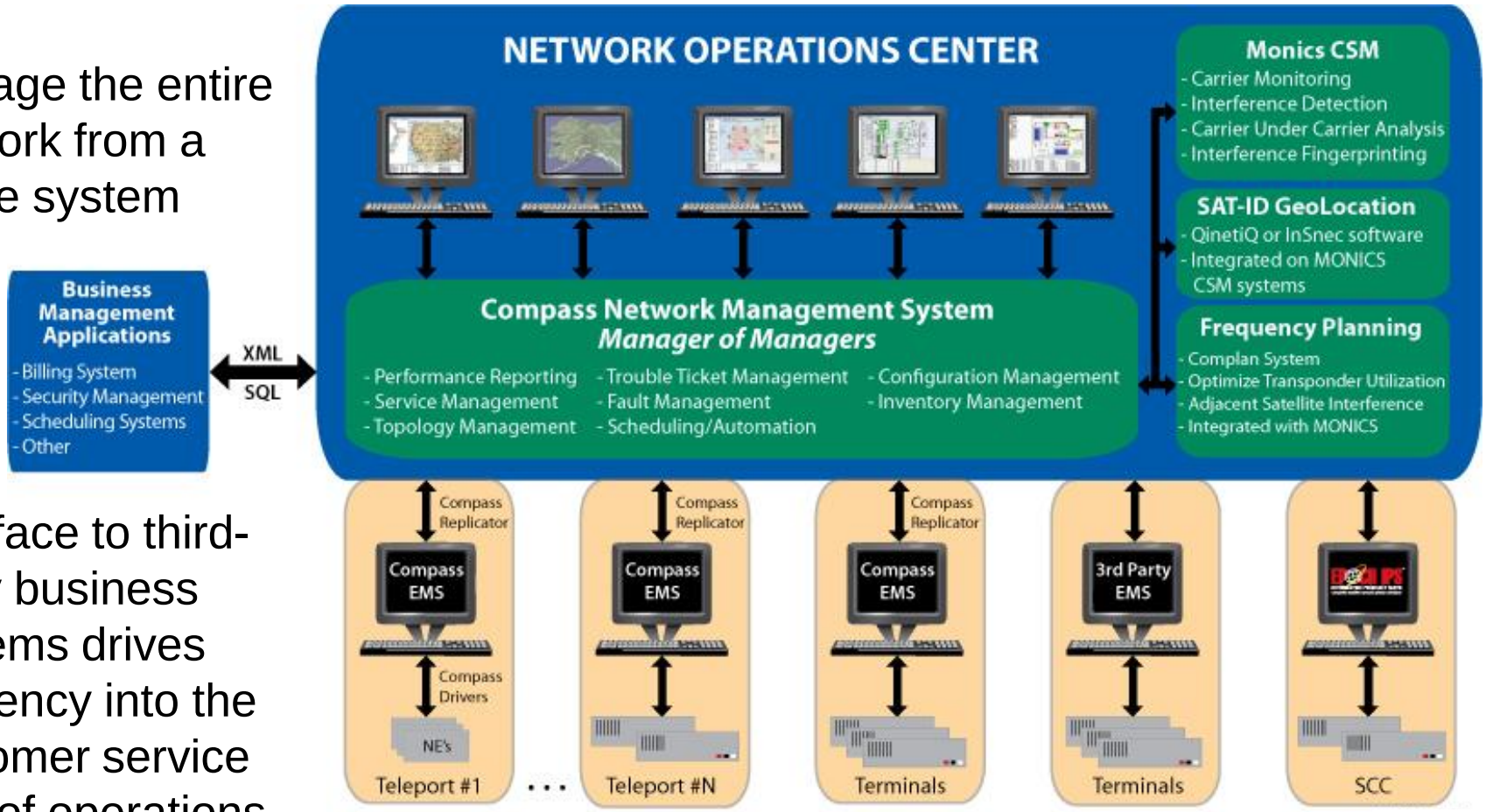



Ground system integrators had to bridge the gap by developing products and architectures designed to communicate

# Stovepipes Can Be Replaced by an Integrated Ground System Architecture

Manage the entire network from a single system

Interface to third-party business systems drives efficiency into the customer service side of operations



# Manager of Managers Advantages

- The user interface provides a single, integrated view of the system and network, thereby allowing management of existing and distributed network managers from one interface
  - Hides multiple systems from the operator and delivers a single system for ground system control
- Provides operators with true end-to-end M&C capability

# Manager of Managers Advantages

- No need to reintegrate hardware, change software or server architecture, or engage in costly rewiring of equipment
  - Businesses with significant investments in management software technology running across diverse systems can simply point an SNMP feed to a MoM, such as Newpoint Technologies' Compass product, and enjoy a fully featured, web-based GUI, such as TrueNorth
- Achieves economies of scale by placing fault management, service provisioning, scheduling, and asset M&C on a single platform

# Manager of Managers Advantages

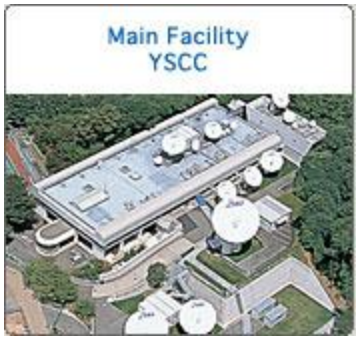
- Labor savings realized by automating and integrating responses previously requiring operator intervention
- Human error is minimized as automated scripts perform appropriate actions faster and in correct order each time
- Reduced training costs because operators need to learn only one software package
- Executive dashboard displays of multiple system status by common report generation tools eliminates the need to produce reports from individual systems

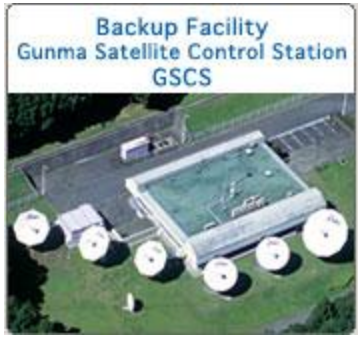
# Example: NASA TDRSS Space Network Expansion

- Primary and backup server installed in Guam to manage Space Network Expansion Equipment
  - RF hardware
  - Test equipment
  - RT Logic wide and narrowband modems
- Provides local GUI for managing equipment
- Data replicated from Guam to WSC
  - Remote management of Guam from WSC
- Interface into GD AIS provided automation software using Compass APIs
- Storage of all performance data using the Compass Historian
  - Crystal Reports used to generate outage and usage reports

# Example: JSAT 9 & 10 TT&C Station

- Centralized management of primary and backup TT&C facilities for JSAT 9 &10 satellites
  - Primary – Yokohama
  - Backup – Gunma
- Primary and backup Compass server interfaces with equipment
  - Heartbeat between computers to monitor health
  - Automatic failover to backup upon hardware failure, Compass software failure, Compass driver failure
- Manages the ACUs, baseband units, and NEC M&C for RF equipment
- Provides failover switching from primary to backup antennas at the primary facility in the event of equipment failure
- Interfaces with EPOCH control center software
  - Allows EPOCH to command and control ground equipment
  - Provides alarm and status information to EPOCH for processing
- Similar solutions provided for Thuraya and Hellas SAT with interface to the SAT Monics CSM system

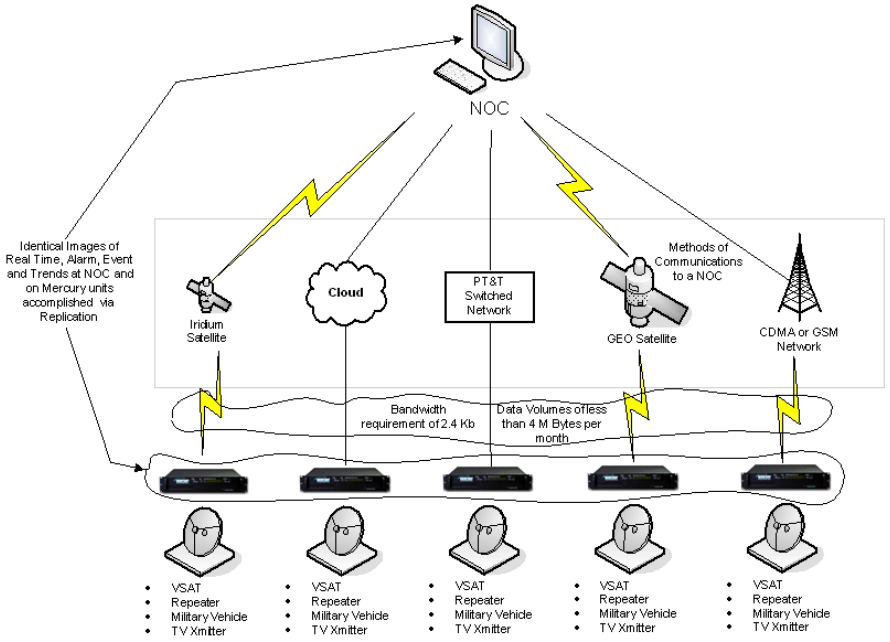
# Manager of Managers Architectural Guidelines

- Select products supporting a wide variety of ground hardware and equipment management systems
- Select products capable of user interface customization
- Select components with open and documented interfaces allowing external access to system data and functionality

# MoM Architecture Guideline 1

***Select products that support a wide variety of ground hardware and equipment management systems***

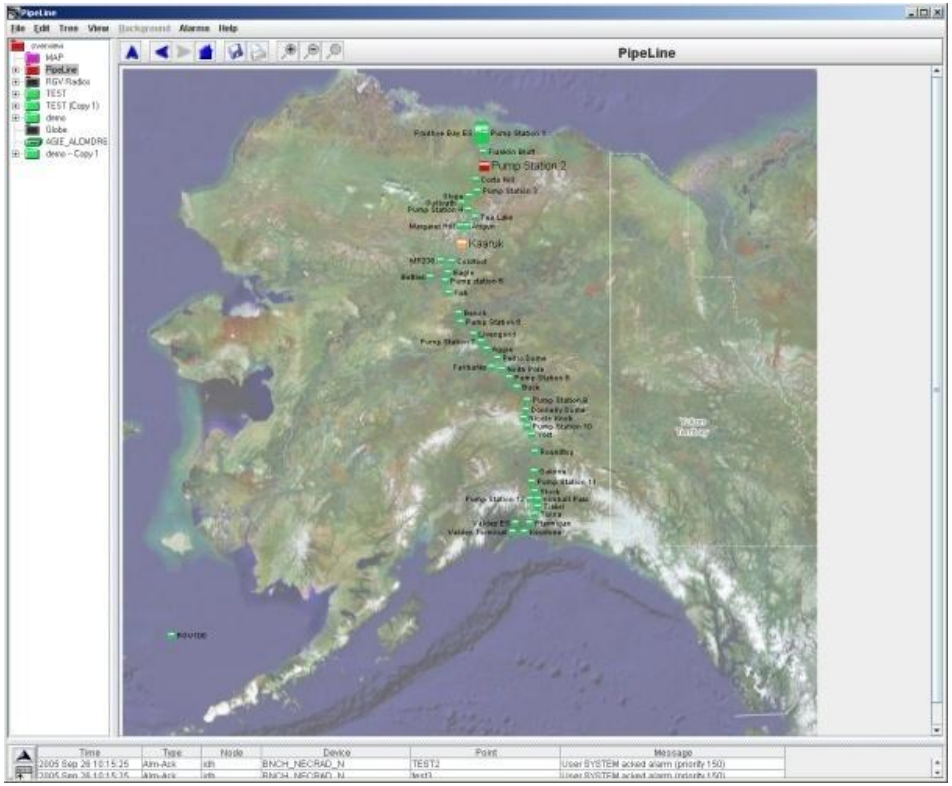
- Allows new hardware to be quickly added to the system
- Uses industry standards:
  - SNMP, RS232/422/485, and GPIB/HPIB
  - Standard satellite domain hardware such as the RT Logic Telemetrix or INSNEC Cortex baseband units




*Newpoint Technologies' Compass Supports Nearly 1000 Different Devices*

# Hybrid Microwave and Satellite SCADA Network

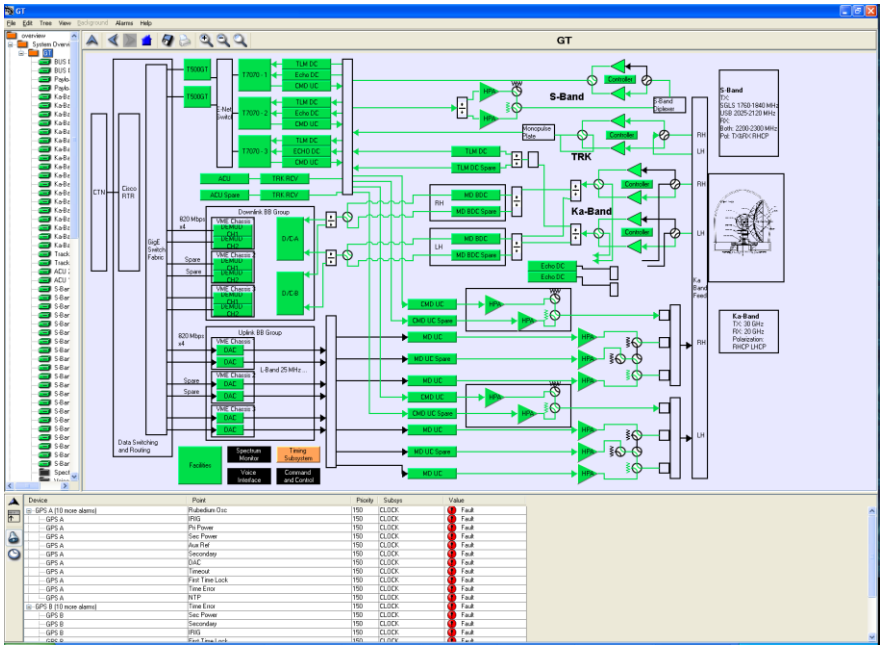
- Managed equipment at satellite hub and remote sites
  - HPAs
  - LNAs
  - ACUs
  - Modems
  - Transceivers
  - Network hubs and switches
  - Multiplexors
  - Generator fuel systems
  - UPS/battery systems
  - Facility alarms



# MoM Architecture Guideline 2

***Select products capable of user interface customization***

- Allows update and customization as new systems added to MoM
- Components with a customizable user interface can accommodate a variety of operations concepts




*Newpoint Technologies' Compass and TrueNorth Customizable User Interface*

# Example: TrueNorth User Interface Customization

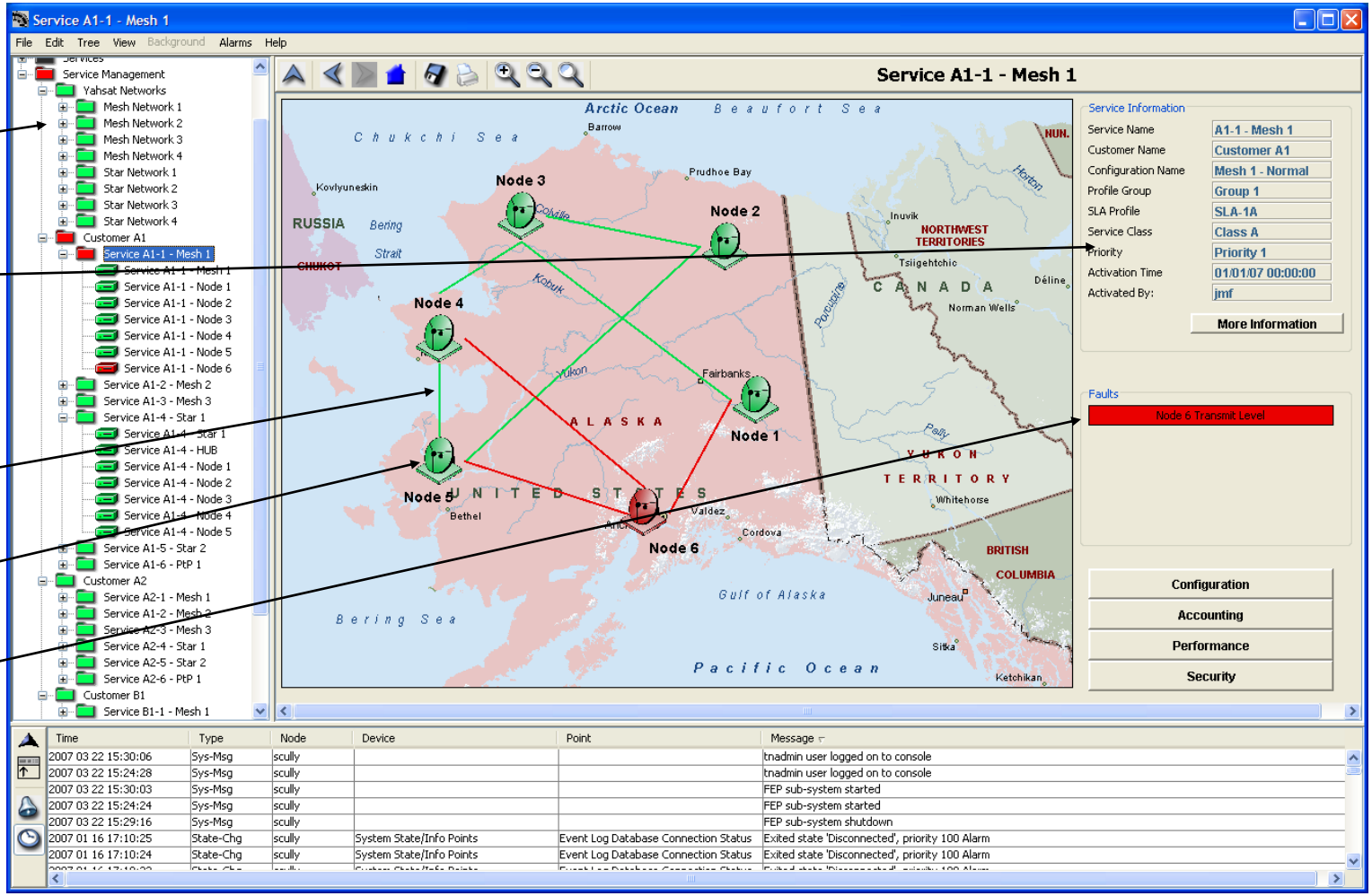
Service Folders

Service Summary Information

Link Status

Site Status

Service Faults

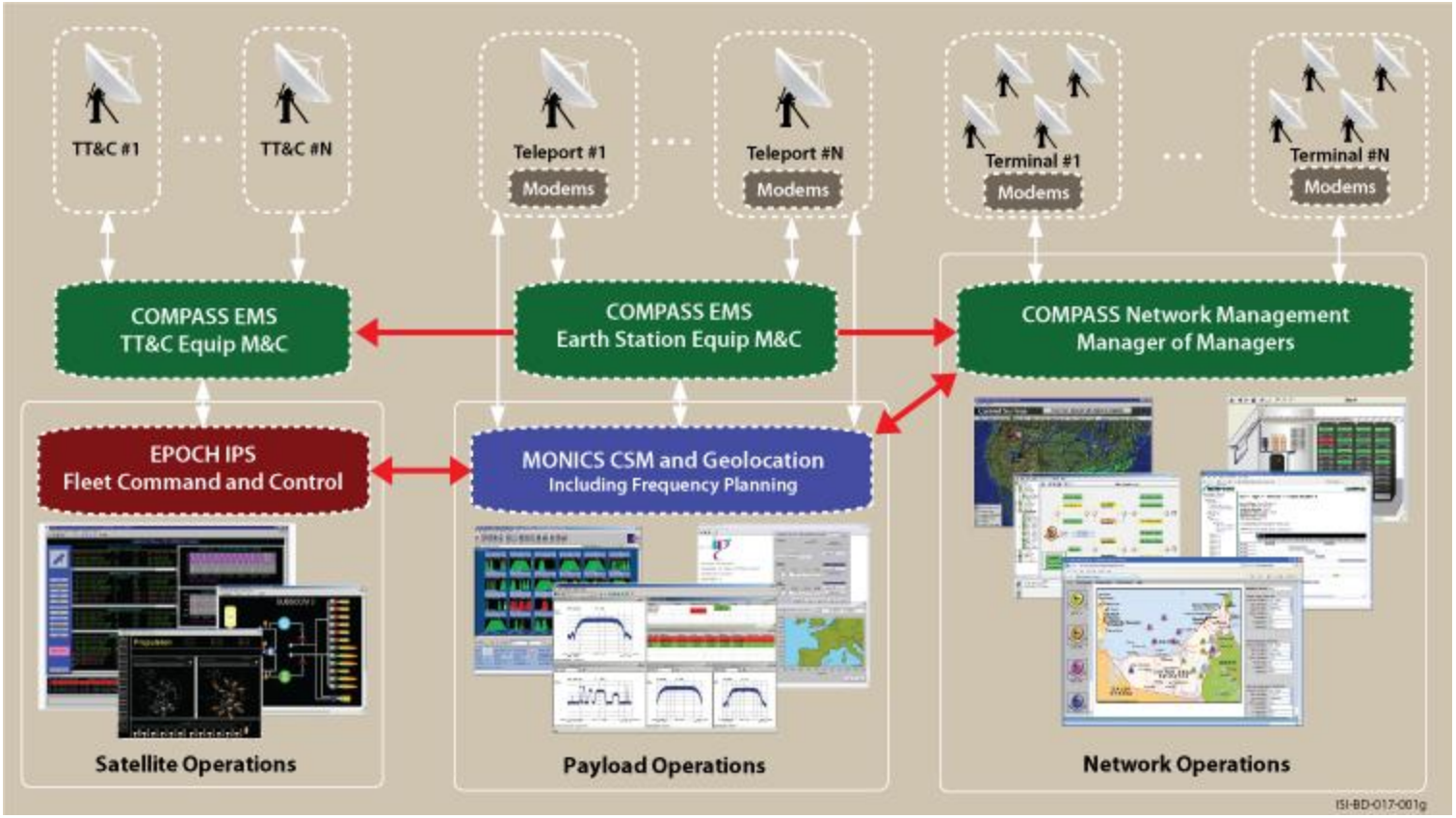


# MoM Architecture Guideline 3

***Select components with open and documented interfaces allowing external access to system data and functionality***

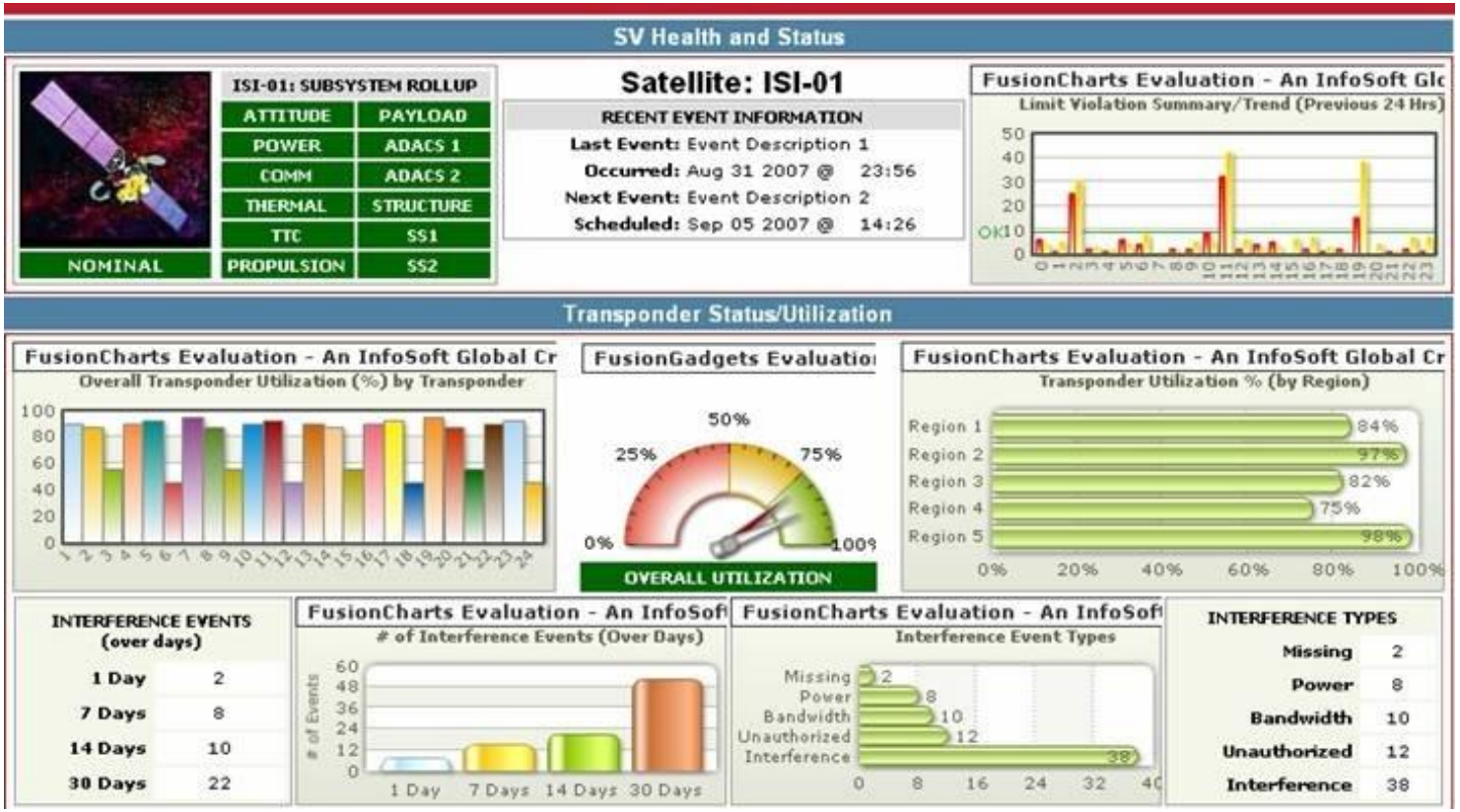
- Reduces integration complexity and risk
- Well-documented interfaces enable interfacing to other systems
- Products should be able to be integrated without dependence on middleware or glue code
- Enables hierarchical Manager of Manager architecture and integration of systems and data

# MoM Architecture: Key to Integrated Ground Systems




Integrating at the product level eliminates multiple, duplicated solutions while enabling data sharing between components

# Situational Awareness: Ground and Space




Trends, overlays, and fusion of data integrated by the MoM architecture provides situational awareness that improves responsiveness and ensures QoS

# Conclusion

- The space and satellite industry is rapidly changing
  - Companies/organizations merge
  - Fleets grow and change as satellites are purchased and retired
  - Ground equipment is augmented, replaced, and consolidated

Satellite Industry Mergers

- Selecting robust and open standards, components, and interfaces enables the Manager of Managers architecture
- Customizable user interfaces can integrate data for the user from multiple new and legacy systems
- Systems designed with the MoM approach provide users situational awareness across the enterprise