



# Ground Equipment Monitoring Service

*The complexity of the protocol should not outweigh the complexity of the device*

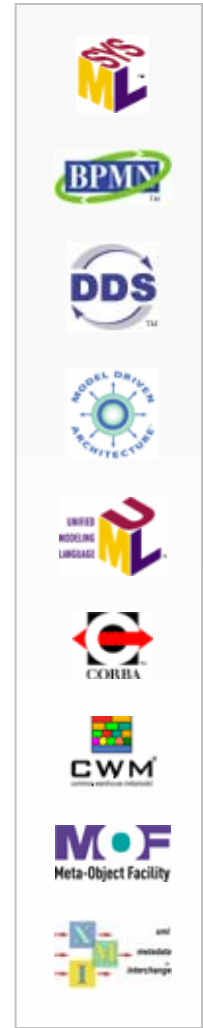
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- Object Management Group (OMG)
  - International, Not-For-Profit Consortium
  - Platform & Domain Task Forces
- OMG Space Domain Task Force (SDTF)
  - Focused On Space Related Standards
  - **XTCE** (XML Telemetry and Command Exchange)
    - Aids In The Transfer Of Telemetry and Command Databases From Satellite Manufacturer To Control Center
    - Now A CCSDS Redbook
  - **SOLM** (Spacecraft Operations Language Metamodel)
    - Aids In Porting Scripts From One TT&C Procedure Language To Another



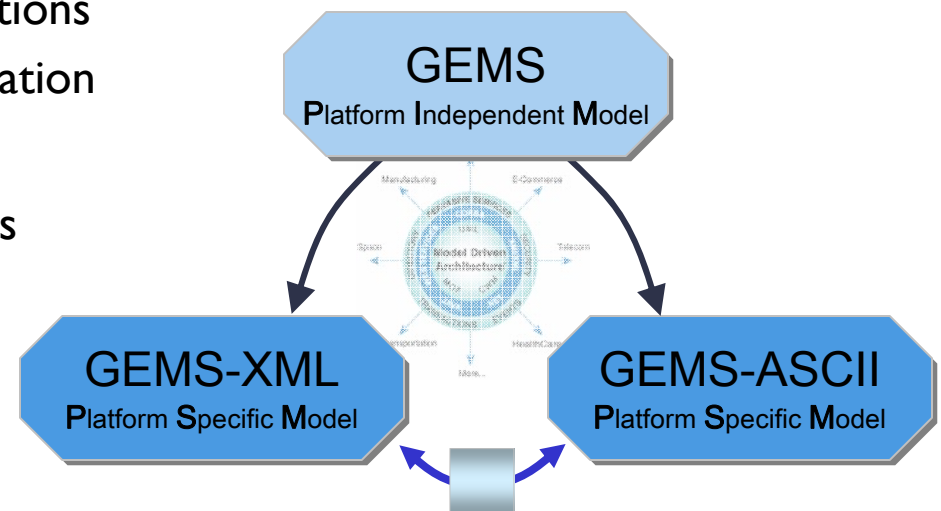
- Device Configuration Should Be Easy And Transparent
  - Setup The Device
  - Obtain Status From The Device
  - Save/Restore Configurations
  - The Device Should Just Do Its Job
- Controlling A Single Device Is Normally Easy
- Controlling Multiple Devices From Multiple Vendors Is Not
- Why Is It So Difficult & Costly?
  - Numerous Transport Mechanisms, Protocols And Platforms
  - Variation Of API Designs And Behaviors
  - Hardware/Software Upgrades Often Impact End-User Software

- Device Control & Status Is Often Secondary To Functionality
- The Choice Of API Or Protocol Is Often Constrained
  - Device Platform (OS, Programming Language, Network/Bus etc.)
  - Vendor Expertise & Product Goals
  - Customer Architectures
- End Result Is Added Cost And Complexity
  - Ground Systems Contain Many Devices From Many Vendors
  - Numerous Custom/Proprietary Interfaces
  - Unexpected Integration Of Standards
  - The Customer Pays For It In The End

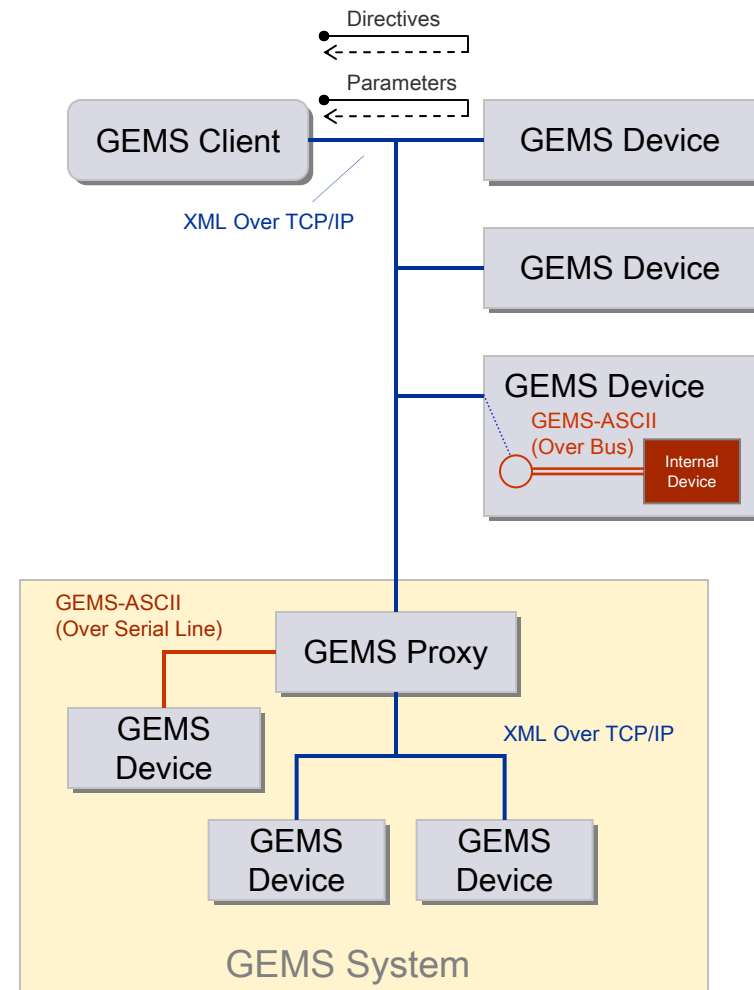
- Ground Equipment Monitoring Services (GEMS)
  - Emerging Specification For Control & Status Of Ground Equipment
- GEMS Approach
  - Simple Solution For A Simple Problem
  - Standard Model For Device Control
  - Map The Model To Specific Protocols & Platforms
- GEMS Features
  - Parameter & Directive Level Control/Status
  - Save/Restore Configurations
  - Scales To Full Ground System Control



- Designed Using OMG Model Driven Architecture Approach
- Platform Independent Model (PIM)
  - Standardizes Obvious Device Control Concepts
  - Defines Use Cases, Message Classes, Parameter Types, Behaviors
- Initial Platform Specific Models (PSM)
  - GEMS-XML
    - Ideal For Network Communications
    - Schema Validation & Transformation
  - GEMS-ASCII
    - Ideal For Serial Communications
    - Board-Level Control



- Point-To-Point Control & Status
  - Set/Get Parameters
  - Invoke Directives
  - Save/Restore Configurations
  - Status Polling
  - Scales To Multiple Devices
- Automatic GEMS Translation
  - Leverages Common Model
  - GEMS-XML ⇔ GEMS-ASCII
- GEMS Proxy
  - Message Routing
  - Message Sets
  - Sequential Processing



## Connection Logic

- Connection Type
- Token Creation
- GEMS Version

## Base Message Properties

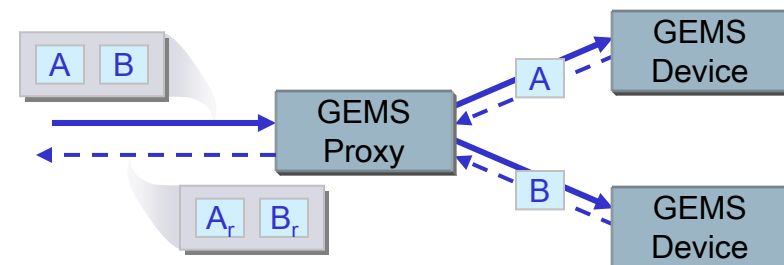
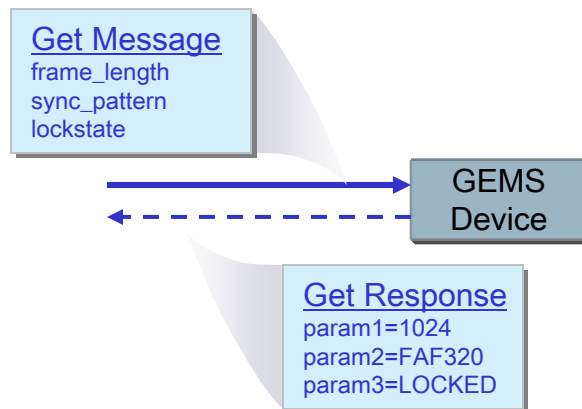
- Message Targets
- Device Version
- Transaction ID
- Connection Token

## Common Definitions

- Parameter Types
- Message Types & Structure
- Response Messages
- Return Codes

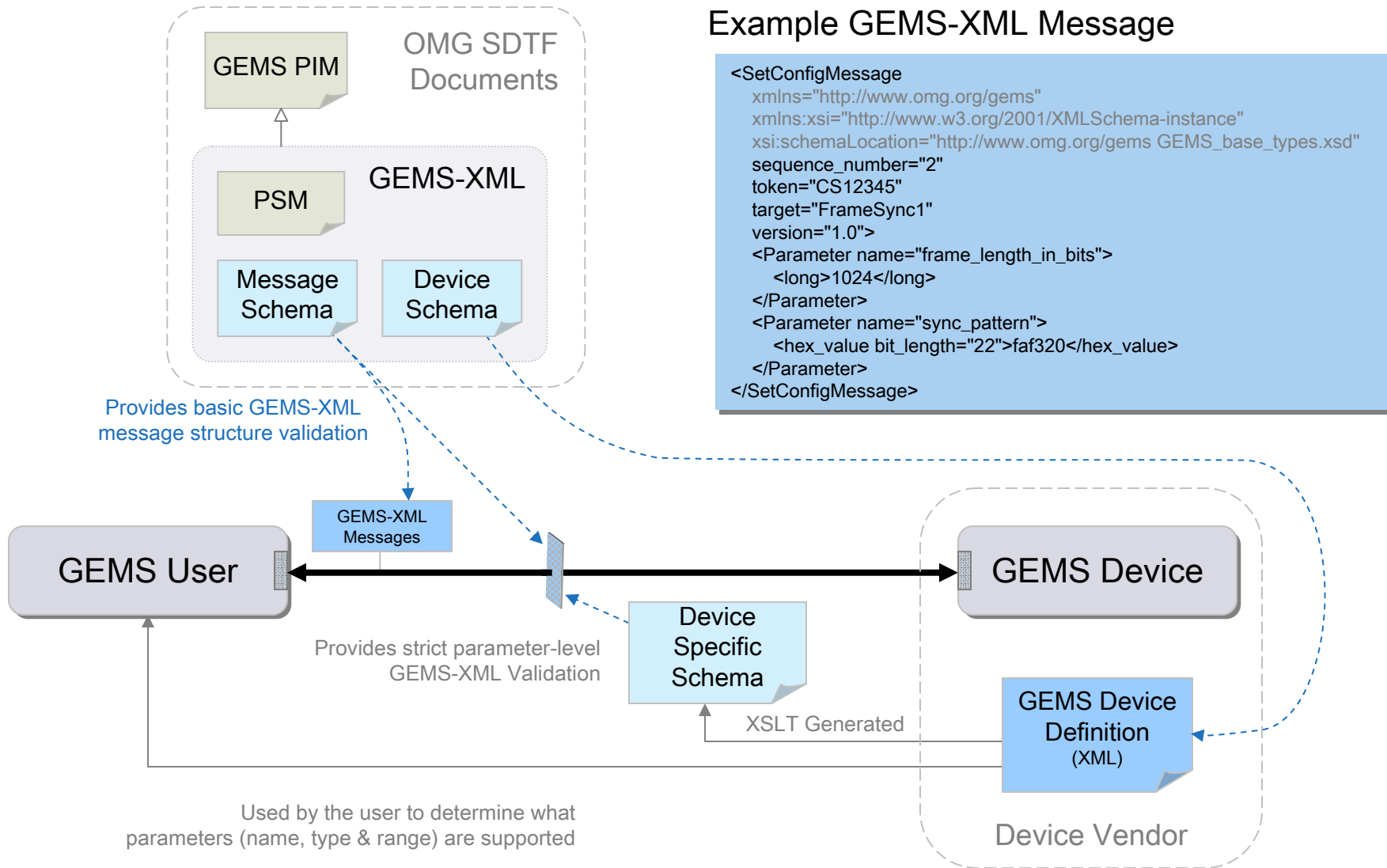
## Common Behaviors

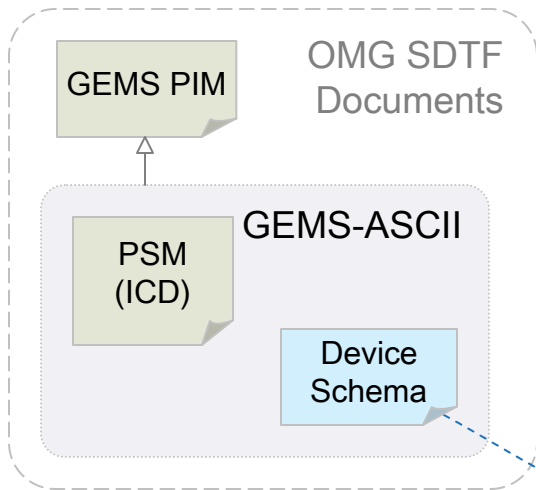
- Transaction-Based Set/Get
- Directive Processing
- MessageSet Processing
- Scalability Using Proxies



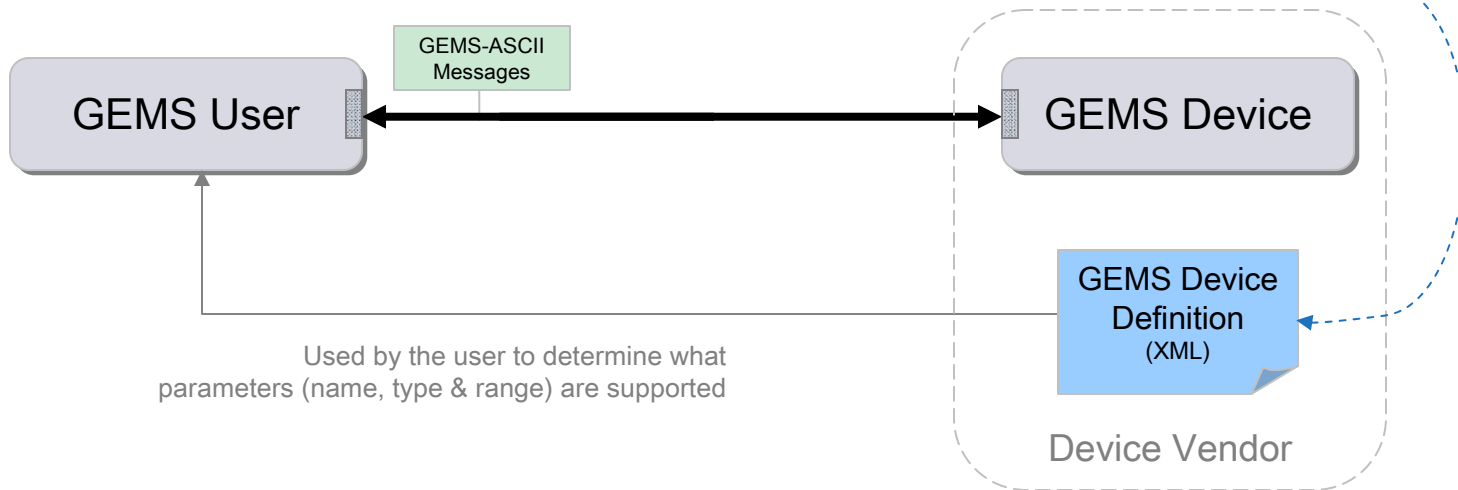
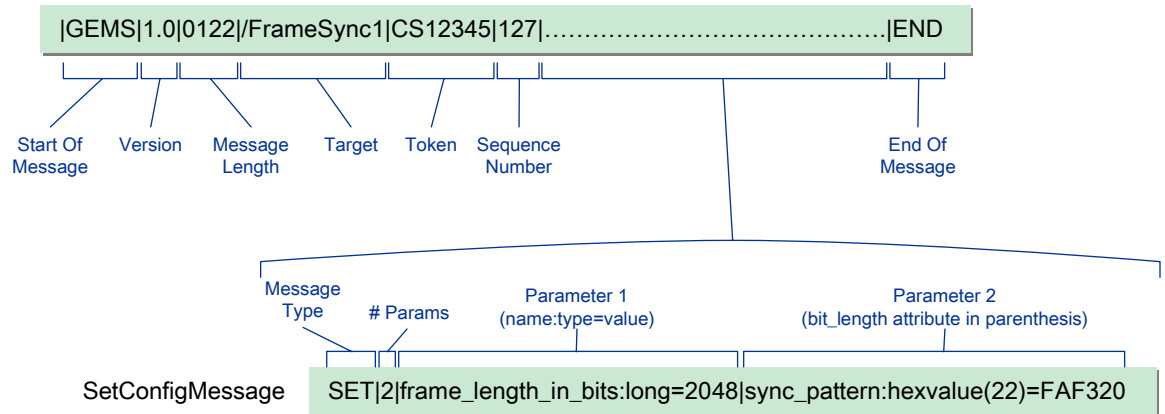








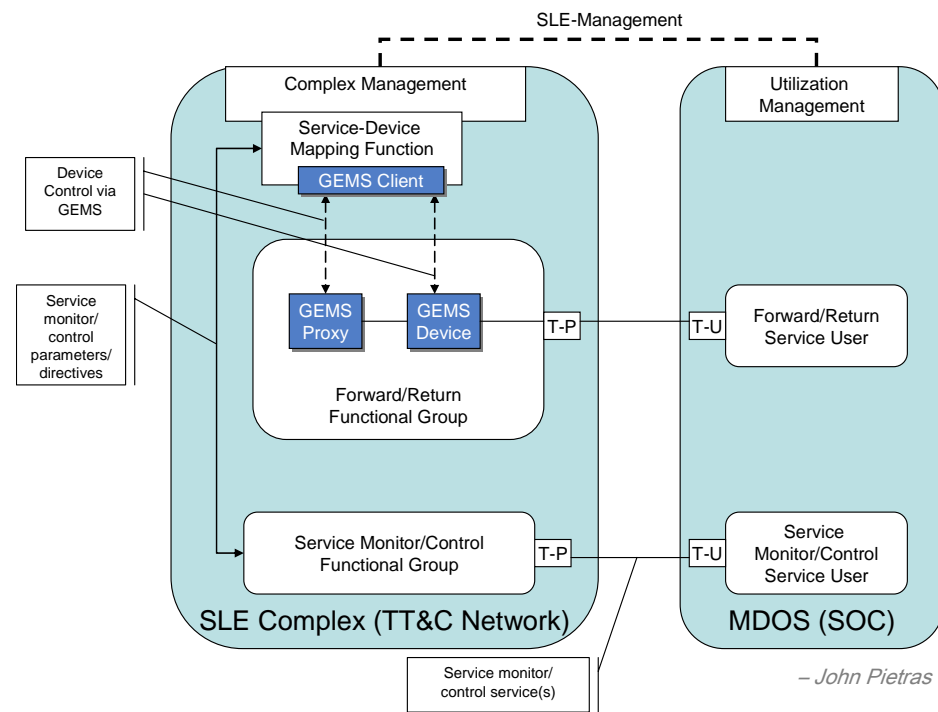
## Standard Header



- Other Related Standards Exist In The Space Domain
  - Higher Level Standards Can Use GEMS
  - Lower Level Standards Are Candidates For A GEMS PSM
- GEMS Model Provides A “Least Common Denominator”

## EXAMPLES

CCSDS Service Management is looking at GEMS to simplify the mapping of the service to the actual devices.



- **OMG Specification Timeline**
  - Initial submission reviewed at December meeting
  - Seeking Feedback & Comments (CCSDS, GSAW etc.)
  - Final Submission September 2007
  - 1 Year OMG SDTF Review & Finalization
- **Additional Considerations / Future Addendums**
  - Device Dictionary
    - Common Parameters For Typical Ground Equipment
    - Likely Managed By OMG SDTF
  - Security/Authentication
  - Asynchronous Events
- **Space Information Day**
  - Brussels, Belgium - June 28, 2007

Thank You

