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Topics

- Multi-Mission Ground System
  - COTS or Fiction?
- Commercial Expectations
  - Where’s the shelf?
- Architectural Parameters
  - The 3-D View.
- Standards and Components
  - Lessons learned in the commercial world.
- Acquisition Strategies
  - Try before you buy.
- Sustainment Strategies
  - Where’s the marching army?
Multi-Mission Ground System

- The multi-mission ground system to be discussed today…
  - Supports multiple satellites
  - Supports satellites from multiple manufacturers
  - Supports multiple ground control sites (primary, backup, remote)
  - Supports multiple orbit types (LEO / GEO)
  - Supports different operations concepts
  - Is currently in use throughout the world at some of the largest commercial satellite operations centers in the world
  - Is available as an integrated suite of COTS products from a company in Maryland. (this company will not to be named so I don’t look like a shameless marketeer)
Commercial Expectations

- The commercial world has come to expect satellite ground systems to be:
  - Off the Shelf
  - Inexpensive (compared to government programs)
  - Compatible with all their satellites
  - Deliverable quickly (in many cases less than 6 months)
  - Safe and Reliable

- The commercial world realizes this means…
  - Specifying certain unique requirements may drive up cost and schedule
  - Specifying certain standards may drive up cost and schedule
  - Specifying certain hardware may drive up cost and schedule
  - Customizations to the system should be to accommodate spacecraft peculiarities not operations peculiarities
Successful commercial architectural parameters. “3-D”

- Decentralization
- Decoupling
- Dynamic Reconfiguration
Decentralization

- All computers are interconnected via LAN/WAN. All software functions can run on any computer.
  - No need to get obsessed with architectural details
    - How do I get redundancy and hot backups?
      - By running another copy of the software
    - Do I run the archives at the station or the control center?
      - Either or both, depends on your needs
    - What if the commanding computer goes down?
      - Have a backup copy running somewhere else take over

- Client functions can run on one client machine or be divided among several client computers
  - Ditto for servers
  - No host computer to get bogged down when you add seats
  - Fine-tune the processing and network load by reallocation
  - Any client can connect to any server or all servers
Decoupling

- Build mission specific features via API’s outside the core COTS software
  - Maintains the integrity of the core software
  - Preserves the usefulness of the core software for all users

- Isolate hardware dependencies with a common layer for interprocess communications
  - Avoid inadvertently incorporating specific frame syncs, telemetry boxes, etc. in your architecture

- Define the satellite and ground characteristics in a database
  - Make changes and reconfigure without rewriting software
Dynamic Reconfiguration

- Provide an open data service for two-way communications
  - Let external programs share data, commands, telemetry, etc. with core functions
  - Allows system to be reconfigured for mission-unique requirements without impacting the core architecture

- Provide a common event mechanism with external triggers
  - Allows core software to launch scripts and external programs in case of an alarm
Sample Architecture Diagram

Which computer runs which function? The design should let you reallocate at will!
Standards and Components

- Don’t dictate an architectural standard
  - Else industry will pass you by: NASCOM, TPOCC
- Don’t dictate a tools standard
  - ELSE industry will pass you by: ADA, FORTRAN
- Industry has lots of components available to choose from, but
  - They don’t all play together
  - They don’t all work as advertised
  - They don’t all exist
- Let the vendor tell you which components he can offer
  - Otherwise you may make the vendor force fit his solution around a few components you have chosen
- COTS software interchangeable components is a myth
  - It works in the hardware world, but is not there yet with software
Acquisition Strategies

- Buy COTS and ask for a customer list and references
  - You can make sure the software really exists
  - You can make sure the system’s core capabilities can be configured for your satellite(s)

- Don’t let blanket support and cost plus contracts
  - This eliminates competition
  - This provides incentive for building a custom system

- Employ the requirements police!
  - Make sure operations peculiarities and personalities don’t get specified in the system
    - Otherwise system cost and schedule go up and up and up
Sustainment Strategies

- No marching army needed
  - The system is COTS after all

- Stay current with the COTS vendor releases
  - You will get new software features with each release
  - Your maintenance costs will be low
    - The cost for bug fixes will be shared by all users through a software subscription
  - Otherwise your COTS system...
    - Will not stay current with the industry
    - Will necessarily become custom after the COTS vendor drops support for its older versions