

GENERAL DYNAMICS

Maximizing Flexibility without Impacting
Operational Responsiveness in
SOA-based Satellite Ground Systems

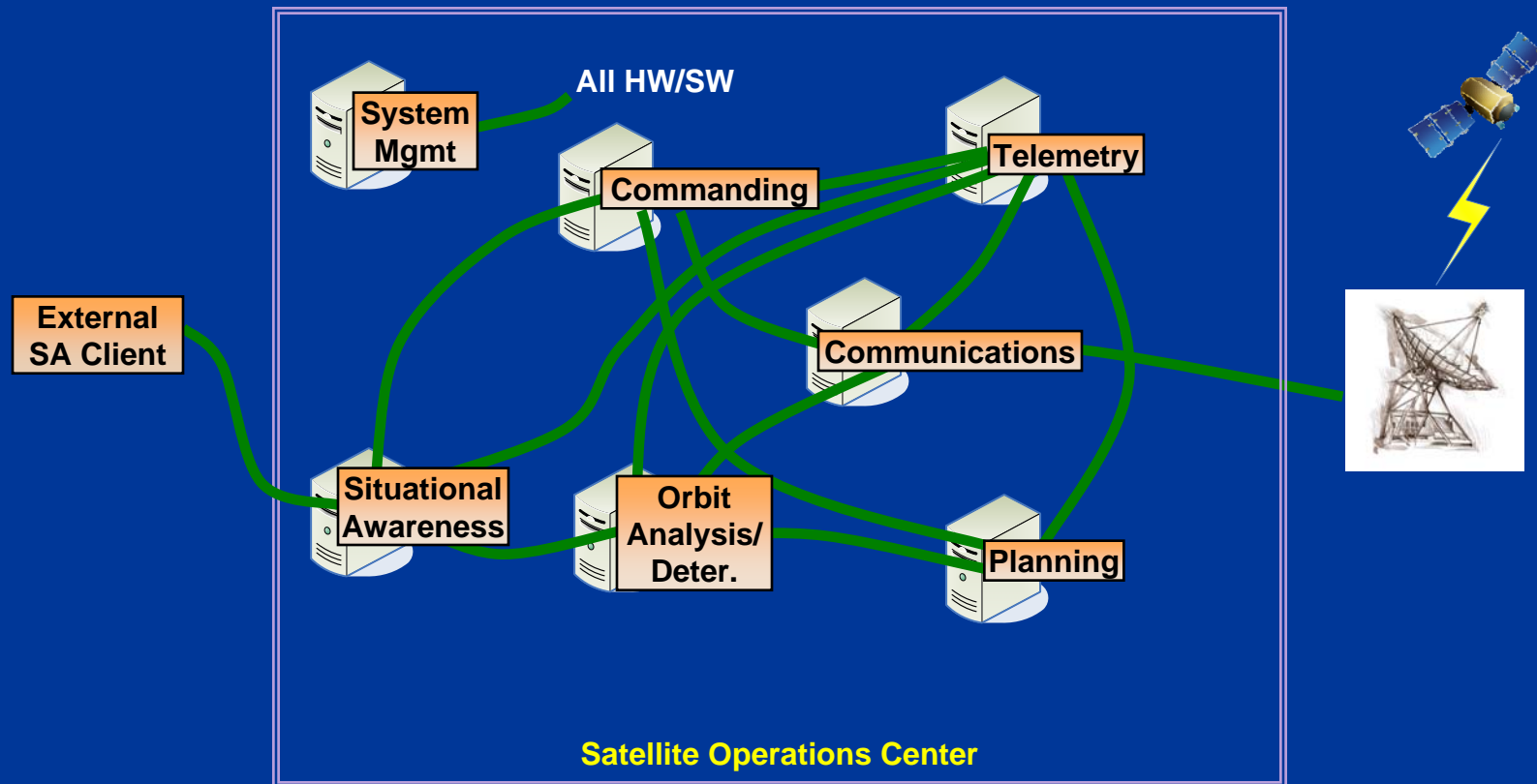
GSAW 2008

Richard Anthony
richard.anthony@gdc4s.com
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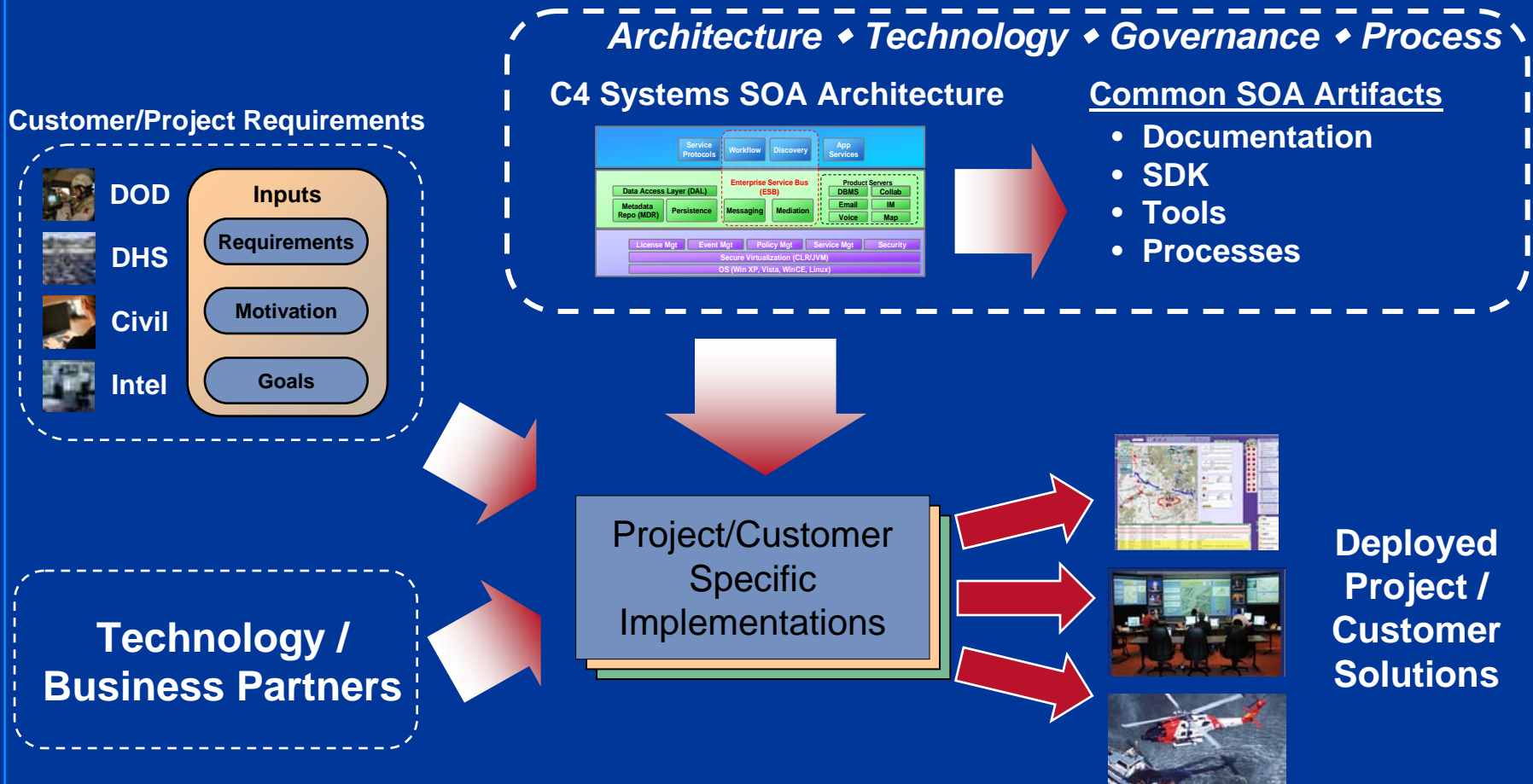
Objectives

- Describe how Service-Oriented Architecture (SOA) can be applied effectively in Satellite Ground Systems
 - Focus on how to achieve benefits of SOA without affecting ground system responsiveness and effectiveness
- Use a set of generic Satellite Ground System architecture views to illustrate
 - Represents a typical software architectural evolution as more is learned about SOA capabilities and applicability
 - Includes SOA applied inside the ground system and SOA also used for external interfaces
 - Views not intended to be specific to Web Services based SOA
- Based on knowledge gained in:
 - Contracted Programs
 - Studies
 - Proposal-related activities
 - IR&D Activities

Satellite Ground System Conceptual SW Architecture (distributed, non-SOA)



General Dynamics C4 Systems SOA Approach



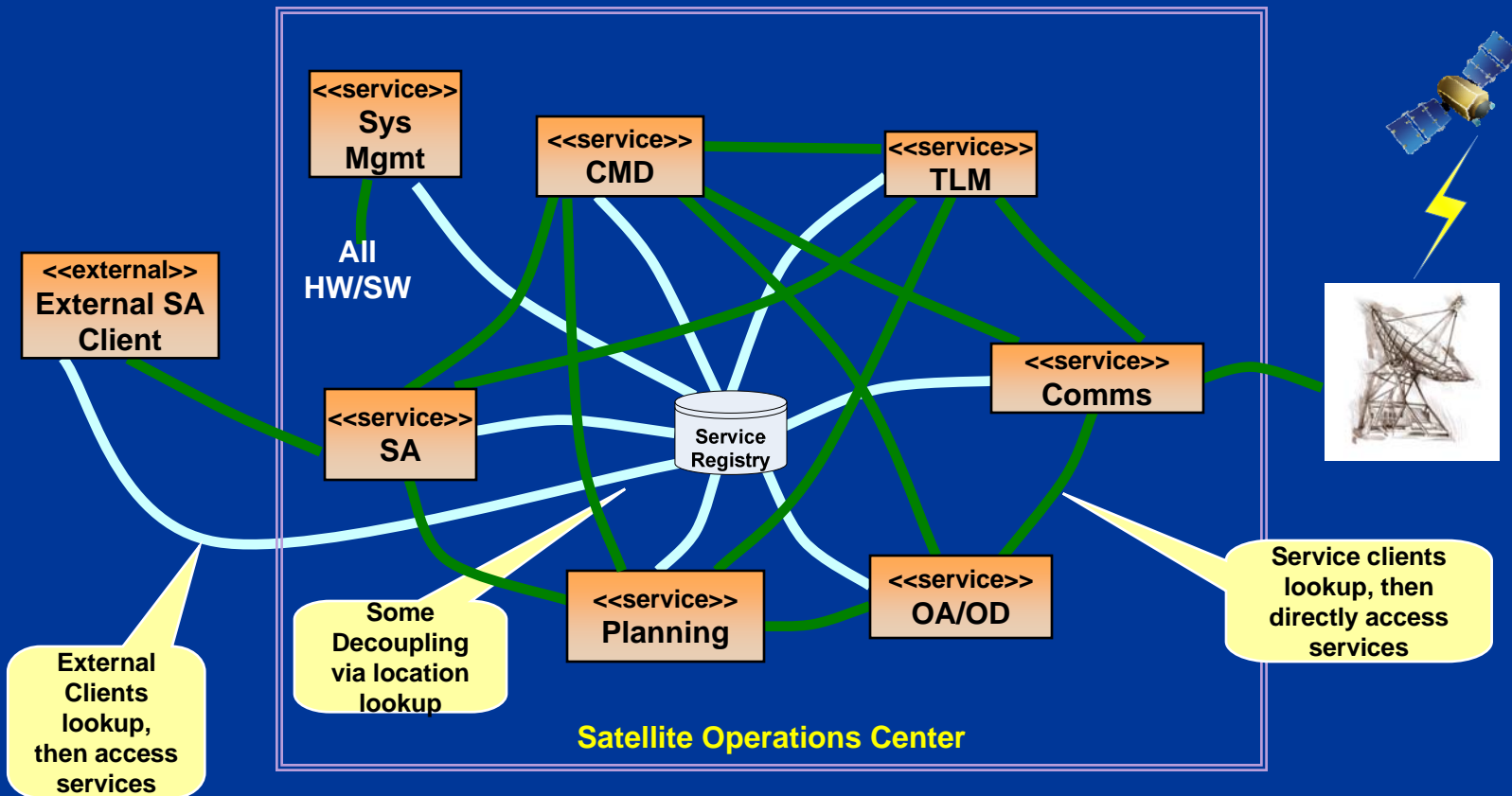
Benefits of SOA

- **Plug and Play of Services with no disruption of operations (agility)**
 - Add / Replace a Service
 - Upgrade a Service
- **Loose Coupling**
 - Reduces dependencies and direct connections
- **Open Standards based (Avoid SOA solutions that are not)**
 - Minimizes dependencies on vendor proprietary implementations
 - Ultimate plug and play is to replace the SOA framework
 - Implementation Should be platform independent (reduces lifecycle costs)
- **Orchestration**
 - Mission Logic - Intelligent Sequencing, Workflow
 - Building coarse-grained services from fine-grained services
- **Mediation**
 - Translation between Different data structures and protocols (JMS, CORBA, SOAP, etc.)
 - Intelligent Routing (Content / Identity based routing)
- **SOA Governance**
 - Administration and management of services
- **Reuse**
 - Use externally provided service rather than a custom application
 - Typical problems of reuse still exist

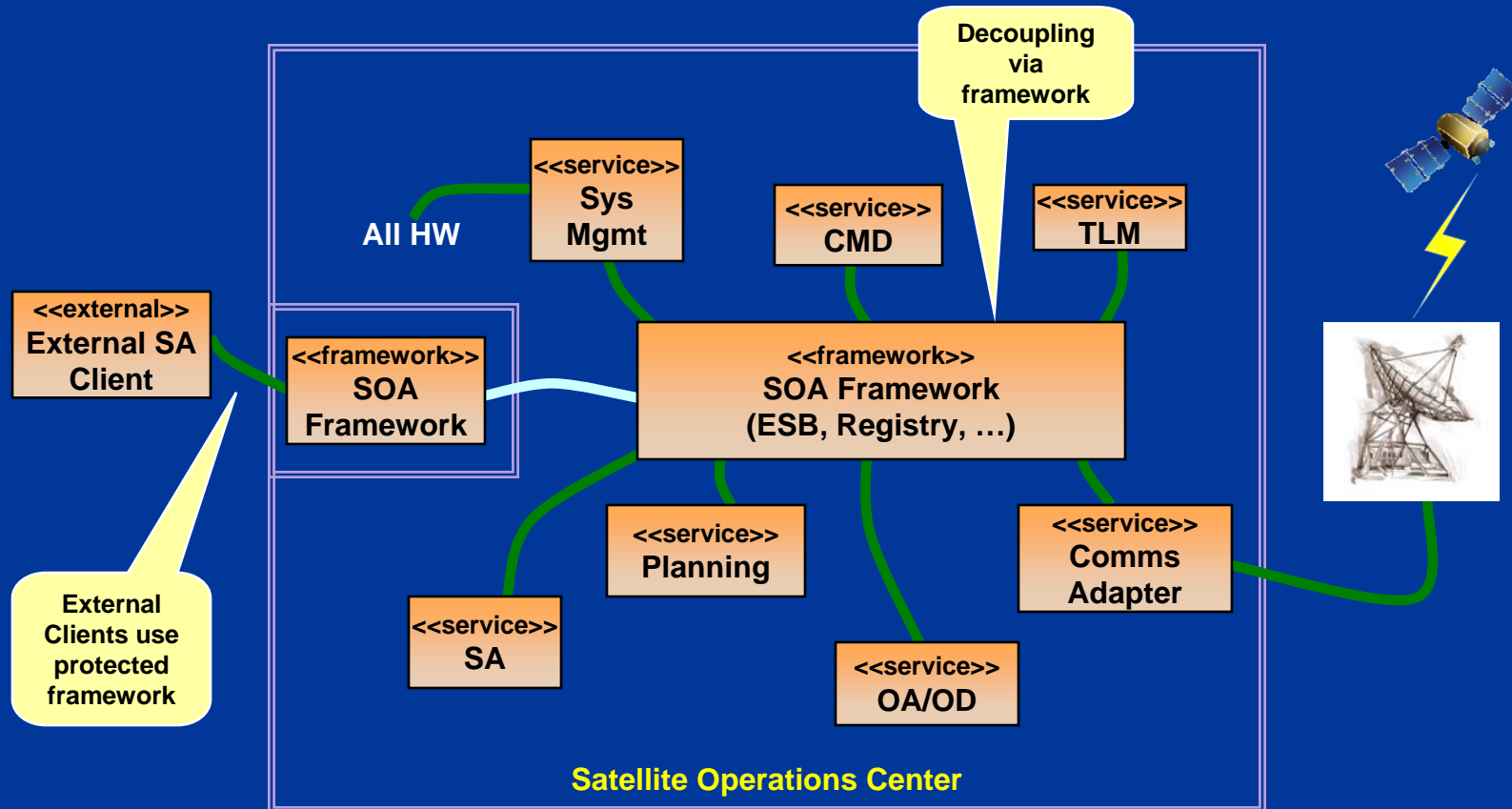
How SOA Impacts Operational Responsiveness

- Implementing everything as a SOA service could inhibit system performance and responsiveness
 - Processing real-time Telemetry (TLM)
 - Alarms
 - Command (CMD) Processing
 - Orbital Data Processing
 - Enterprise Management
 - Processing / Providing data on external interfaces
- Interfaces to existing TLM / CMD / Orbital Processing Products may need to be adapted
- Security mechanisms may inhibit system responsiveness
- Without proper design updates to services may cause delays
- Services need to be developed/deployed with reliability and availability in mind
- Management of the SOA Framework can add complexity

A First Approach: Initial SOA-based SW Architecture, no SOA Framework



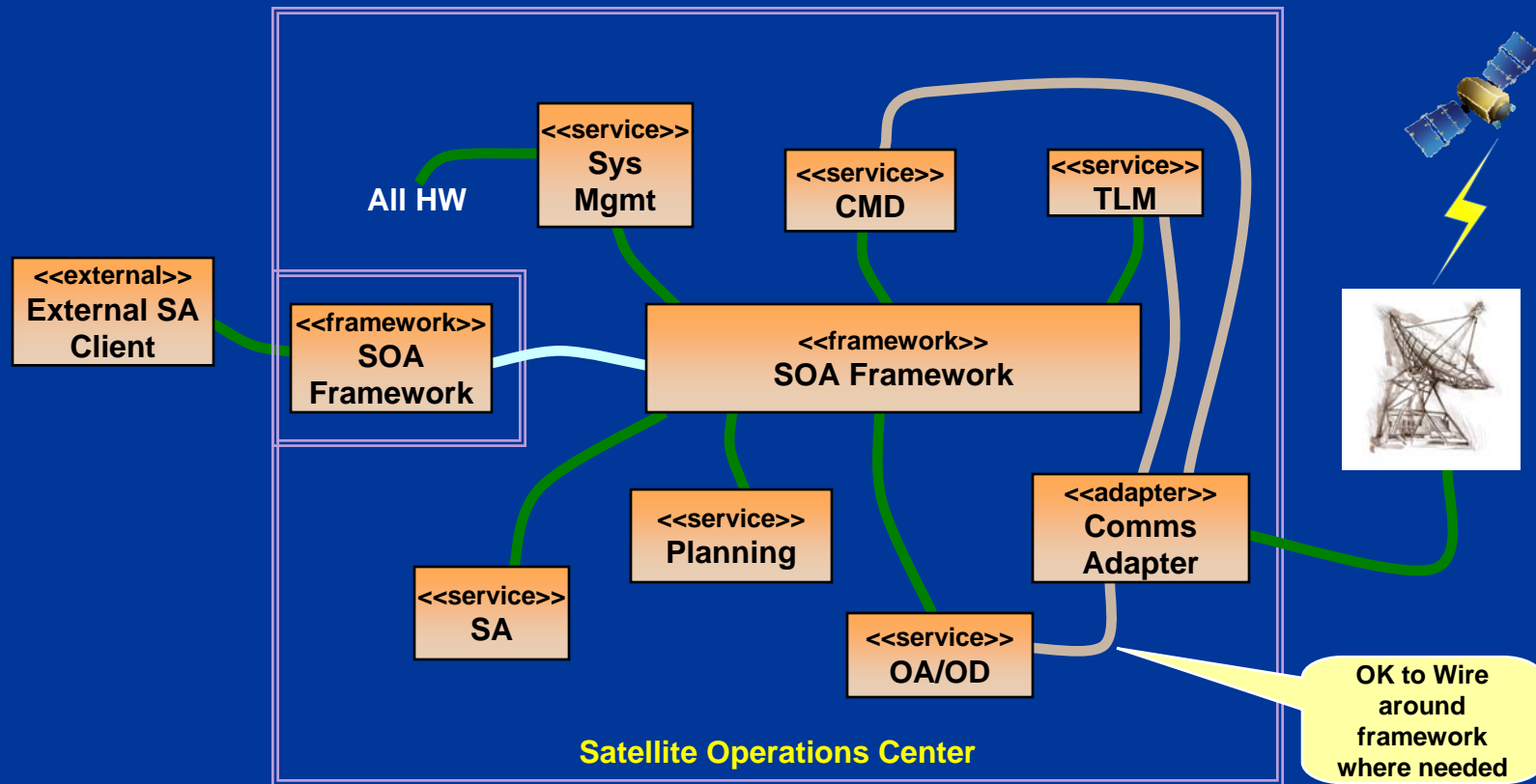
Second Attempt: SOA-based Ground System Architecture, Framework-Based



Where is SOA Applicable and Not Applicable in Satellite Ground Systems?

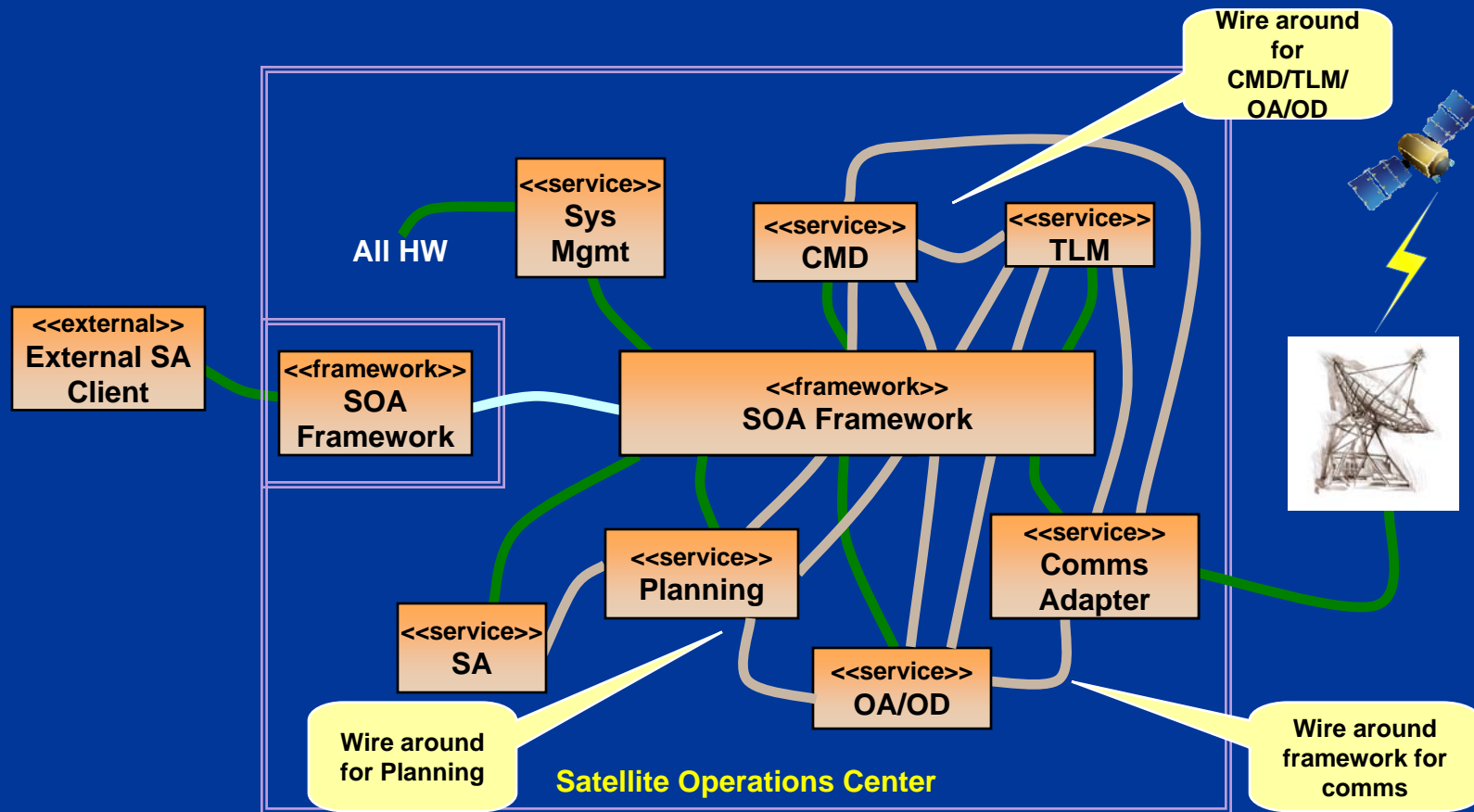
- SOA is applicable where benefits of SOA can be achieved and responsiveness is not impacted
 - TLM / CMD history query and publish/subscribe services
 - Situational Awareness (SA) services
 - Satellite subsystem status
 - Link status
 - Network Element status (high-level)
 - Critical Alarms
 - Planning and Scheduling interfaces
 - External information query services
 - External Satellite SA
 - Mission data processing status / query
 - Utility Services
 - XML transforms, logging, alerts, etc.
- Not Applicable where SOA impacts operational responsiveness
 - Real-Time TLM / CMD Processing
 - In the middle of intensive tasks such as Orbital Data Processing
 - Direct feed to/from earth terminals

A Potential SW Architecture: SOA Where it Makes Sense



Guerilla SOA: Evolution of SOA

(Jim Webber, ThoughtWorks)



Conclusions / Looking Ahead

- Use SOA where it makes sense
 - When SOA can provide benefits, e.g. agility
 - Where Operational Responsiveness is not impacted
 - It's OK to wire around the SOA Framework where necessary, usually for performance reasons
 - First, make sure there really is a performance issue
- The approaches discussed here can also be applied to other types of ground systems
- Other technologies to consider for ground system architectures
 - Database technologies
 - High-speed networking
 - Server and storage technologies
- For further information Contact: richard.anthony@gdc4s.com