



CCSDS Architecture Working Group

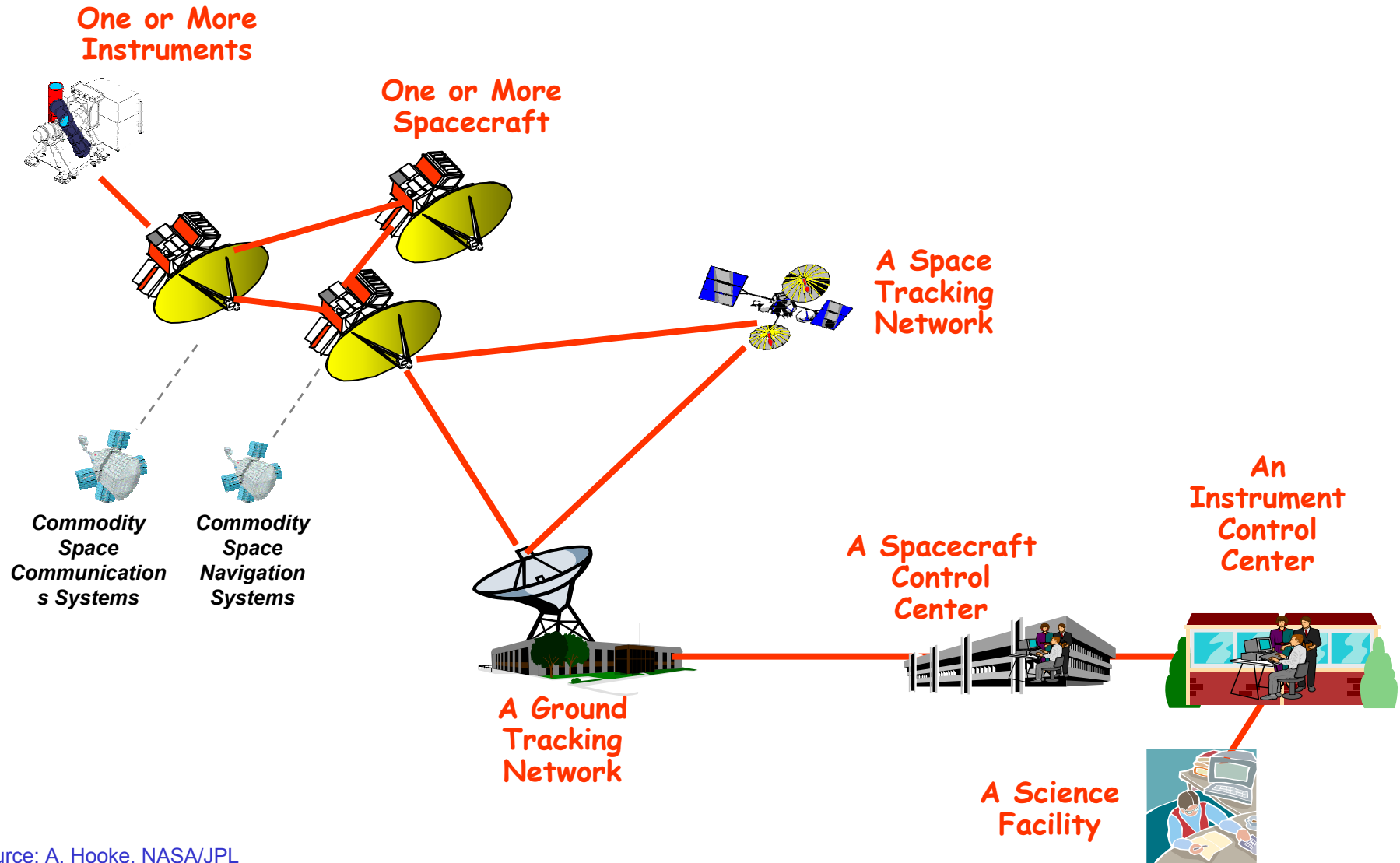
Space Data Systems Reference Architecture

20 February 2003

Hooke/JPL, Reich/CSC, Sawyer/GSFC,
Shames/JPL, Yamada/ISAS, Chair



A Physical View of a Space Data System



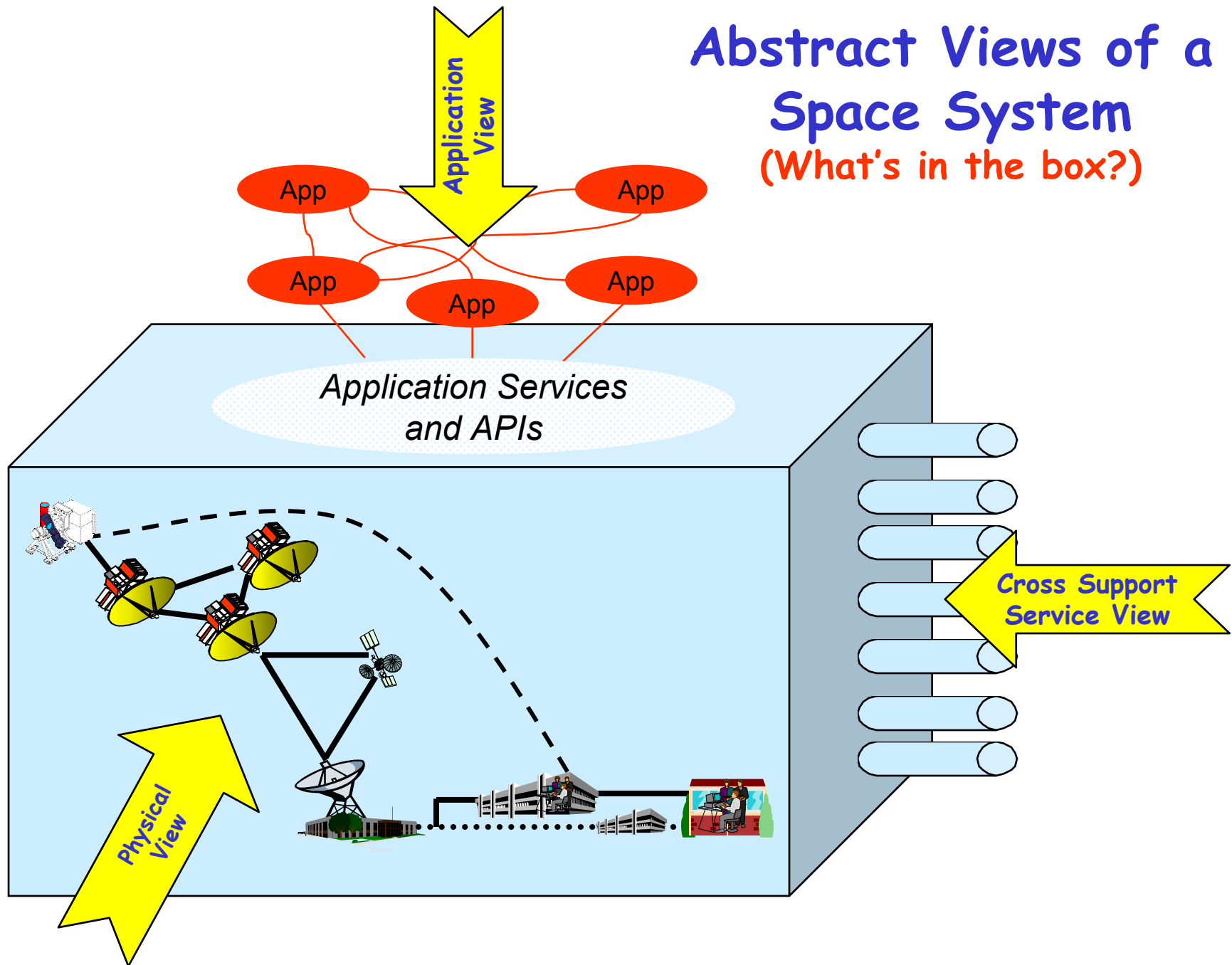


Reference Architecture Purpose

- Establish an overall CCSDS approach to architecting and to developing domain specific architectures
- Define common language and representation so that challenges, requirements, and solutions in the area of space data systems can be readily communicated
- Provide a kit of architect's tools that domain experts will use to construct many different complex space system architectures
- Facilitate development of standards in a consistent way so that any standard can be used with other appropriate standards in a system
- Present the standards developed by CCSDS in a systematic way so that their functionality, applicability, and interoperability may be clearly understood

Abstract Views of a Space System

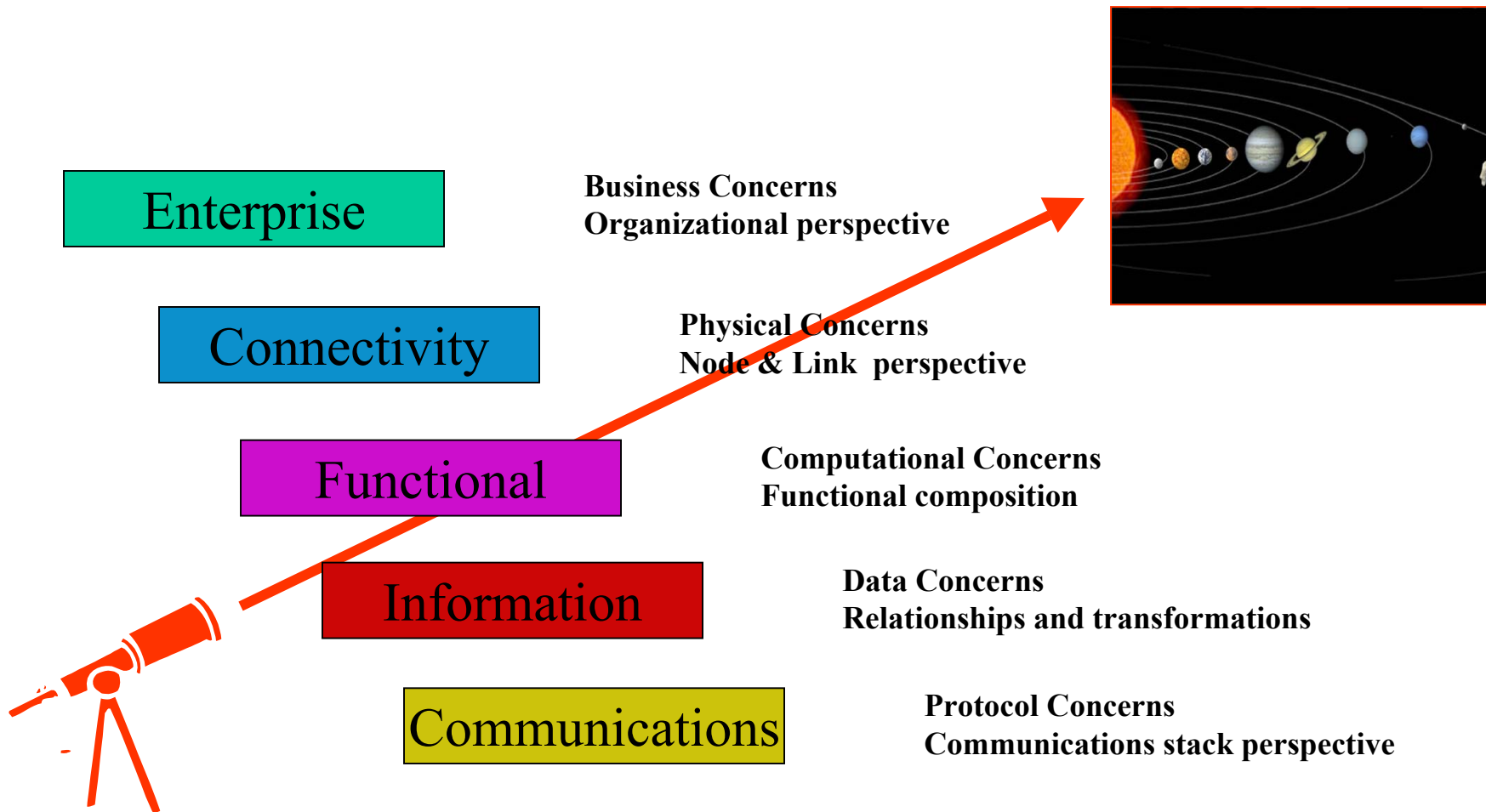
(What's in the box?)





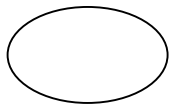
Space Data System

Several Architectural Viewpoints

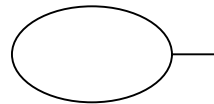




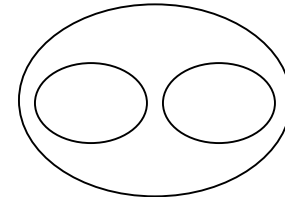
Space Data System Architectural Notation



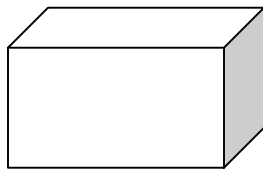
Object



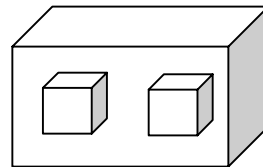
**Object with
Interface**



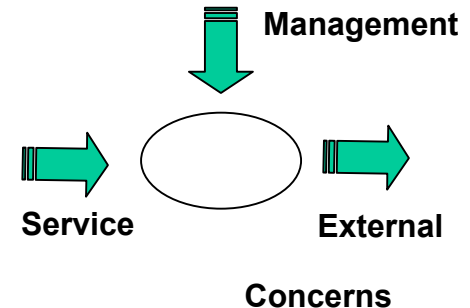
**Object
Encapsulation**



**Node
(physical location)**



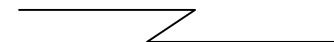
**Node Encapsulation
(physical aggregation)**



**Logical
Link**



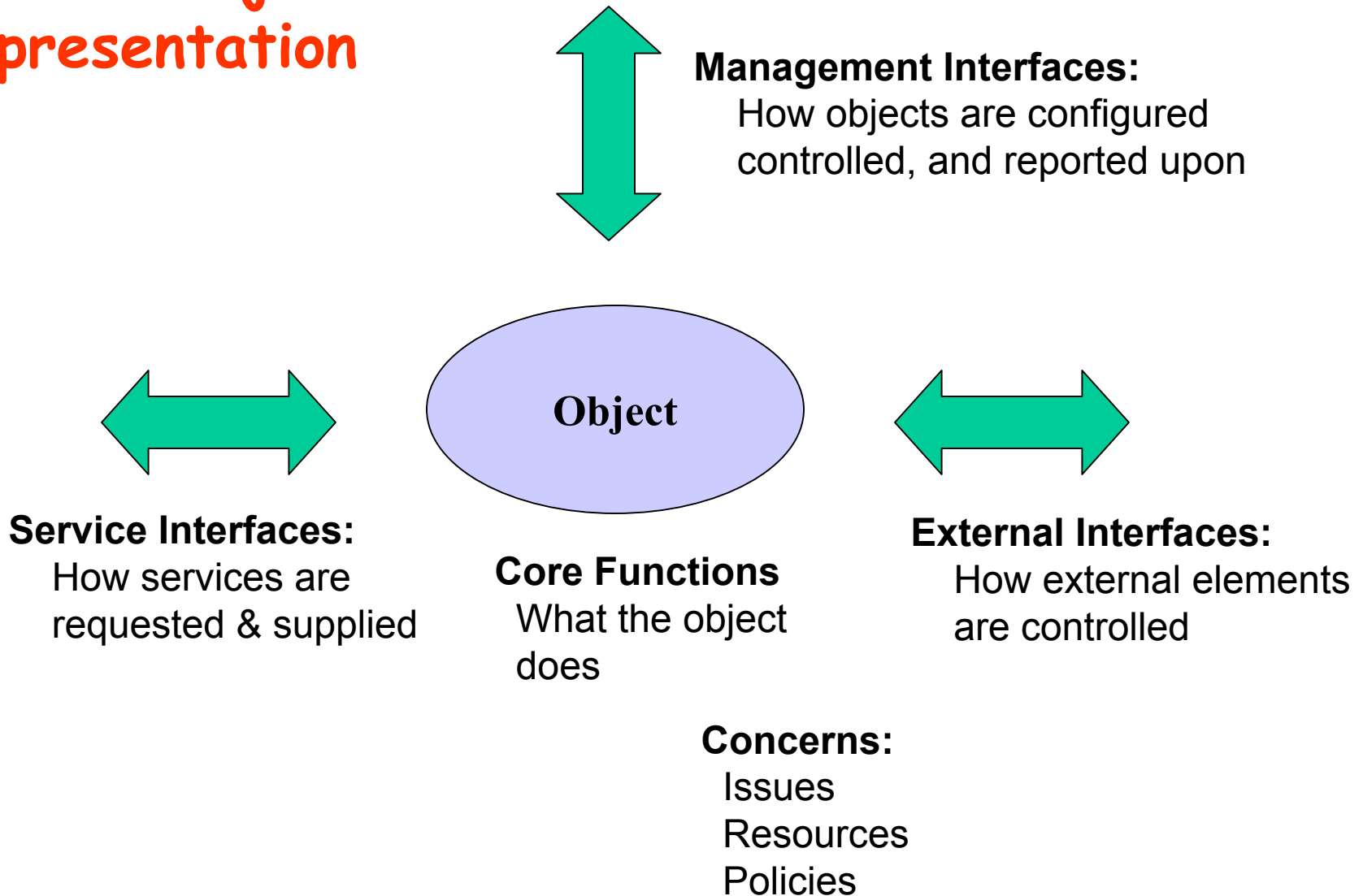
**Physical
Link**

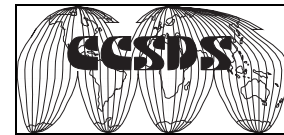


**Space Link
(rf or optical)**



Unified Object Representation

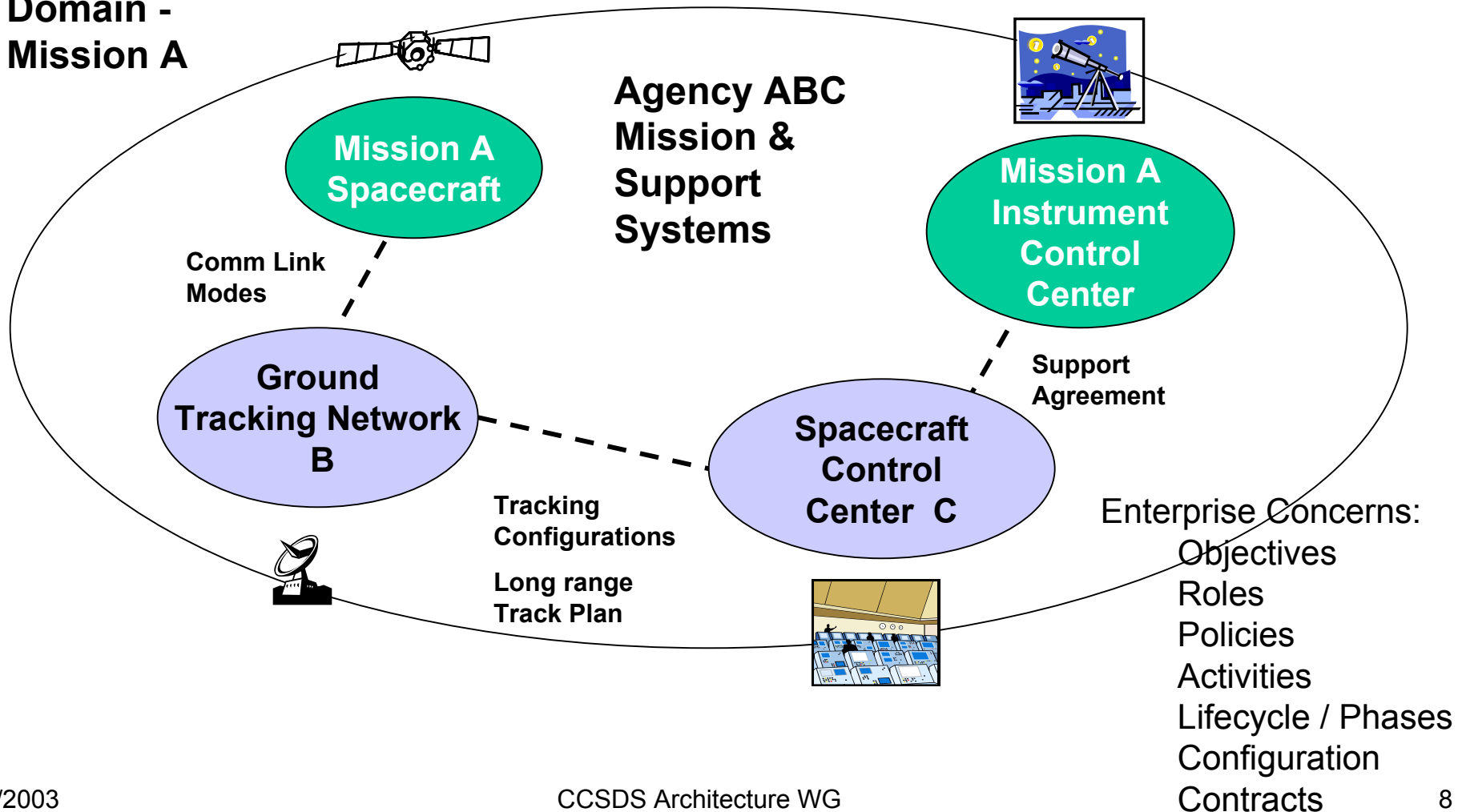




Enterprise View

Single Agency Mission Domain & Enterprise Objects Operations Planning Phase

**Operations
Domain -
Mission A**

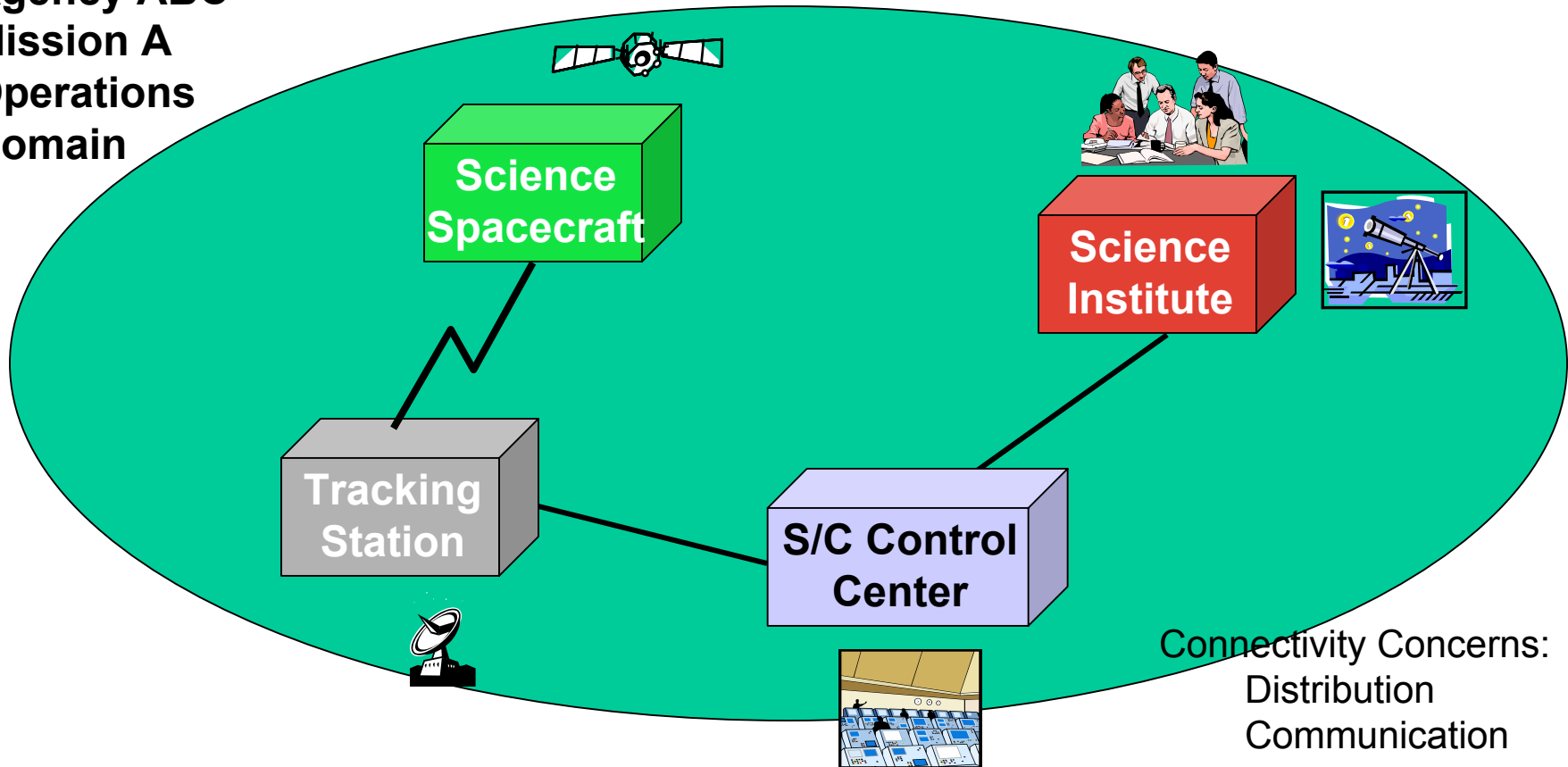




Connectivity View

Single Agency Mission Domain & Nodes

Agency ABC
Mission A
Operations
Domain

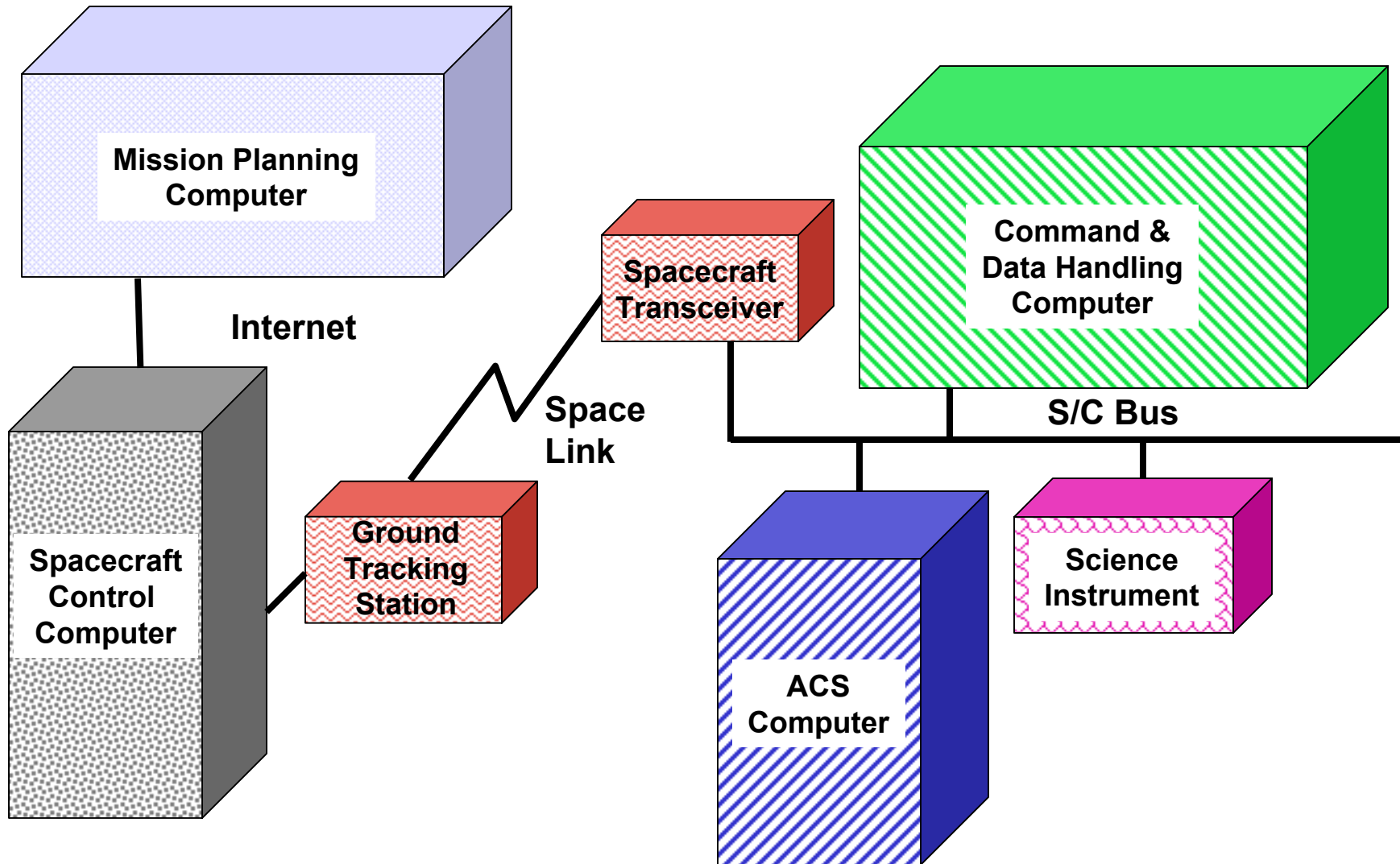
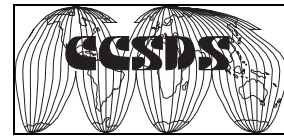


Connectivity Concerns:

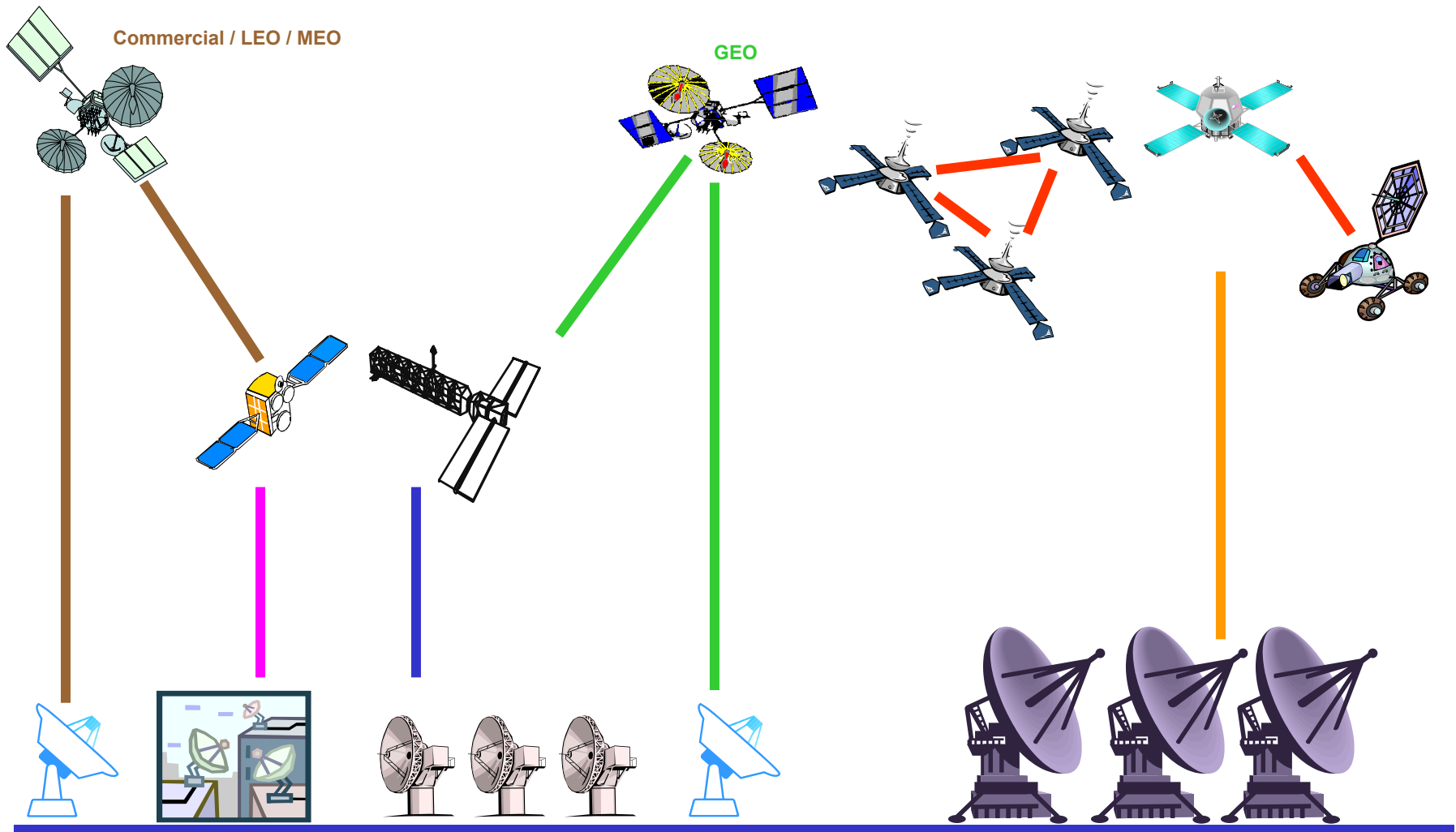
- Distribution
- Communication
- Physical Environment
- Behaviors
- Constraints
- Configuration



Connectivity View Nodes



Connector Properties: Types of Space Links

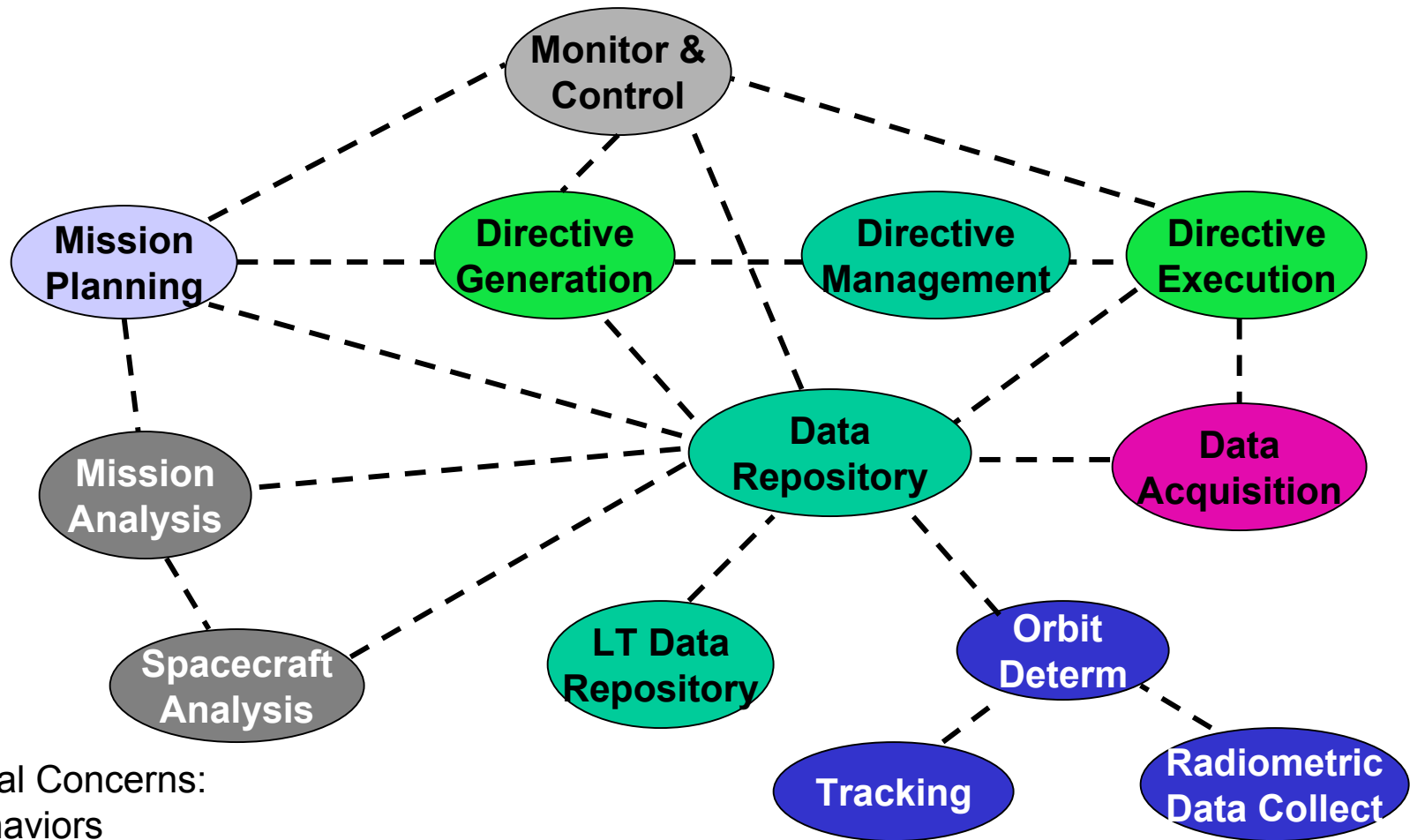


- | | | | |
|---|--------------------------------------|---|--------------------------------|
|  | Near-Earth, LEO Direct |  | Deep Space Direct (DSN, other) |
|  | Near-Earth, GEO Relay |  | In-Space Proximity/Relay |
|  | Near-Earth, Commercial LEO/MEO Relay | | |
|  | Near-Earth, Direct Broadcast | | |



Functional View

Example Functional Objects & Interactions



Functional Concerns:
Behaviors
Interactions
Interfaces

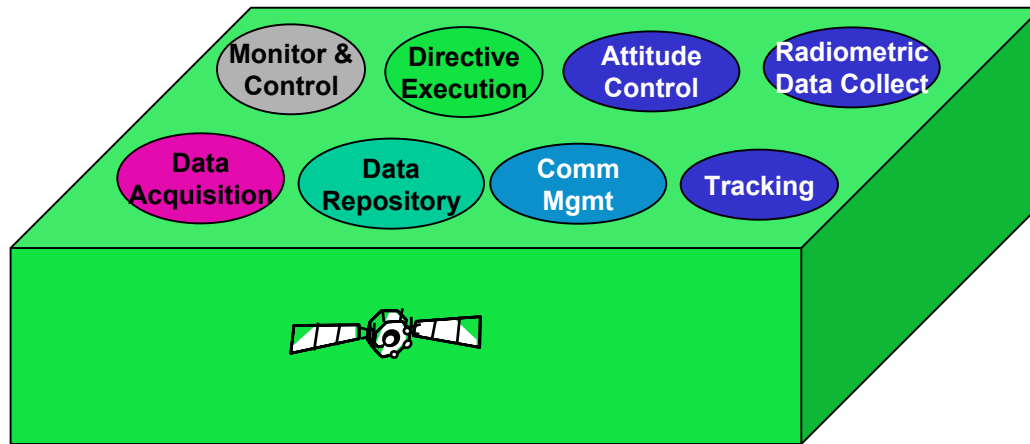


Connectivity View - Redux

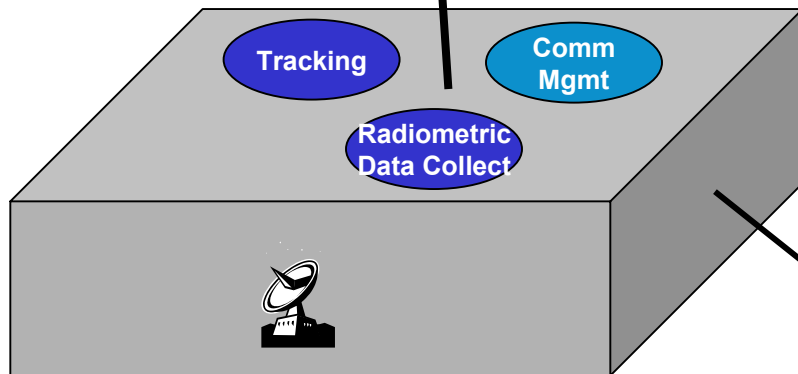
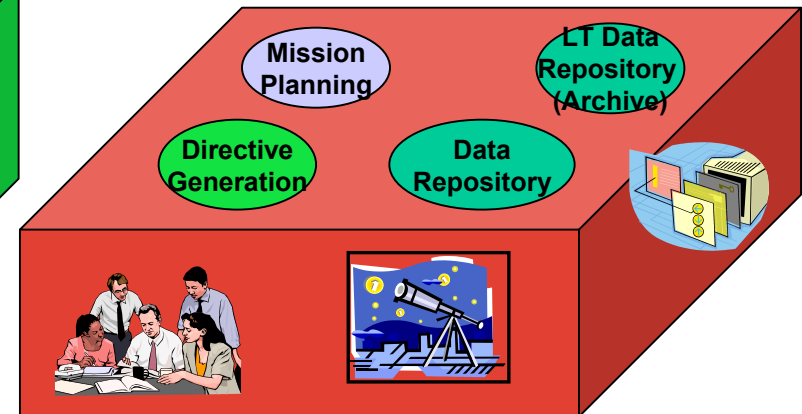
Mapping Functions to Nodes



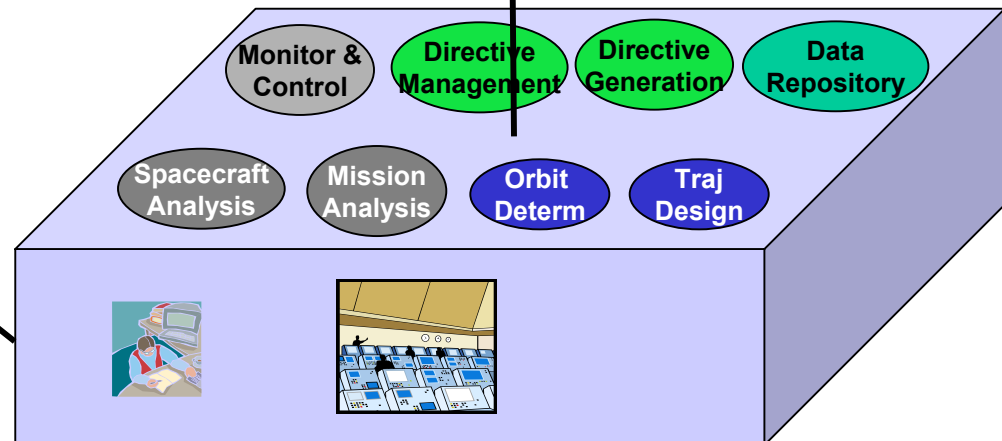
Science Spacecraft



Science Institute



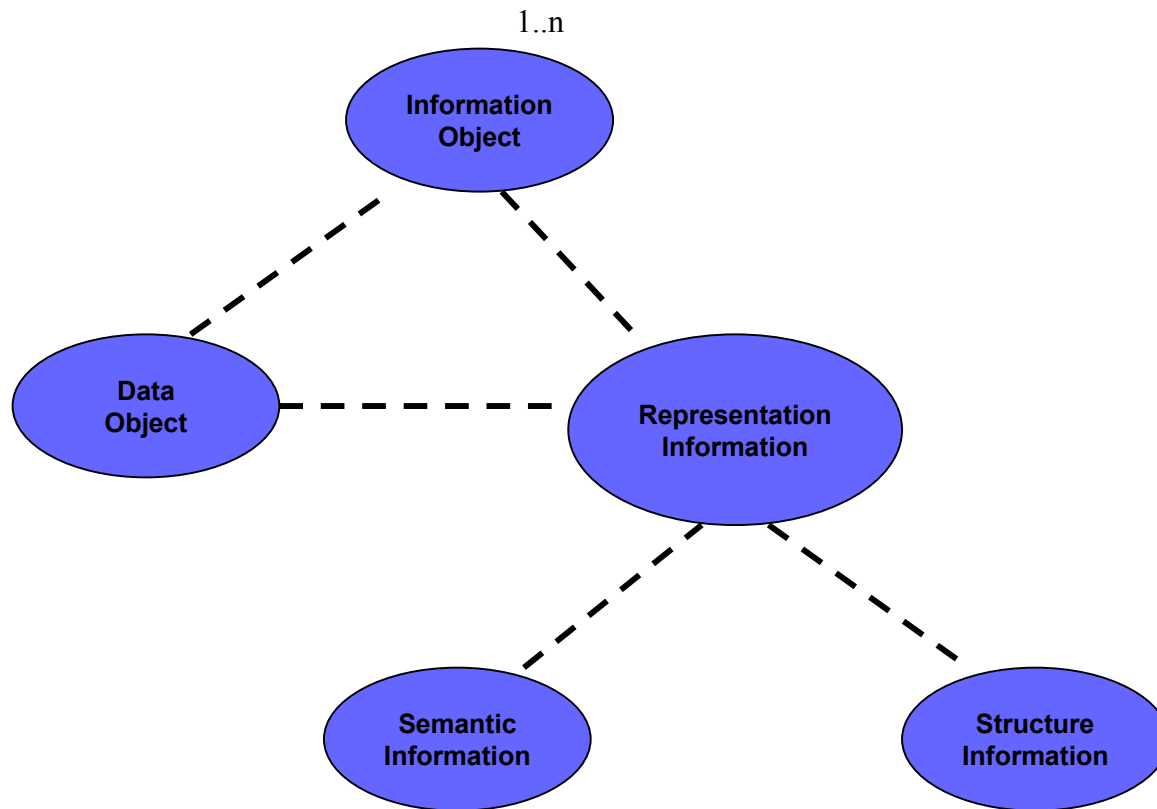
Tracking Station



S/C Control Center



Information Object Basic Relationships



Information Concerns:
Structure
Semantics
Relationships
Permanence
Rules



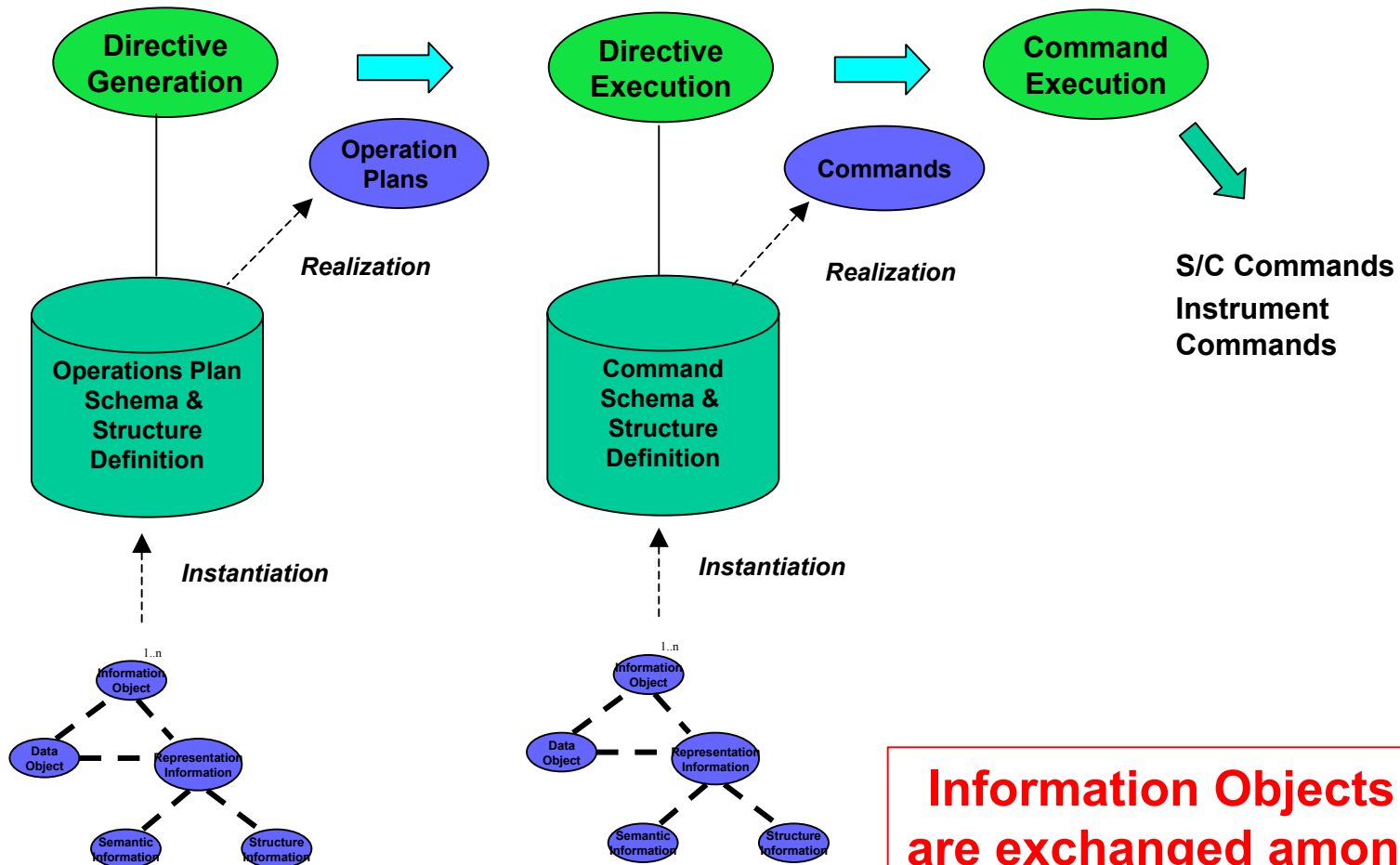
Information Objects Relationship to Functional View

S/C Event Plans
Observation
Plans



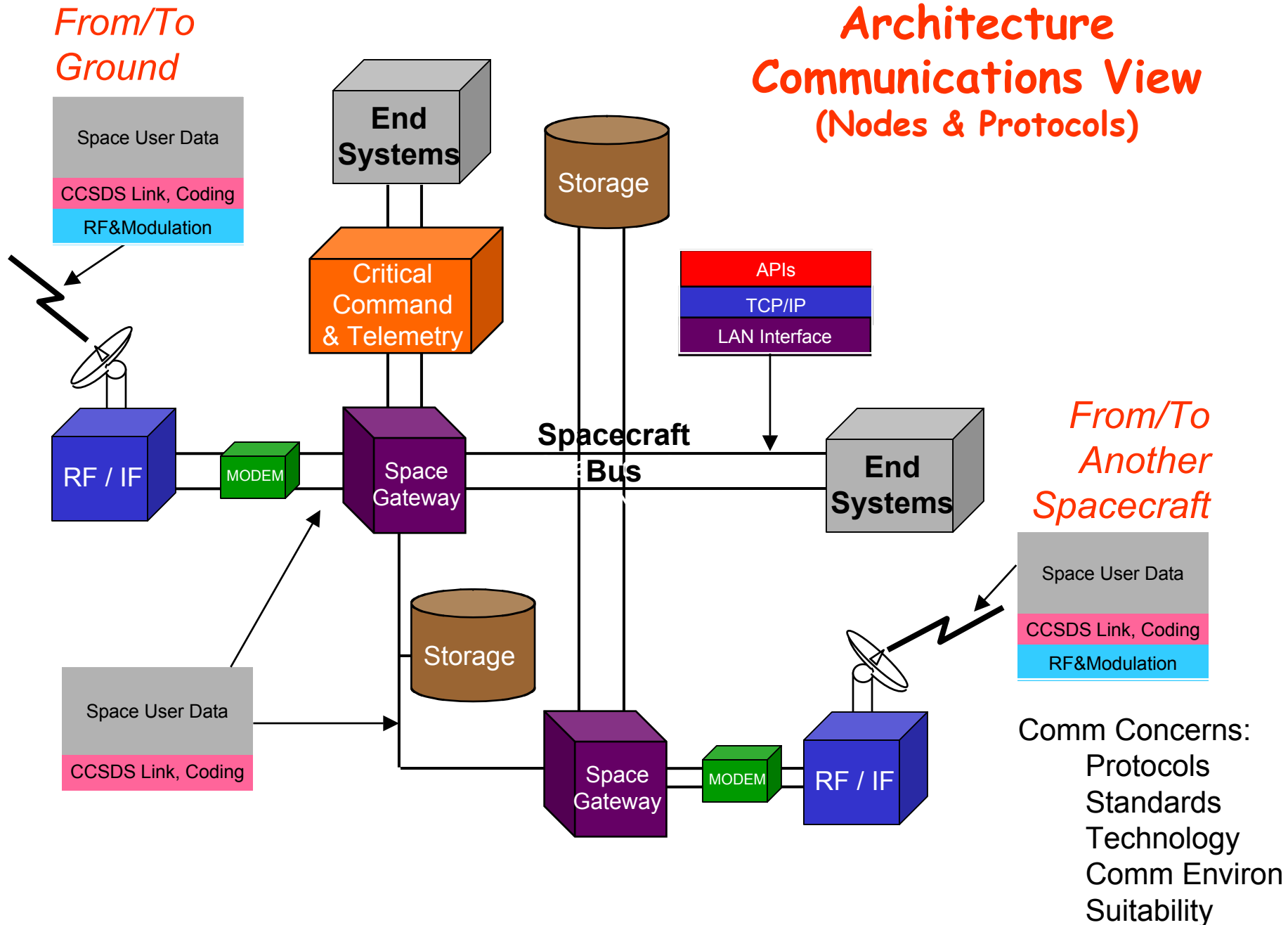
Actual Data
Objects

Data Models

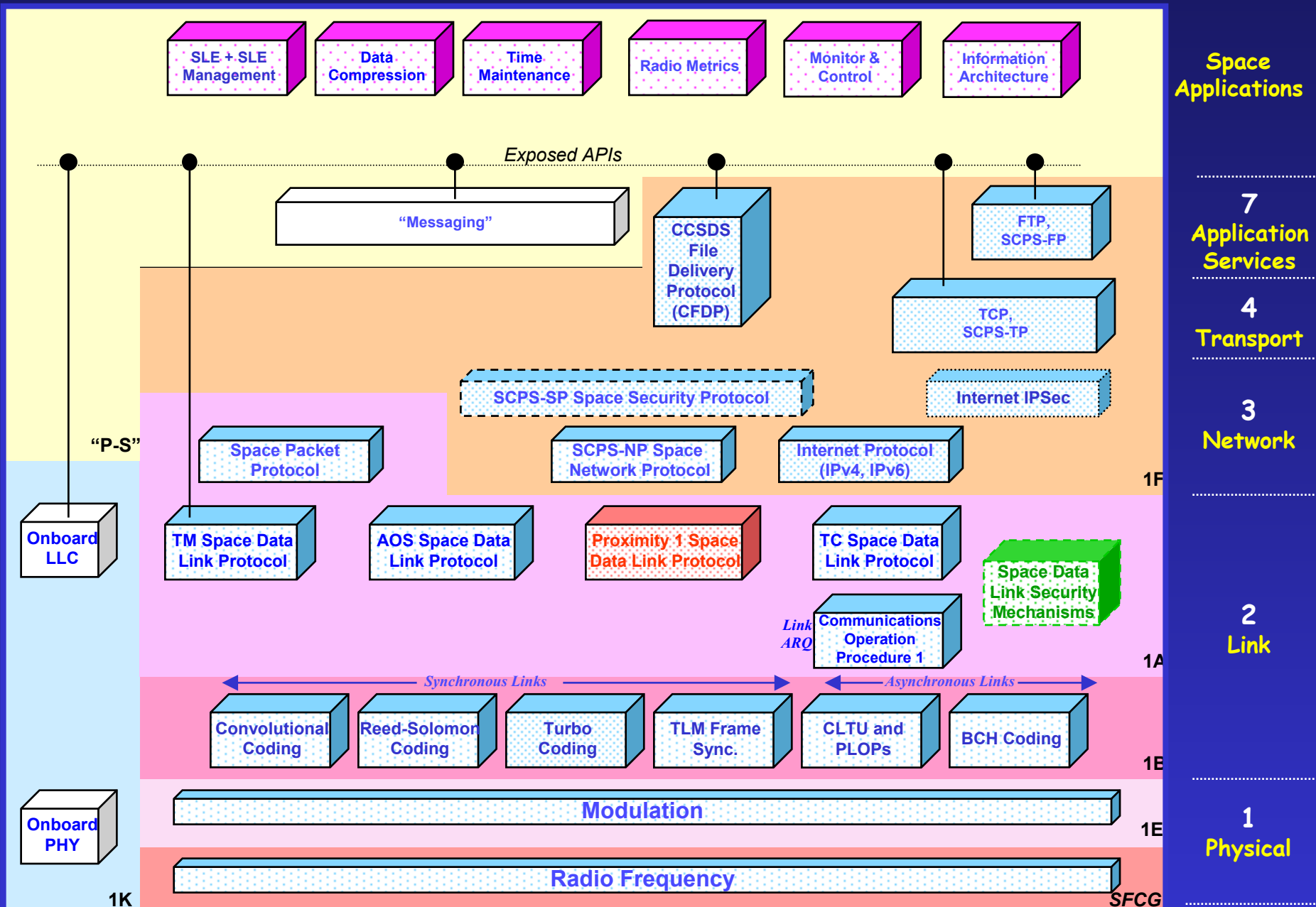


Abstract
Data Architecture
Meta-models

A Spacecraft Internal Architecture Communications View (Nodes & Protocols)



CCSDS Space Communications Standards



Space Applications

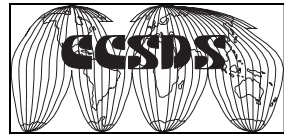
7
Application Services

4
Transport

3
Network

2
Link

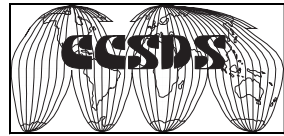
1
Physical



Architecture Working Group

Future Activities

- AWG will refine the conceptual model and define the Architect's Toolkit
 - Toolkit will support description of structure and behavior of space data system architectures
 - Toolkit will eventually permit modeling and simulation of active behavior of systems
- The AWG will evolve and maintain the toolkit in response to changing technologies and external requirements.



BACKUP SLIDES



Basic Layered Structure of RASDS Software Systems

