Space Project Mission Operations Control Architecture (SuperMOCA)

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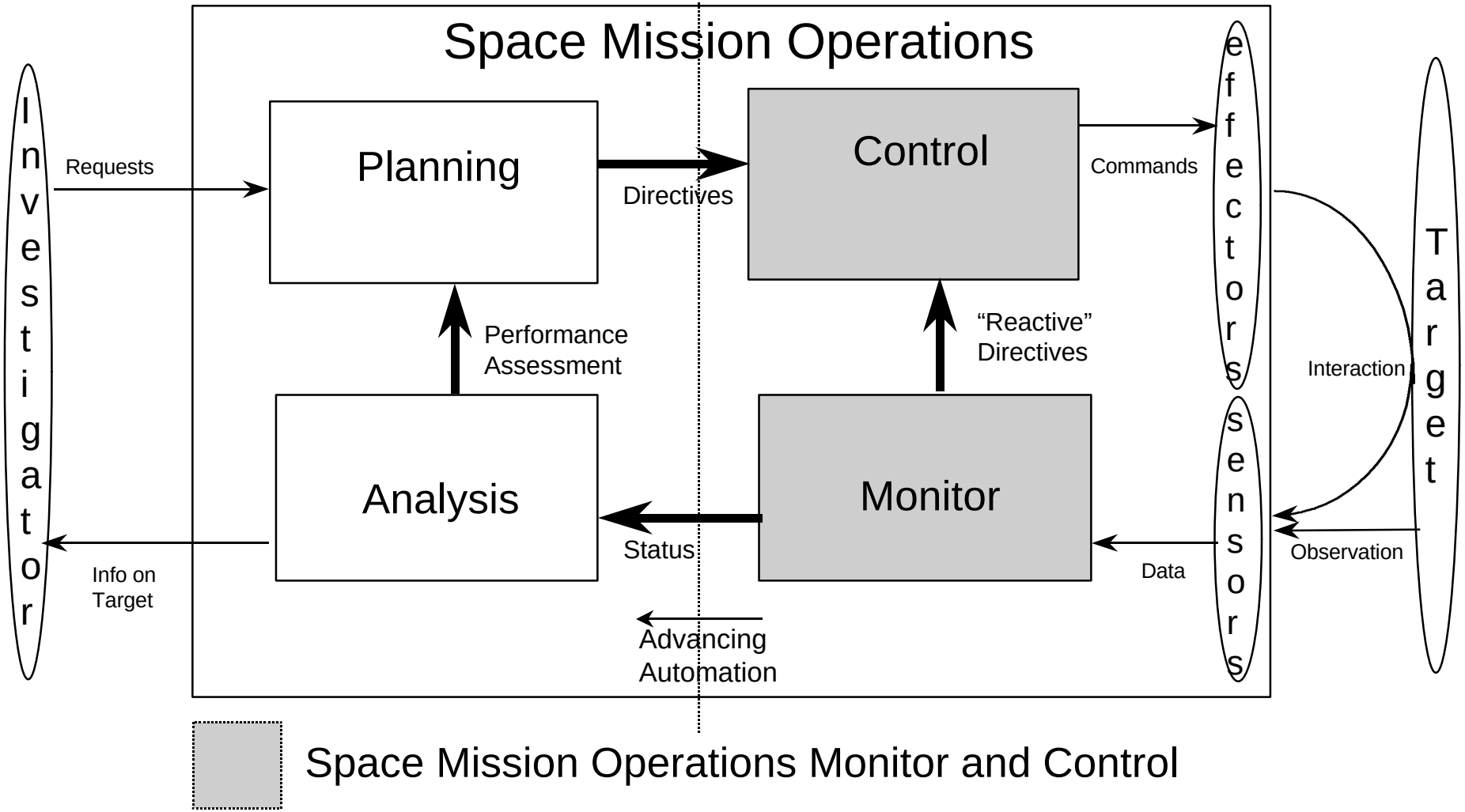
Presentation to Spacecraft Control Working Group # 20

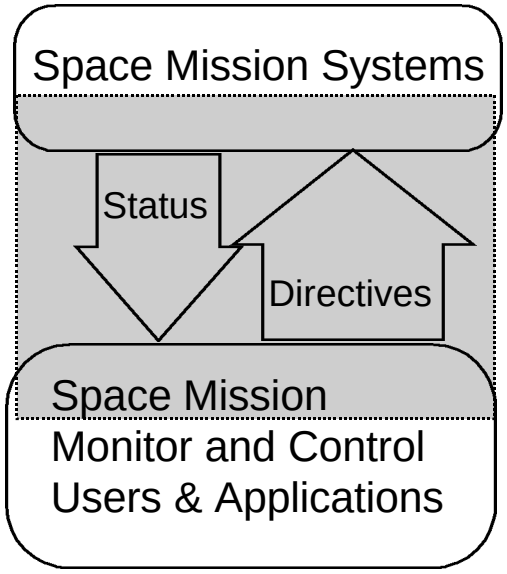
Context for Space Mission Operations Monitor and Control



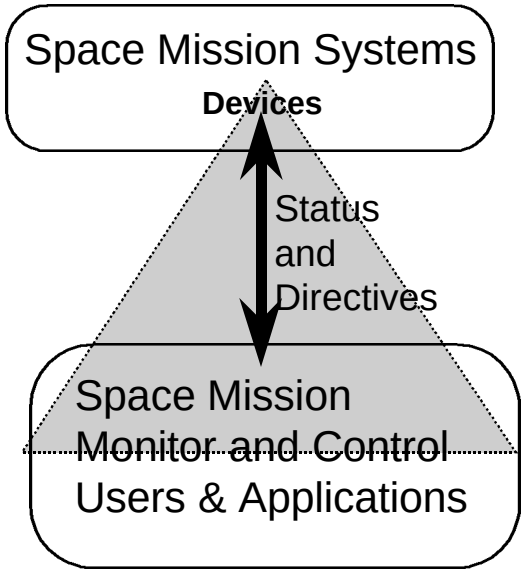
Scope of Architecture and Specifications

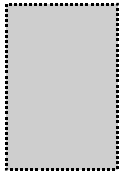
Note: There are many aspects to the architecture; only layering will be discussed today.

Architecture



Specifications





SuperMOCA Architecture addresses monitor and control dialogue between users and all components of Space Mission Systems

SuperMOCA Specifications only address monitor and control dialogue between users and devices of Space Mission Systems

What SuperMOCA Is

- An architecture for the monitor and control of mission resources used in space mission operations. These resources are:
  - ground terminals
  - launch complexes
  - launch vehicles
  - spacecraft
- A set of specifications that apply to the devices used in space mission operations and the products used to monitor and control those devices. These specifications:
  - are consistent with the above architecture
  - are open and supplier-independent

What Problem is SuperMOCA Attempting to Solve?

- The current monitor and control of the ground-based and spaceborne systems used in space mission operations is expensive
- The computer-based capabilities currently used to support the above process are expensive to:
  - Design and build
  - Integrate and test
  - Operate
  - Maintain and repair
- This current level of expenses for monitor and control will not be supportable by the operations budgets of future (e.g., 1999 and beyond)

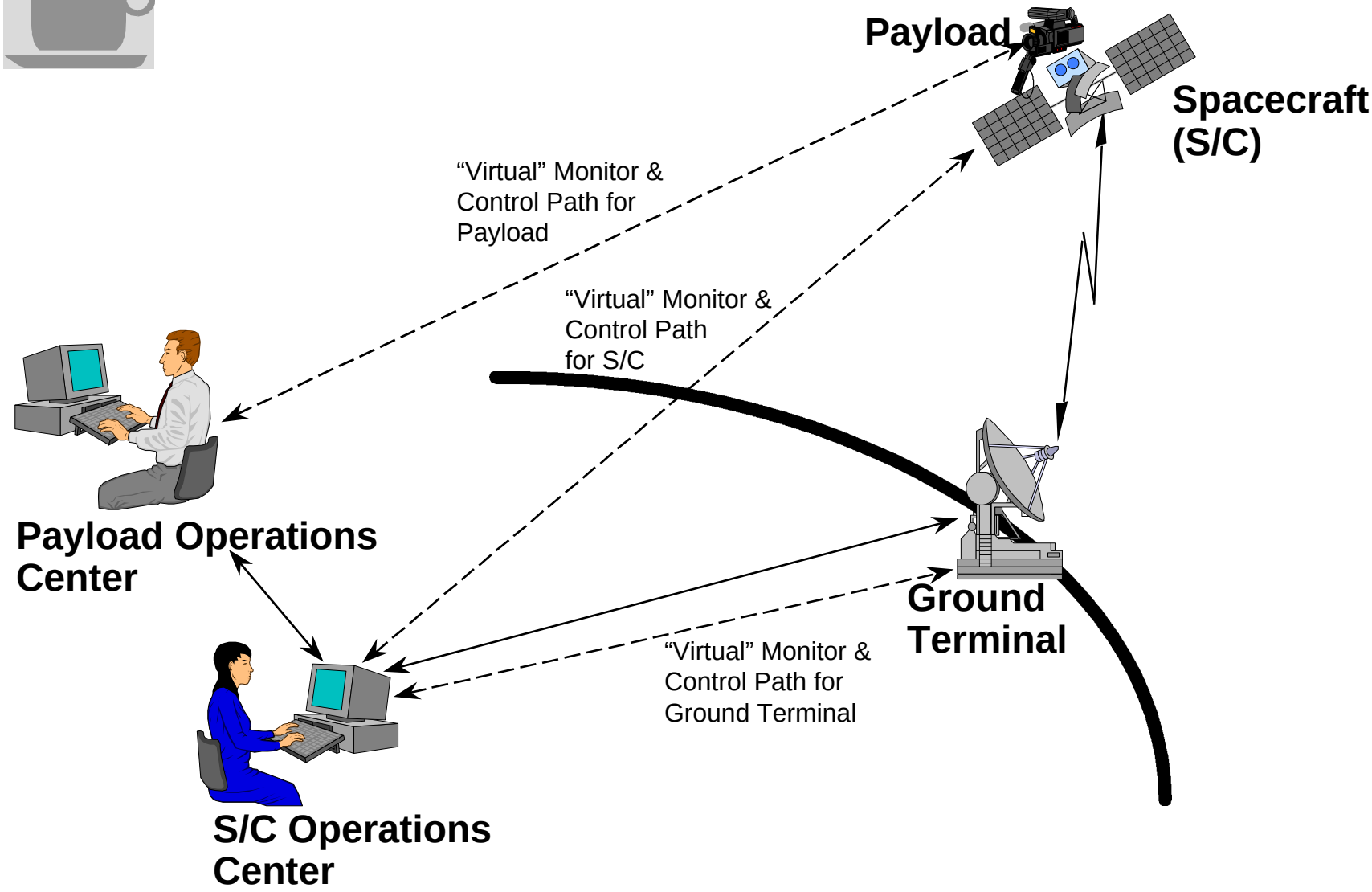
How does SuperMOCA Address the Problem?

- Takes advantage of the fact that commercial products are cheaper to acquire, operate, and maintain and are more reliable than custom, in-house products
  - High quality and reliability are achieved by continuous improvement based on feedback from large customer base
  - Development cost of products and upgrades to them are amortized over large customer base
- Facilitates the migration from current custom, in-house products to adopted or adapted commercial products to carry out its space missions through an architecture that is commonly understood by space mission operations customers and suppliers
- Promotes a lucrative space mission operations market through the use of “open” standards
  - Markets lead to commercial products
  - Standards-based commercial products already exist in markets that are similar to space mission applications (e.g., industrial process control applications)

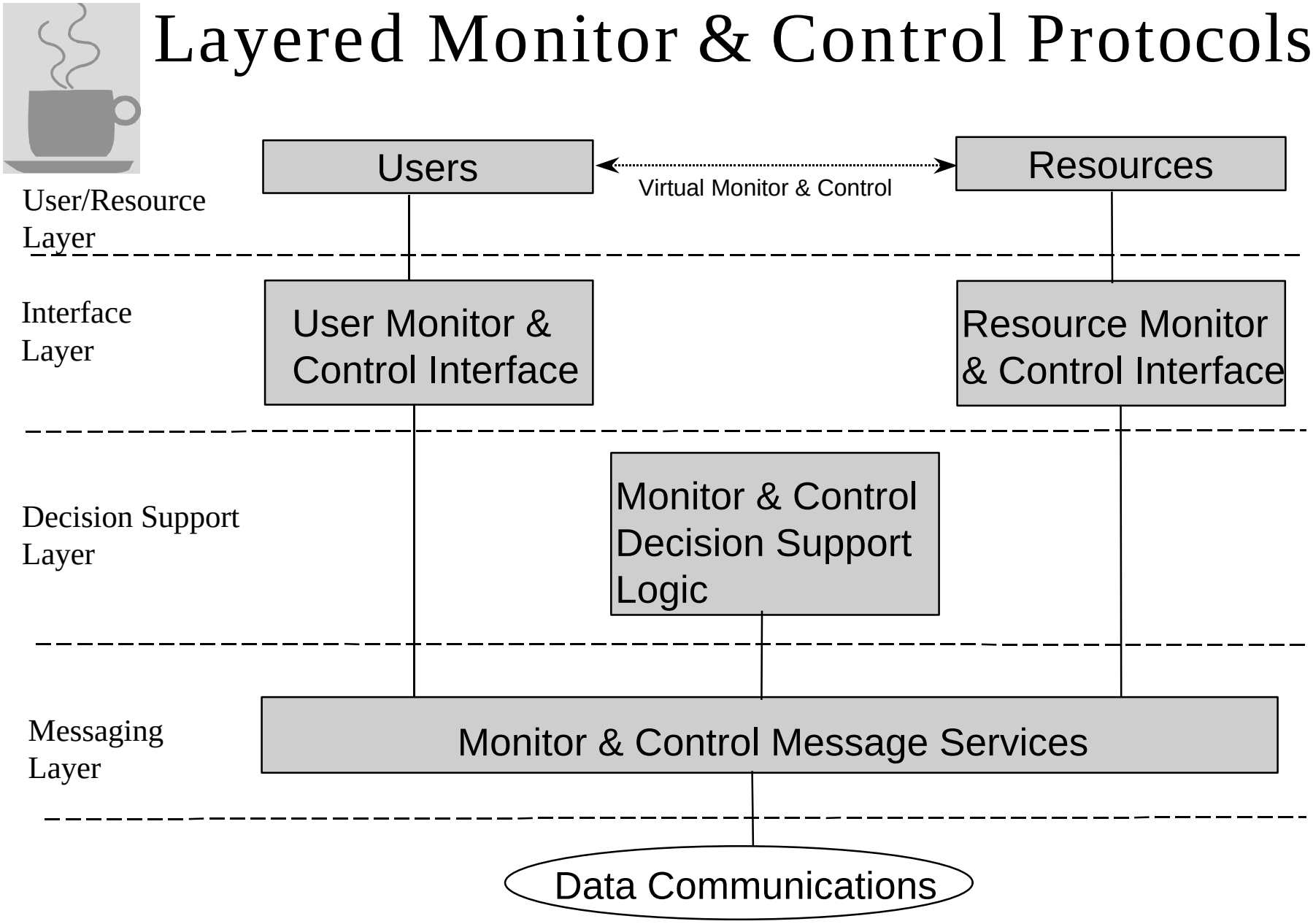
History Behind the Task

- Ideas for technologies, related standards and their applications in mission operations were developed in late 1980's as part of Space Station work
  - dropped after one of the station redesigns
- Ideas were kept alive and promulgated through an AIAA Spacecraft Control Working Group
- Goddard Space Flight Center Mission Operations Control Architecture (MOCA) Task developed an architecture and operations concept for their earth orbiting operations in the 1993 - 94 time frame
- Technologies, standards, architectures, and operations concepts were brought together by SuperMOCA in 1995 - 97

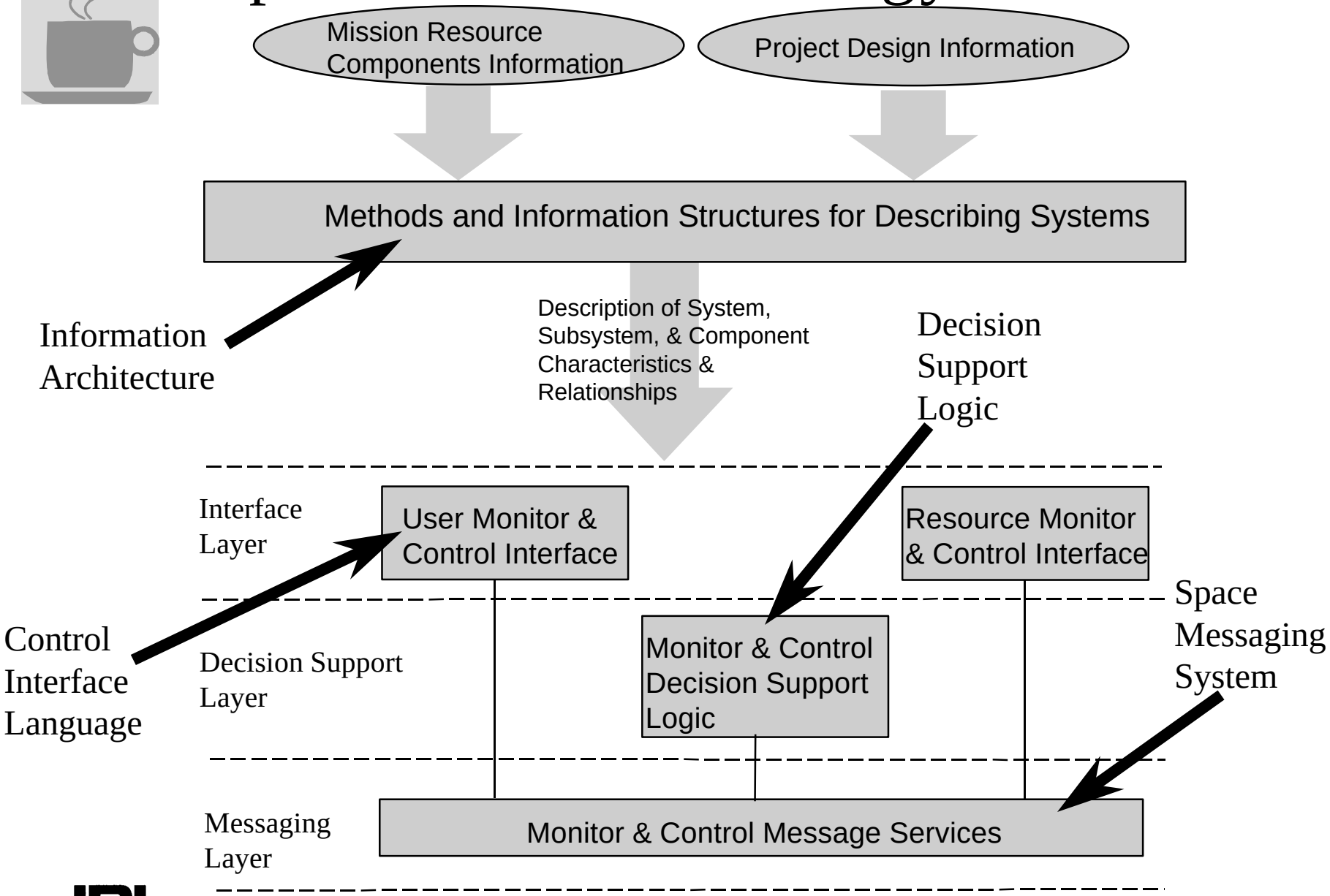
Mission Operations Monitor & Control



Layered Monitor & Control Protocols



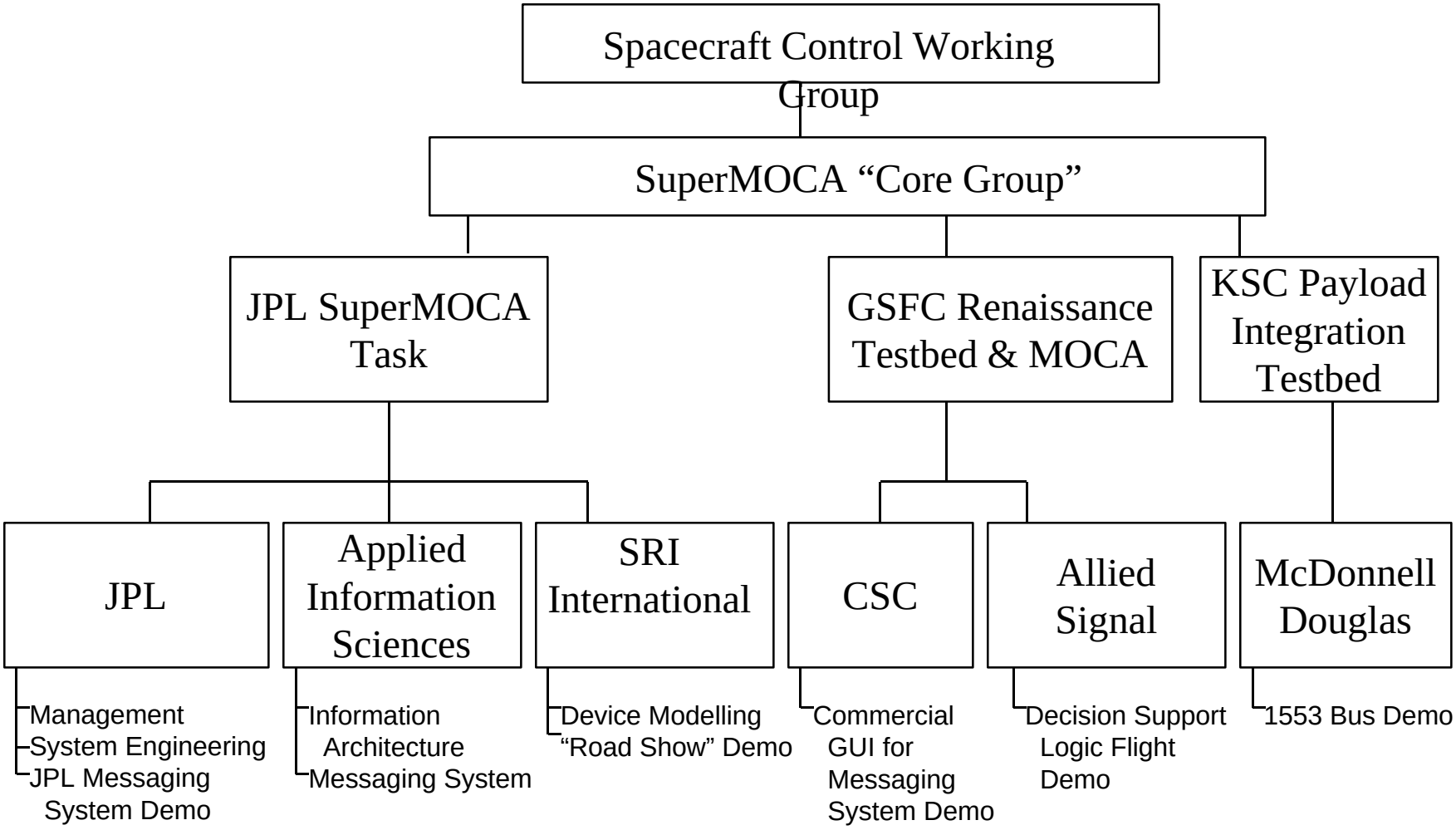
SuperMOCA Technology Areas



SuperMOCA Technology Areas

- Control Interface Language - a text-based, mission operator-oriented language allowing the mission operator to monitor and control activities of remote space mission resources
- Decision Support Logic - capabilities that preserve mission resource health by preventing any control commands from being executed that would damage the resource.
- Space Messaging System - provides messaging services that are the mechanisms used to communicate monitor and control information between a user and a device
- Information Architecture - the standardized structure into which the monitorable and controllable characteristics of concrete mission resources can be captured and used to configure the generic capabilities of SuperMOCA as mission-specific applications.

Organization for FY 97 Work



Demonstration Systems

- JPL Messaging System Demo
  - End-to-end monitor and control messaging system demo with simulated spacecraft camera and attitude control
  - End-to-end monitor messaging system demo with ground tracking station
- GSFC Renaissance Testbed - commercial GUI product integrates with messaging system for operator monitor and control
  - to be linked to JPL Messaging System Demo
- Device Road Show - monitor and control messaging system (over TCP / IP and Fieldbus) with commercial GUI operator interface, camera, and GPS receiver
  - includes device descriptions
- KSC 1553 Testbed - messaging system over space vehicle 1553 bus

SuperMOCA Homepage

- You can find it at:
  http://champwww.jpl.nasa.gov/supermoca

- You can access:
  - News & Announcements
  - Papers
  - Documents
  - Explanation of Demos
  - Points of Contact
  - Status Reports
  - Links to Related Home Pages

Roadmap for Rest of the Agenda

- SuperMOCA Technologies Discussed Today
  - Space Messaging System - Randy Heuser, JPL
  - Device Modeling and Descriptions - Elin Klaseen, SRI International
  - Structures for Descriptive Information - Lee Neitzel, Applied Information Sciences
- SuperMOCA Demonstration Systems
  - Road Show Demonstration - Elin Klaseen
  - JPL Demonstration - Carlos Carrion, JPL
  - KSC Testbed - Velda Musgrove, McDonnell Douglas
- What do you think we should do next? - All