



Architecture Based Design Applied to a Remote Sensing Satellite Planner

David Kaslow
Lockheed Martin M&DS

Architecture Based Design



- **Architecture Based Design (ABD™) process**
 - Mechanism and repositories for evolving and documenting an architecture and design
 - Provides for depiction, communication and validation of an architecture and design
- **ABD view is:**
 - Description from one cohesive aspect of what a system does and how it is put together
 - Depicted by a model
 - Related by to other views by shared information and data

Government's desire for requirement 'thin-specs' increases need to communicate architecture and design

Architecture Based Design Views



- **Mission Application**
 - Hierarchical depiction of the executing elements of the system & connectivity through message traffic and data structures
- **Mission Scenario**
 - Hierarchical depiction of the scenarios as a sequence of events and actions taken by mission applications to satisfy a system function
- **Data**
 - All persistent data structures and messages
- **User**
 - Operators and end-users interacting with the system

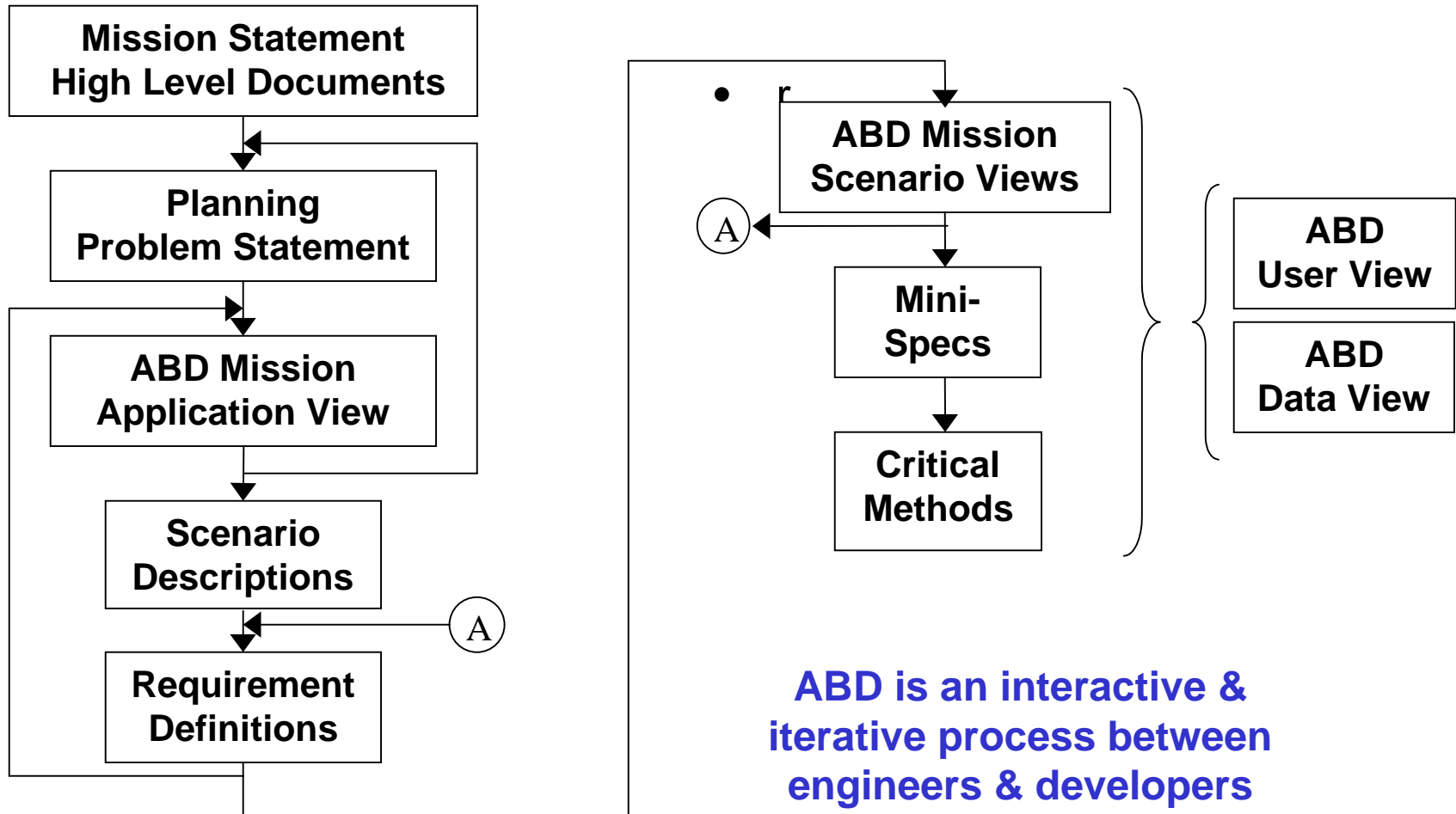
ABD is a design-centric process versus the historical requirements-centric process

Architecture Based Design Views



- **Hardware**
 - Processing, communication, data server and special purpose computing elements
 - **Infrastructure**
 - Layers of functionality between the mission applications and the hardware
 - **State/Mode**
 - System conditions and mission conditions of operations
 - **Object**
 - Depicts construction of the system in terms of objects and classes
 - **Facility**
 - Rooms and supporting systems needed for deployment
- Scenario, hardware and infrastructure views support performance validation and system verification.**

ABD Process Flow



Mission Planner Rqts for a Remote Sensing Satellite



**Generate 7 day plan in 6 hours
Update 3 hour portion in 5 min.**

**Generate collection activities
based on:**

**Mission objectives
Collect opportunities
Collector characteristics
Collection strategies**

Generate:

**Collection support
Resource management
Asset maintenance
activities**

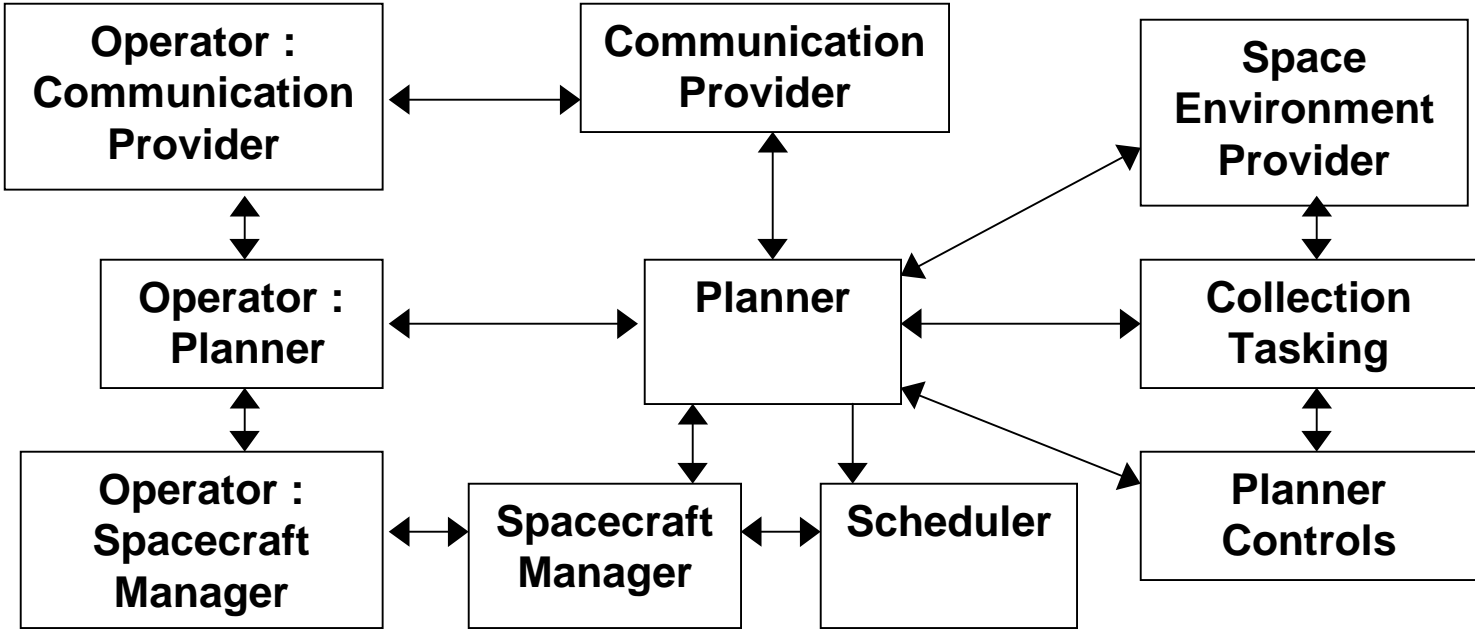
**Place activities on a plan
Allocate resources & assign
assets**

Based on:

- Mission objectives**
- Collector characteristics**
- Collection spacecraft capabilities, constraints, & models**

**ABD was applied on an
IR&D project - preliminary
architecture and design**

Mission Application View

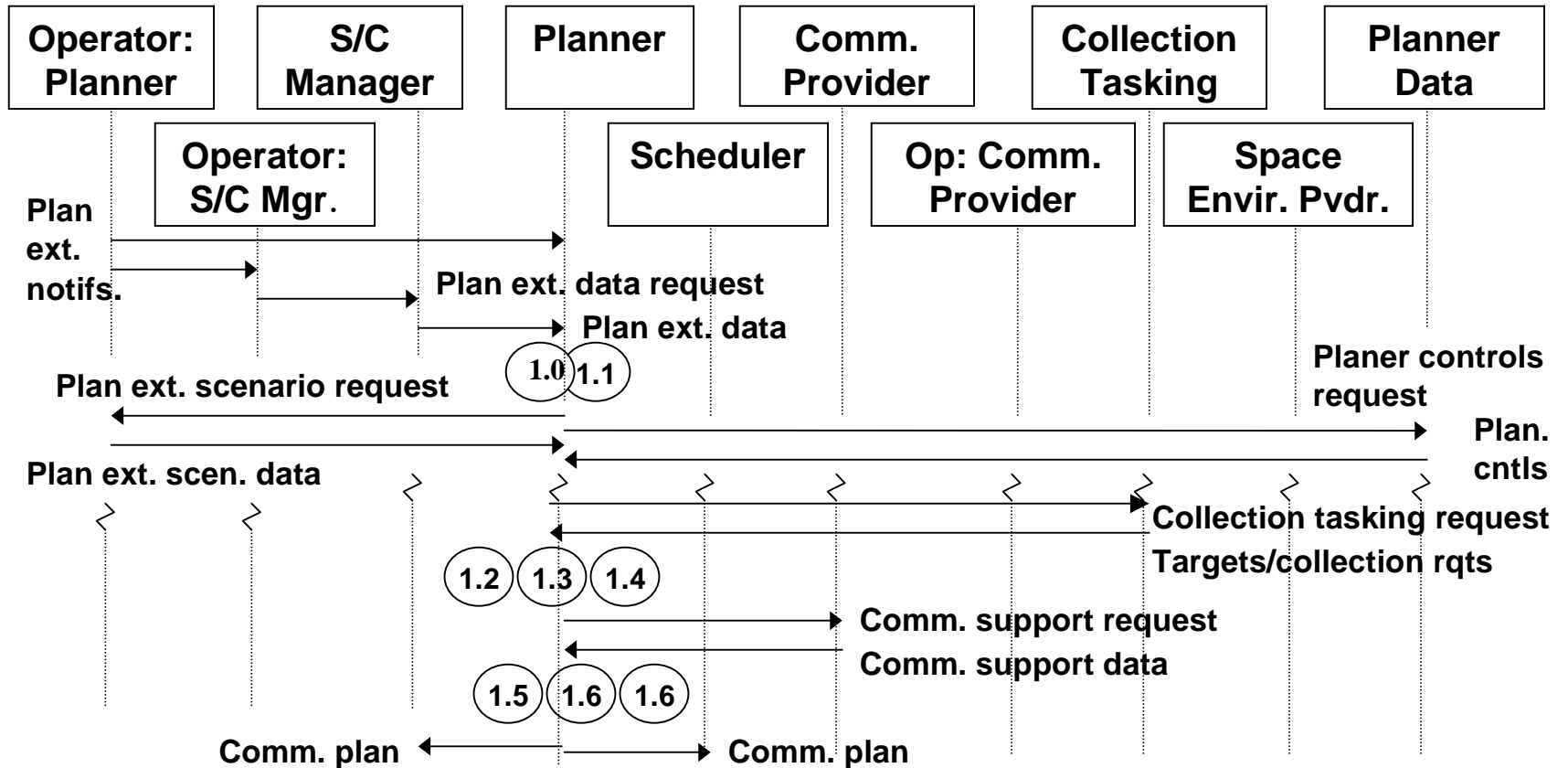


Descriptions of elements and data flow attach to the view.

The Mission Application View provides the relationship of the Planner to the other elements.

Mission Scenario View

Plan Extension



Scenarios provide design detail for specific system capabilities



Mini-Specs & Critical Methods

Plan Initialization Critical Method

Plan Extension Critical Method

Prologue :

The Planner Op. determines that a new day is to be added ...

1.0 Support for Operator. Ext. Definition

Requirements: ..

Inputs: ..

Processing: ..

Outputs: ...

1.1 Initialize

1.2 Generate Summarized Tasking

1.3 Generate Value Profile

1.4 Construct Candidate Activity Plan

1.5 Construct Comm. Plan

1.6 Construct Activity Plan

1.7 Provide Activity and Comm. Plans

Replan Critical Method

Plan Update Critical Method

Prologue

...

3.0 Support for Operator Update Definition

3.1 Initialize

3.2 Determine if Plan Needs Update Due to Changes in Tasking

3.3 Update Communication Plan

Requirements: ...

Inputs: ...

Processing: ...

Construct Candidate Activity Plan (1.4)

Construct Candidate Comm. Plan (1.5)

Construct Activity Plan (1.6)

Provide Activity and Comm. Plans (1.7)

Outputs: ...

Observations



- **Reviews and consistency checks**
 - **Facilitated by ABD since views are matured and iterated in unison**
 - **Focus is on data needed for design and implementation**
 - **Best carried out by a small team within the project**
 - **External review team may need tutoring in ABD and tools**
 - **Or need supplementary hard copy material**
- **First time implementation of ABD - separate efforts to:**
 - **Establish initial architecture and design - text based documents and diagrams**
 - **Evaluate and select requirements and design tool sets**
 - **Then transfer initial design to the tool set**

Conclusions



- **Application of ABD does not magically result in an architecture and design. Still needs:**
 - **A source and good understanding of concepts and requirements**
 - **Experienced and knowledgeable engineers and developers**
- **ABD strength is in:**
 - **Breadth of the views**
 - **Relationships and consistency checks between the views**