SPO Lessons Learned From Flight SW Architecture

Major Mark Tuttle

Air Force Space and Missile Center

310-363-6977

markd.tuttle@losangeles.af.mil

From SPO's Perspective Architecture Development is a Comprehensive Activity

Objective:

- Provide Information Needed for **Efficient** Development of Processor Subsystems & Components
- Remove 80% of HW/SW Development **Risk**

Work Products

Partitioning:	Validation:	Execution:
• HW Block Diagrams	• Algorithm Simulation	• Integration Plan
• UML Model(s)	• Discrete Event Sim	• WBS – Org Chart(s)
• Interfaces (ICD, IRS)	• Risk Assessment	• Schedule - Cost
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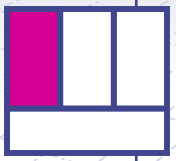
Other Items – Infrastructure:

Proactive Requirement Acquisition Through Requirement Capture Plan

- Late Requirements Can Degrade Quality and Productivity in the Architecture Phase
- Late Requirements Can Add Risk of Significant Rework to Architecture and Design Resulting in Expected Schedule Slippage
- Poor Requirements Can Degrade Quality of Test Program



Demanding a **Plan** for How Requirements Are **Discovered** and Requirements Are **Validated** is a Mechanism Usable by SPO to Help Ensure That Architecture is Based on a Quality Understanding of **Needs**!

Requirement Capture is a Proactive Contact Sport

Risk's Relationship to Architecture Not Commonly Considered

Development Quality

Optimization
Proactive - Risk
Process
Hacking

Rule of Thumb:

Earlier an Issue is Worked the Less it Impacts Cost and Schedule

A Good Risk Management Plan **Protects** Schedule

Propose an Architecture

Assess its Risk Areas – Evaluate Total Risk

Rearchitecture to Attack Risk Areas

Architecture Must Support System Lifetimes 30 Year or Longer

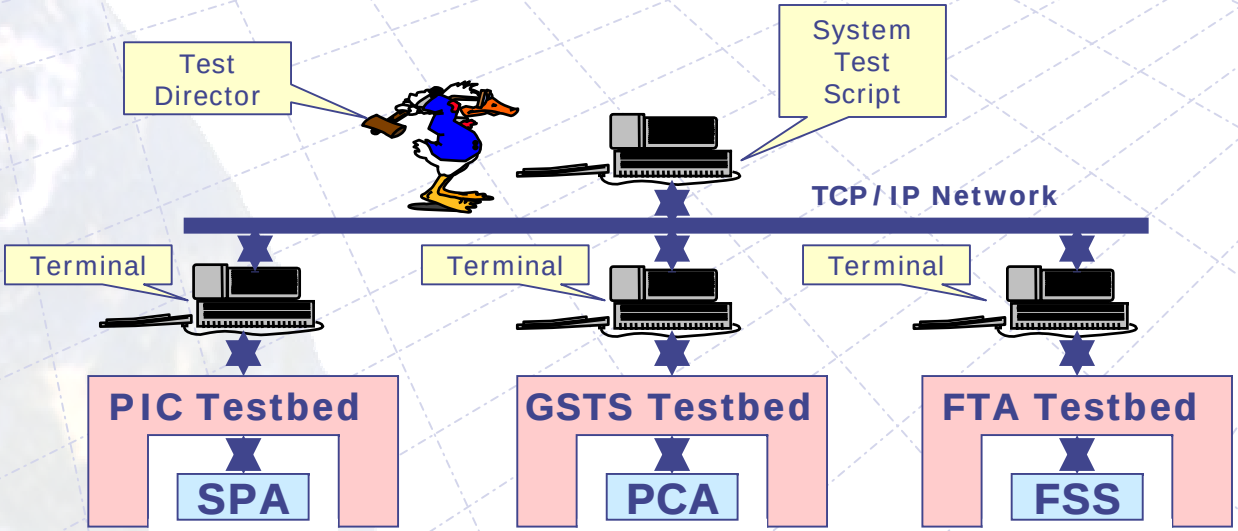
- The Cost of Large Complex Systems is so Large that They Can Only be **Justified** by **Amortizing** Over a Long Operational Life (30+ Years).
- HW Will Become Obsolete and/or Non-Supportable. New More Cost Effective HW Will be Available
- Maintenance Can be Much Larger Cost Than Development

- Evolution and Growth Considerations Need to be Included Within the Architectural Design Activity
- Technology Insertion Plan Documents Architectural Approach

Architecture Needs to Consider Impacts to All Phases of an Acquisition

Test Equipment and Tools Must be Considered as Part of the Architecture

- Not Uncommon for Test Equipment to Be Larger Than System Being Developed
- High Complexity to Support Distributed Testing and Development
- Goal is to Support **Continuous Integration** of SW Subsystems



Integration and Test Should be Considered as Part of the Architecture

Cost Modeling - Powerful Tool for Validating the Architecture's Executablity

- Large Complex SW Systems Typically Partition into Multiple Subsystems Each Executed by Different Development Teams.
- Coordinating the Development Timing Between Teams Critical for Productivity and Continuous Integration

- **During Planning Phase**: Cost Modeling is the Tool that Supports Schedule Analysis Needed for Multiple Team Timing Coordination.
- **During Execution Phase**: Periodic Replanning Necessary to Maintain Multiple Team Coordinated Development Efficiency

The Operational Parameter Database is Part of the Architectural Development

- **Early** Work Needed to Derive Maximum Benefit From Investment in DB - Part of Integration Planning
- Impacts Integration – Integration Plan Needs to Identify How DB Will Be Utilized

- DB Design (Architecture Support) Has Three Components
  - Processes to Acquire and Enter Parameters – Error Rates
  - Schema, Metadata, Change Management – Storage Design
  - Design of the Processes That Will Utilize And/or Change DB Items
- Change Notification

Included in Integration Plan

Metrics – What You Can't Measure You Can't Manage

- Metrics Provide a **Tool** for Management Communication.
- The 5 to 7 Rule **Must** be Employed (KISS – Focused)
- EV Accounts for 2 Entities Leaving **Only** 3 to 5 Available Metrics

- Architecture Activity Needs to Select the 3 to 5 Metrics
- Customize to Fit Program Specifics
- Change Metrics as Development Progresses
- If a Metric Doesn't Support SPO Decisions Don't Use It

Temperature Charts Can be Used by SPO to Communicate Architecture Status

SPO Assessment

Partitioning:

- HW Block Diagrams - Requirements
- UML Models - Requirements
- HW/SW Allocation
- HW Interconnects
- SW Interconnects

Validation:

- Algorithm Performance Simulation
- Critical Functional Threads
- Discrete Event Simulation
- Risk Assessment

Execution:

- Integration/Test Plan
- Performing Orgs
- Schedule
- Cost Knowledge

Summary – Final Thoughts

- SW Enables Higher Levels of Complexity – Architecture Breaks It Down into **Manageable** Components. Major Reduction in Development Risk
- Current Management From HW Centric World – Success Seems to Relate to Ability to **Educate** Management. Architecture can be used as a Tool to Educate.
- Quality First Upfront – Resist Management Schedule Pressure. Architecture Helps Understand Scope of Job.