The System Architecture Tradeoff Analysis Method®
(SySATAM®)

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The System ATAM is a method that helps stakeholders ask the right questions to discover potentially problematic architectural decisions (risks).

Discovered risks can then be made the focus of mitigation activities—for examples:
- changing architecture
- further analysis
- extending prototyping.

Tradeoffs can be explicitly identified and documented
- Tradeoffs made already
- Upcoming tradeoffs
Purpose of the System ATAM – 2

The purpose is **NOT** to provide precise analyses. . . the purpose **IS** to discover risks created by architectural decisions.

We want to find *trends*: correlations between architectural decisions and predictions of system properties.
Presentation Outline

What is an ATAM?

**Similarities** and **Differences** between ATAM and System ATAM

Highlights of Differences

Experiences and results
Phase 2 – Stakeholders

The following is a partial list of potential stakeholders:

software architect  developer
maintainer          integrator
tester              standards expert
performance expert  reliability/availability expert
security expert     safety expert
project manager     product line manager
customer (buyers, acquirers)  end user
application builder  mission specialist/planner
system administrator  network administrator
service representative  domain representative
system architect    device H/W expert
What is an ATAM -1

Process

- Actors
  - sponsor (Program management) and architects (6)
  - Lead Evaluator – has lead evaluator training
  - Evaluation team (4) - all have taken ATAM training courses
  - Stakeholders (20)

Schedule

- Phase 0:
  - Partnership and Preparation
  - Telecon
- Phase 1:
  - Architecture Centric Evaluation
  - 1.5 - 2 days each for conducted at customer site
- Phase 2:
  - Stakeholder Centric Evaluation
- Phase 3:
  - Report
  - Few Weeks phone, email
What is an ATAM -2

Technical Basis

• Business and Mission Drivers
  • New threats, capabilities, technology, automation, legacy
  • Scalability, schedules, budgets, joint, coalition, FMS
• There is a documented software architecture (SAD, UML Diagrams)
  • Multiple viewpoints, views, framework
• Quality attributes are the architecture drivers
  • Performance : avoid too slow, too late, bottlenecks
  • Availability : avoid fragility due to failures
  • Security : avoid spoofing, unauthorized access
  • Usability : avoid operator overload
  • Sustainability : avoid hard to update functions and new COTS
  • Interoperability, scalability, extensibility etc
What is an ATAM -3

Technical Basis (Continued)

- Scenarios represent the quality attributes
  - Stimulus, environment, response
  - “A tank commander’s COP shows an identified threat, he has authorization to engage the threat, when it comes within his range he conducts a successful engagement and reports it via the COP”.
  - Elicited in a meeting with stakeholders (or from previous QAW)

- Architectural approaches can be identified and analyzed
  - Passive and active redundancy, publish/subscribe, client/server, reliable protocol

- Architectural Decisions
  - Provide a tool to assist with mapping spectrum allocation to force structure
  - Break down a system into components for transportation
  - Use a proxy-based pub/sub
What is an ATAM - 4

Technical Basis (Continued)

- Walking scenarios through the software architecture, and having the ATAM team and stakeholders probe the quality attributes exposes architectural risks and maps each risk to business drivers
- These risks can be “rolled up” into risk themes mapped to business drivers

Results- content

- A number of scenarios (10 to 15) are analyzed and documented
- Table of risks, trade-offs, programmatic issues, atta-boys
- Rollup of the risks into risk themes

Results- documents

- Summary Outbriefing after Stakeholder Phase (1 hour)
- Report (50, 60 pages) of findings with an Executive Summary (2 pages)
Commonalities and Differences -1

The System ATAM (including software) basically conforms to the ATAM process, technology, and results as follows:

<table>
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<tr>
<th>Process</th>
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<th>Phases</th>
<th>Architecture</th>
<th>Quality Attributes</th>
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<tr>
<td></td>
<td>System and Software Architects</td>
<td></td>
<td>Need system (block diagrams) and software</td>
<td>A few additional QA (transportability, shake and bake, force modularity, spectrum</td>
<td>Stress system aspects as well as software</td>
<td>Combination of system and software architects</td>
<td>No differences in either the outbriefing or the report</td>
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<td>Fast Tracking of subject matter experts (SME)</td>
<td>More careful scoping (what’s in, what’s out)</td>
<td>architecture views and white papers</td>
<td>management)</td>
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<td>System Architectural Approaches</td>
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<td>SM designers</td>
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**Technical**

**Process**

**Actors**

System and Software Architects
Fast Tracking of subject matter experts (SME)
SM designers

**Phases**

More careful scoping (what’s in, what’s out)

**Architecture**

Need system (block diagrams) and software architecture views and white papers

**Quality Attributes**

A few additional QA (transportability, shake and bake, force modularity, spectrum management)

**Scenarios**

Stress system aspects as well as software

**Analysis**

Combination of system and software architects
System Architectural Approaches
Highlights of Experiences -1

ATAM

• Four 2 day courses providing the basic software architecture knowledge, including an ATAM team lead evaluator course
• Have conducted numerous ATAMS
• Have an ATAM Reference Guide for the team
• Have extensive set of templates to assist the team in all activities
• External organizations (commercial, DoD contractors) have qualified leads

SySATAM

• Have a process in-place for conducting SySATAMs
• Still in piloting Phase- have conducted 2 SySATAMs
• Have extensive set of templates to assist the team in all activities
Highlights of Experiences -2

SME Experiences

- On one system an Evaluation Team member was also an SME
- On the other the SME was a seasoned Mechanical Engineer and a domain expert
  - Took the SME training
  - Evaluation team had to initially prompt the SME for risks.

New Quality Attributes and associated risks

- Force Modularity, Mobility, Spectrum Management
- Logistics, installation, mechanical checks

New Considerations

- DoDAF operational views
- Experimental simulation and analysis results
- White papers
- Manual versus automated activities are more prevalent
Highlights of Experiences -3

Architectural Representations

• System architecture documentation consists mainly of block diagrams and sequence diagrams and some DoDAF lower level views

Stakeholders

• System engineers tend to trump the software engineers
• Good exercise for system and software arch and eng to get on the same page

Surprises

• Preparation phase was easier than expected, scoping was straightforward
Typical Risk Themes

- There are a number of significant system engineering issues that require further analysis as a basis for architectural decision.
- CONOPS for Using Programs has not been updated/supplemented to take this system into effect.
- Architectural support for flexibility is powerful. However, without careful management of flexibility it could become overly complex and impose an unnecessary cognitive burden on users.
- Approach to automate and reduce test time not thought out.
- Fault Tolerance approach needs to be developed.
Conceptual Flow of ATAM

- Business Drivers
- System & Software Architecture
- Quality Attributes
- Architectural Approaches
- Scenarios
- Architectural Decisions
- Tradeoffs
- Sensitivity Points
- Non-Risks
- Risks

Analysis

Risk Themes

Impacts

distilled into
Conclusion

System ATAM is a natural extension to the ATAM
  • Basic approach works just fine
SME is needed with functional/domain expertise
  • Fast track training was effective
Risk Themes identified areas to help the programs choose what to explore to firm up the architecture
  • Both software and system risks were revealed
Have been too busy “doing” to develop lessons learned
  • But need to do more pilots first
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