Requirements Architecting: Object-Oriented To M&S-Driven

Sachin Mehta
Lead, Systems Engineering
Space Superiority & Geospatial Sector
L3Harris Technologies
Problem Space Introduction

• “…the majority of the tools on the market do not cover requirements traceability, and that even fewer provide support for the particular traceability requirements now enforced by DoD STD-2167A [U.S. Department of Defense 1988a]” [Gotel and Finkelstein, 1994]¹.
• “…traceability refers to the ability to cross-reference items in the requirements specification with items in the design specification” [Roman, 1985]².
• All too often, however, there is a lack of bonafide foundational relations between textual statements and architectural design.
• Thus, unique methods to enforce requirements traceability across architecture design specifications will be discussed by:
  – Orienting the system/mission around aggregate objects.
  – Exploiting systems modeling and simulation.
Proposal: Analytical Foundation for Requirements To Architecture

- Desired warfighting mission effects can be realized via exploiting M&S when we need to ensure the “…deliberate planning, analyzing, organizing, and integrating of current and emerging operational and systems capabilities…” [Gold, 2016].
- Design specifications can be seamlessly tied across the ‘black’ and ‘white’ box perspectives.
- Requirement specifications can be formulated that ‘trace to’ & revolve around the architectural paradigm.
Case Study – Remote Sensing SoS Bridge

- The Statement of Work (SOW) reads the contractor shall develop technical requirements and a system architectural description.
- In many development cycles, there is an “over emphasis on simplistic use case…” [Firesmith, 2007] and representation of the system/mission solely by a single object.
Formulate The Context Using M&S

- Decompose the mission context to elaborate functionality, external/internal boundary points, and performance.
- Aggregate behavioral threads and non-functional requirements (NFRs), within each use case, to multiple objects.
Exploit M&S To Analyze Capabilities

Objects executing in parallel

Required resources
Exploit Simulation Modeling, ctd.

- Utilize stateful and transformational programming, where applicable.
- Robust development environments provide the ability to define behavior, signals, data structures, algorithms, and timing.
Black Box Perspective

- Orient yourself around aggregate objects from the simulation model.
- Where requirements are realized: create operations, create signal receptions, and stereotype interfaces.
- Utilize ‘generalization’, to specify ‘black box’.
- Define integrated queries within development environment.
**White Box Perspective**

- Detailed design specifications obtained from “non-simplistic” M&S-driven (and object-oriented) analyses.
Requirements → Architecture
Case Study Video Clip
Conclusion

• Validated operational capability specifications can be realized when orienting the system/mission around multiple objects.

• Requirements can be architected with a stronger analytical foundation, using formal M&S as a driver.

• Design and requirements can be tied together by orienting the system/mission around multiple objects and using formal M&S as a driver.
Thank You!

Sachin Mehta  
Lead, Systems Engineering  
L3Harris Technologies  
Space & Airborne Systems Segment  
Space Superiority & Geospatial Sector  
Sensor and Applied Defense Solutions Division  
Sachin.Mehta@L3Harris.com
References


