

Design for Harmony: Architecting Adaptive & Agile Enterprises Using Value-Centric Time Scales

Christopher Roberts, PhD in Engineering Systems (expected in 2011)

Committee: Prof. Debbie Nightingale, chair; Prof. Joe Sussman; Dr. Donna Rhodes



Biography

Chris Roberts is currently pursuing a Ph.D. in Engineering Systems. His experience includes four years as a systems engineer and enterprise architect at Booz Allen Hamilton. He holds a B.S. in Engineering Physics from Embry-Riddle Aeronautical University, a Diplôme d'Ingénieur, from EPF (a French engineering school), and an M.S. in Technology and Policy from MIT.

Related Publications

Richards, M., C. Roberts et al. "Scenario Planning in Dynamic Multi-Attribute Tradespace Exploration," IEEE Systems Conference. March 2009.
 Ross, A. et al. "Responsive Systems Comparison Method: Case Study in Assessing Future Designs in the Presence of Change," AIAA Space 2008. September 2008.
 Roberts, C. "Architecting Evolutionary Strategies Using Spiral Development for Space Based Radar." MIT Master's Thesis. June 2003

Motivation

- Current Enterprise Architecting methods do not adequately consider uncertainties in future operating contexts or dynamic changes in stakeholder values
- Furthermore, enterprise architecting is not well integrated with the technical product planning and development lifecycle
- Lack of synchronization in enterprise management, technical lifecycle, and external processes impedes the adaptive capacity of the enterprise to mitigate or exploit uncertainties

Illustration of the Lack of Synchronization between the development lifecycle, contextual changes (epoch), and the transitions available (adaptive capacity)

Year	2007	2008	2009	2010	2011	2012
Epoch	2-4 years	2-4 years	2-4 years	2-4 years	2-4 years	2-4 years
System	Concept Development (0 yrs)	Design, Build, Test, Launch (6 yrs)			Fly & Possible Upgrades	
Transitions	Change Modifications	Tech Insertion Opportunities	Software Infrastructure Changes	More Vehicles		

Changing interaction with changing Environment (Ross)

- Modern computing techniques and theoretical advances in engineering systems design allow new methods of exploration and evaluation of complimentary enterprise and product architectures under varying assumptions about the future

Hypotheses

- Value-centric time scales can be used to harmonize enterprise management processes, technical program cycle times, and dynamic contextual variables, resulting in more adaptive and agile enterprises and products
- Expansion of technical design tradespace exploration to include enterprise considerations will enable the identification of additional strategies to mitigate or exploit uncertainties

Representation of interactions between the Product Architecture & other components of the Enterprise Architecture

Value Focused Time Scale Analysis Lead to Adaptive & Agile Strategies (adapted from Nightingale & Rhodes)

Research Goals

- Improve understanding of the dynamic interactions between enterprise and product architectures, including the integration of technical and social considerations for the effective creation, evaluation, and management of adaptive capacities (e.g. real options)
- Operationalize adaptability and agility for use as a decision metric in the conceptual design of major defense acquisition systems.
- Develop and test a methodology to improve the strategic analysis of enterprise and product architecture options for managing changing contexts and stakeholder expectations

Representation of a Program Manager's perspective in balancing forces exerted on the technical architecture of a satellite radar system by dynamics in the enterprise, user needs, and context

(Richards, Roberts et al.)

Managing Nested Complexity

- The design, evaluation, and management of technical systems occurs within social systems
- Interactions between the technical/physical "layers" and the surrounding social/institutional "sphere" gives rise to nested complexity
- Value-Centric Time Scale analysis enables the design of dynamically synchronized social and technical architectures

Representation of technical systems embedded in social systems using the Complex, Large-scale, Interconnected, Open Systems Framework (CLIOS)

(from Sussman)

Relevant Literature

Technology	Management	Policy
Engineering Systems Fundamentals & Research Publications		
Lean Enterprises & Enterprise Architecting		
Technology Strategy		
Product Development & Systems Architecture		
Product Planning & Acquisition Strategy		
Complexity Theory		

Research Timeline

Activity	Timeline
Research Definition, Literature Review, Key Question Development	Fall 2007
Data Gathering, Theory Development & Refinement	Spring 2008
Case Application, Computer Experimentation & Analysis	Fall 2008
Coursework, Research Definition, Literature Review	Spring 2008
Coursework, Research Substantiation & Proposal, General Exams	Fall 2008
Data Gathering, Theory Development, Conference Publications	Spring 2009
Data & Theory Refinement, Computer Simulations	Fall 2009
Computer Simulations, Case Applications, Conference Publications	Spring 2010
Synthesis & Refinement, Impact & Outreach Activities	Fall 2010
Dissertation, Journal Publications	Spring 2011

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