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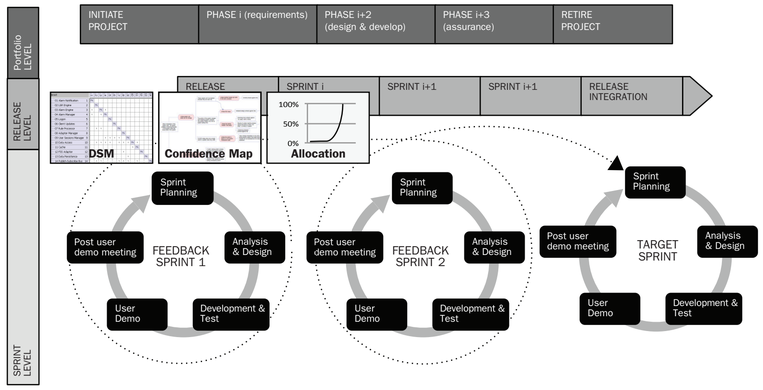
Value-Driven Incremental Development

Integrating Architecture Analysis and Assurance With Development

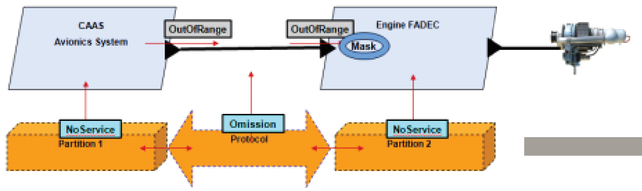
Objective

Investigate how quality attribute requirement allocation and dependency analysis inform incremental development and assurance through managing rework during development.



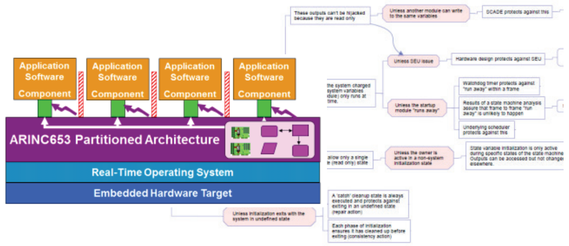
Multi-dimensional Analysis

What is the design implication of a release decision?



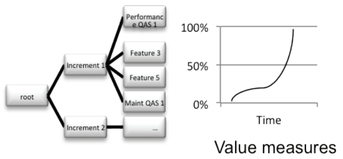
Architecting for Incremental Assurance

What are the assurance implications of a release decision?



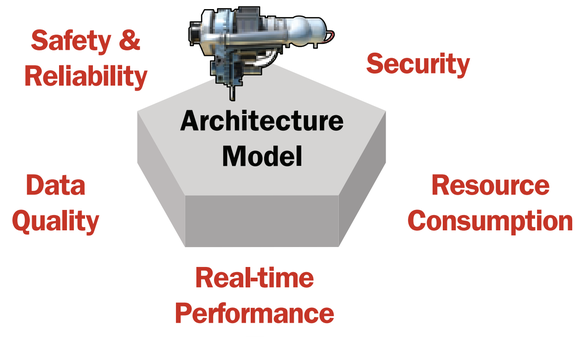
Quality Attribute Allocation

How do we break architectural features into increments; what measures are needed to make good release decisions?



Solution Approach

- Collect quality attribute requirements using architecture-tactics questionnaires
- Create models for deployment view augmented with partitioning and fault-tolerance information
- Generate an experiment environment where models can be seamlessly exchanged
- Apply modifiability and fault-propagation metrics
- Validate that augmenting with fault-tolerance information provides information about propagating rework
- Validate whether incremental-assurance information can be contained within architecture changes



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App. Layer	NAV 1	LTa							LS							
	COMM 2		LTc							LS						
	USM 3			LTc							LS					
	SU1 4				LTc							LS				
	SU2 5					LTc							LS			
	SU3 6						LTc							LS		
	CND_M 7							LTc	SR	SR	SR	SR	SR	SR	SR D	
	IMC_D 8	LD						SR	LTa						SR	
CND	COMM_D 9		LD					SR		LTc					SR	
	USM_D 10			LD				SR			LTc				SR	
	SU1_D 11				LD			SR				LTc			SR	
	SU2_D 12					LD		SR					LTc		SR	
	SU3_D 13						LD	SR						LTc	SR	
	REND 14							SR	SR D	SR D	SR D	SR D	SR D	SR D	LTb	
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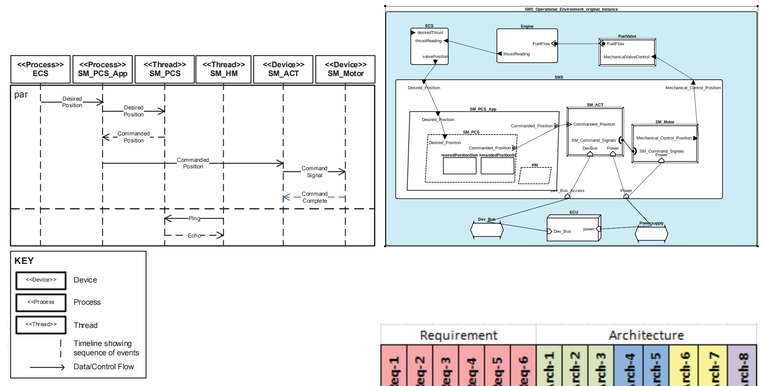
Multi-Dimensional Analysis Drives Increment Value Assessment

Selected FY14 Results

- Improved rework analysis by making **architectural dependency** information (e.g., fault-propagation dependencies) available to developers during architecture modeling and development
- **Eliminative argumentation** defined as a core concept that is a basis for arguing confidence and in establishing the theory of confidence
- Incremental evolution of **quality attribute requirement allocation** using architecture tactics-based data collection occurs through small refinements and ratcheting of response measures. Empirical studies and surveys with organizations revealed architectural rework occurs in such context and can be managed by better quantification of technical debt.



		Requirement						Architecture							
		SMS-Req-1	SMS-Req-2	SMS-Req-3	SMS-Req-4	SMS-Req-5	SMS-Req-6	SMS-Arch-1	SMS-Arch-2	SMS-Arch-3	SMS-Arch-4	SMS-Arch-5	SMS-Arch-6	SMS-Arch-7	SMS-Arch-8
Requirement	**SMS-Req-1**: desired position	.	1					1			1		1		
	SMS-Req-2: actual position		.					1			1		1		
	SMS-Req-3: actual and commanded positions			.					1	1		1			1
	SMS-Req-4: command completion				.	1	1	1			1		1		
	SMS-Req-5: command duration				1	.	1	1			1		1		
	SMS-Req-6: response delay				1	1	.	1			1		1		
Architecture	**SMS-Arch-1**: SMS.SM_PCS							.			CDS				L
	SMS-Arch-2: SMS.SM_PCS.DesiredPositionState							D	.	A				A	
	SMS-Arch-3: SMS.SM_PCS.CommandedPositionState							D	A	.				A	
	SMS-Arch-4: SMS.SM_ACT							S			.	.	CD		
	SMS-Arch-5: SMS.SM_ACT.StepsToDo										D	.			
	SMS-Arch-6: SMS.SM_MOTOR										S		.		
	SMS-Arch-7: SMS.SM_MOTOR.ActualPositionState								A	A			D	.	
	SMS-Arch-8: SMS.SM_HM							LP							.

Multi-view analysis allows developers to see different types of dependencies that need to be investigated when changes occur

Collaborators

Carnegie Mellon University, Clemson University, University of British Columbia, University of Pennsylvania, DoD and industry partners

Software Engineering Institute | Carnegie Mellon University

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