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Do Teams Using Agile Methodology Need Modeling?

Gundars Osvalds, ESEP, CSM
MetaTech Consulting
Annapolis Junction, MD
gundars.osvalds@gmail.com

David L. Lempia
Rockwell Collins
Cedar Rapids, IA
david.lempia@rockwellcollins.com

Why Modeling?

- INCOSE Systems Engineering Vision 2025
  –"Modeling, simulation, and visualization enable complex systems understanding that helps us to anticipate and verify solutions and their total cost before building them."
- Better understanding of emerging systems behavior
  - due to complex software
- Physical environments
- Human interactions
- External interfaces
- Essential for successful systems development

Ref 1.

Software Methodologies

Different approaches in reducing requirements risk

Waterfall

- Many programs get large and complex because programs attempt to reduce risk by defining all requirements at beginning of program
  - But risk is increased when a large batch of requirements take a long time to be implemented and errors discovered late in the program life
  - Changes to requirements at end of program usually result in schedule and cost impact

Agile

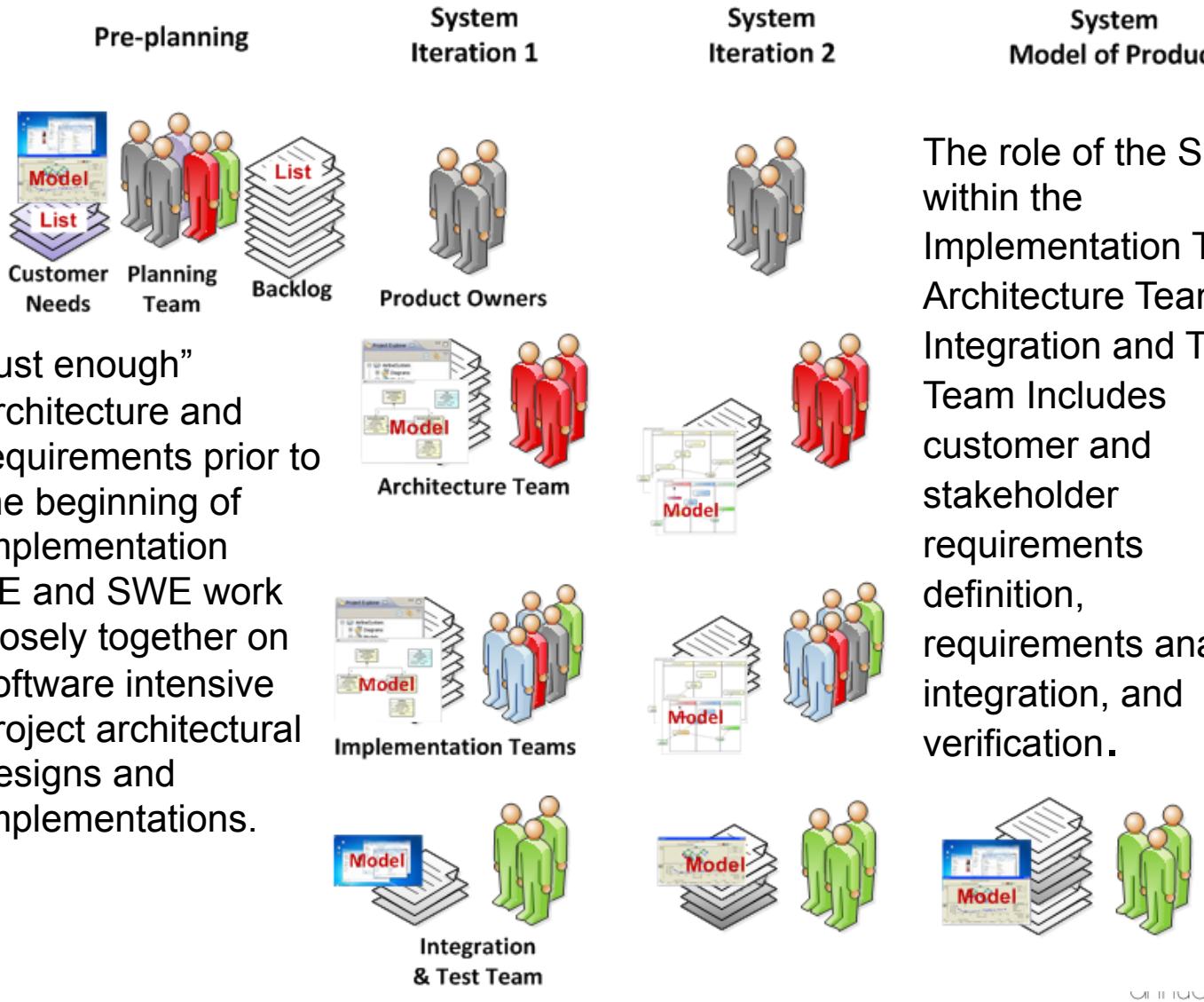
- Risk is reduced by delivering requirements defined features in small chunks (iterations).
  - Therefore all requirements don't have to be known at start of program
- Stakeholder review of deliverables at each iteration provide feedback for changes and enhancements

Can Agile Methodology Support Modeling?

Yes, model are used to:

- Develop initial requirements visioning
  - System Behavior and User Interface Models
- Define model iteration functionality
  - Use Logical and Physical Models
- Determine desired system performance at a Quality level
  - Use Quality Attribute Model
- Define cost of system attributes
  - Develop Economic Models and combine with Quality Attribute Models to update Architecture
- Provide for stakeholder evaluation and system testing
  - Develop a software and/or hardware based Mock-up Model

Agile SE Framework



"just enough" architecture and requirements prior to the beginning of implementation

SE and SWE work closely together on software intensive project architectural designs and implementations.

The role of the SE within the Implementation Teams, Architecture Team, the Integration and Test Team Includes customer and stakeholder requirements definition, requirements analysis, integration, and verification.

Ref 2.

Applying Modeling

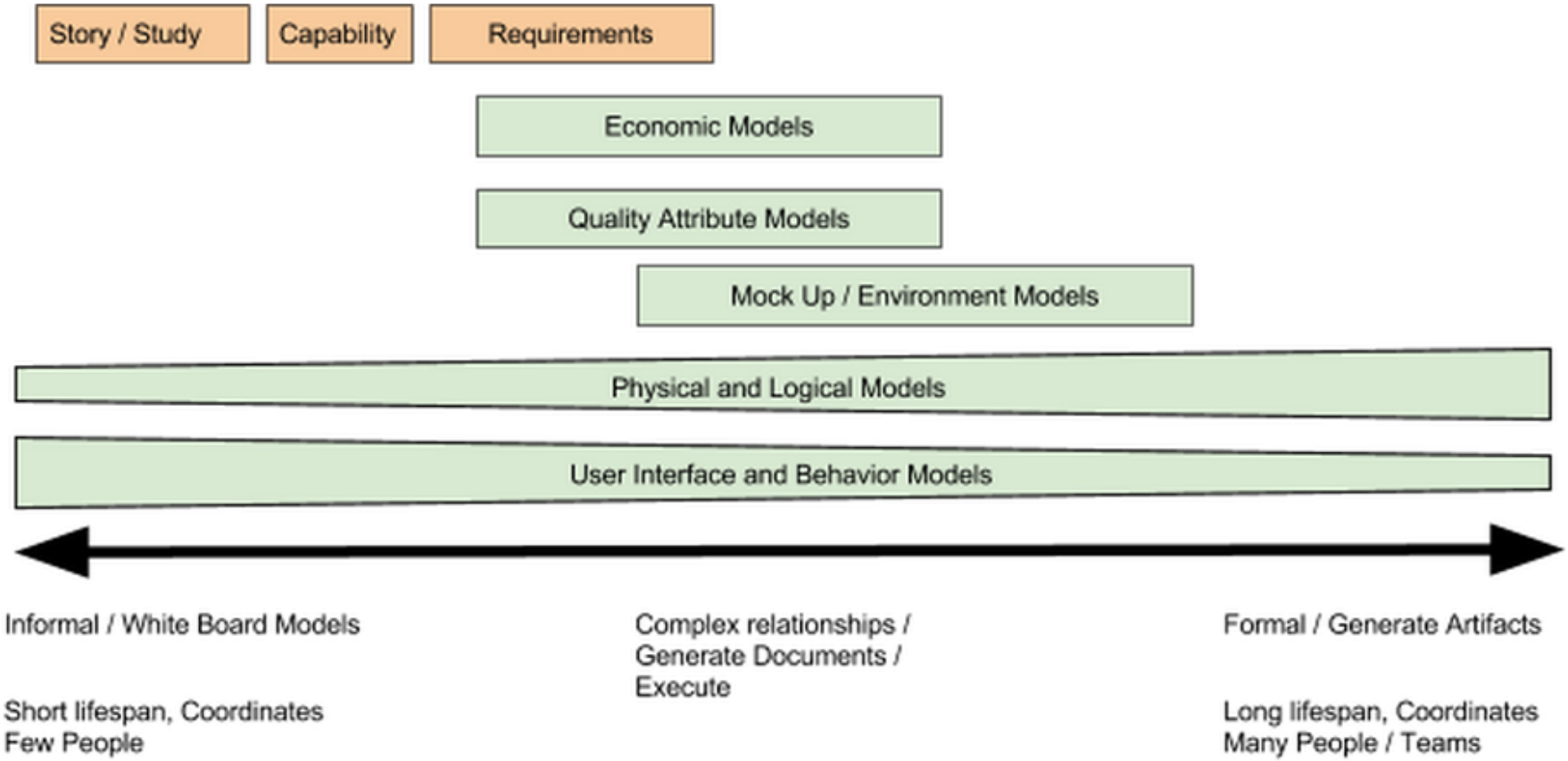
Waterfall – focus is to reduce long term risk

- In order to reduce risk in a large complex program the application of formal models is used to reduce risk
  - They may require substantial resources and time to complete, test and validate
  - Models are not the same as implemented code therefore even good models may not accurately represent the actual implementation
- Informal models can be used to address a specific issue during implementation
  - But changes are not welcome to planned programs due to schedule and cost impact

Agile – focus is to reduce requirement risk

- Agile Methodology can work well if requirements are not compete or well defined at start of program
  - Risk is reduced by not finalizing requirement until it is needed since implemented capabilities are well known
- If all requirements are complete then as development is implemented at each iterations the customer can verify that the system is operating as desired
  - Thus continuously reviewing risk with the ability to correct issues during the development
- Informal or formal models are developed to address an iteration or program issue

Models for Agile Iterations



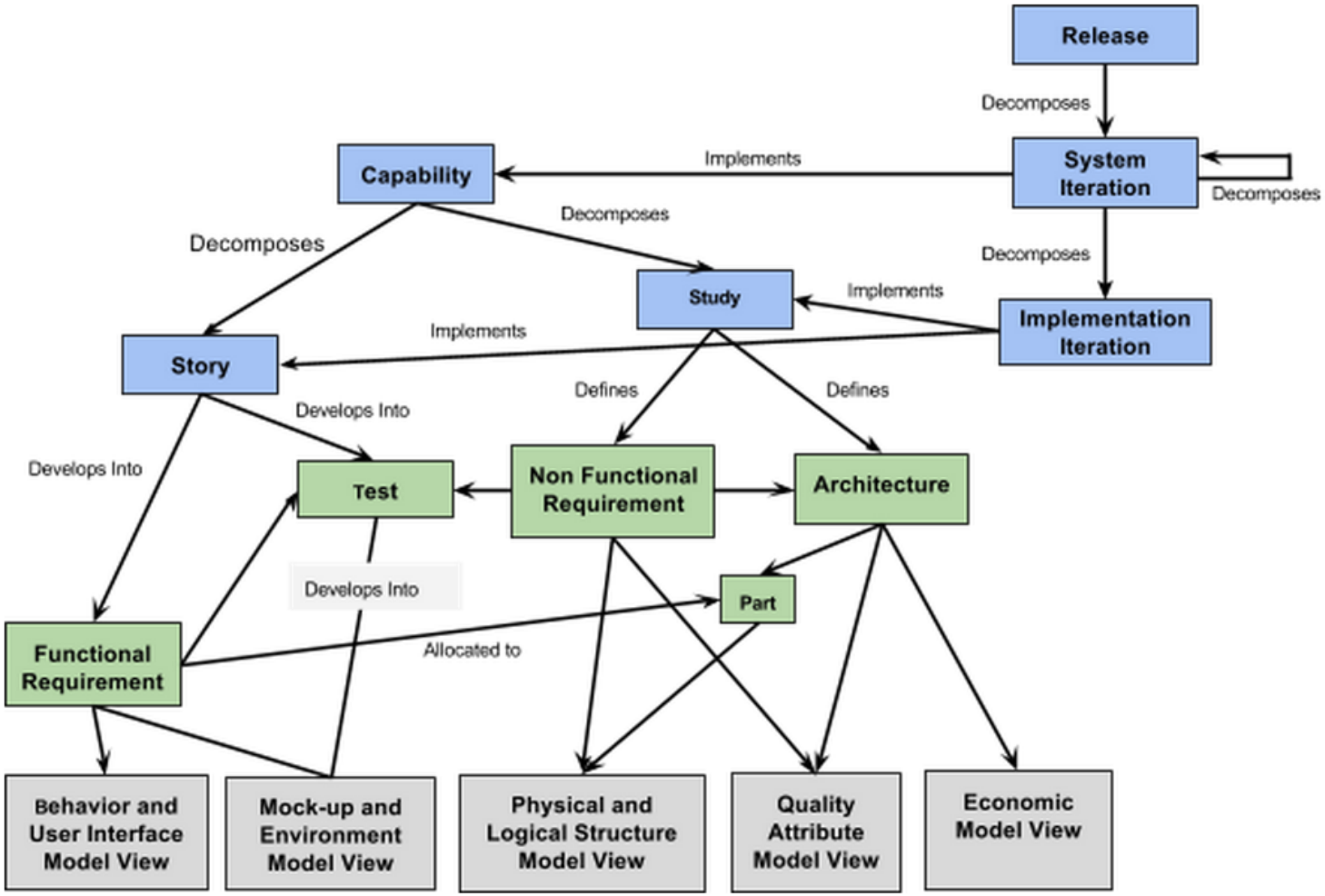
Recommended Agile Models

Model	Used to Verify
• Behavior	✓ Stakeholder needs are understood
• User Interface	✓ External interfaces satisfy functional requirements
• Logical	✓ Defines relationships between components
• Physical	✓ Describes hardware support for system capability
• Quality Attribute	✓ Applied to non-functional requirements
• Economic	✓ Which capability should be implemented next
• Mock-up	✓ What the customer wants
• Environmental	✓ Functionality when used for prototyping and testing

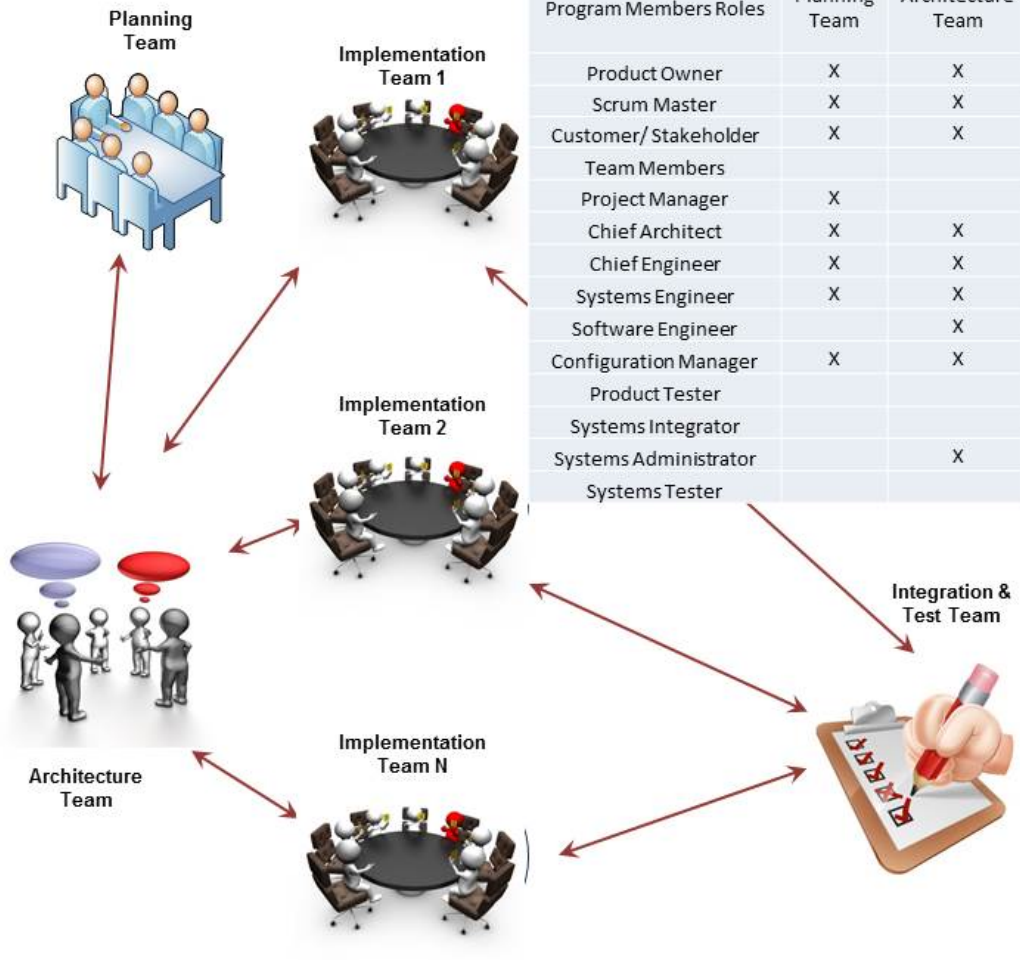
Model Support for Agile Development

- Models can and should be used to support systems design and development using Agile Methodology
- Agile Methodology models are:
  - Used to support decisions during design and development
  - Focused on addressing local iteration issues and thus need to be quickly developed
    - May use post-it notes and white boards
    - Use computer based tools if they can quickly produce results
  - Can also be used to define program issues using formal models

Agile Models Taxonomy



Agile Teams



Program Members Roles	Planning Team	Architecture Team	Implementation Team(s)	Integration & Test Team
Product Owner	X	X	X	X
Scrum Master	X	X	X	X
Customer/ Stakeholder	X	X	X	X
Team Members				
Project Manager	X			
Chief Architect	X	X		
Chief Engineer	X	X	X	X
Systems Engineer	X	X	X	X
Software Engineer		X	X	
Configuration Manager	X	X	X	X
Product Tester			X	
Systems Integrator				X
Systems Administrator		X	X	X
Systems Tester			X	X

Ref 1.

Model Support

Models \ Teams	Product Owner Team	Architecture Team	Implementation Team	Integration and Test
Capabilities, Stories, Studies, Requirements	A	R	R	C
Behavior Models and User Interface Models	A	I	R	C
Physical Models, Software Structure, Protocols, Mechanical, Electrical, Cables, Hydraulic, …	A	R	R	C
Mock-up and Environmental Models	I	A	R	**R**
Quality attribute and Cost Models - Size, Weight, Power, Cost, Safety, Reliability, Flexibility, ...	A	R	C	I
Accountable - approves models				
Responsible - multiple model contributors				
Consulted - contributor provides special knowledge or expertise				
Informed - uses Models				

Conclusion

- Use of models improve understanding of stakeholder needs thus improved satisfaction of their needs
- Models are important in communicating and understanding between implementation teams
- The use of models should result in improved productivity and risk reduction
- How does one show a Return On Investment (ROI) when using models?
  - Less problems?
  - Less rework?
  - Satisfied customer?
  - Faster development?

References

- Ref 1 - INCOSE 2014 *A World in Motion; Systems Engineering Vision 2025*, International Council on Systems Engineering. June 2014.
- Ref 2 -“Systems Engineering for Software Intensive Projects Using Agile Methods,”
  - Larri Rosser, Phyllis Marbach, Gundars Osvalds, David Lempia.
  - Presented at INCOSE 2014 Symposium
  - Published in INCOSE INSIGHT Magazine; Volume 17, Issue 2, July 2014
  - Selected as INSIGHT “Best Article” of 2014

Questions

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