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SET Program Overview

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Session Plan

- Goals:
  - Build a awareness of the SET Roadmap
  - Determine top SET areas for future research
- Agenda:
  - Present Research Summary – 25 minutes
  - Brainstorm Areas of Interest – 20 minutes
  - Evaluate Ideas – 40 minutes
  - Summarize Results – 5 minutes

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Problem Statement

Problem Statement:

Traditional Systems Engineering (SE) is not adequate to meet the challenges or today's net-centric, information-based environments and threaten SE with a loss of relevancy. Requiring elaborate documentation, detailed requirements definition, and static long term plans are all ineffective in these environments and counter-intuitive to the technologists working in this domain.

Program Goal:

Transform the discipline of SE to meet the emerging challenges and increase its relevancy.

SE Communication and technical-baseline cycle must be faster than the 'change cycle'.

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SE Approaches

	Industry	Optimal	Leverage	Shortfalls
Traditional SE	Defense & Aerospace	Large, *mission critical	Formal Reviews, Text based documentation	Inflexible, overwhelmed by complexity
Agile Processes	Software	Small, opportunistic	Small, integrated teams, constant communication	Inability to scale, mission critical issues
Electronics	Computer, Networking, Games	Large, mission critical	Technology, tool automation	Domain specific

•No 'one-size fits all' solution
•No existing approach appropriate for the rapid fielding of complex systems

* 'mission critical' refers to the need for key safety, reliability, availability aspects – NOT importance of capability

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Summary of Gaps & Opportunities

- ***Cycle Time Reduction** – A suite of processes and tools, including those noted above, which can increase the quality of the systems while compressing latency through the life cycle; these include tools which not only accelerate new development, but also eliminate unnecessary work such as facilitating reuse and providing correct by design construction

- **Legacy Integration** – the capability to monitor and characterize the current legacy system to ensure that the addition of new applications and services have the desired capabilities, and the ability to integrate independently evolving components into a larger interoperable system

- **Risk/Opportunity Management** – tools which can assist in the assessment of program risk and value creation to allow for the proper tradeoffs between these competing goals based on the capabilities of the organization and the challenges of the system under development

- **Human Aware/Self-Adaptive** – the capability to optimize the use of humans in the system to take advantage of self-adaptive human capabilities

**Ubiquitous Attribute*

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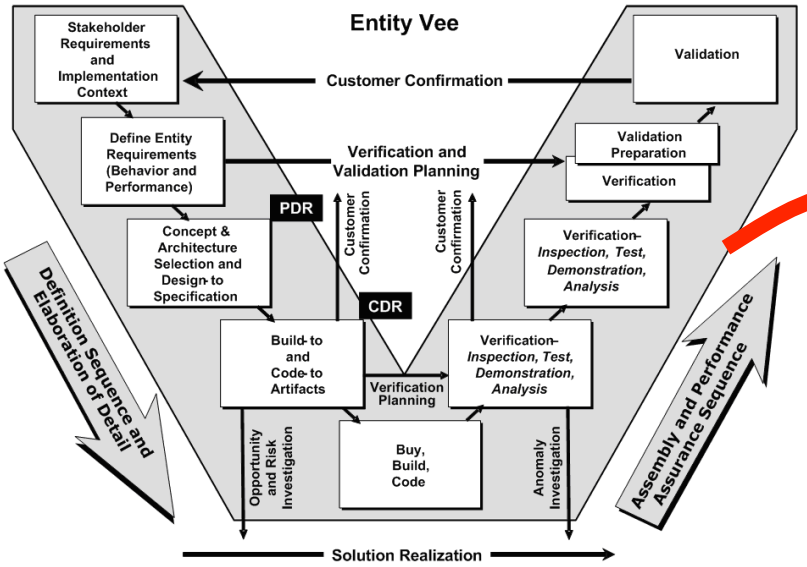
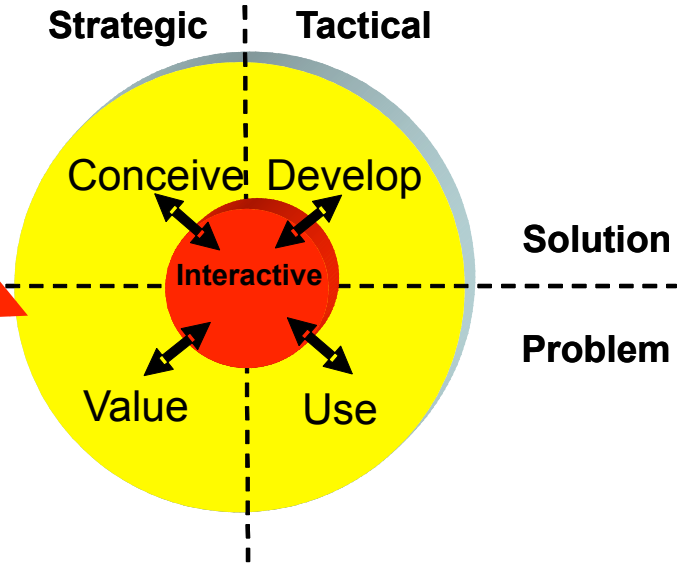
Future State

Analysis Driven



Predictable, Linear

Empirical Feedback Driven



Opportunistic, Non-Linear

Problem Cannot be solved by "doing the same thing faster" (i.e., scale)!

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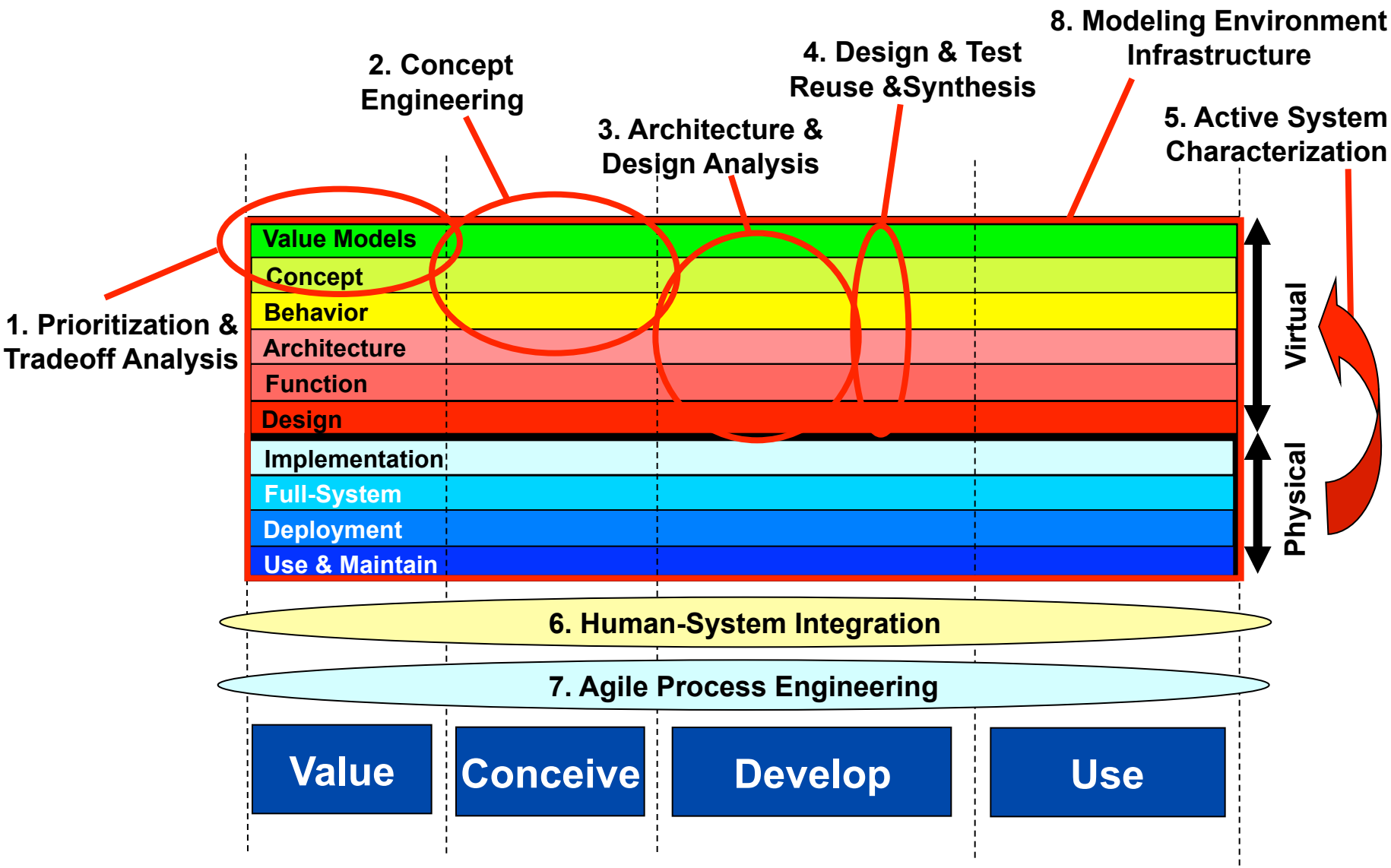
SET Research Areas



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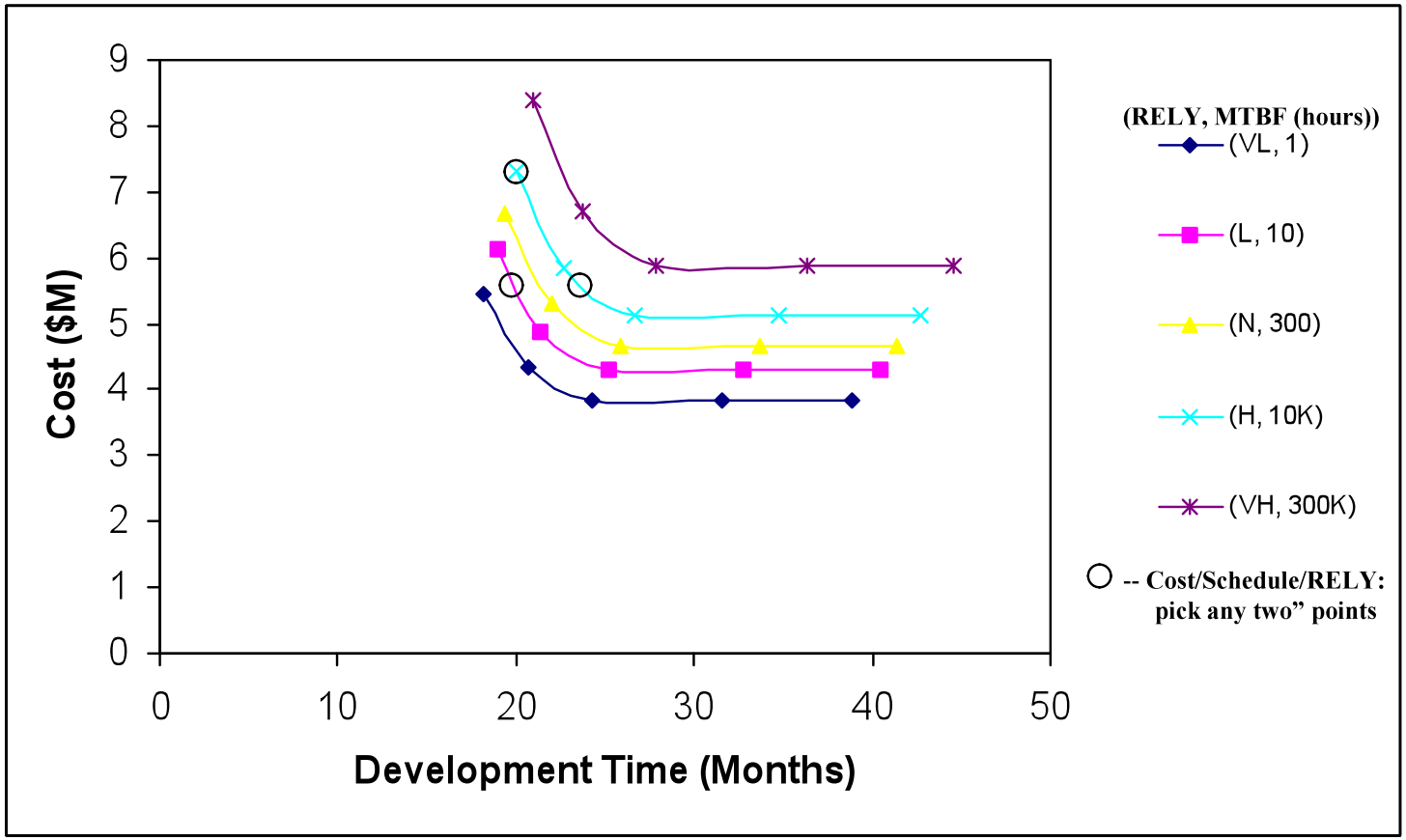
Prioritization and Tradeoff Analysis



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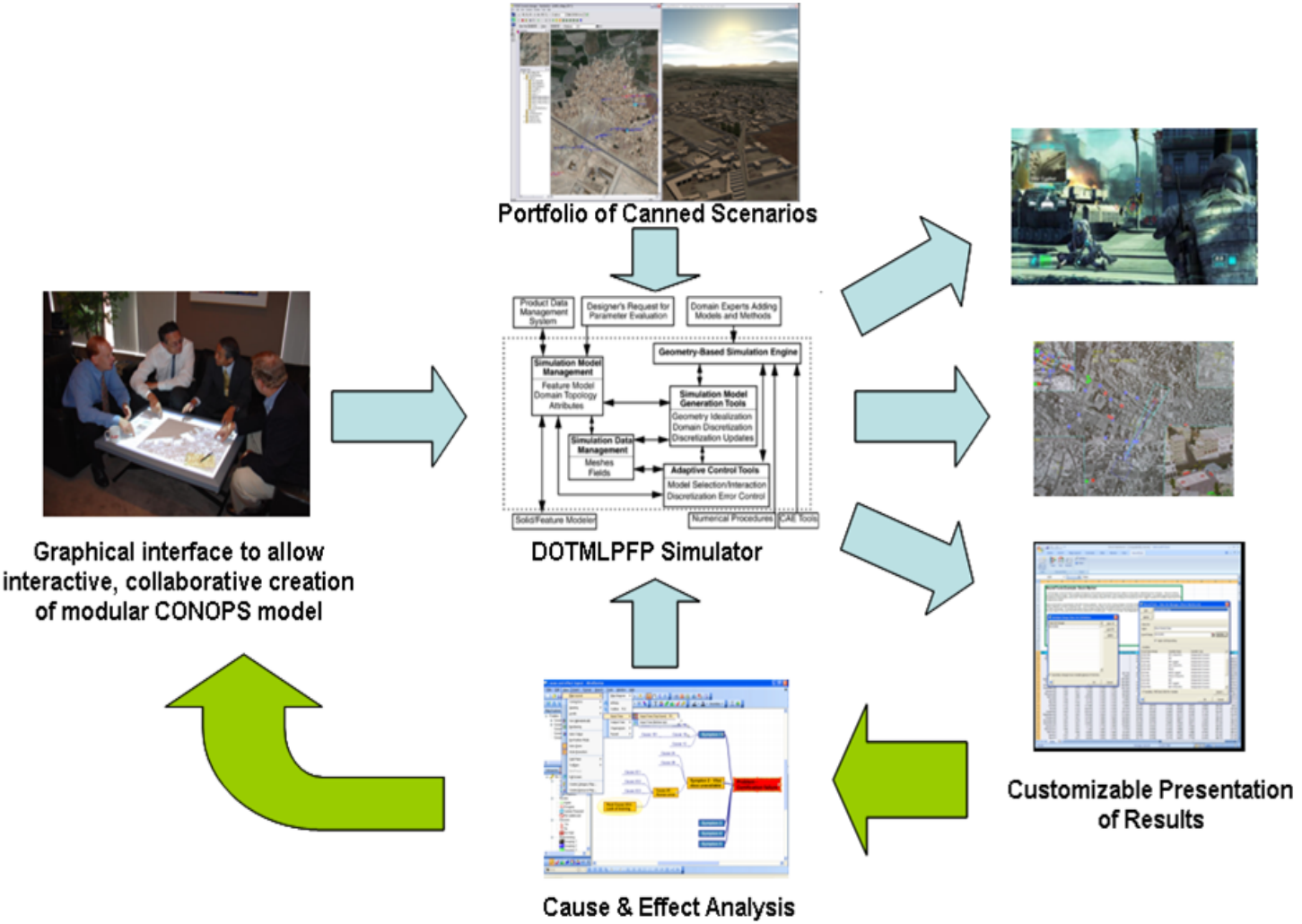
Concept Engineering



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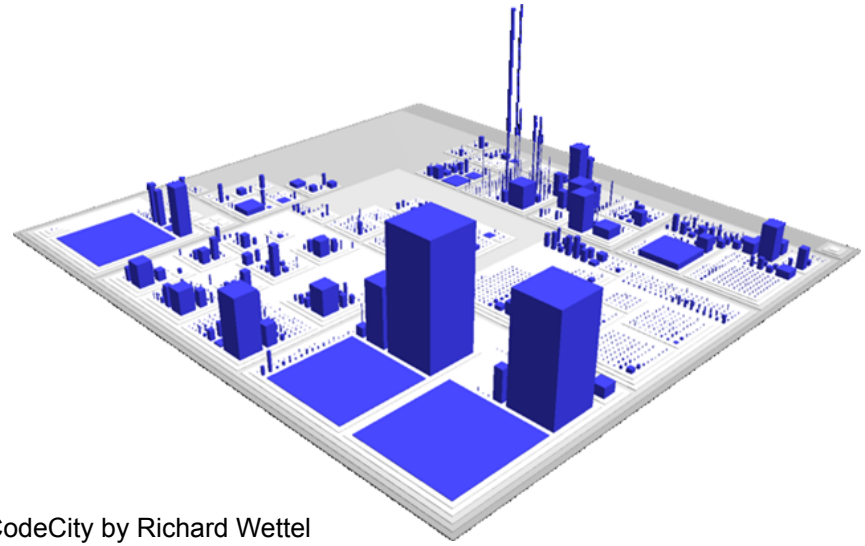
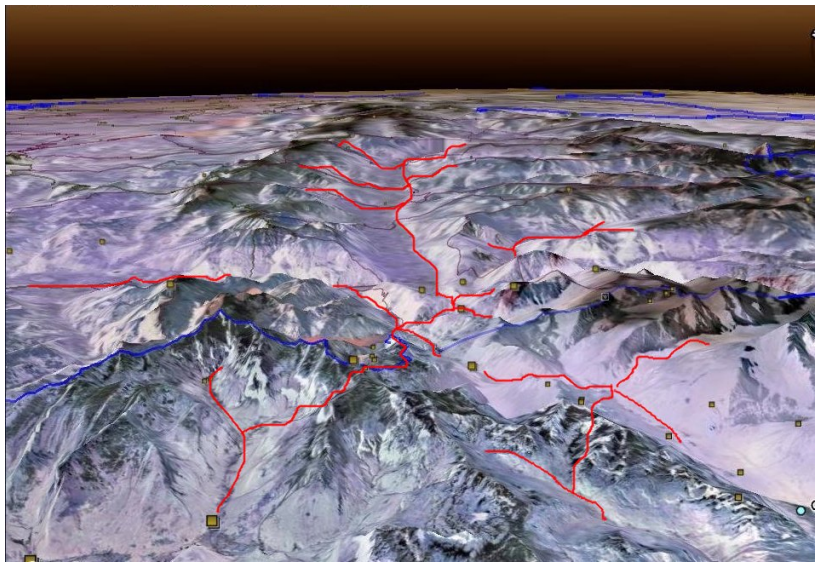
Architecture and Design Analysis

- Visualizations of the entire architecture of a developing system so that the full impact of proposed changes and updates to the system can be anticipated despite system complexity
  - one visualization option could be as a “terrain” where fault-lines represent system fragility



CodeCity by Richard Wettel



Source: Azad Madni & Colin Neill, “Architecture and Design Analysis”, SET Workshop

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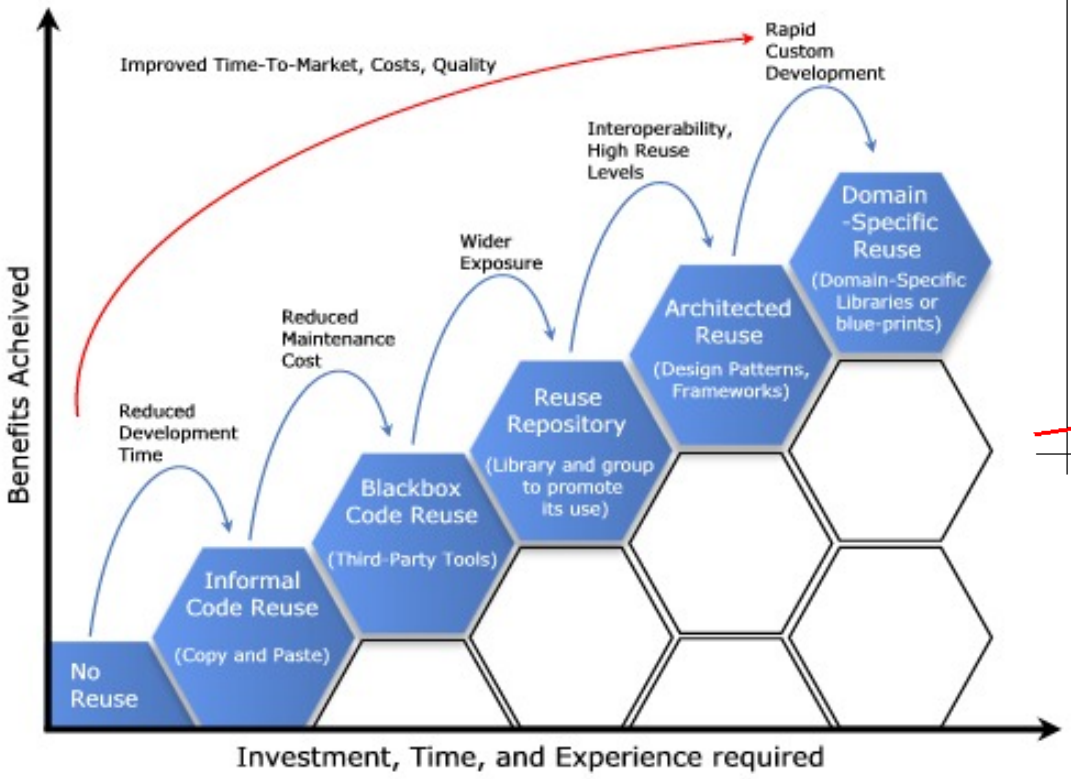
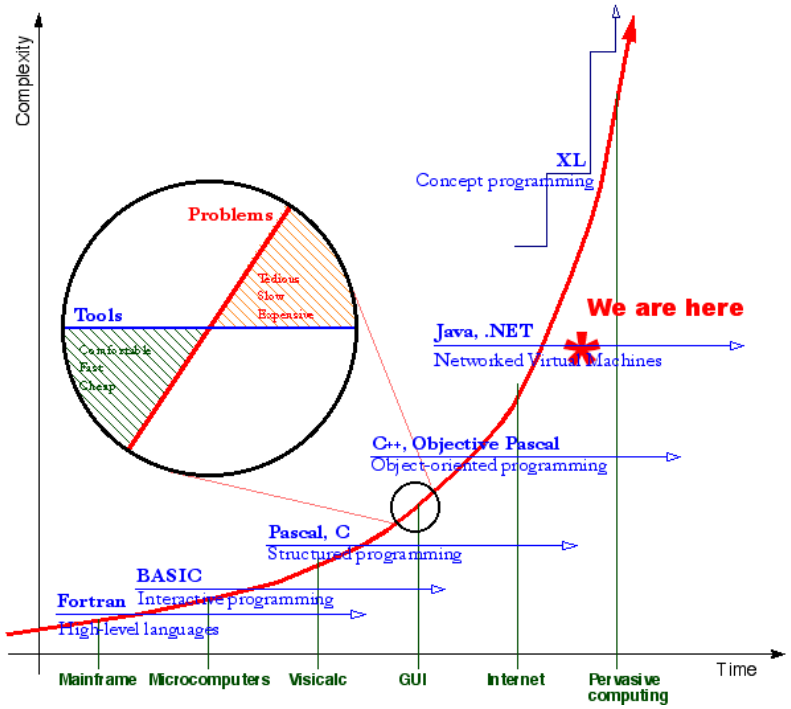
Design and Test Reuse and Synthesis



Software Reuse

Source: http://sabertooth-interactive.com/images/reuse_diagram.jpg



Synthesis

Source: http://xlr.sourceforge.net/concept/top.html

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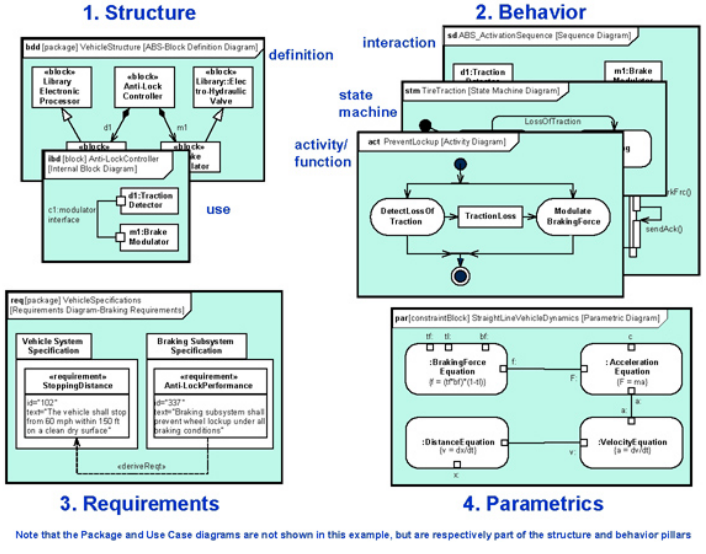
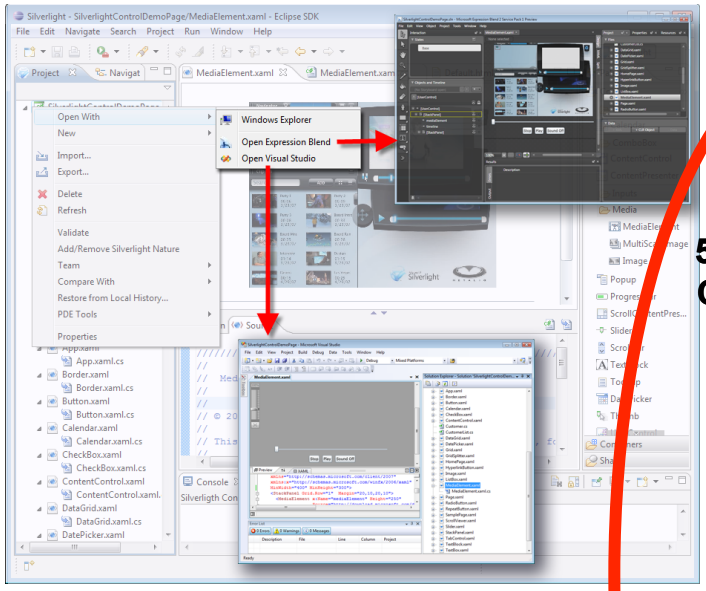
Active System Characterization

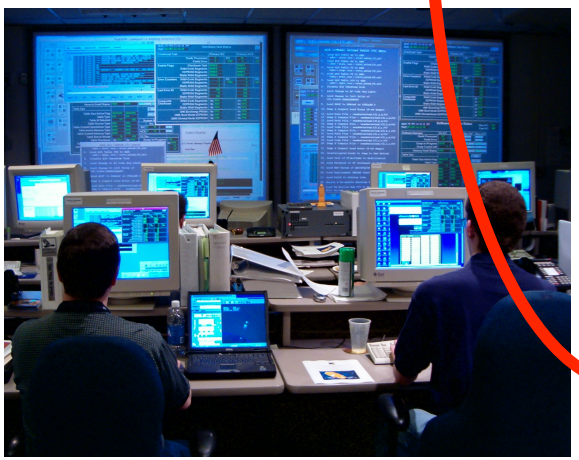




5. Active System Characterization

Virtual

Physical



Source: http://cn.opnet.com/solutions/application_performance/images/apm_diagram.jpg

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Human-System Integration

SE Life Cycle

HSI considerations before/ during adaptation

Dynamic System Adaptation Contexts

HSI methods need to address both the full SE life cycle and dynamic system adaptation contexts.

Source: http://www.msidesign.se/designs/MMI%20Loop.gif

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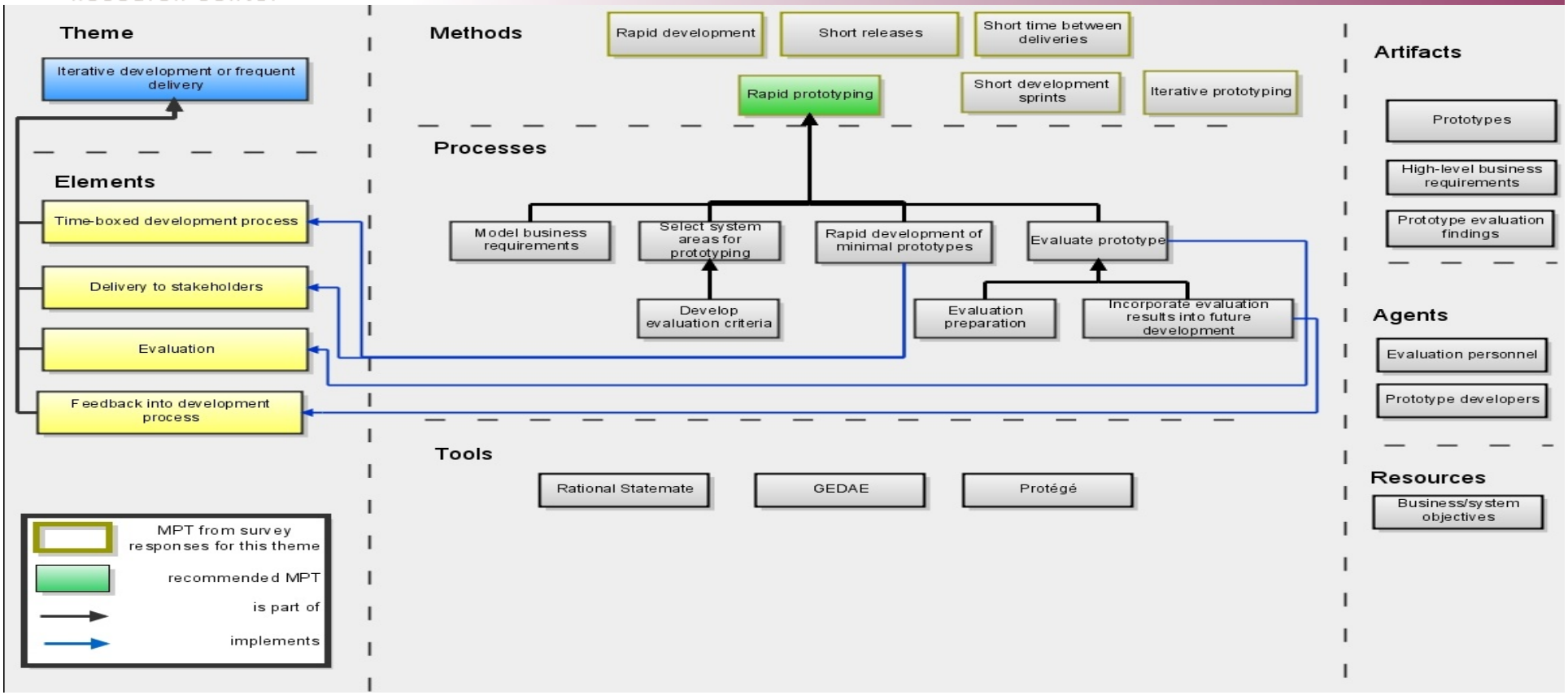
Agile Process Engineering



- Based on surveys of govt and commercial entities already working on agile systems engineering
- Initial results proved useful for:
  - Identification of gaps where MPTs currently missing
  - Teams trying to implement agility
  - Reasoning about contributions of MPTs to project success

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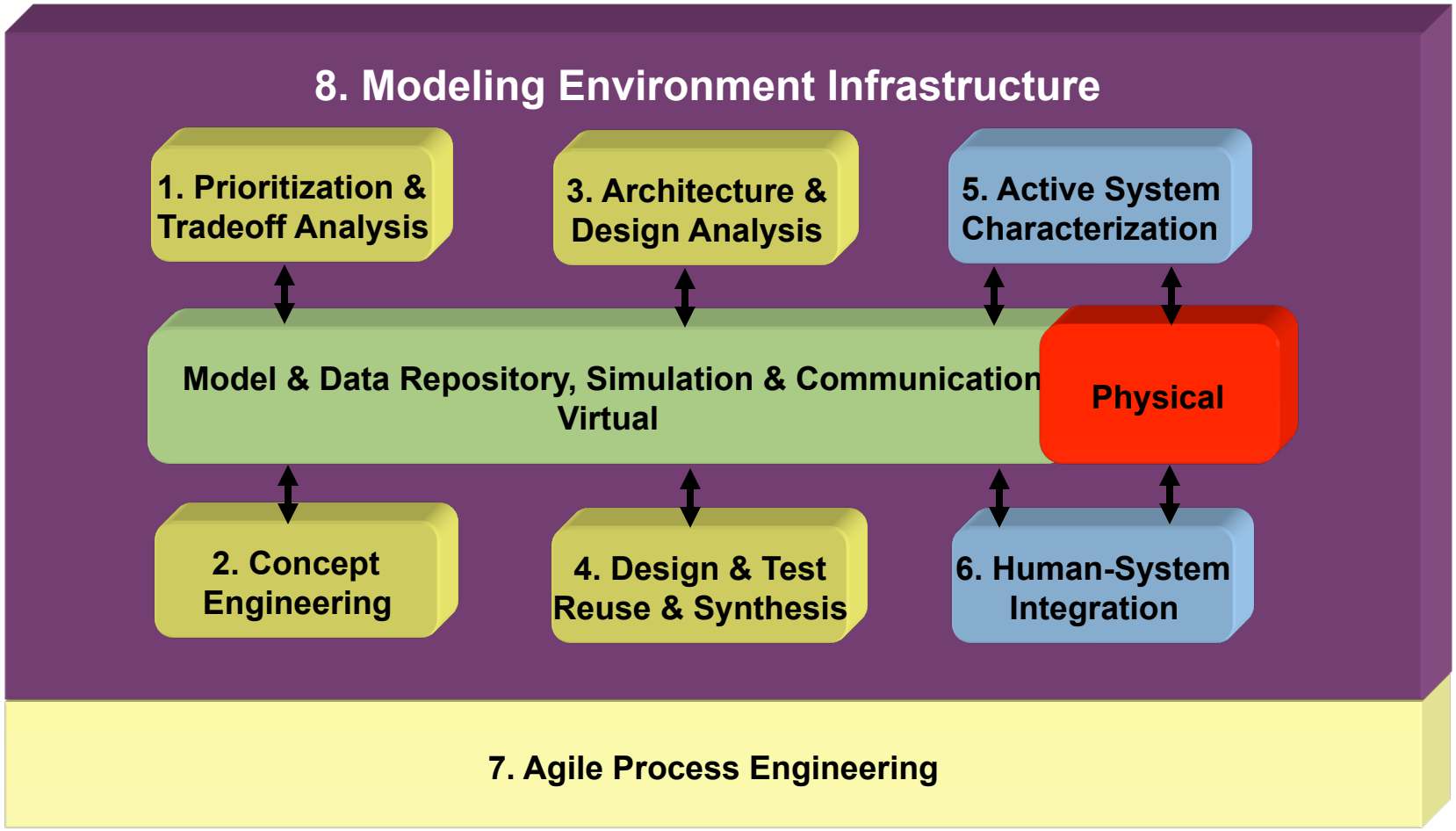
Modeling Environment Infrastructure



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Brainstorming Session

1. Tradeoff Analysis
2. Concept Engineering
3. Architecture & Design Analysis
4. Design & Test Reuse & Synthesis
5. Active System Characterization
6. Human-System Integration
7. Agile Process Engineering
8. Modeling Environment Infrastructure

Evaluation

Benefit	Near Term (1 - 2 years)	Middle Term (3 - 5 Years)	Long Term (5+ Years)
High			
Med			
Low			

Availability Timeframe

Evaluation

Benefit			
High			
Med			
Low			
	Low	Med	High

Relative Cost

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Recommendations

1. …

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Conclusions

- ...