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Augmenting Agile Software Development to Improve Systems Thinking

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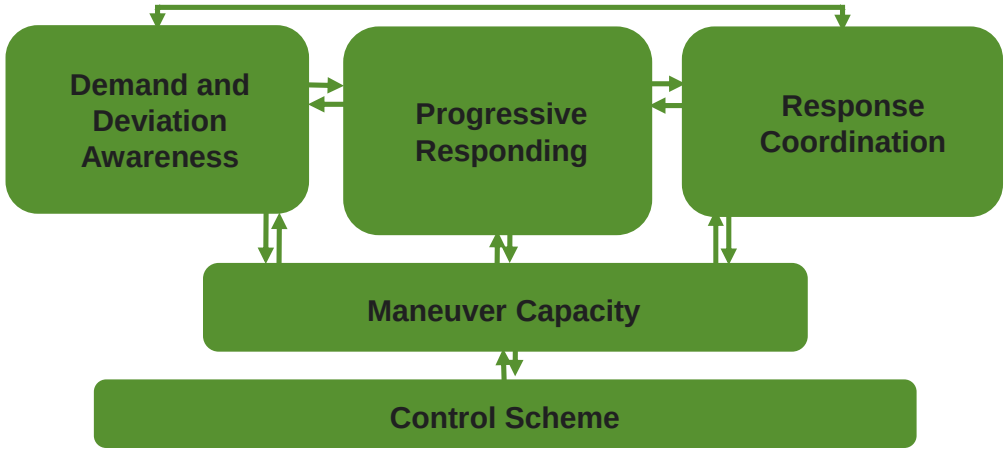
TRUSTS Framework

- Transform with Resilience during Upgrades to Socio-Technical Systems (Neville et al., 2021)
- Specifies characteristics of complex work systems that enables them to respond adaptively and resiliently to threats



Objective

- Discover opportunities in Agile Software Development for which the TRUSTS framework can provide developers with requirements for resilience without compromising the overall integrity of Agile
- Use added TRUSTS layer to minimize technical debt accumulation through continuous deployment in Agile development

Agile Process

Agile: Why is it Important?

- Work/tasks broken down into manageable chunks or sprints (about 1 month each)
- Each principle of Agile occurs in each sprint
- Encourages continuous changes to requirements throughout development cycle
- Retrospective occurs at end of each sprint: what went right? What went wrong? What are we doing in the next sprint?

Critiques of Agile

- Focuses too much on velocity, not enough on quality (Behutiye et al., 2017; Cunningham, 1992)
- Technical debt: the tradeoff between short-term benefits of rapid delivery and the long-term value of developing a software system that is easy to evolve, modify, repair, and sustain (Nord et al., 2012)

Significance of Resilience

- Resilience: the ability to responsively adapt to anticipated and detected changes in the operational environment (Woods, 2006)
- Defining resilience requirements early in development can help reduce technical debt

Agile Touchpoints for TRUSTS

Tabletop Exercises (TTX)

- Short-term vs long-term TTX
  - One eight-hour session vs multiple weeks meeting 1-2 hours/week
  - Long-term allows for smaller ask of team's time, evolution over time, use of external resources
- Incorporate 1 hour of long-term TTX into each sprint's retrospective
  - Outcome from TTX informs next sprint's requirements

Preliminary Results

- Use case observations: airspace control concept dev project
  - “I don’t care, just hand me requirements”
  - TRUSTS team felt too late for requirements step, but too early for TTX step
- Initial interviews: 6 Agile SMEs
  - “Sponsors overly concerned with ‘Agile metrics’ like velocity, but ‘did we deliver what we wanted to’ should determine success”
  - “During a sprint, outside of weekly meetings, 1 step was talking through each piece of puzzle, outlining each piece, each person builds out separate piece and the hardest part was connecting everything after that”

Next Steps

- Deliver survey to software developers/others with Agile experience
  - Priorities of 12 Agile Principles
  - Understand prior knowledge of resilience engineering
  - “Who’s responsible for system resilience?”
- Engage in another round of interviews focused more on the technology development side and TTX incorporation
  - Develop protocol and best practices for teams running TTX

Discussion

References

Behutiye, W. N., Rodríguez, P., Oivo, M., & Tosun, A. (2017). Analyzing the concept of technical debt in the context of agile software development: A systematic literature review. *Information and Software Technology*, *82*, 139–158. https://doi.org/10.1016/j.infsof.2016.10.004

Cunningham W. (1992). The WyCash Portfolio Management System. *OOPSLA'92 Object Oriented Programming Systems, Languages and Applications*, Vancouver, B.C., Canada, October 18-22. NY: ACM, 29-30. doi: 10.1145/157710.157715.

Neville, K.J., Rosso, H., Pires, B. (2021). A systems-resilience approach to technology transition in high-consequence work systems. *Proceedings of the 9th Symposium on Resilience Engineering*, June 21-24, Toulouse, France

Nord, R. L., Ozkaya, I., Kruchten, P., & Gonzalez-Rojas, M. (2012). In Search of a Metric for Managing Architectural Technical Debt. *2012 Joint Working IEEE/IFIP Conference on Software Architecture and European Conference on Software Architecture*. https://doi.org/10.1109/wicsa-ecsa.212.17

Woods, D. D. (2006). Essential characteristics of resilience. In E. Hollnagel, D. D. Woods, & N. Leveson (Eds.), *Resilience Engineering: Concepts and Precepts* (pp. 21-34). Ashgate.