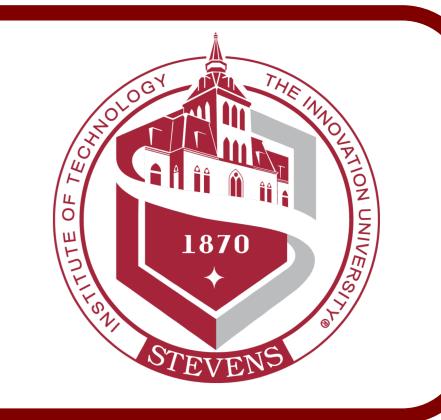# RT-193: Framework for Analyzing Versioning and Technical Debt
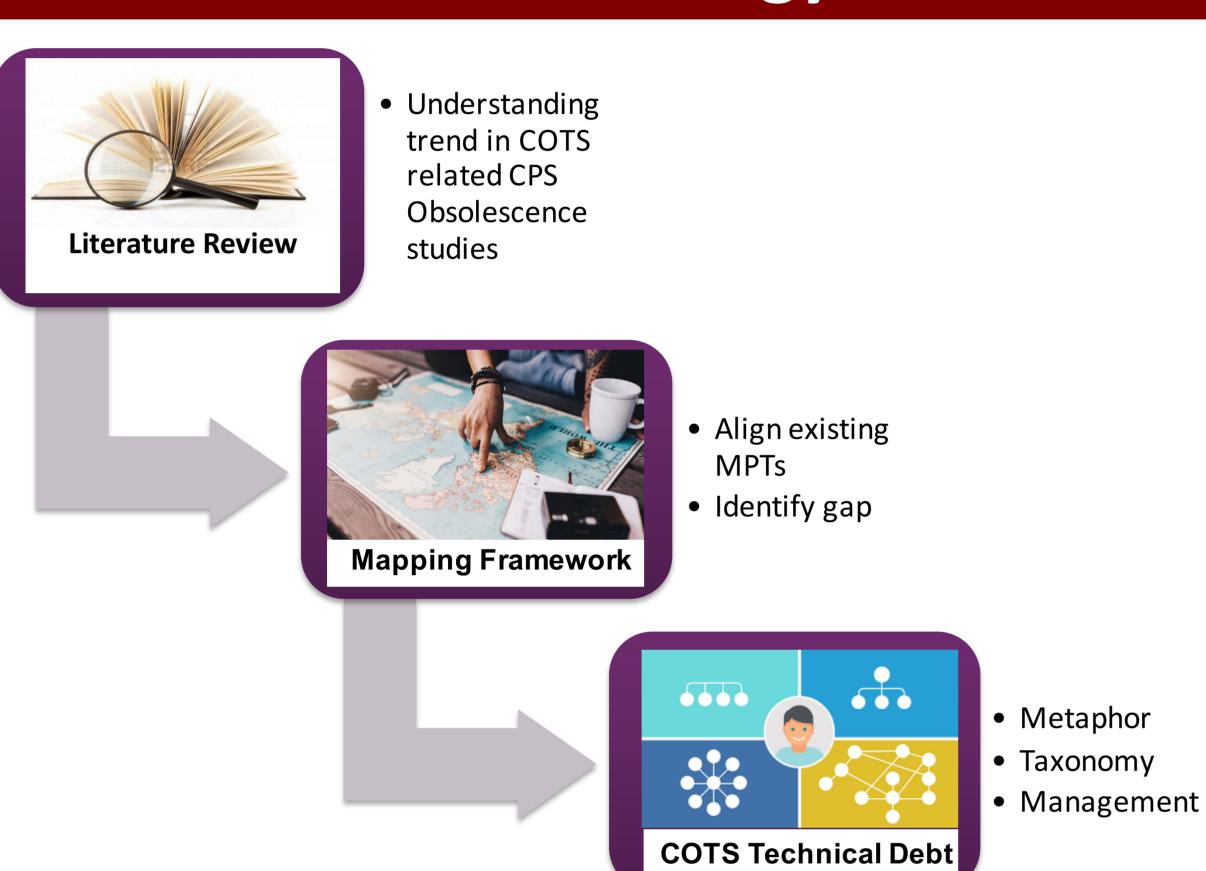
Dr. Ye Yang, Dr. Jon Wade, Turki Aleyani
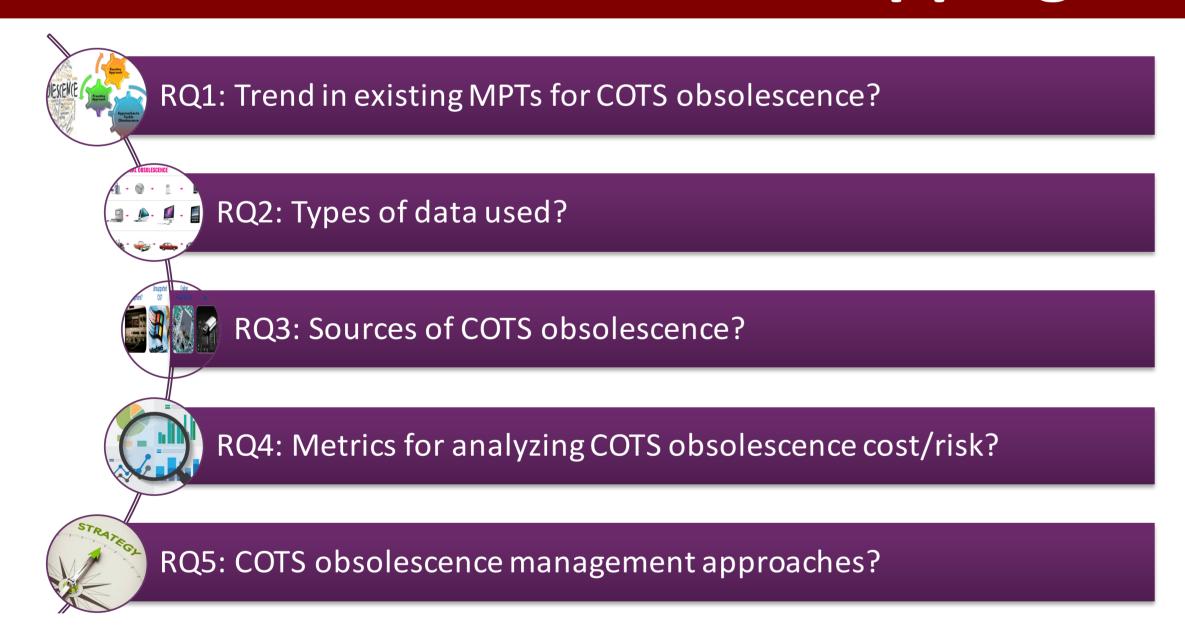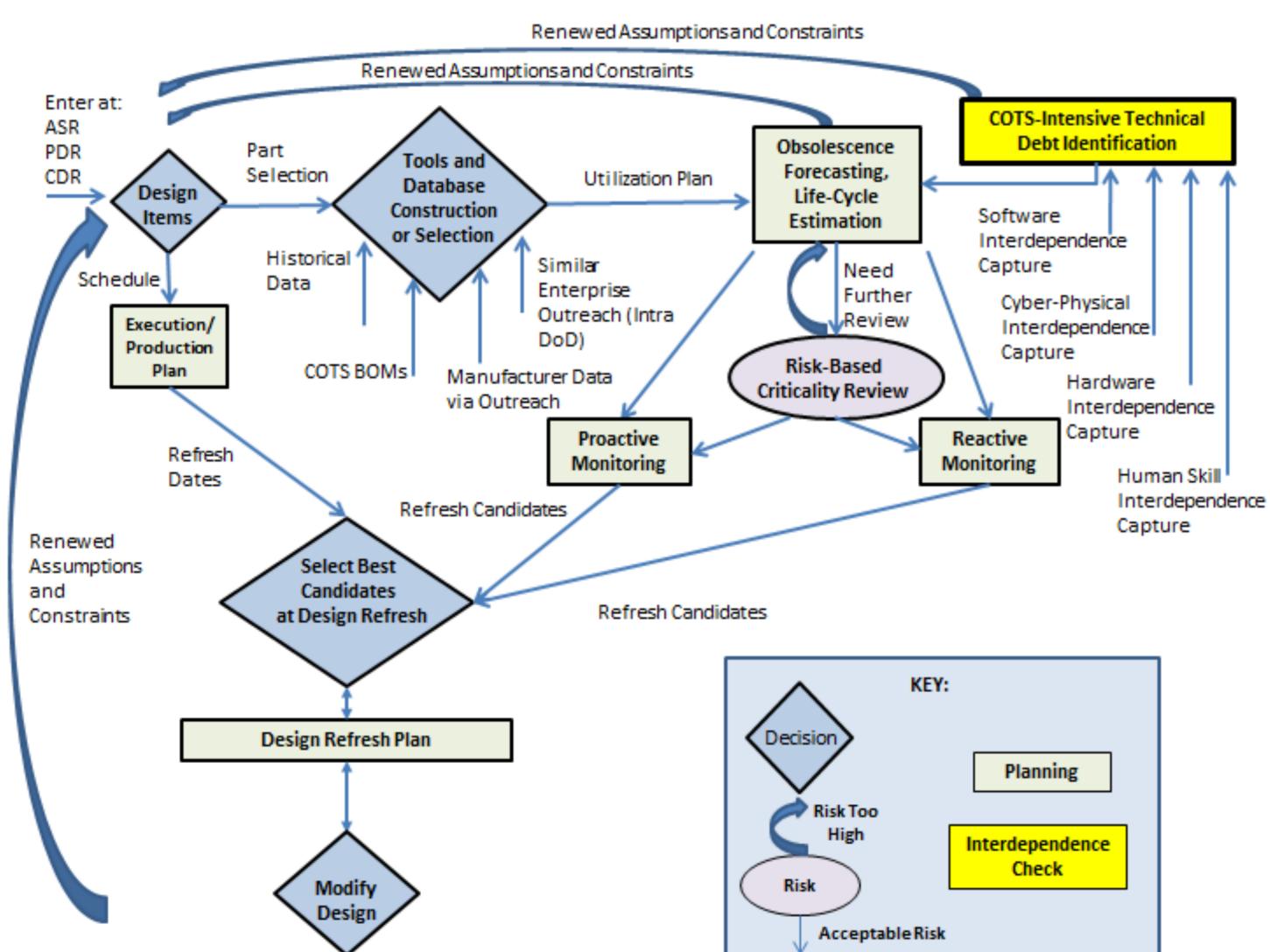Stevens Institute of Technology

Research Task / Overview

- COTS components are increasingly imposing long-term management issues such as obsolescence, poor reliability, lack of readiness, and inability to be readily maintaining systems in an efficient and effective manner.
- The main challenge is the lack of a common metric and measurement framework to serve as basis for understanding, communicating, analyzing and predicting the life cycle consequences incurred by COTS obsolescence issues.
- This project starts with a systematic literature review on the topic of "technical debt" across multiple general scope digital libraries, evaluate and synthesize a classification of technical debts applicable to COTS-intensive military systems, and develop appropriate metrics and measurement to support future modeling and analysis effort.

Methodology

- Understanding trend in COTS related CPS Obsolescence studies

Literature Review

- Align existing MPTs
- Identify gap

Mapping Framework

- Metaphor
- Taxonomy
- Management

COTS Technical Debt

Literature Review & Mapping

- RQ1: Trend in existing MPTs for COTS obsolescence?
- RQ2: Types of data used?
- RQ3: Sources of COTS obsolescence?
- RQ4: Metrics for analyzing COTS obsolescence cost/risk?
- RQ5: COTS obsolescence management approaches?

Goals & Objectives

- The purpose of this project is to leverage the metaphor of "Technical Debt" and existing research from software engineering domain, develop a counterpart concept of "Technical Debt" at system level to categorize typical patterns of COTS/NDI hardware and software technical debts applicable to system engineering life cycle of US Army's Cyber-Physical-Systems (CPS), and eventually develop metrics to support the analysis and mitigation of technical debts in COTS-intensive systems.

A Taxonomy for COTS Technical Debt

COTS Category	TD Description	Analogy to existing work
Function	The degree of functionality mismatch between COTS capabilities and system needs.	Local TD; Data TD
Performance	The degree of mismatches between COTS capabilities and system needs, w.r.t. quality/extra-functional properties.	MacGyver TD; Data TD
Interoperability	The degree of interface/ assumption mismatches among various interdependent COTS components, as well as among COTS and system custom components.	MacGyver TD; Data TD
Configuration Version	CPS configuration version planning needs to address solution availability plan. Greater tendency of COTS version upgrade/refresh may lead to more obsolete COTS.	Unavoidable TD; Local TD; MacGyver TD; Foundational TD; Data TD
Documentation & Support	Lack of documentation and vendor support will seriously impact on issue resolution related to obsolete COTS.	Unavoidable; Data TD
System Evolution Limitations	Requirements imposed by COTS may place great limitation on system evolution.	Unavoidable TD; Foundational TD; Data TD
Organic	People-centric perspective of TD focusing on organizational decision-making, behaviors, and practices associated with those personnel responsible for introductions of new technologies & systems and/or the sustainment of existing systems	Local TD; Naïve TD; Strategic TD

Future Research

- Towards Effective COTS Technical Debt Management (TDM) for CPS Systems
- Investigate major obsolescence issues related to both COTS software and hardware and map to the COTS TD taxonomy
- Modelling and Simulation of COTS changes and impacts w.r.t. CPS environment
- Better align COTS TD management techniques and align with existing acquisition activities
- Modelling and Simulation of COTS TD management activities within CPS context

Contacts/References

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