• 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.

**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**

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

**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

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References: