Modeling, Specifying, Discovering, and Integrating Trust into Distributed Real-time and Embedded Systems
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Mission: To develop principles and an associated framework that will enable the creation of trustworthy Distributed Real-time and Embedded (DRE) Systems.

“Trust is the expectation that a device will behave in a particular manner for a specific purpose” – Trusted Computing Group

In this research, a “device” is a software service and its trust can be defined as the conformance of its functional and non-functional behavior with respect to its specification.

Long Term Objectives

- How to model and incorporate trust during early phases of a DRE system’s software lifecycle?
- How to represent, select and compose trusted services to build a specific DRE systems from a collection of available service repositories?
- How to empirically validate the outcomes of the proposed research by creating various prototypical systems?

Limitations of Existing Approaches

- Trust is considered as an afterthought
- Trust models are not aligned with the software lifecycle
- Do not provide a generalized trust model

Trust Model (TrDRES)

\[ T_{iv(a)} = (iv_a (B;D;U)) \]

\[ T_{xv(a)} = (xv_a (B;D;U)) \]

- Trust of the software is evaluated using its artifacts \((a)\).
- Enhance trust representation which uses subjective logic.
  (by Jøsang et. al.).

\[ T_a = f (T_{iv(a)} ; T_{xv(a)}) \]

Trust Contract of a Service

User Requirements \((R)\) about Lag-Time \(\approx\) functional Relation to Service \((S_{iv(s)} , S_{xv(s)})\)

Investigating different ways of Trustworthy Service Selection and Negotiation
- Subjective Logic Evidence-based Approach
- Probabilistic Operator-based Approach

Long-term monitoring of Software Services

Case Study: Composition of Trust

Trust of Property

<table>
<thead>
<tr>
<th>Predicted value</th>
<th>Actual value</th>
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</thead>
<tbody>
<tr>
<td>Trust of Response Time</td>
<td>&lt;0.263, 0.0, 0.737&gt;</td>
</tr>
<tr>
<td>Trust of Error</td>
<td>&lt;0.422, 0.012, 0.566&gt;</td>
</tr>
<tr>
<td>Normalized Trust of Response Time</td>
<td>&lt;0.632, 0.368, 0&gt;</td>
</tr>
<tr>
<td>Normalized Trust of Error</td>
<td>&lt;0.806, 0.194, 0&gt;</td>
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</tbody>
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Improve the certainty:
- Incorporating domain knowledge.
- Learning compatibility of services dynamically.