Exploring current issues in CPS Theory $(\mathcal{S}, I)$

Thanh H. Nguyen

New Mexico State University

tnguyen@cs.nmsu.edu

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Overview

1. Issue 1: Complicated Relations between Properties and Concerns
2. Issue 2: The Conflicts between Properties
3. Issue 3: Timing Constraits
4. Issue 4: More Advanced Trustworthiness Queries

Issue 1: Problem Description

- In CPS theory, there are 2 most important relations between *concern* and *property*: $addBy(C, P)$ and $subconcern(C, C_1)$
- A concern C is satisfied iff **all sub-concerns of C** are satisfied AND **all properties that address for C** are satisfied.
- However, there exists a case that: $\exists p_1, p_2 \in P, c \in C$ and $addBy(c, p_1) \wedge addBy(c, p_2)$ and c has no sub-concerns, $sat(c)$ holds if $sat(p_1) \vee sat(p_2)$ holds.
- Example, properties $\{two\_factos\_auth, finger\_printing\_auth\}$ address concern *Authorization*. concern *Authorization* is satisfied if a physical device uses *two_factos_auth* OR *finger_printing_auth*.
- This idea is not appropriate with current CPS Theory.

Issue 1: Solution – Extend CPS Ontology

- We propose new terminology: *Supplementary Property* (SP)
- We propose new relation between *Supplementary Property* and *Property*: $supportFor(SP, P)$ denotes that supplementary property SP supports for property P.
- A property P is satisfied IFF the truth value of P is *true* OR one of supplementary properties of P is True.
  `holds(sat(P),S) :- holds(sat(SP),S), supportFor(SP,P).`
- In CPS theory $(\mathcal{S}, I)$. The relation $r \in R$ denotes the relation between a component c and a set of supplementary properties sp. The predicate $relation(c, sp)$ denotes that component c is related with supplementary property sp.

Issue 1: Changes in Planning Engine

- The extension of CPS Ontology will support to improve the reasoning and the mitigation strategies generation.
- The CPS action is not only able to turn ON/OFF the supplementary property (make the truth values of these properties True or False), but also is able to switch component to use authentication function between $\{two\_factors\_auth$ and $finger\_printing\_auth\}$.
- Generate the more powerful mitigation strategies (multiple types of actions which changes truth value of supplementary property AND changes the relation between component and supplementary properties).

Issue 2: Problem Description

- We

Issue 2: Solution – Likelihood of Concern Satisfaction

- We

Issue 3: Problem Description

- We

Issue 3: Solution

- We

More Advanced Trustworthiness Queries

- We