Win Win Formal Modeling

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Outline

1. WinWin overview
2. Formal modeling objectives
3. Formal modeling results
   - System and artifact states
4. Formal modeling implications
5. Formal modeling objectives achieved
WinWin Overview

1. PROBLEM SPACE VIEW

2. OPERATIONAL CONCEPT

3. SYSTEM EQUILIBRIUM

4. ARTIFACT RELATIONSHIP

Formal Modeling Objectives

- Reconcile multiple views of system
- Fully understand system behavior
  - Nominal and off-nominal cases
    * Many-many relationships among artifacts
    * Concurrent negotiation of interlocking issues
    * Modifying or deleting artifacts
- Clearly communicate system status to users
Formal Modeling Results
System and Artifact States
- Initial scenario: achieve equilibrium
  - Simple artifact life cycles
- Recognized need to recover equilibrium
  - Equilibrium state transitions
  - Artifact life cycle interactions
- Recognized concurrency-control problems
  - Artifact locking
  - Many-many relationships
  - Compound states
- Recognized other off-nominal cases
  - Artifact modification and deletion
The Option Life Cycle

For any option o, state(o) is decided by the state of its adopting agreement as follows:

- unused \( \text{iff } (\forall (a \in A) (o \in \text{adopts}(a))) \)
- pre-used \( \text{iff } (\exists (a \in A) (o \in \text{adopts}(a)) \land (\text{state}(a) = \text{open})) \)
- vote-in-progress \( \text{iff } (\exists (a \in A) (o \in \text{adopts}(a)) \land (\text{state}(a) = \text{vote-in-progress})) \)
- used \( \text{iff } (\exists (a \in A) (o \in \text{adopts}(a)) \land (\text{state}(a) = \text{passed})) \)

Stakeholders propose option to an issue
Adopting agreement is dropped
Option is adopted by an open agreement
Adopting agreement is dropped or failed
Stakeholders start a vote on the adopting agreement
Stakeholders pass the vote on the adopting agreement

The Win Condition Life Cycle

Basic States (in a specific artifact chain):
- free
- uncovered (u)
- pre-covered (p)
- vote-in-progress (v)
- covered (c)
Compound States Involving Multiple Artifact Chains

Artifact Relationships v.s. Artifact Life Cycles
Augmented Win Condition State Transition Diagram

Formal Modeling Implications
- Makes relationships explicit
- Identifies and prevents potential aberrant behavior
  - Conditions for locking and unlocking artifacts
  - Certain undesirable state combinations
- Suggests stronger status summaries
Conditions for Unlocking Artifacts

Initial Implementation:

- Vote: Vote-in-progress (V); lock win condition
- Vote fails: Uncovered (U); unlock win conditions

Formal modeling:

new agreement

Vote-in-progress (V); lock win condition

new agreement

vote on new agreement

Vote-in-progress (V); do not unlock win conditions

Win Condition Summary (current)
Win Condition Summary (suggested)

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Formal Modeling Objectives Achieved

- Reconcile multiple views of system
  - Problem space view -> Artifacts & relationships -> Artifact state model -> System equilibrium model
- Fully understand system behavior
  - recognized need to recover equilibrium
  - recognized concurrency-control problems
  - recognized off-nominal cases
- Clearly communicate system status to users
  - suggests stronger state summary
  - avoids misleading users and misuse of system
  - signals when an artifact is locked