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# Uncertainty Tolerant Decision Support (Rendezvous)

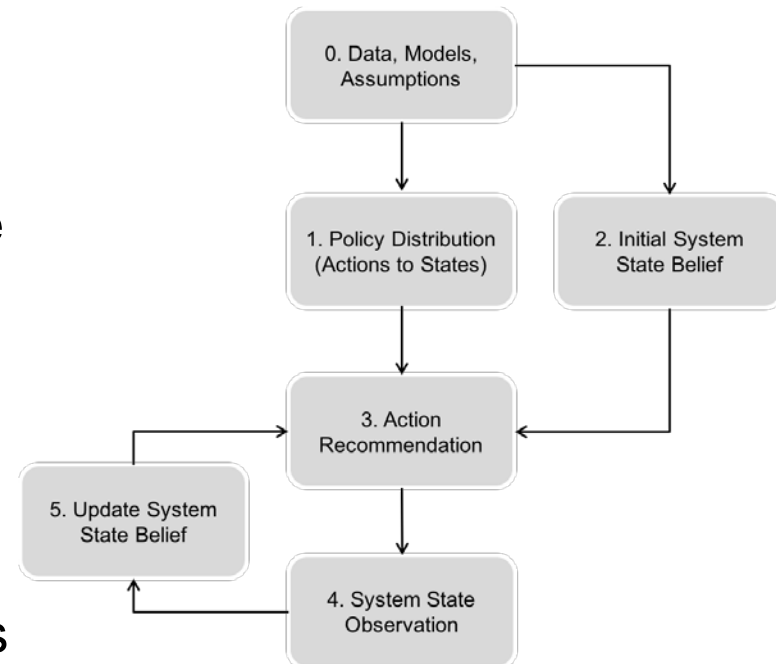
**SAM CHATTERJEE**

Asymmetric Resilient Cybersecurity Initiative Roadshow

May 12, 2017

- ▶ Effective cyber defense requires characterization of system state, knowledge of attacker and defender activities, and their relationships
- ▶ Real world contains various sources and types of uncertainties: system state, transition, observation, attack types
- ▶ Cyber defender has to identify optimal strategies that can enhance cyber-system resilience under compromised conditions
- ▶ Practical challenges with game-theoretic approaches for network security
  - Tractability
  - Mathematical guarantees
  - Multiple equilibria
  - Mixed uncertainties

- ▶ *Rendezvous*: decision-support engine that generates optimal cyber defense action recommendations and policies in a dynamic setting with imperfect information
- ▶ Characterize uncertainty through stochastic state transition and observation models
- ▶ Reformulate mathematical games that account for imperfect information for use in cybersecurity decision-support
- ▶ Implement mathematical solvers within a simulation setting that generate policies and recommended defense actions based on an ensemble of games

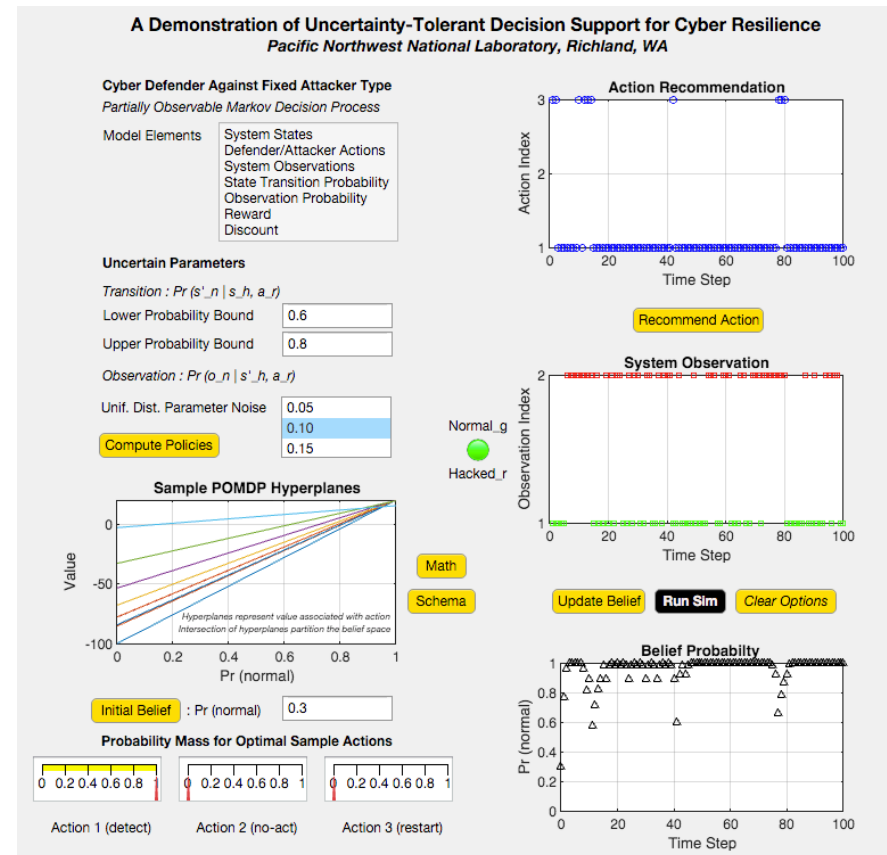


▶ *Rendezvous* decision-support engine generates optimal cyber defense actions that operators may choose from to maximize the system's ability to continue mission critical operations

▶ The recommendation engine is flexible and tunable to fit specific operating environments

▶ Accommodates defensive, offensive, or deceptive strategies

▶ Provides decision support to human-focused or automated systems with emphasis on capturing uncertainty in state measures





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