A Meta-Game Theoretic Approach to Cyber-Physical Co-Design of Secure and Resilient **Control Systems**

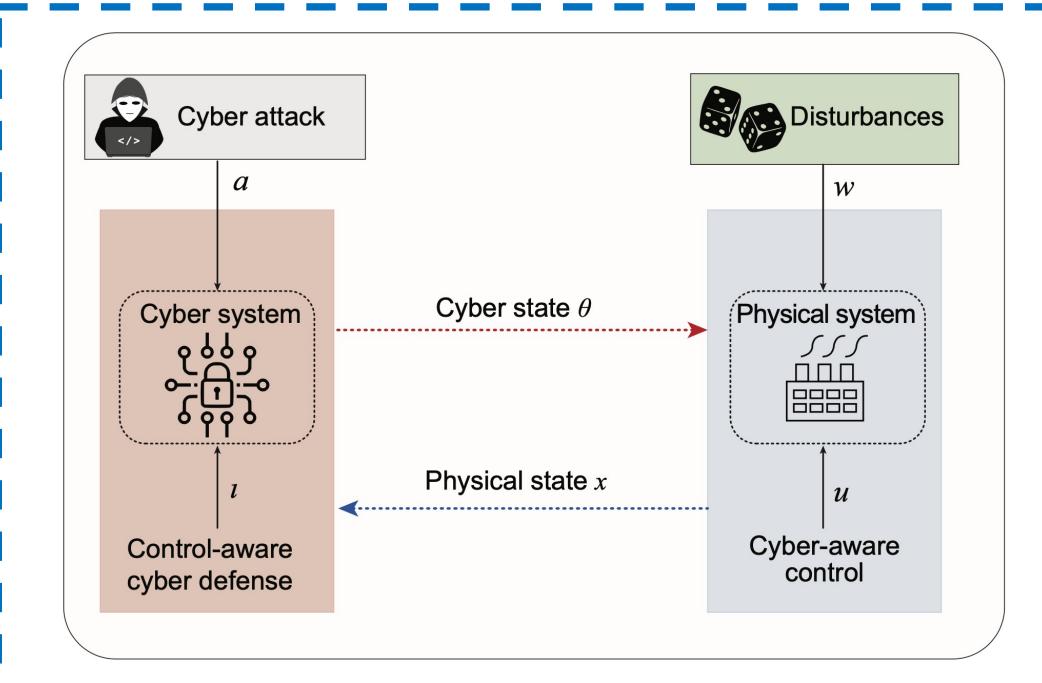
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Challenges:

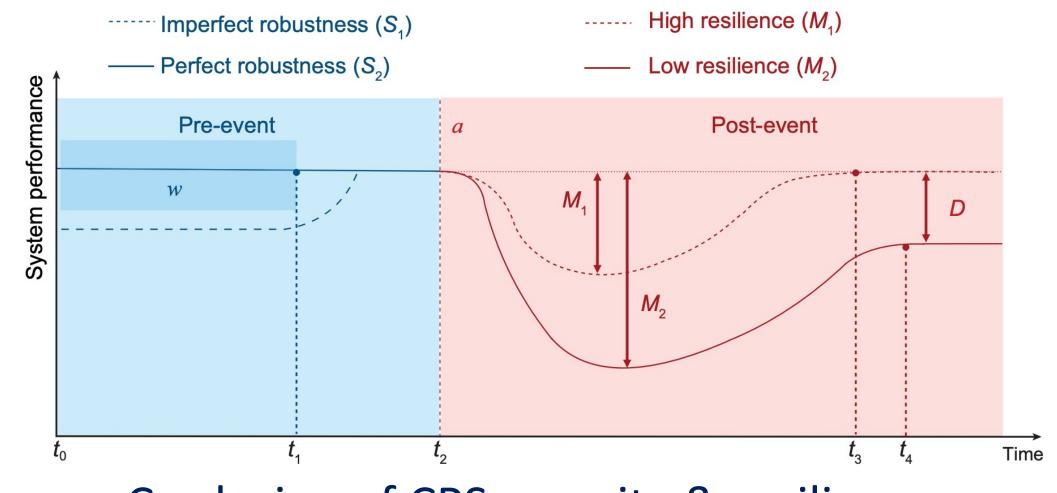
- Multi-layer modeling and decentralized cyber-physical control design.
- Holistic design of CPS robustness, security and resilience.
- Dynamic evolution of multi-layer networks & strategic adversarial attacks.
- Coordination, planning, and design of constrained and interdependent heterogeneous cyber-physical networks.

Goals & Contributions:

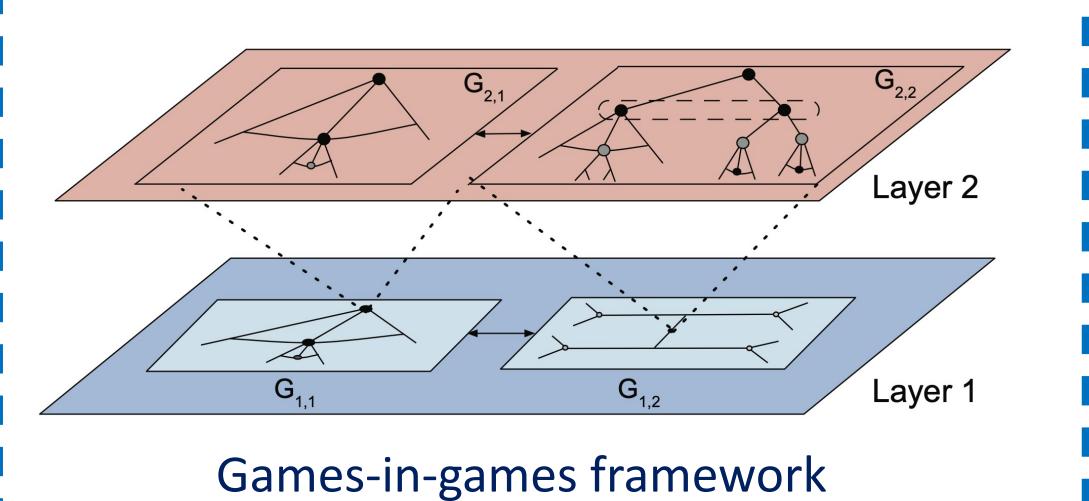
- Developing autonomic, self-organizing, and self-healing networks that can reconfigure according to changing network conditions.
- Developing impact-aware proactive cyber defense mechanisms & securityaware resilient physical controller.
- Proposed a games-in-games approach for CPS cross-layer integration and analysis under adversarial attacks.
- Offered a scalable and computationallyefficient mechanism for achieving system robustness, security and resiliency.

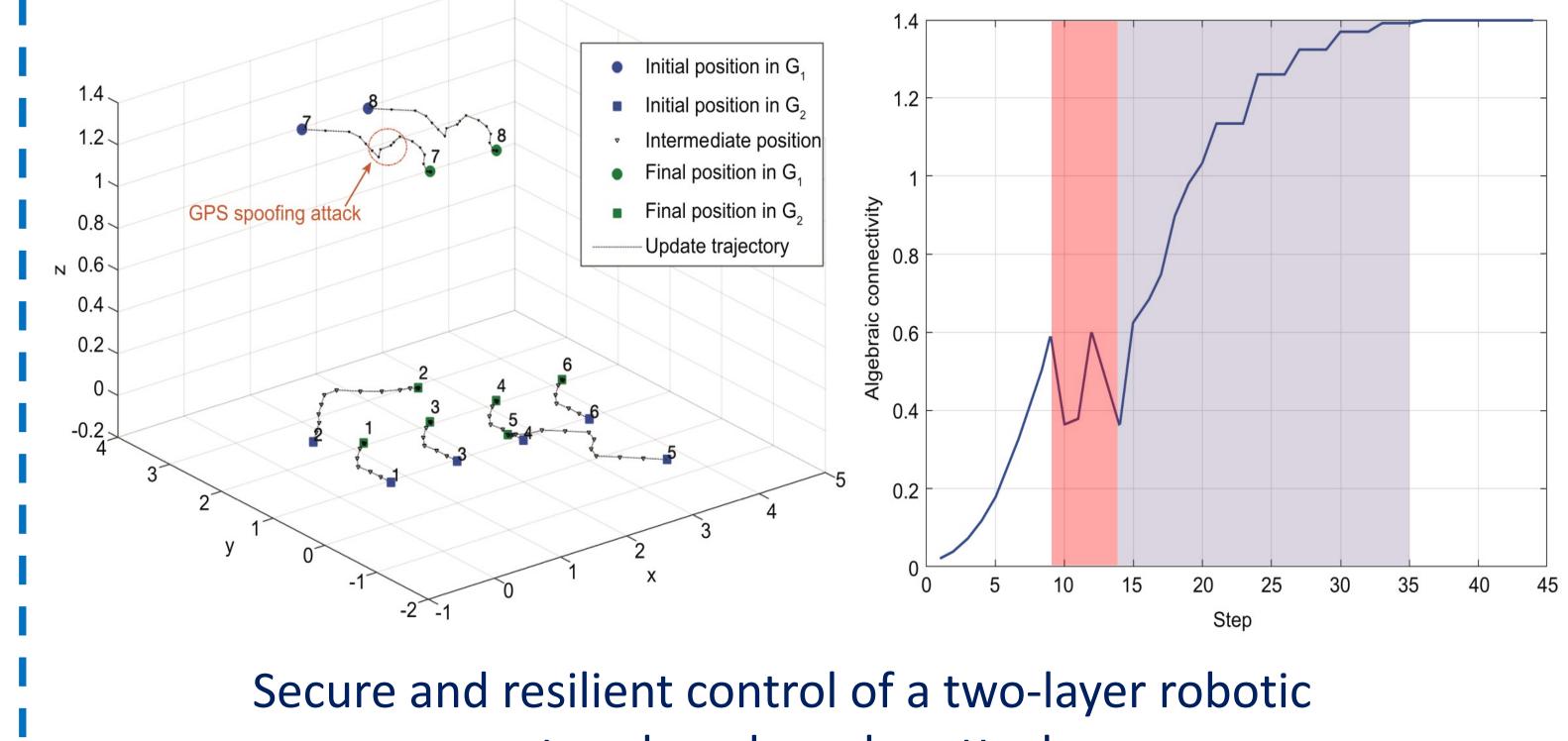


Cyber-physical cross-layer model



Co-design of CPS security & resiliency





network under cyberattack.

Scientific Impacts:

- A system co-design foundation for achieving cyber-physical security and resiliency.
- Game- and decision-theoretic frameworks for security and resilience which are applicable to a wide variety of multi- agent CPS.
- Applications: Unmanned vehicles, industrial control systems, manufacturing robots, IoT.

Broader Impacts:

- Protect nation's critical infrastructures by safeguarding cyber & control systems.
- Train workforce on trustworthy CPS discipline.
- Organized workshops and tutorials on CPS security.
- Pave the way for development of startups and enterprises focusing on the security and resilience aspects of CPS.