Alloy-based Game-theoretic Framework for
Analyzing Security Issues in Small-scale Smart Grid Systems

Jianye Hao

Computer Science and Artificial Intelligence Lab
Massachusetts Institute of Technology

jianye@mit.edu

Background and Motivation

- ## Small-scale smart grid system

    - A networked group of distributed energy sources (e.g., solar panels, wind turbine) at the power distribution network side
    - One promising and key feature in the future smart-grid system
   - Highly vulnerable to malicious (physical and cyber) attacks

Switching devices (sensor, actuator)

Energy sources
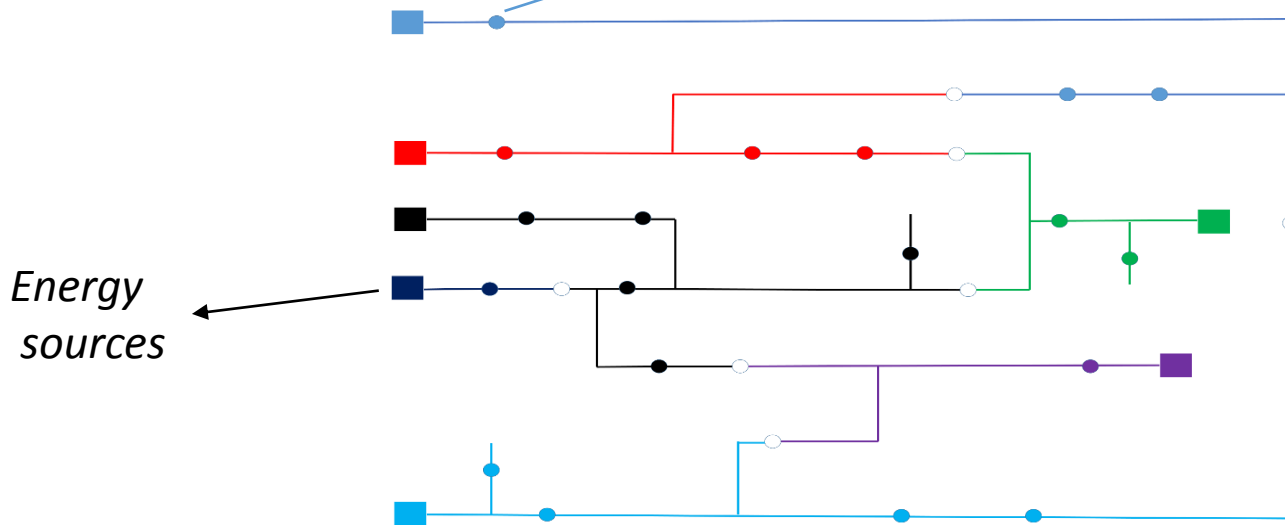
An example of power distribution network

Background and Motivation

- Difficulties in analyzing security issues in small-scale smart grid system
  - Involves multiple self-interested entities (energy providers) -> game theoretic frameworks
  - Complex interdependency between network components/network structure -> formal verification techniques (e.g., Alloy)
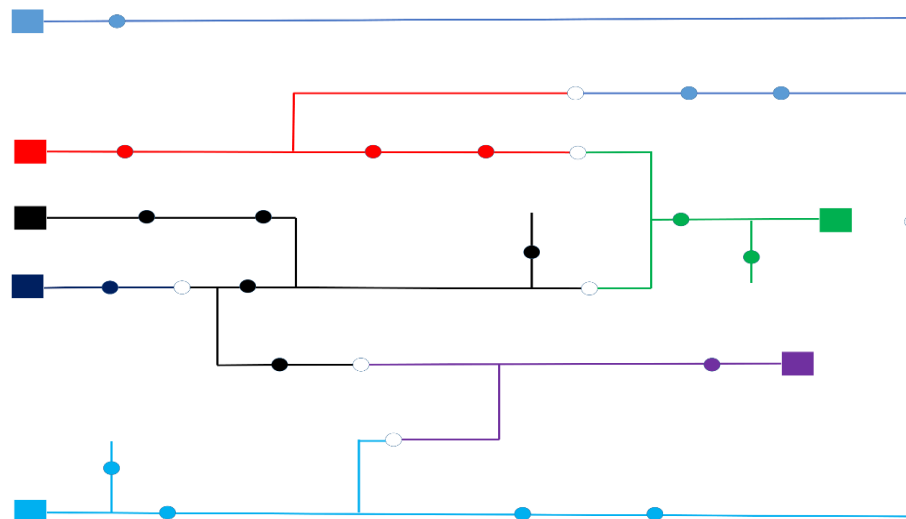
An example of power distribution network

Proposed Framework

- N+1 Repeated *Stackelberg* Game
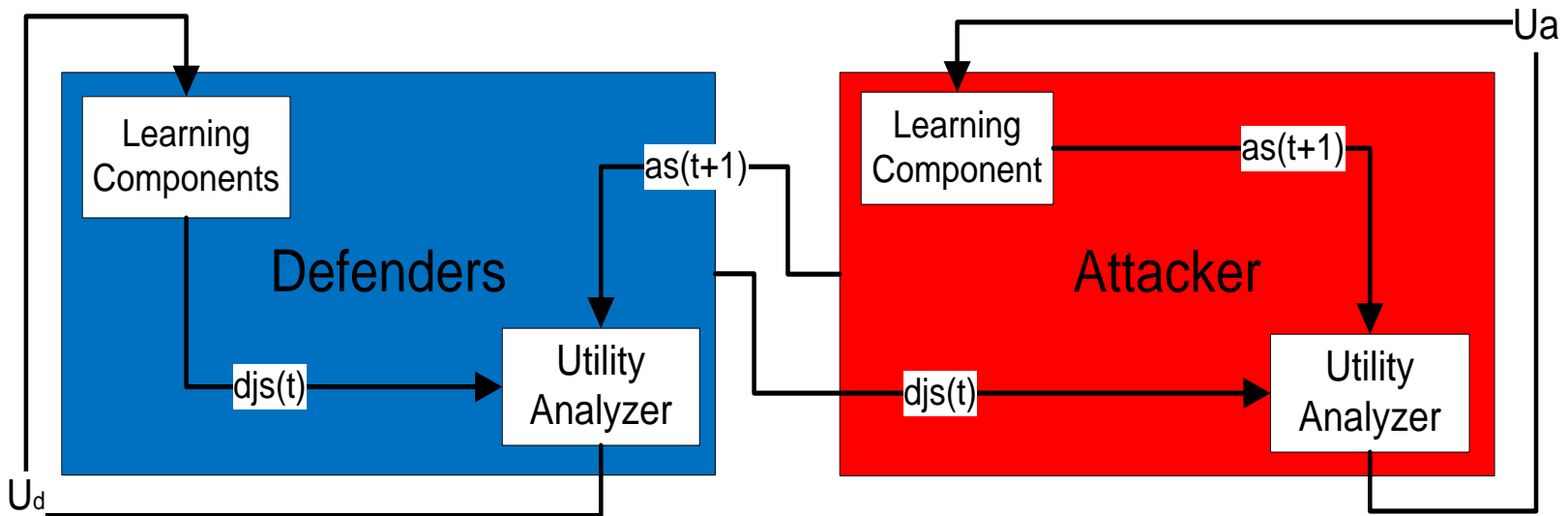
Investigating whether and how the players are able to finally converge to certain stable strategy profile (e.g., Stackelberg equilibrium) such that certain desirable security state (or security property) of the system can be guaranteed.

Thank you!