SCATOPSY: Malware Threat Mitigation in ICS/SCADA Operations

Dr. Wenke Lee, Moses Ike
Georgia Institute of Technology
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Objective

Detect Malware Activity in SCADA workstations (e.g., Human Machine Interfaces or HMI) by correlating malware execution-relevant datapoints in ICS host and network behaviors

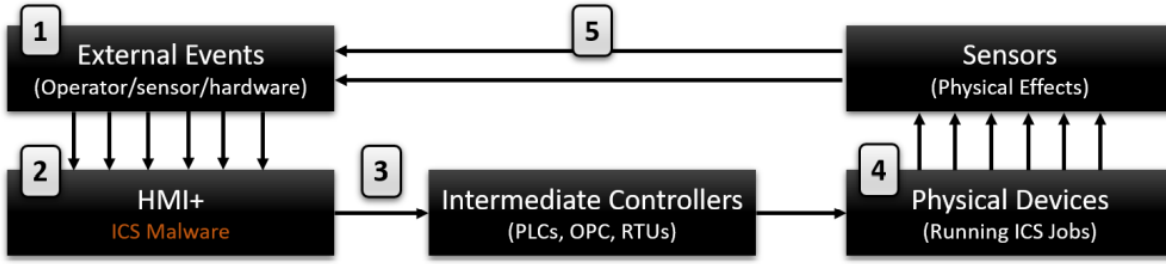

Figure 1: End-to-End ICS/SCADA process-control operation form a feedback control loop

- Observation/Insight
  - Unlike in Traditional IT, ICS/SCADA host operation is driven by ICS events (e.g., sensor measurements of physical process states)
  - To evade detection, modern ICS attacks stage and launch their payloads within these normal events to blend with benign SCADA host operations

  - Idea: Identify and model legitimate end-to-end SCADA behavior, which differentiate from attacker's malicious activities, enabling us to detect them

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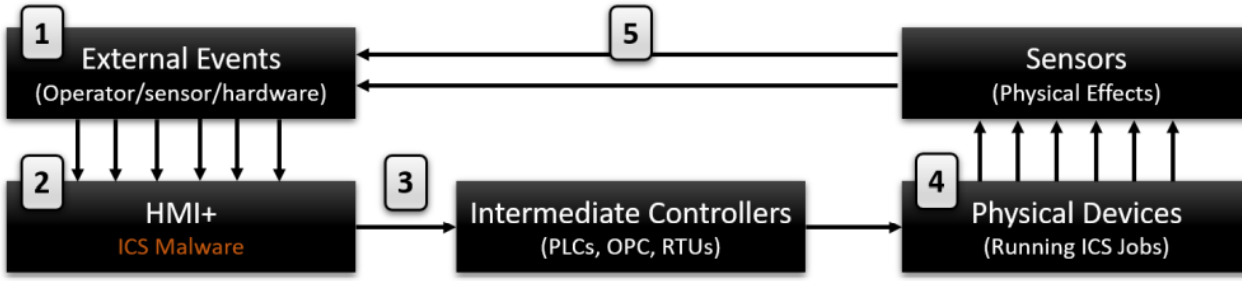
Approach and Challenges



- Build a baseline of legitimate ICS operation sequences 1-> 2-> 3
  - ICS Event -> SCADA Host Execution -> ICS Network Signal
  - Detect anomalous sequences in host execution and network activity
- Challenges:
  - I. Data Model for multi-dimensional sequences
    1. ICS Sensor Readings `<ICS parameter, state, timestamp>`
    2. SCADA Execution `<Process Activity/API call, Argument, timestamp>`
    3. ICS Network Signals `<ICS parameter, func_code, state, timestamp>`
  - II. Sequences may not be enough. Can be evaded by advanced malware ?
    - Additional physical properties/constraints may be needed
      - Statistical and Temporal behaviors

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Initial Results

- Investigated the 2016 Industroyer Malware Attack on Ukraine Power Grid
  - Industroyer attacked circuit breakers and caused power outage
  - Analyzed Host and Network behaviors of the attack

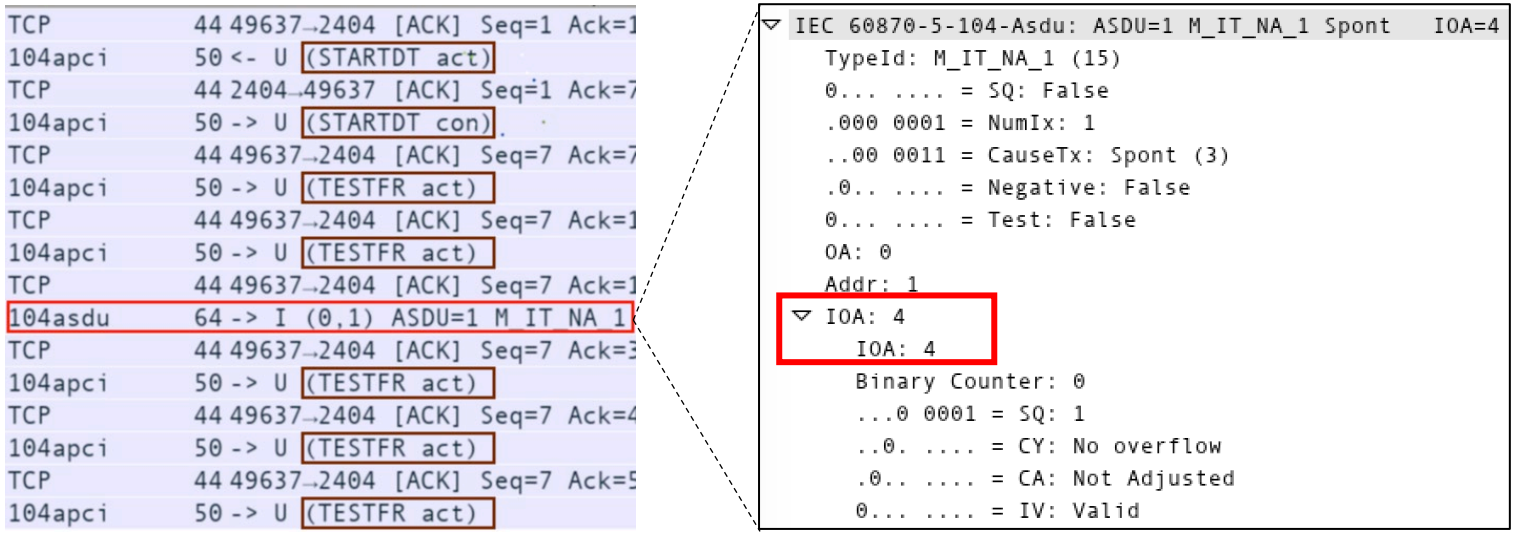

Figure 2: Industroyer Malware's ICS network behavior: Showing attack payload

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Integration and Commercialization Plan

- Integration opportunities with RAD Gateway
- Commercialization based on further use case analysis
  - Distributed or centralized data collection and analysis?
  - Offline or online detection ?

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Thank you

Questions ?

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