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SHADOW FIGMENT

Model Driven Deception for Cyber-Physical System Defense

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U.S. DEPARTMENT OF ENERGY

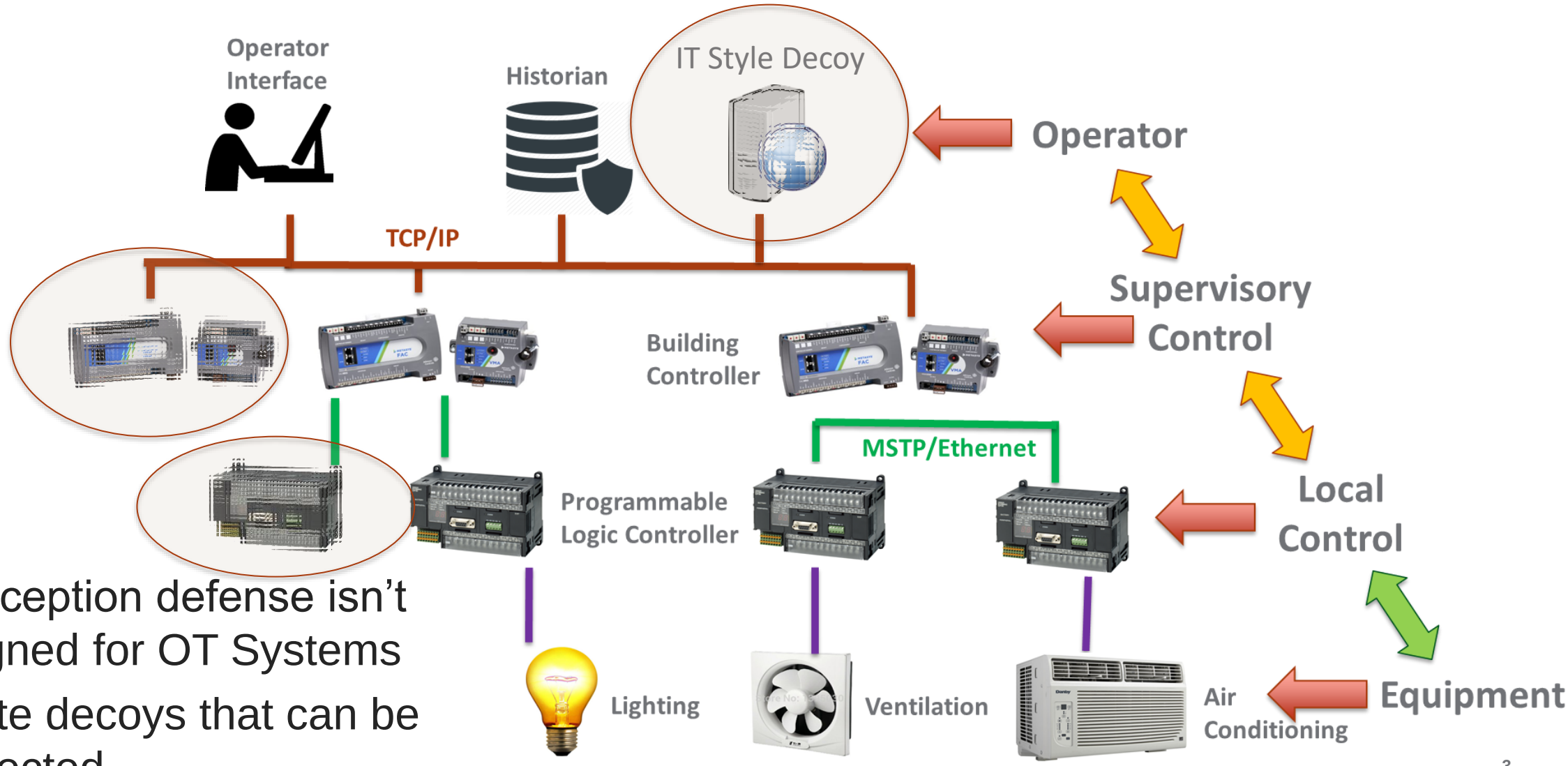
Business Problem

- Critical infrastructure systems have unique cybersecurity challenges
- Owners prioritize **system uptimes** & system availability
- Security solutions must not impact availability

99.999% UPTIME

- Protecting every asset is cost prohibitive
- Common IT solutions aren't supported
  - No continuous patching
  - Lack of crypto

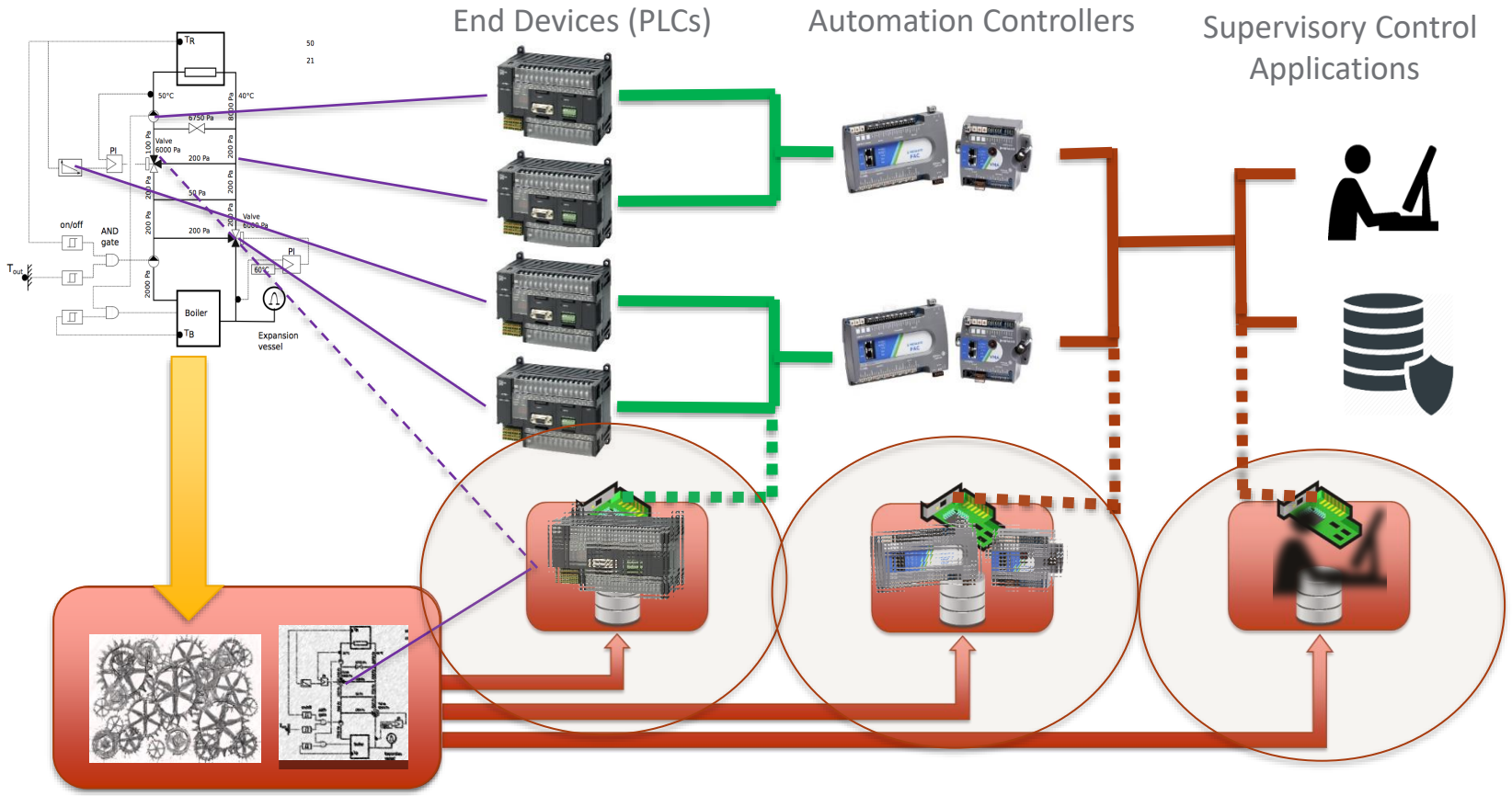
Technical Challenge



- IT deception defense isn't designed for OT Systems
- Create decoys that can be connected

Solution Architecture

- Proof of concept platform providing:
  - ML based process modeling
  - Decoy execution environment
  - Dynamic definition of deception



Development History & Results

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Principal Investigator
Thomas Edgar, Cyber Security Researcher
- Security applications for critical infrastructure
- Successfully licensed previous R&D100 winning technology

Development History
- 2017 Began internal research
- 2019 Began DOE TCF project
- 2019 IEEE HST publication

Funding History
- $200k Internal
- $150k DOE TCF
- $150k (*in-kind*) Attivo Networks

Technology Readiness Level
- TRL ~6

Research
- William Hofer, Cyber Security
- Juan Brandi-Lozano, Data Science
- Garret Seppala, Software Engineer
- Katy Nowak, Data Science
- Draguna Vrabie, Control Engineer

IP Protection
- US Application No. 16/389,758 and CA CA3041865A1 (priority date: 4/2018)

Market Validation
- DOE Technology Commercialization Fund award
- Attivo Networks collaboration

Technical Requirements & Benefits

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Requirements

- Execution platform (could be appliance)
- Network span/tap
- Deception deployment/configuration; ongoing
- Alert monitoring (SIEM integration)

Benefits

- Orient attacker resources away from real CPS
- Bias attacker's beliefs on real CPS operation
- Enhance detection of adversarial behavior with reduced false positive rate
- Understand threat objectives

Technical Roadmap

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Data

- Develop any unique data collection mechanisms
- Develop data parsers for control system protocols

Profiles

- Define high fidelity profiles of sector equipment
- Develop unique decoy services for sector equipment

Models

- Validate generative modeling with sector data
- Define common collections/ configurations of deceptions for sector

Platform

- Create execution platform
- Develop user interface
- Create interfaces with incidence management tools

Pilot

- Pilot within Ethernet based control system

Thank You

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Shadow Figment PoCs:

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SHADOW FIGMENT
DEMO

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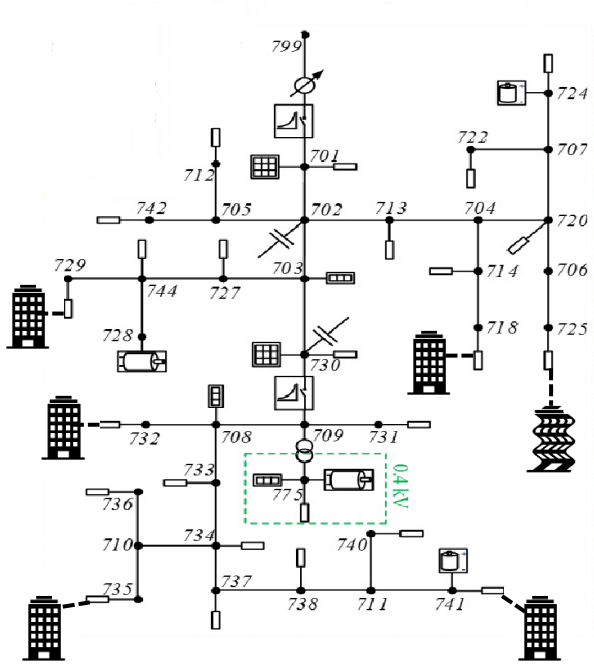
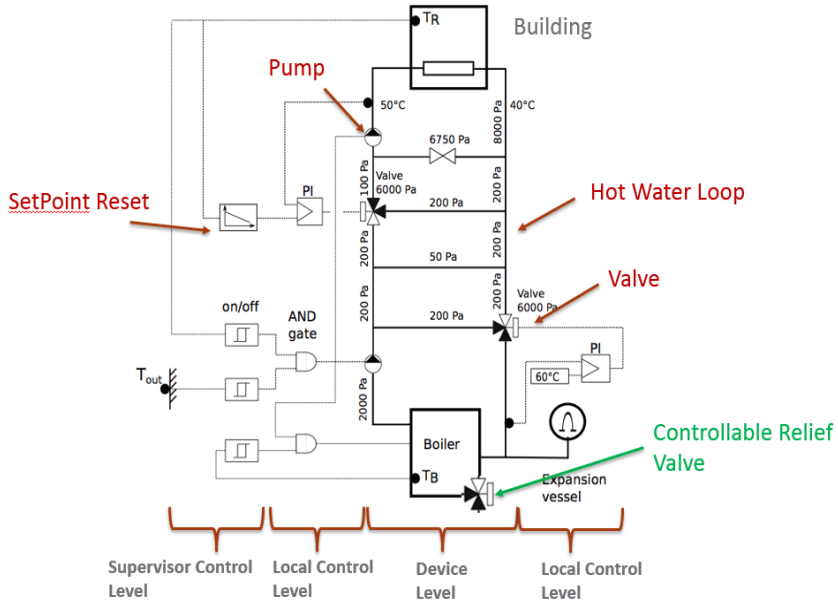
Demonstration Objectives

- Show decoy deployment
  - Two types of deception
- Highlight effect on threat awareness
- Demonstrate value to defender



System copy deception



Integrated decoy deception

Creating Decoys

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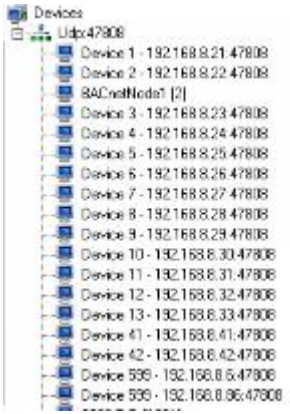
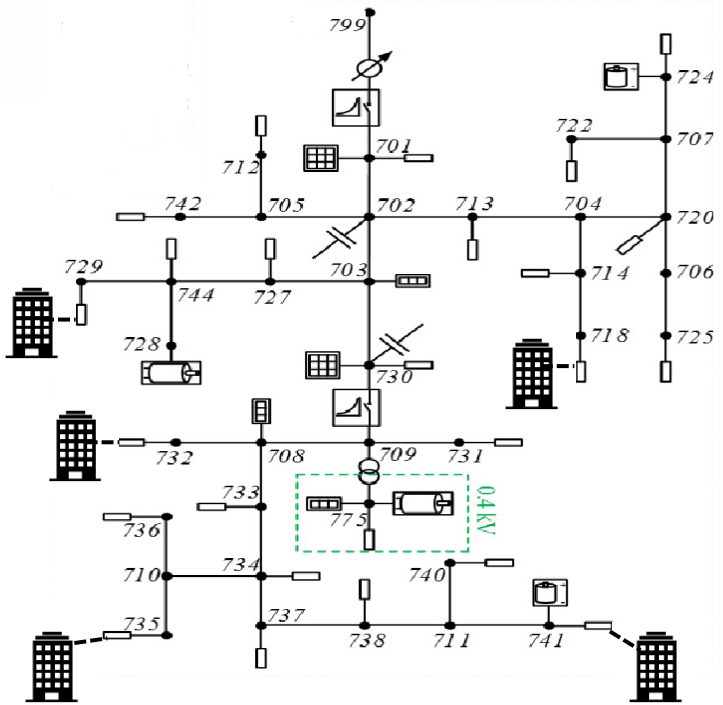
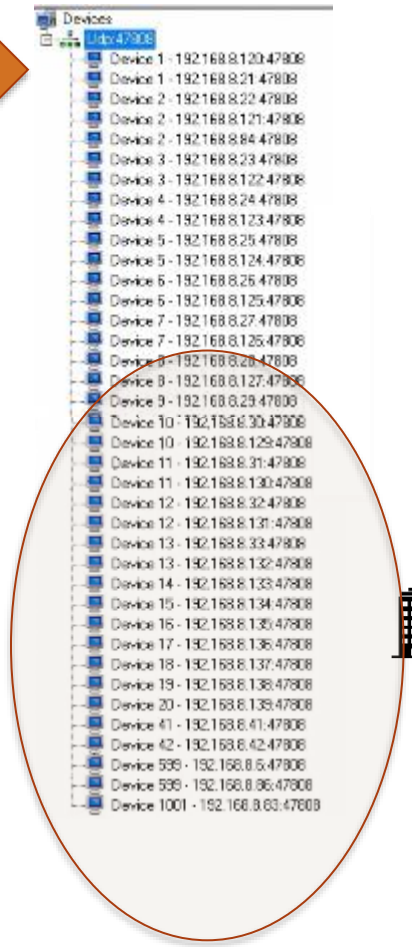
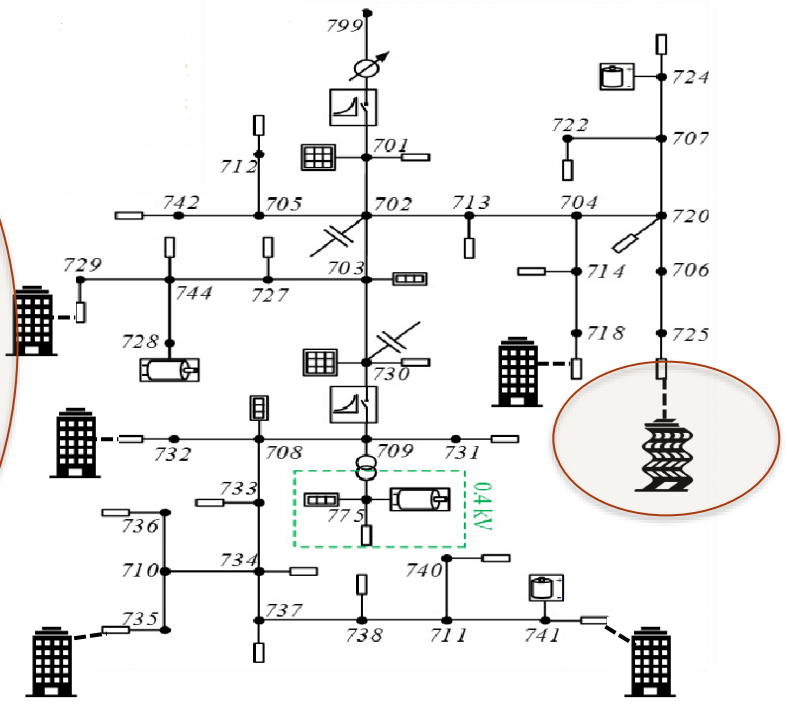


Actual Devices

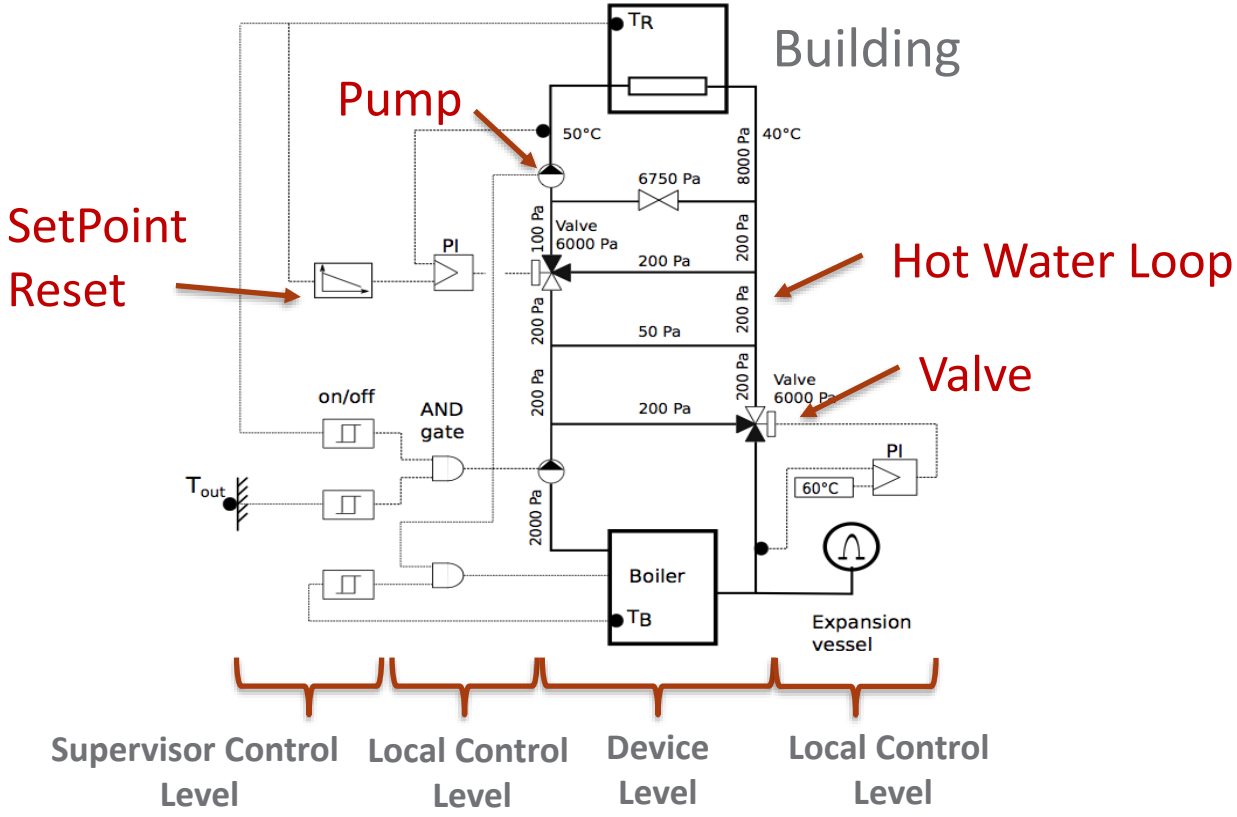


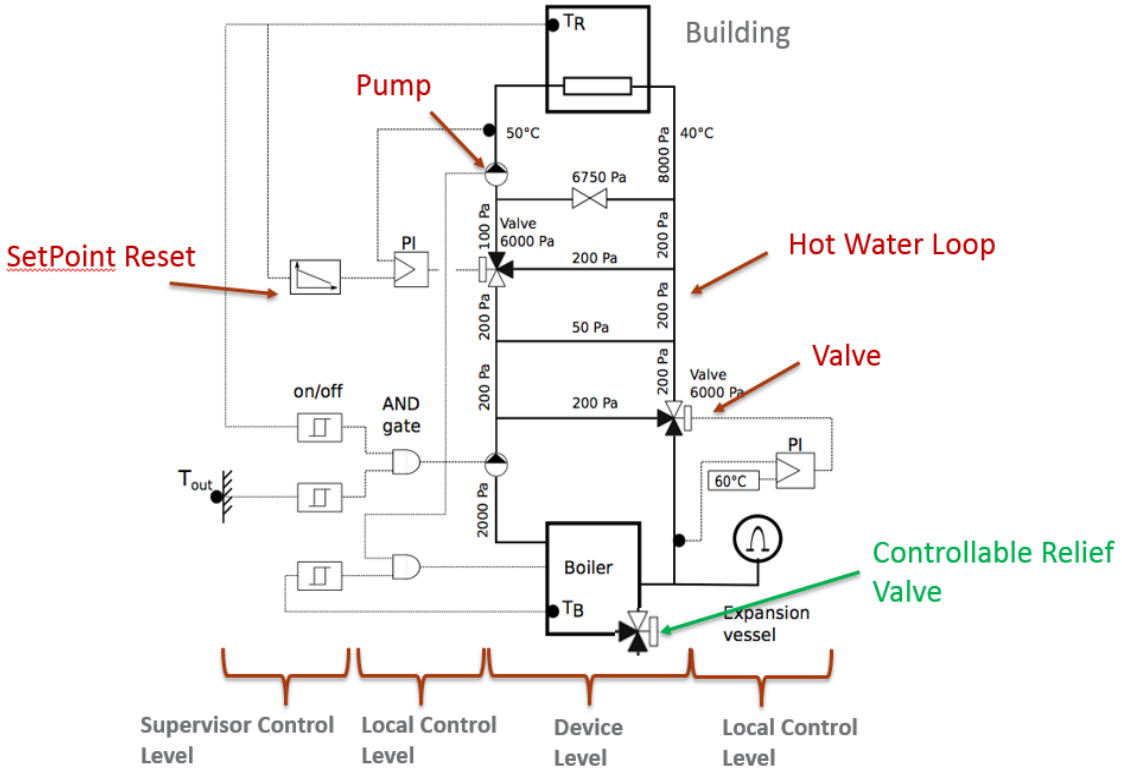


After Decoys Created



Boiler Model Decoy

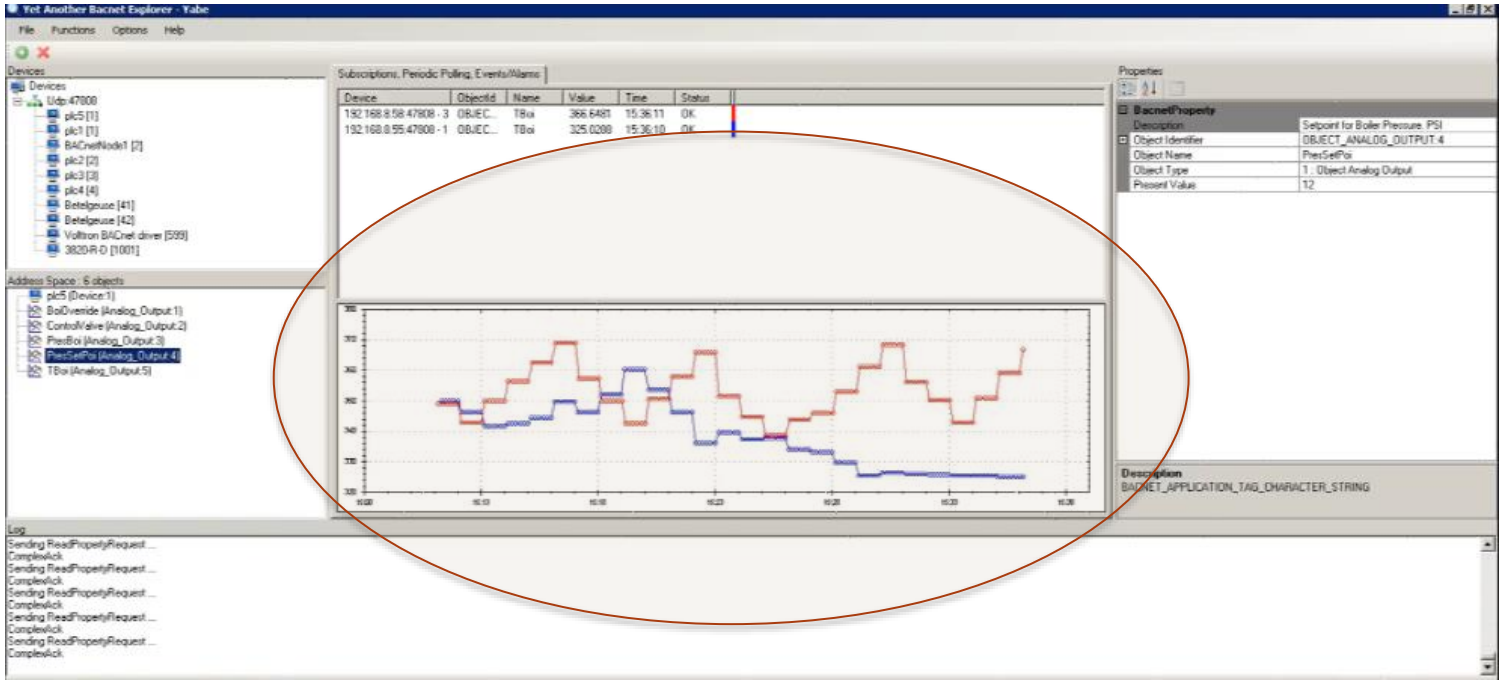




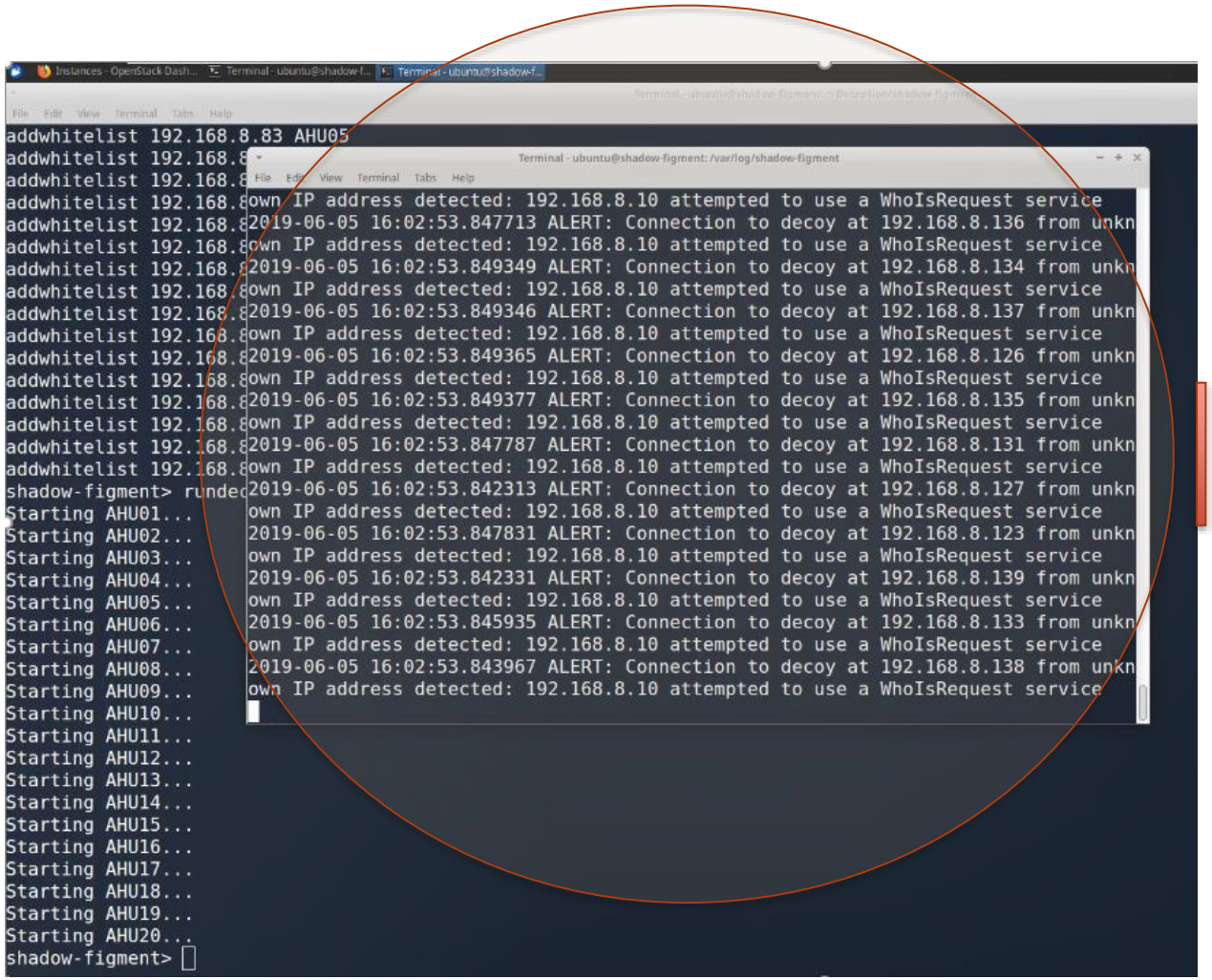
http://simulationresearch.lbl.gov/modelica/

Decoy PLC 5 with Control Valve and ability to override the status of the boiler

Deceiving the Attacker



Alerting the Defender



SIEM/SOAR Platform