IFIP 77th Meeting Session 2

Session Chair: Karthik Pattabiraman, UBC

Presenters:

Gabriel Giunta, Industry and Security Technology

Luis Garcia, UCLA

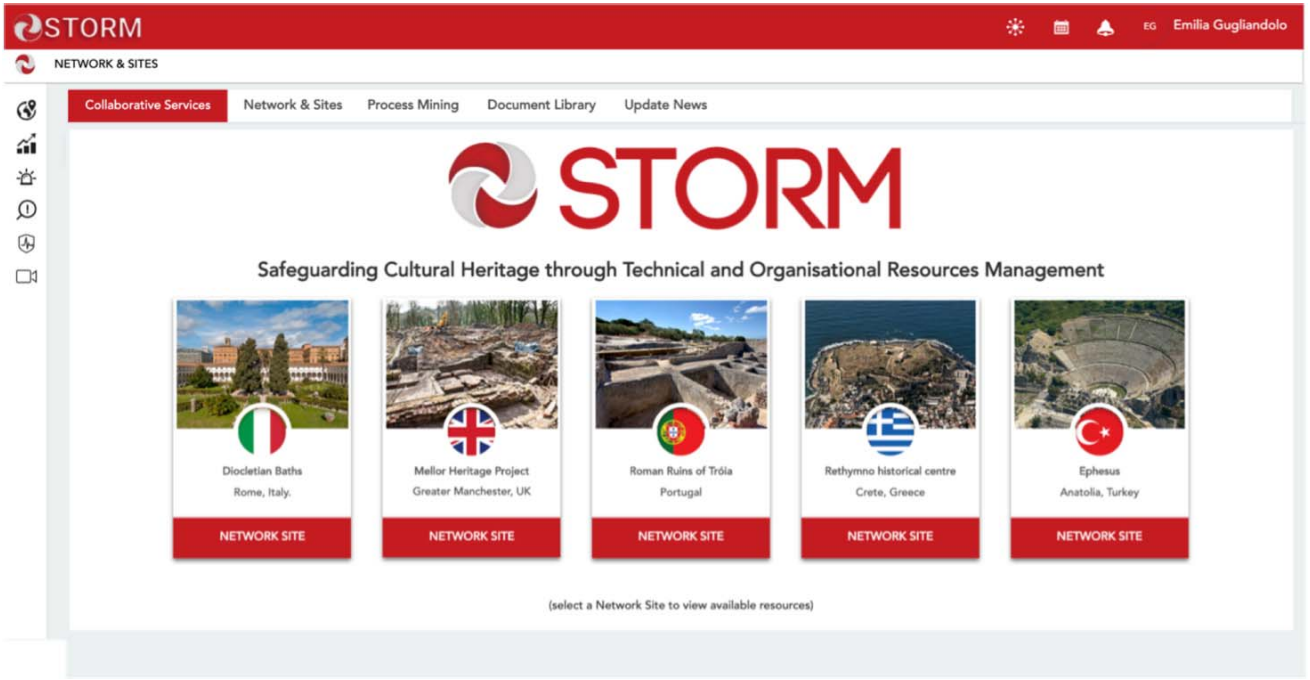
Gabriel's Presentation - 1

- CIP reference architecture - has many layers- Cyber, Physical, Human
- Integrate data from many different source (cyber, physical, human, web/social media etc.)
- Provide a detailed model of the events to mine correlations among them
- Complex event can be comprised of multiple simple events - applying CEP techniques

Gabriel's Presentation - 2

- Need domain expert to define rules to combine simple event into complex events (formal language for describing the rules)
- Binary classification of yes/no decisions with rules
  - No probabilities attached to the rules.
- Event information sent in JSON format. Different processes at different levels of Critical Infrastructure Protection.

Gabriel’s Presentation - 3



Luis's Presentation- 1

- Distinction between safety and security
  - Safety applies to physical world, security to cyber world
- Attackers: Maximize physical impact while being stealthy
- TSV (Trusted Safety Verifier): Given a set of infrastructure safety requirements, does the PLC program satisfy them ?
- Physics-aware attacks and defences: LTL constraints and verifier
- PLC architecture and adversary model

Luis's Presentation - 2

- 2-way data manipulation via Harvey: Firmware malware that lies about system state
- Find the points in the firmware at which to perform the replacement and insert the malicious code there (engineering decision)
- Demonstrated this on a real power system testbed - drove the voltages to unrealistically high levels
- Challenge: no trusted hardware on legacy devices - need attestation solutions
- Physics-based Attestation: Based on timing requirements of the attacker - perturb the sensors slightly and observe the effects on the system

Luis’s Presentation - 3

- Domain specific solution: 3D printing attestation (when you have malicious firmware)
- Control-Behaviour Integrity: Associate control-flow states with Physical states (ScadMan)
- Hybrid-Systems Modeling of CPS: Discrete state transitions + continuous variables (Dynamic Differential Logic)
- Formal rules for macro-programming IoT devices – If-this-then-that type of rules (remediation of the conflict)
- Robust multi-modal inferencing in heterogeneous IoT environments

Take-aways (in my opinion)

- Protecting CPS systems is challenging
  - Many different layers of abstraction, need to correlate among the events
  - Lack of trusted attestation mechanisms; attacker can cover their tracks
- Situational knowledge can come from many different sources
  - Domain experts composing complex rules (Gabriel)
  - Physics of the environment and deployment (Luis)
  - Knowledge of the program's code and behavior (Luis)
- Need for easy-to-use mechanisms to extract situational knowledge at scale