

# **Towards Secure, Privacy-Preserving, Verifiable Cyberphysical Systems** Pls: Esin Tureci (Princeton), Kelly Shaw (Williams) CNS 1739674 Oct 1 2017-Sept 30 2021 CPS/IoT systems are distributed over numerous sensing, actuation and computing devices, with a diverse set of specifications including physical and often safety-critical aspects to their operation and time sensitive requirements and energy constraints.

## **Challenges for achieving correctness and security:**

 Increasing frequency of dynamic code compilation and deployment as well as heterogeneity across devices, systems and within individual devices make achieving correctness and security challenging for CPT/IoT systems

### **Scientific Impact:**

• The advances we made in creating tools that verify consistency guarantees in parallel systems have the potential of speeding up the development of new parallel architectures and distributed systems in research and commercial products.



### **Solution:**

 Verification of Consistency Guarantees Using Litmus Tests: Musli Tool, PerpLE

**Detection and Prevention of Inconsistent Cloud Backend Data Updates in IoT Platforms:** OKAPI Smart Home Application Runtime Cloud Threads SSSS

 Detection of Potential Inconsistent Data Updates in IoT Applications: Created tools that analyze applications statically discover unintended/erroneous behavior

### **Broader Impact:**

State Update

Distributed Key-Value Store

Locked

Locked

Device State Value

Smart Lock Locked

On

Light

• Reduce resources spent testing new systems for correctness when system verification is performed by system designers (PerpLE)

 Make IoT systems that are deployed in people's homes and various commercial settings safer for users when adopted into IoT platforms and software development (OKAPI, MUSLI)