

# CPS: Breakthrough: Securing Smart Grid by Understanding Communications Infrastructure Dependencies

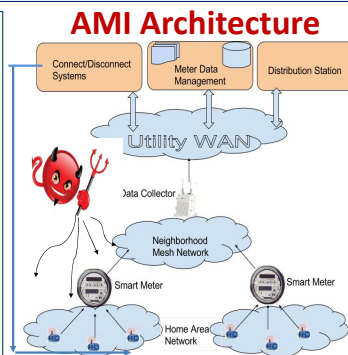
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<https://cs.mst.edu/research/labs/crewman/projects/funded/past/smartgridsecurity/>

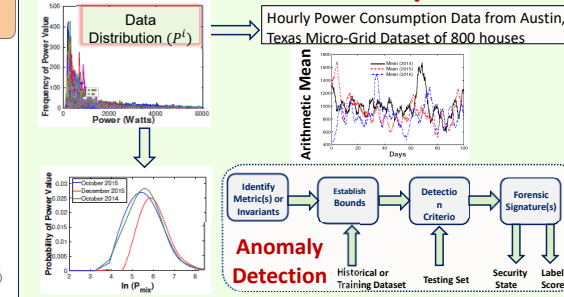
**Objectives:** (1) Characterize interdependence between electric grid and communication systems; (2) Secure Advanced Metering Infrastructure (AMI) and Phasor Measure Unit (PMU) against data integrity (falsification) attacks by detecting compromised meters; (3) Build robust (trust) models for attack mitigation; (4) Validate novel solutions with real traces from smart meters.

## Challenges

- Smart meter data exhibit huge fluctuations that make mean and variance ineffective
- Accurate anomaly detection & distinction between legitimate and malicious changes
- Large no. of compromised meters with smaller margin of false data injection
- Various types of data falsification attacks



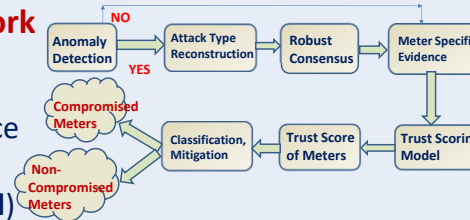
## Scientific Impact



- Data-driven anomaly detection across CPSs
- **Stable Invariant Metric:** Harmonic Mean to Arithmetic Mean ratio
- Applicable to smart transportation, water distribution, and smart public health networks

## Solution: Novel Cyber-Physical Security Framework

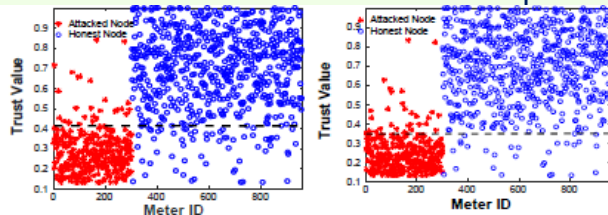
- Entropy based Trust Model with binary evidence space (**Supervised Learning**)
- Folded Gaussian Trust w/ multinomial evidence space (**Semi-Supervised Learning**)
- Information Theoretic Diversity Index (**Unsupervised**)



- Privacy-preserving state-less (short-term) and state-full, isolated & organized attacks detector
- Decreases false alarms with high detection rate
- Validated with real datasets: 800 meters (Austin) & 5,000 meters (Dublin, Ireland)

## Broader Impact (on Society)

- Robust anomaly detection saves bills, and minimizes hazards and demand response



## Broader Impact (Education and Outreach)

- Trained 1 Postdoc, 2 PhDs, and 3 REUs
- Led to SaTC and JUNO2 STEAM projects
- Taught a new course on Advances in CPS
- Big Data & IoT Security Workshop'17-21
- Keynote talks and invited seminars
- Published 1 book, 10 journal articles and more than a dozen conference papers

