High-Fidelity High-Resolution and Secure Monitoring and Control of Future Grids: a synergy of AI, data science, and hardware security

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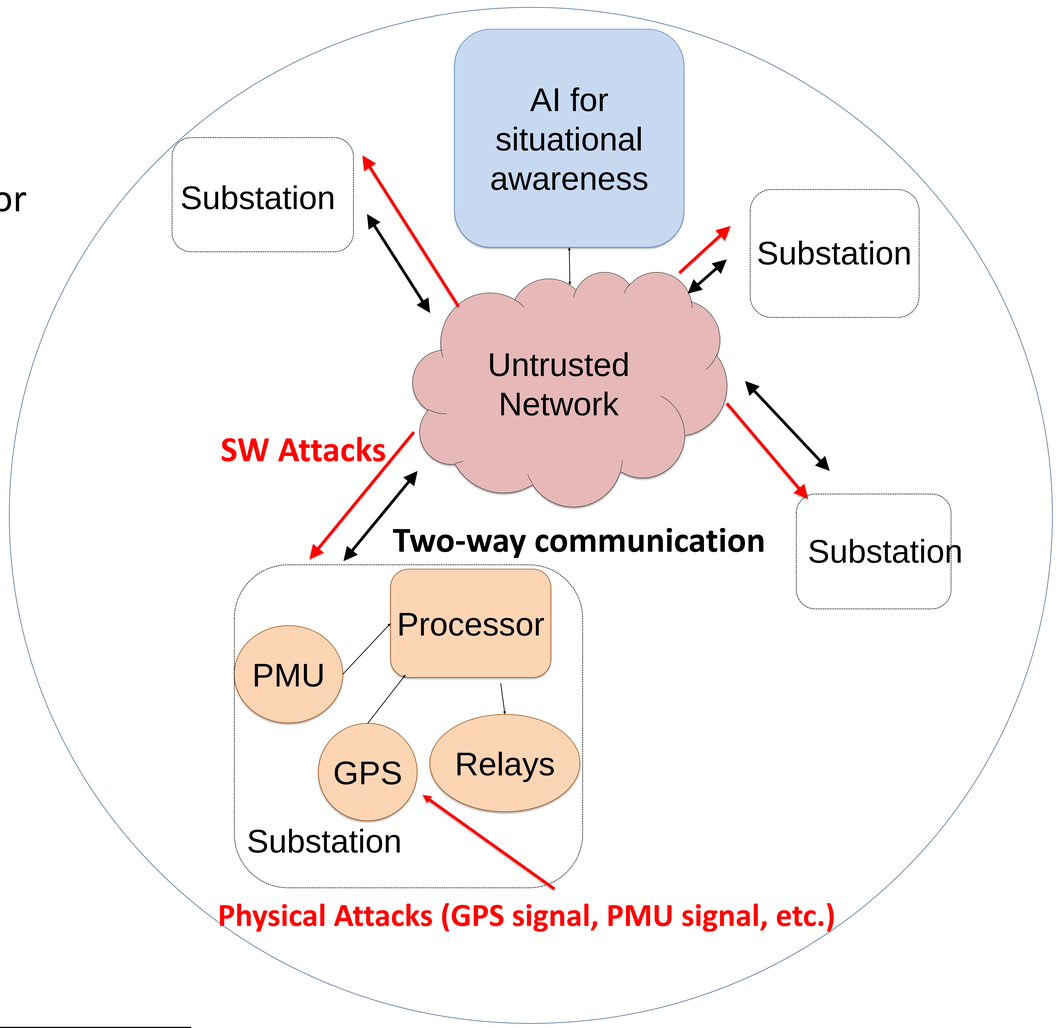
**(Award #: 1932501,1932196
09/15/2019-08/31/2022)**

Challenge:

- Highly complex and rapid system power dynamics requires a CPS approach to grid resilience.
- The potential of adversarial attacks calls for sophisticated and integrated monitoring and computing architecture.

Solution:

- A novel high fidelity compression system for real-time continuous point-on-wave streaming via subband coding
- A deep learning approach to real-time detection of data and system anomalies
- A data recovery approach to correct data quality issues with analytical guarantees
- A machine learning approach to disaggregate loads at substations
- A new attack demonstration for today's secure computing platforms
- Hardware acceleration for high-dimensional searches to improve safety and security guarantees



Scientific Impact:

- Science of CPS monitoring and control: Develop ML and AI approaches to secure monitoring and control of highly dynamic engineering systems
- Science of CPS security: Develop secure and resilient computing architecture for digital substations and remote terminal units.
- Potential impacts on other CPS fields
  - –Secure autonomous CPS systems
  - –Multi-modal sensing and data fusion
  - –Human in the loop decisions

Broader Impact:

- Two orders of magnitude improvement over the state of the art in compression ratio for high resolution streaming of PMU and CPOW measurements.
- Enabling high-resolution monitoring and control technology that prevents catastrophic failure from natural disasters.
- Increasing the public trust in incorporating AI technology in critical domains.
- Education and Outreach: smart grid summer camp, Curie Academy.

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