U.S. DEPARTMENT OF ENERGY | Office of Cybersecurity, Energy Security, and Emergency Response

Resilient Framework with Authentication, Key Management, and Data Collection for Energy Sensors in Energy Distribution Networks

CREDC
CYBER RESILIENT ENERGY DELIVERY CONSORTIUM

An attack-resilient framework to enhance the security of sensor-based monitoring of energy delivery system physical infrastructure

Digital sensing across energy delivery systems (EDS) monitors the health of the infrastructure such as power lines, pipelines, and valves and is a promising replacement to physical inspection, which can be invasive, dangerous, and expensive. However, sensors remain vulnerable to failure or attack. If the EDS is attacked, system sensors may become unresponsive, which may result in the incident going unreported to the control center or the delivery of false information. The research team is developing an end-to-end resiliency framework for sensor networks and data collection mechanisms in EDS. This framework includes authentication protocols and real-time key management for different sensors (e.g., valves, pumps, and gas meters) and diverse oil and gas network topologies. It also includes context-aware adaptive routing and transmission protocols for collecting control data from sensors to ensure resilient data collection under failures. The goal of this research is to create a resiliency framework for energy sensors in energy delivery physical infrastructures for gas, oil, and power grid networks where the sensors provide insights into the health of the physical infrastructures (pipelines and powerlines).

KEY TAKEAWAYS

- Develops a resiliency framework for sensor networks and data collection structures in energy delivery systems, including secure key distribution
- Investigates resilience of sensor networks in various topologies for gas, oil, and power line infrastructures
- Operationalizes a secure sensor network to provide reliable insight into the health of energy physical infrastructures, even in the presence of a cyberattack

OUTCOME

The results of the resilient framework are protocols and software functions for sensors and algorithms to provide appropriate placement of sensors over different oil and gas topologies where sensor nodes have various capabilities. These results can be used in planning tools for EDS operators who will be able to visualize sensor placement over various topologies, identify potential weak points caused by certain sensor distributions, and determine the effects of protocol implementation on the availability of sensor measurements under failure and attack scenarios.

PARTICIPANTS	ROLE
CREDC CYBER RESILIENT ENERGY DELIVERY CONSORTIUM	The CREDC performs multidisciplinary research and development that focuses on the cybersecurity of energy delivery systems. The central project goal is to create an ecosystem where research results lead directly to the development of applications and methodologies, which are then validated in realistic contexts.
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN	Leads research, development, and testing
香港科技大學 THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY	Collaborates on key management algorithms and protocols

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CYBERSECURITY FOR ENERGY DELIVERY SYSTEMS (CEDS)

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Website: https://www.energy.gov/ceser

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