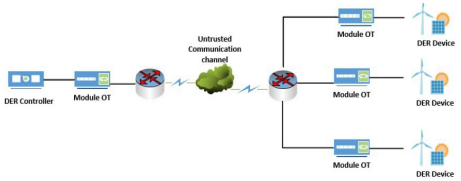
Module-OT: A Turnkey Solution for Securing Energy Systems

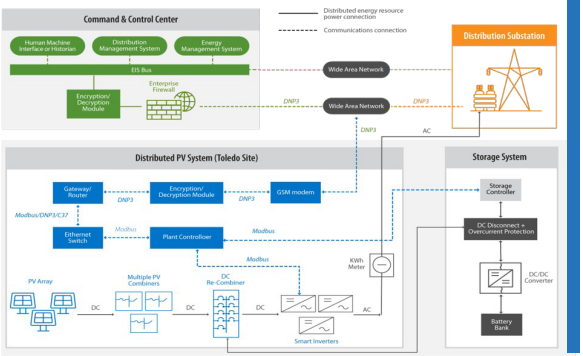
As energy systems become more distributed, the surface area for potential cybersecurity threats is expanding. Current solutions for securing critical infrastructure are often too expensive and oversized to meet this growth. Utilities and industry need a cost-effective technology to secure communication on operational technology networks. NREL developed Module-OT to serve this need.

How Does it Work?

Module-OT provides data integrity and confidentiality for critical infrastructure using end-to-end encryption. It is a "bump-in-the-wire" approach that authenticates, authorizes, and encrypts data, allowing devices to connect through untrusted networks with no risk to utilities or system operators. As open-source software, Module-OT can be easily deployed in a multitude of environments or readily embedded in various devices, making it possible to secure the millions of energy resources that are already connected to utility networks.

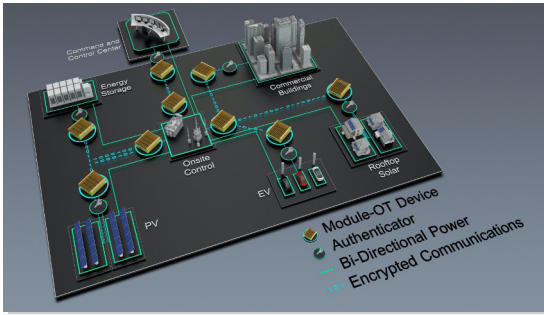


Module-OT in a Renewable Energy System



Ready for Deployment

Module-OT has been validated rigorously in laboratory settings and in the field. At a utility partner site in Albuquerque, Module-OT secured communications between the utility's control center and its energy assets. The site contains 500-kW of solar photovoltaics and storage, interfacing through a telecommunications network with the control center and distribution substation. These distributed energy assets and their connections would traditionally be difficult and expensive to comprehensively secure, but by incorporating Module-OT at two key junctions, the partner created stopgaps for reliable security system-wide.



Why Module-OT is Unique

- Validated against Federal Information Processing Standard 140-2
- Verified cryptography through NIST Cryptographic Algorithm Validation Program
- Minimal requirements for memory and processing power
- Supports legacy communications and interfaces
- Validated in a high-fidelity utility-scale distributed energy environment
- Vendor, technology, and protocol agnostic
- Portable and easy to install for any Linux-based operating system
- Compliant with all IEEE 1547-2018 protocols
- Open-source and available online

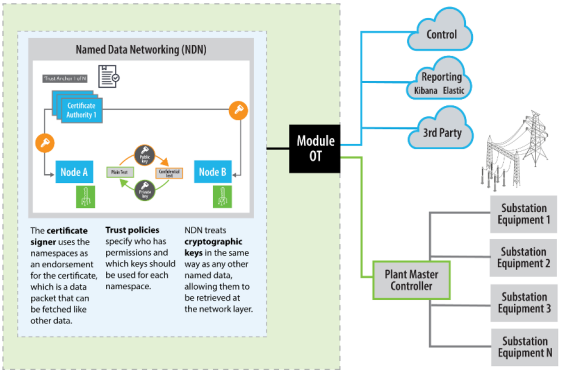
Future Security Now

Module-OT has been demonstrated to provide advanced security and networking when deployed along with a future internet architecture called Named Data Networking (NDN). The combined technologies—NDN and Module-OT—offer a comprehensive networking solution that includes intrusion detection, a secure communications gateway, and network analysis. This hardware-software solution could be scaled inexpensively to secure any size of DER facility or energy infrastructure.

Versatility for Cybersecurity

With more energy system devices than ever connecting over data networks, we have entered a new era of cyber threats. Module-OT is a simple, reliable, and low-cost solution to protect system networks of diverse architectures or design. Module-OT also provides cybersecurity for more than just energy systems. It is useful for systems using operational technology, with potential applications in sectors such as finance and healthcare.

NDN Based Intrusion Detection System with Secure Authentication Gateway



This project was developed with Operant Networks.

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Defense TechConnect Innovation Summit and Expo
Washington, D.C.
September 27-29, 2022
NREL/PO-5R00-83842