



CENTER FOR CYBERSECURITY
AT THE UNIVERSITY OF WEST FLORIDA



On Teaching and Learning Industrial Control Systems Security Using Open Platform Infrastructure

*2025 CAE Symposium
Charleston, SC
April 8-10, 2025*

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UWF Center for Cybersecurity*

In the
beginning....

2009: NSF Major
Research Infrastructure



2025 CAE Community Symposium

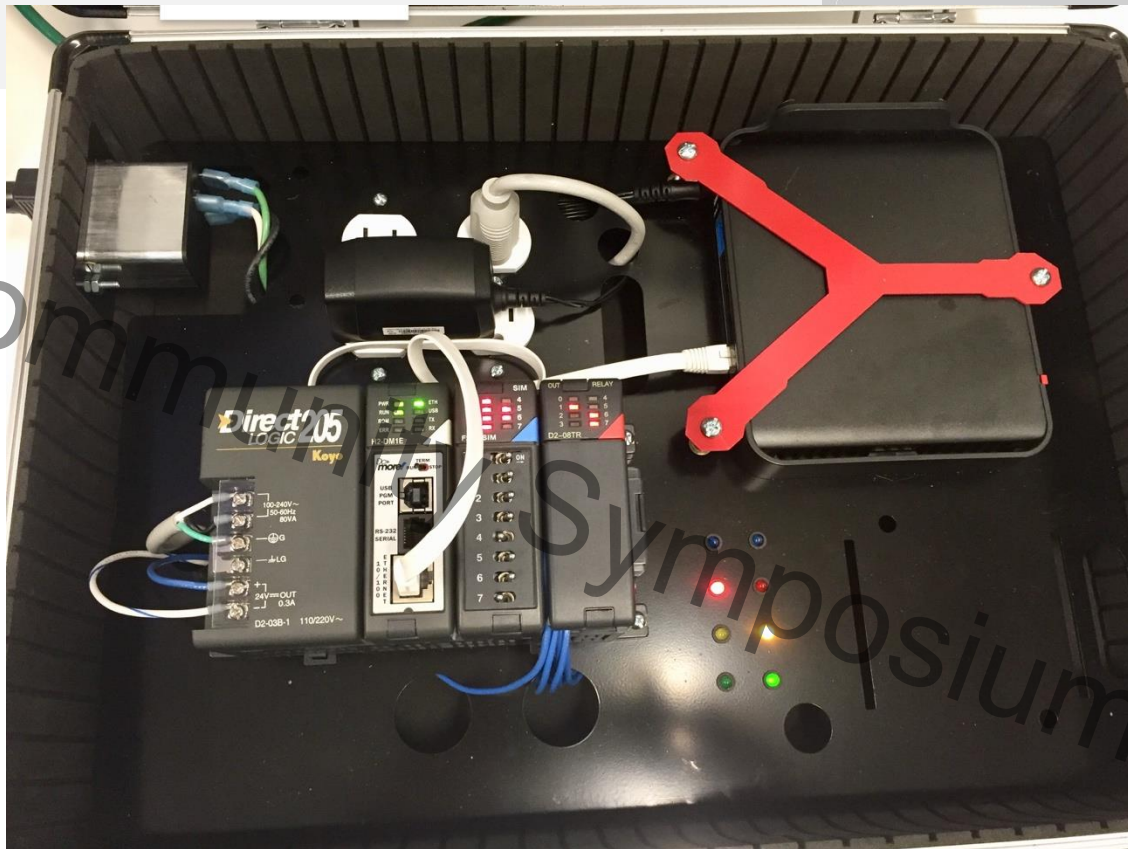
Portable RTUs

2011: Security of field devices



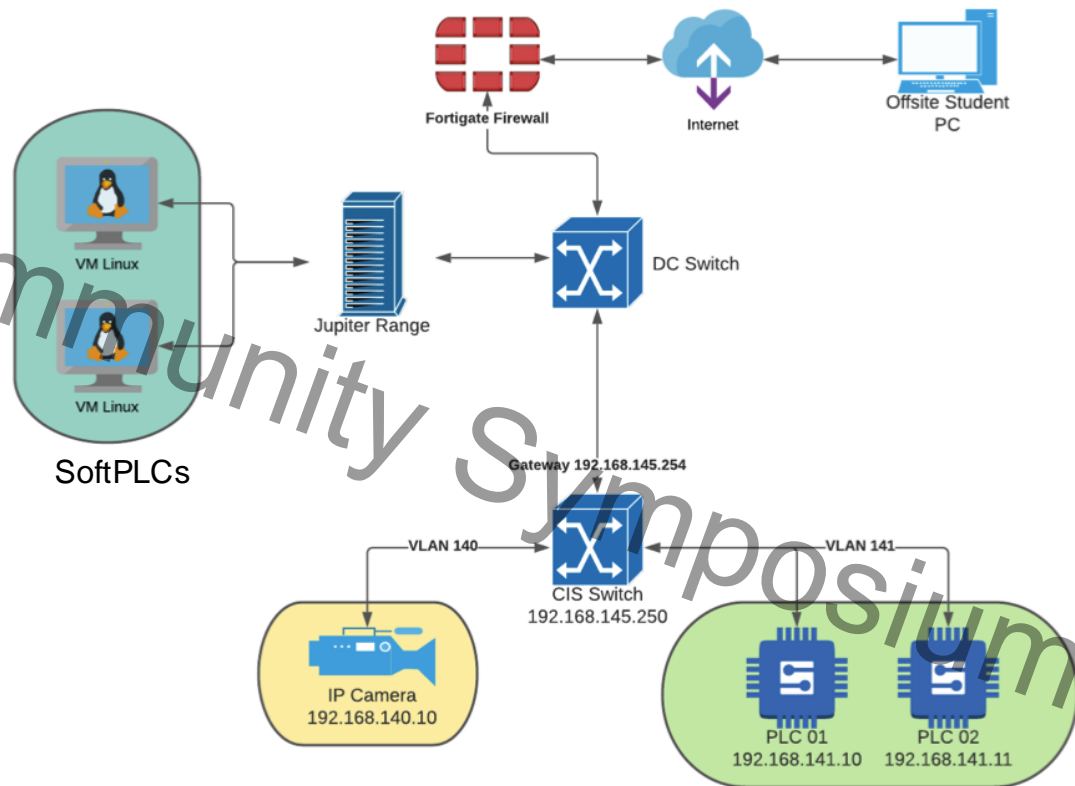
Training Tool Suite

2014: Faculty
Development
Workshop on ICS-
SCADA Security



ICS-Renewable Energy Security Training

2022-2023: UCCS-UWF
Faculty Development
Workshop Online
Training



Contributions to the CAE Community

- An affordable infrastructure for an effective ICS security training;
- Useful insights into the design and implementation of ICS Open Platform Infrastructure (OPI);
- A method to validate of ICS vulnerability assessment and security testing tools; and
- A methodology to enable the introduction of up-to-date, real-world ICS security scenarios to augment active learning.

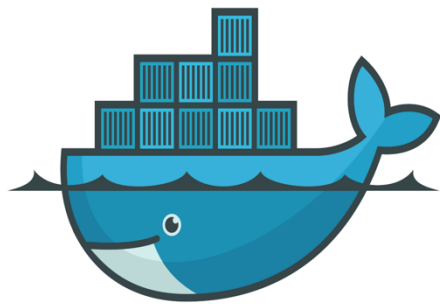


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Open Platform Infrastructure (OPI)

- Open Platform Infrastructure enables lightweight containers to securely run in isolation on a given host
- Containers can easily be shared and run on multiple hosts with the assurance that every host gets an identical container that works the same way (Docker (2024))

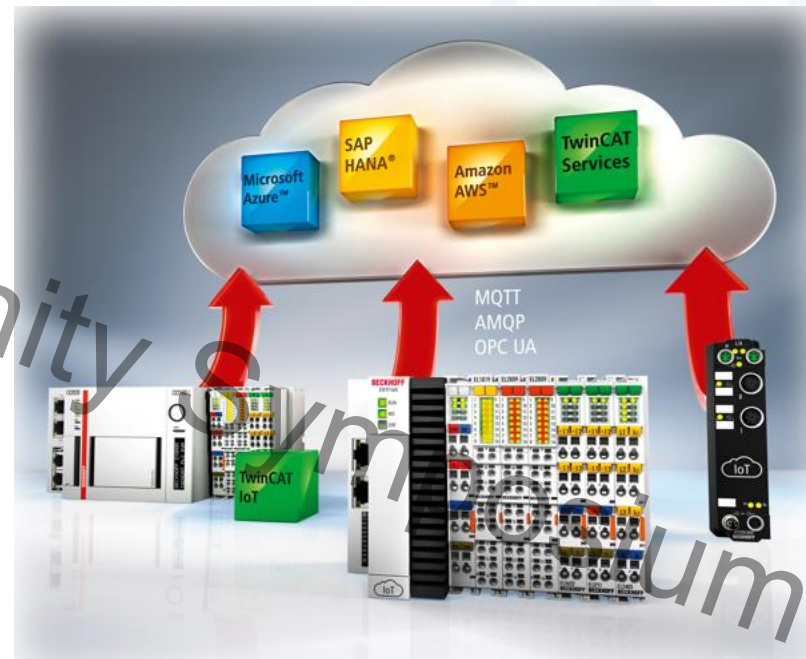


docker

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ICS-Open Platform Infrastructure (ICS-OPI) Design Guidelines

- Works on virtualized PLCs operating on standard ICS protocols;
- Occupies a small footprint and operates in isolation;
- Realizes an IT-OT network infrastructure;
- Facilitates the development of digital twins for ICS security;
- Enables interfacing with an external Human Machine Interface (HMI);
- Facilitates the simulation of ICS attacks and defenses by security purple teams.



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ICS-Open Platform Infrastructure (ICS-OPI) Design Implementations

Virtualized PLCs operating on standard ICS protocols

-OpenPLC operating on ModbusTCP, DNP3, and Ethernet/IP

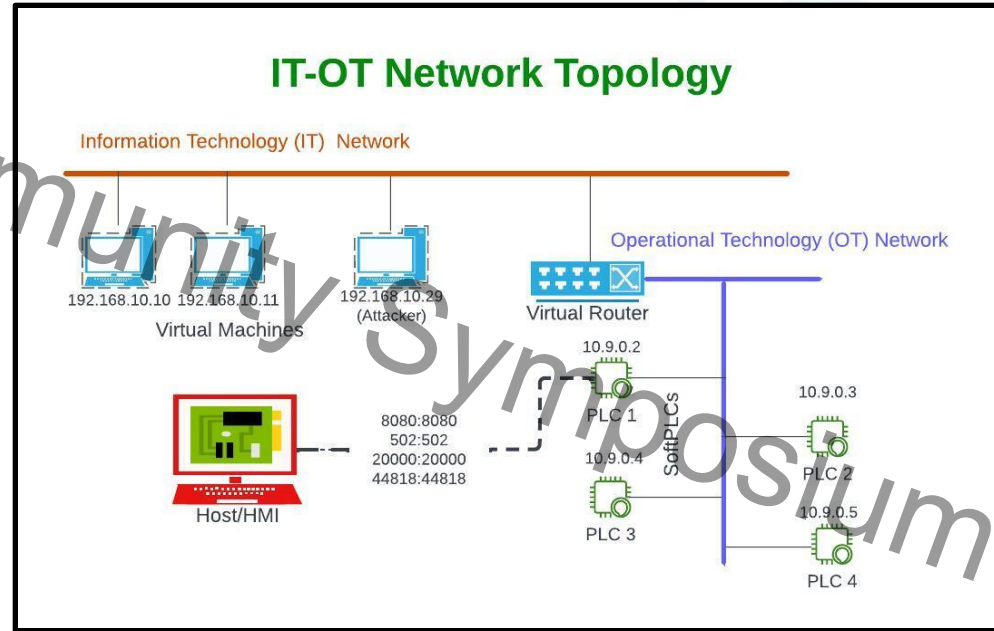
Small footprint in isolation

-Implemented by Docker containers

Realizes an IT-OT network infrastructure

-Implemented by Docker containers with defined network

-Utilizes Docker compose



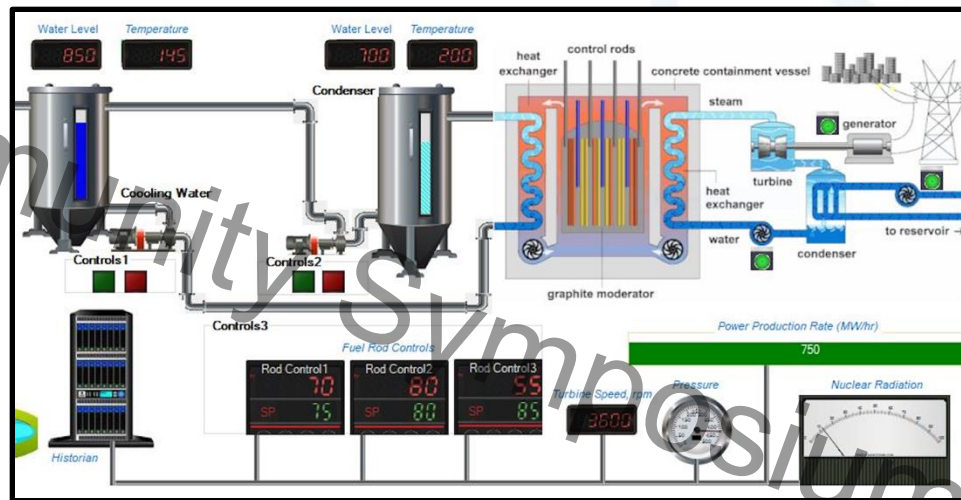
ICS-Open Platform Infrastructure (ICS-OPI) Design Implementations (cont)

Facilitates the development of digital twins for ICS security

-Combined OpenPLC, Docker containers, Network definitions on Docker-compose, and HMI implementation utilizing AdvancedHMI

Enables interfacing with an external Human Machine Interface (HMI)

-The implemented HMI is integrated with the softPLC



ICS-Open Platform Infrastructure (ICS-OPI) Design Implementations (cont)

Facilitates the simulation of ICS attacks and defenses by security purple teams with the following use cases:

- Reconnaissance
- Lateral movement
- Deep packet inspection
- ICS packet crafting
- Digital forensics
- Intrusion detection and prevention
- Threat intelligence and hunting



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The Evolution of ICS Security Training



CLARK



Future Directions

- Expand the collection of ICS security case studies and scenarios to address newly discovered vulnerabilities
- Create virtual OPIs that incorporate devices found in renewable energy and power grid systems
- Expand and improve the creation of digital twins as instruments to carry out enhanced ICS security
- Automate the process of creating security scenarios for the effective utilization of digital twins in security training and education



Forthcoming ...

- Faculty development workshop at the UWF Center for Cybersecurity in Pensacola, FL. Travel stipend up to \$1200 afforded to faculty participants in July 2025.
- Complete OPI-ICS Security curriculum will be shared with the CAE community utilizing the CLARK System.



Acknowledgements

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