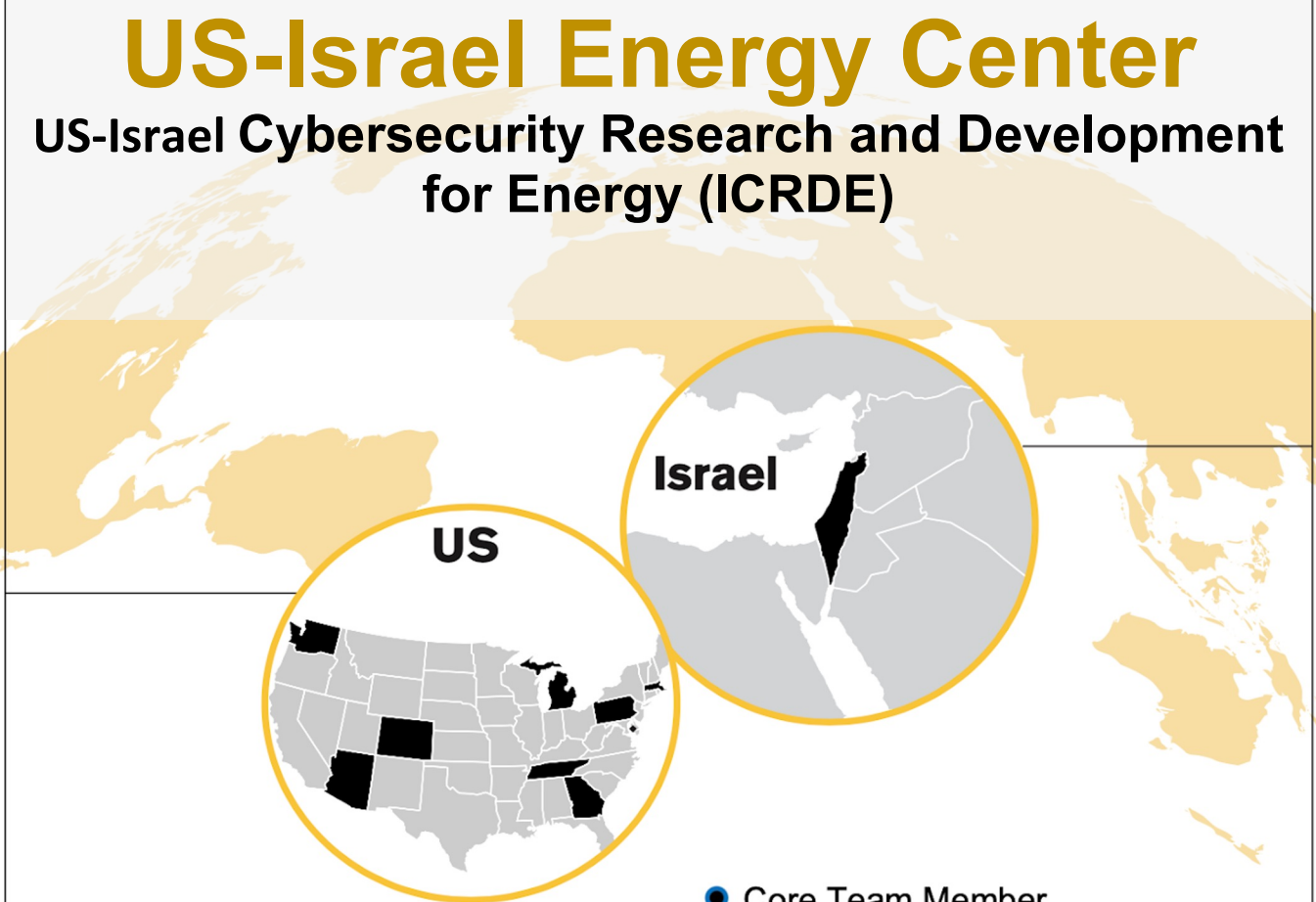


Arizona	<ul style="list-style-type: none"> <li>ASU</li> <li>Nexant</li> </ul>
Colorado	<ul style="list-style-type: none"> <li>NREL</li> </ul>
Georgia	<ul style="list-style-type: none"> <li>Georgia Tech</li> </ul>
Tennessee	<ul style="list-style-type: none"> <li>Delek</li> </ul>
Massachusetts	<ul style="list-style-type: none"> <li>Fova Energy</li> </ul>
Michigan	<ul style="list-style-type: none"> <li>OPAL-RT TECHNOLOGIES</li> </ul>
Pennsylvania	<ul style="list-style-type: none"> <li>DLC</li> </ul>
Washington	<ul style="list-style-type: none"> <li>SEL</li> </ul>
Washington, DC	<ul style="list-style-type: none"> <li>MITRE</li> </ul>

# US-Israel Energy Center

## US-Israel Cybersecurity Research and Development for Energy (ICRDE)



	<ul style="list-style-type: none"> <li>meptagon</li> <li>head for a better process</li> </ul>
	<ul style="list-style-type: none"> <li>CONTEL TECHNOLOGIES</li> <li>for Smart Manufacturing</li> </ul>
	<ul style="list-style-type: none"> <li>MRC</li> <li>ALON TAVOR POWER</li> </ul>
	<ul style="list-style-type: none"> <li>SIGA</li> <li>OT Solutions</li> </ul>
	<ul style="list-style-type: none"> <li>Ben-Gurion University of the Negev</li> </ul>
	<ul style="list-style-type: none"> <li>OTORIO</li> </ul>
	<ul style="list-style-type: none"> <li>ARAVA POWER</li> </ul>
	<ul style="list-style-type: none"> <li>cybereason</li> </ul>
	<ul style="list-style-type: none"> <li>RAD</li> </ul>
	<ul style="list-style-type: none"> <li>DK INNOVATION</li> </ul>

- Core Team Member
- Team Member (Volunteering Work)
- Advisory Board



# PANEL A:

## SIMULATION AND SECURITY ASSESSMENT IN ICS



**Rami Puzis**

Israel Lead @ ICRDE

Associate Professor @ Ben-Gurion University

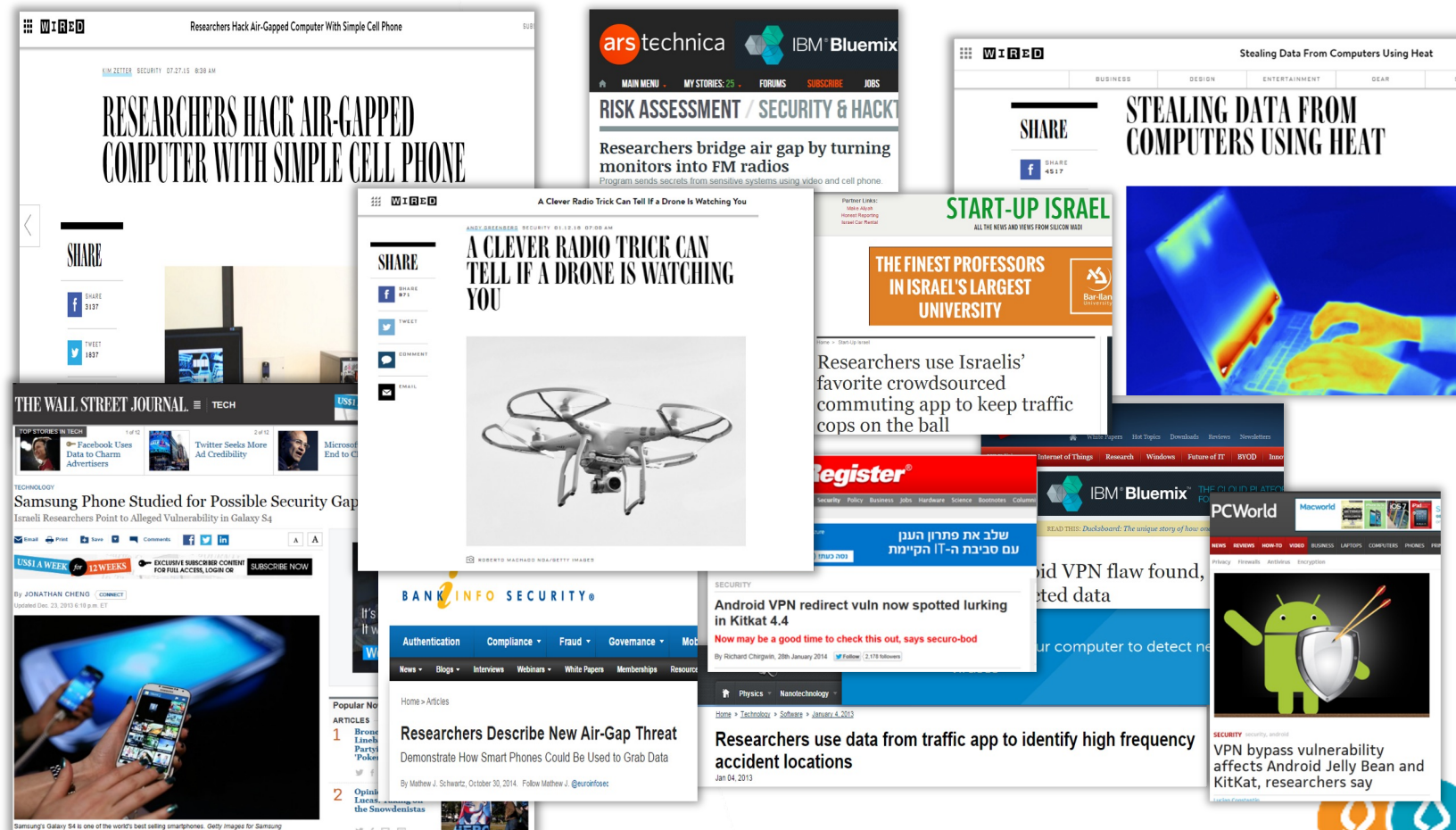


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*MODERATOR @ PANEL A*

Find vulnerabilities,

Exploit, **Fix it!**, so nobody else can



# PANELISTS @ PANEL A: SIMULATION AND SECURITY ASSESSMENT IN ICS



**Aditya Ashok**  
Director – Energy  
Systems Research  
OPAL-RT Corporation



**Seth Hoedl**  
President, Chief Science  
Officer & Co-Founder  
Post Road Foundation



**Harry Thomas**  
OT Security Advisor  
OTORIO



**Rui Yang**  
Group Manager  
National Renewable  
Energy Lab

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# About OPAL-RT Technologies



- Founded in 1997 in Montreal, QC, Canada
- 350+ employees, growing sustainably
- 1000+ customers in all industries around the world
- 20% of annual revenue re-invested in R&D
- 40% academic, 60% industries
- 90% revenue from electrical and power electronics sectors
- Markets
  - HIL, RCP, real-time laboratories
  - ...and fast off-line and on-line close-to-real-time (cloud) simulation
  - for education, R&D and all industries: energy, power electronic, automobile, off-highway vehicle, aerospace, ships, trains ...

## Strong International Footprint



### International subsidiaries, offices and Excellence Centers:

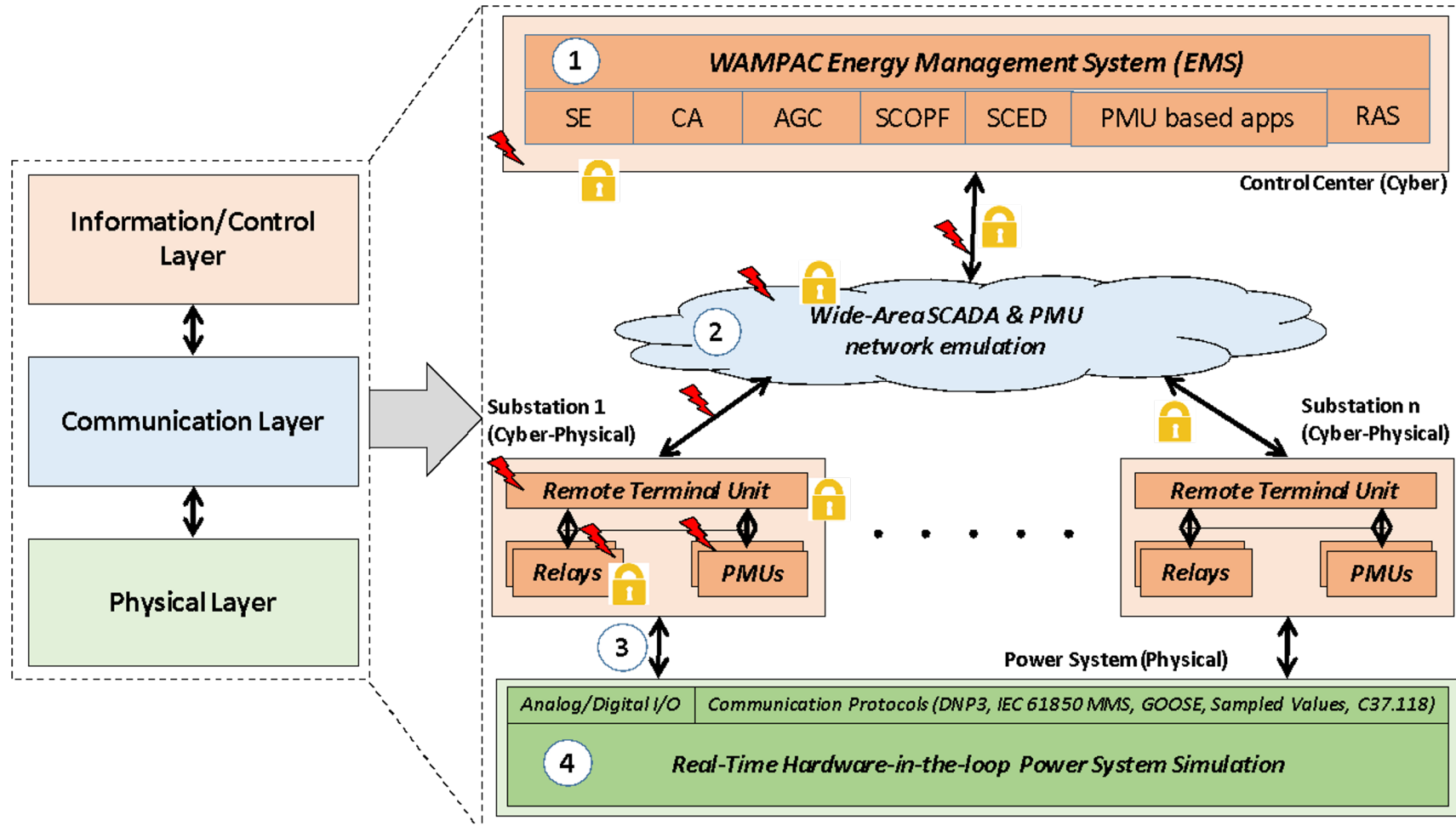
- USA (Michigan, Colorado), Germany, France (Paris and Lyon), India, China, Brazil, Australia

### Distributors:

- China, Australia, Japan, Korea, Singapore, *Israel*, Ukraine, Kazakhstan, Oman, Pakistan, Qatar, Turkey, United Arab Emirates , Kingdom of Saudi Arabia

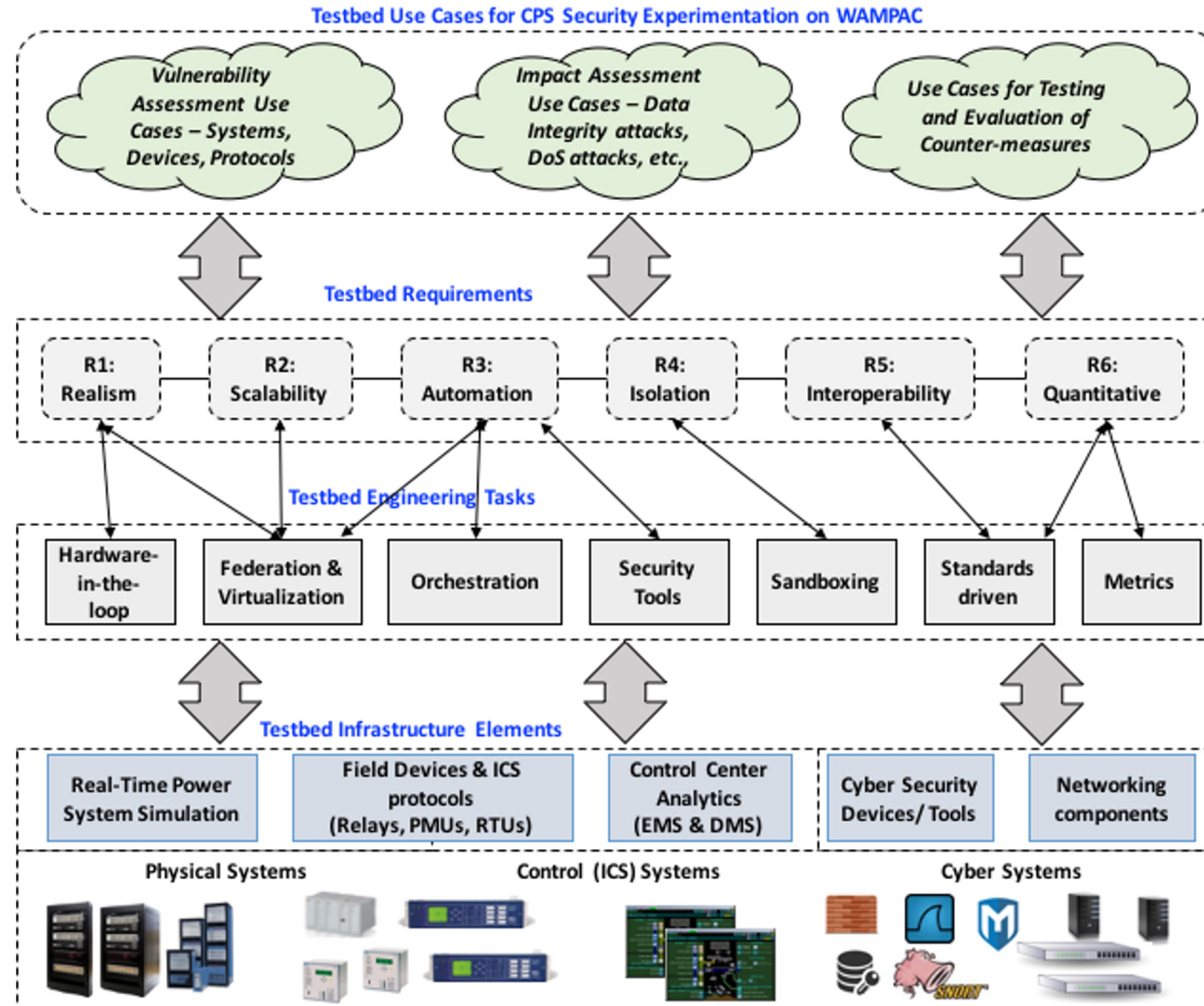


# Conceptual Cyber-Physical Testbed Architecture



Aditya Ashok, et. al, "A Cyber Physical Security Testbed For Smart Grid: System Architecture And Studies", Proceedings of the Seventh Annual Workshop on Cyber Security and Information Intelligence Research (CSIIRW 11), Oak Ridge National Laboratory, Tennessee, 2011.

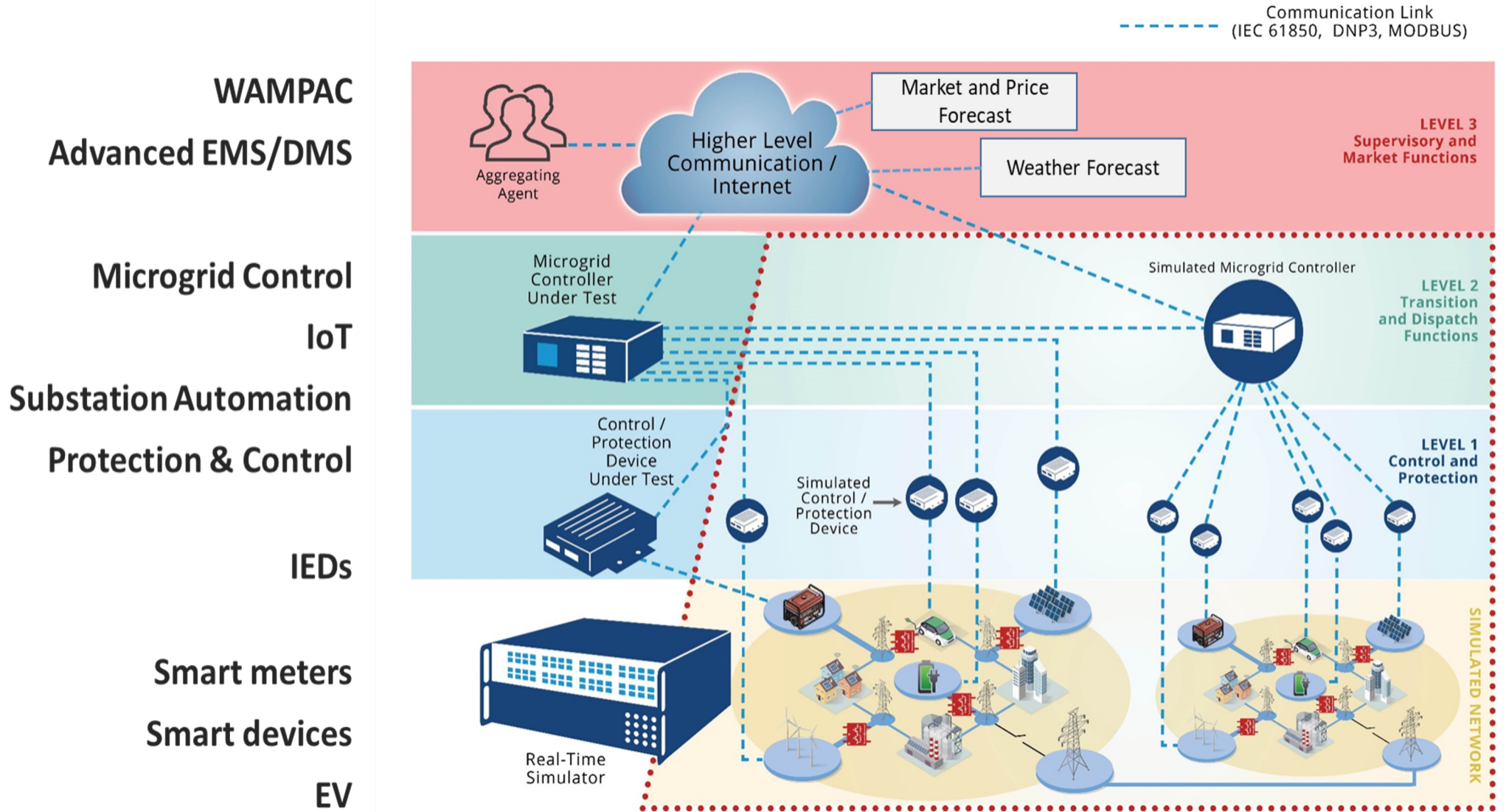
# Engineering Cyber-Physical Testbeds



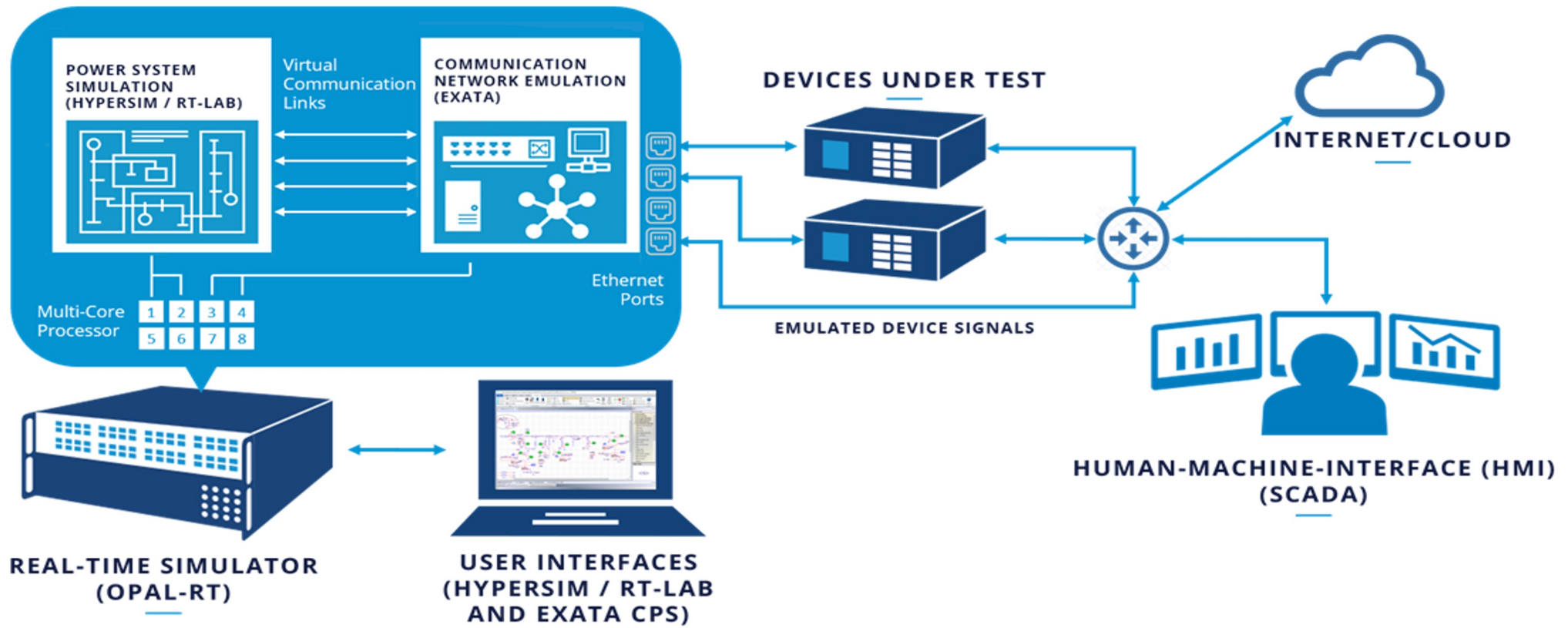
Aditya Ashok, Iowa State University - PhD Dissertation titled 'Attack-resilient state estimation and testbed-based evaluation of cyber security for wide-area protection and control,' 2017.



# A Layered View for Cybersecurity Experiments



# An Integrated Simulator for Cybersecurity Experimentation



# PANELISTS @ PANEL A:

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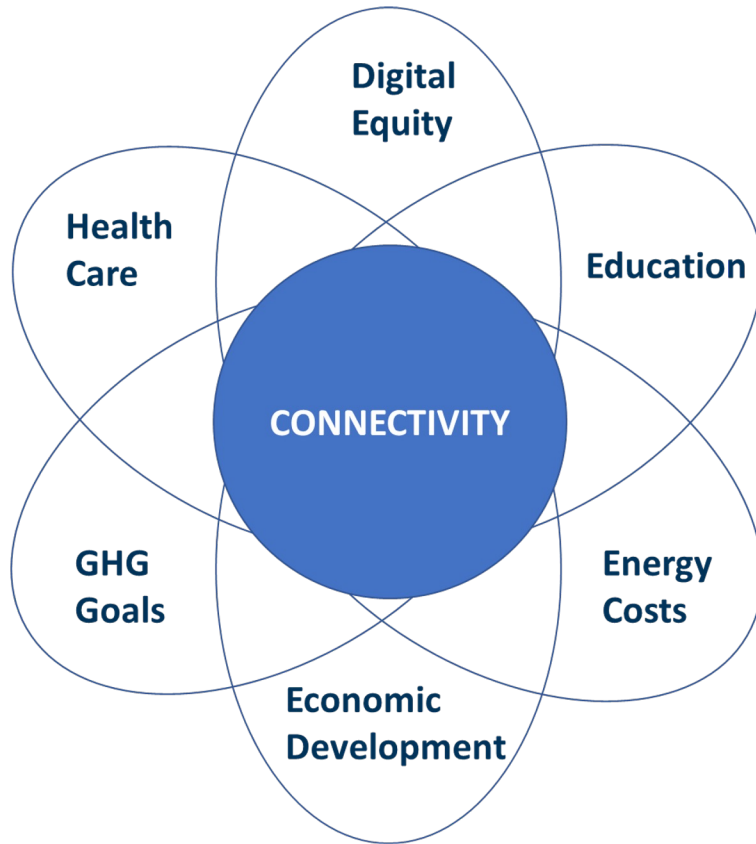


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OTORIO



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Energy Lab

# Post Road Foundation



- 501(c)(3) non-profit, spun out of Harvard Kennedy School
- Focus on sustainable infrastructure for the 21<sup>st</sup> century: cutting-edge connectivity networks for broadband and associated synergies, like grid modernization
- Three activities: (1) policy research (incl. energy justice/ethics); (2) develop fiber optic networks; (3) technology demonstration projects
- Funded by The Rockefeller Foundation, The Ford Foundation and DOE.



FORD FOUNDATION

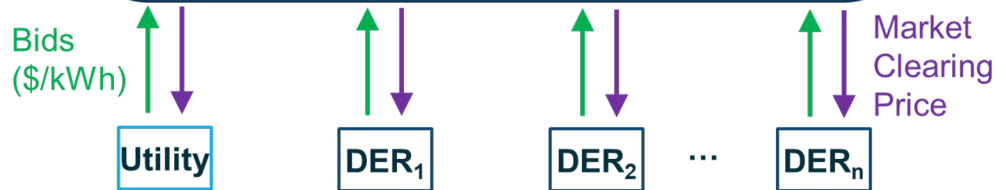
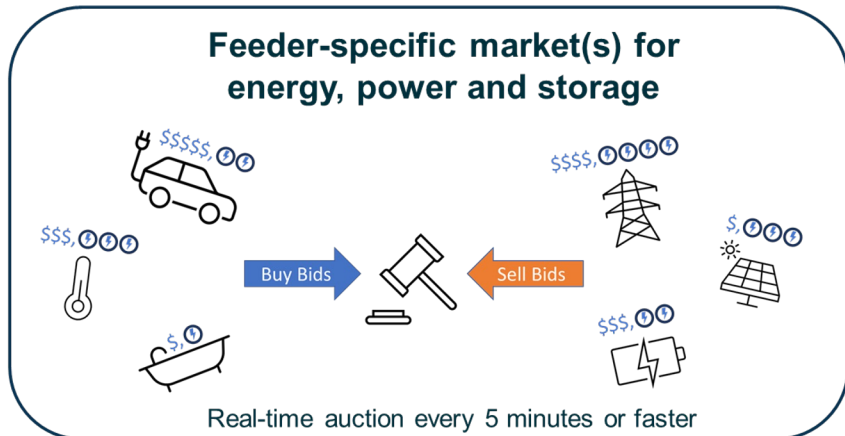
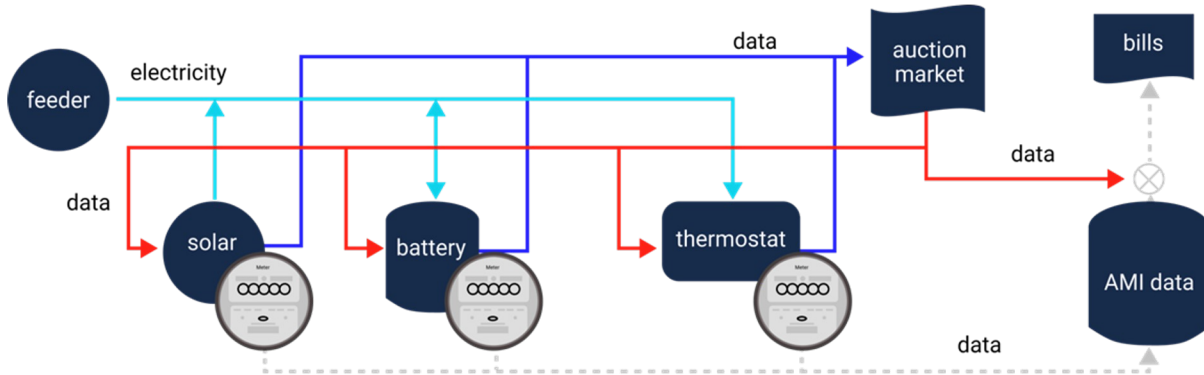


The ROCKEFELLER FOUNDATION

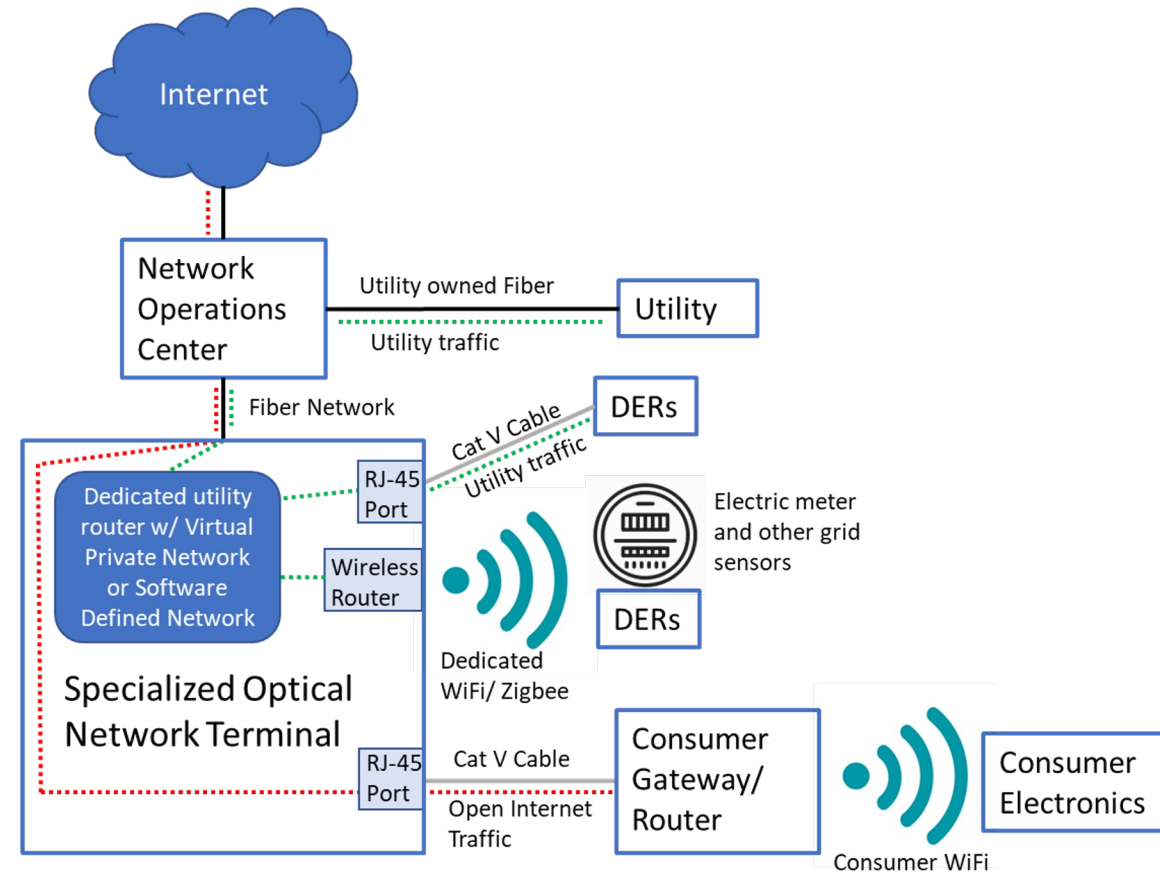


This material is based upon work supported by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under the Building Technologies Office Award Number DE-EE0009780. The views expressed herein do not necessarily represent the views of the U.S. Department of Energy or the United States Government.

# Projects with Cybersecurity Concerns



Transactive Energy in Rural America



DOE GRIP Proposal

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# Industrial-native Digital & Cyber Risk Solutions

Enabling reliable, safe and efficient digital production

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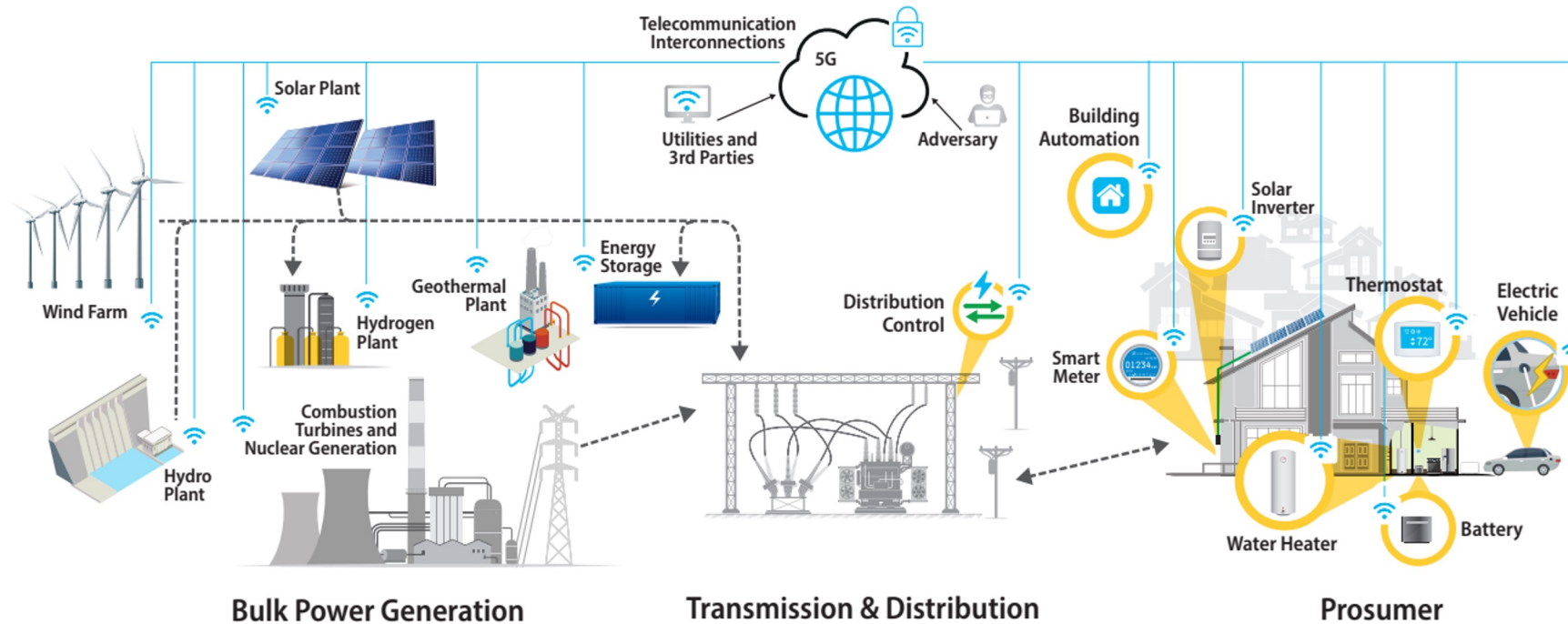
**Harry Thomas**  
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# NREL's Cybersecurity Research for Future Electric Grid



## Technology Innovation

- Foundational R&D that integrates cybersecurity into the design of energy devices and systems
- Applications in EV charging and 5G communications networks

## Market and Planning

- Custom tools to support energy decision makers
- Advance standards and share best practices

## Deployment Strategies

- Replicate cyber and physical characteristics of any system
- Train, teach, and analyze organizations for cybersecurity deployment

# NREL's Cyber Range



# Situational Awareness for Grid Anomalies

**Objective:** To deliver a high-fidelity and scalable transient dynamic simulations tool which models how the control system responds in real-time to changes in system states resulting from cyber-physical events.

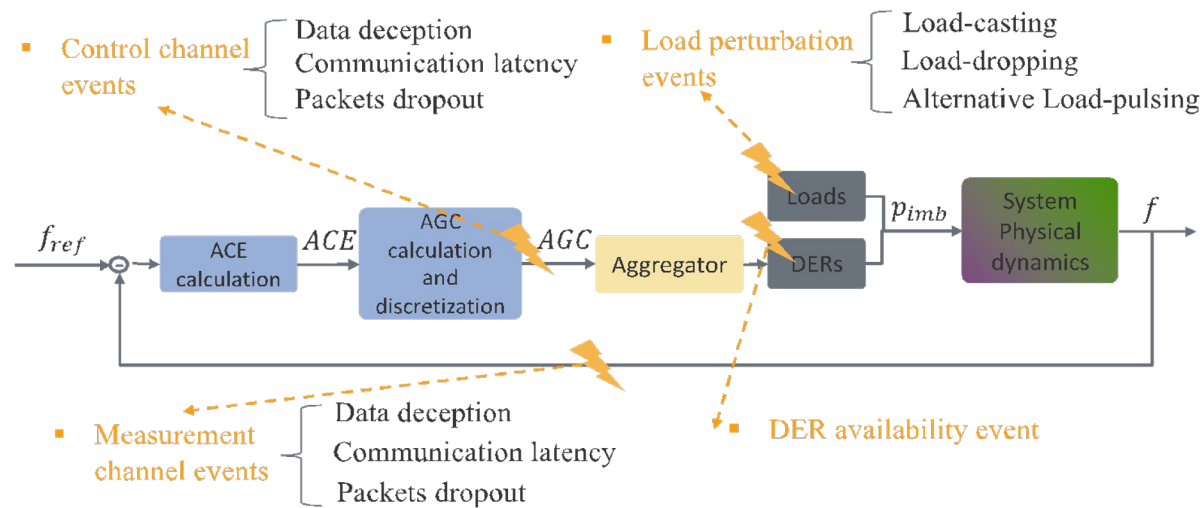


Illustration of the closed-loop AGC control and cyber-physical events entry points

- Messages (packetized data blocks) are exchanged via the co-simulation end-point interfaces to enable the AGC control provided by DERs.
- Event can be generated with configurable event type, start time, end time, target feeder, target devices, and event magnitudes.

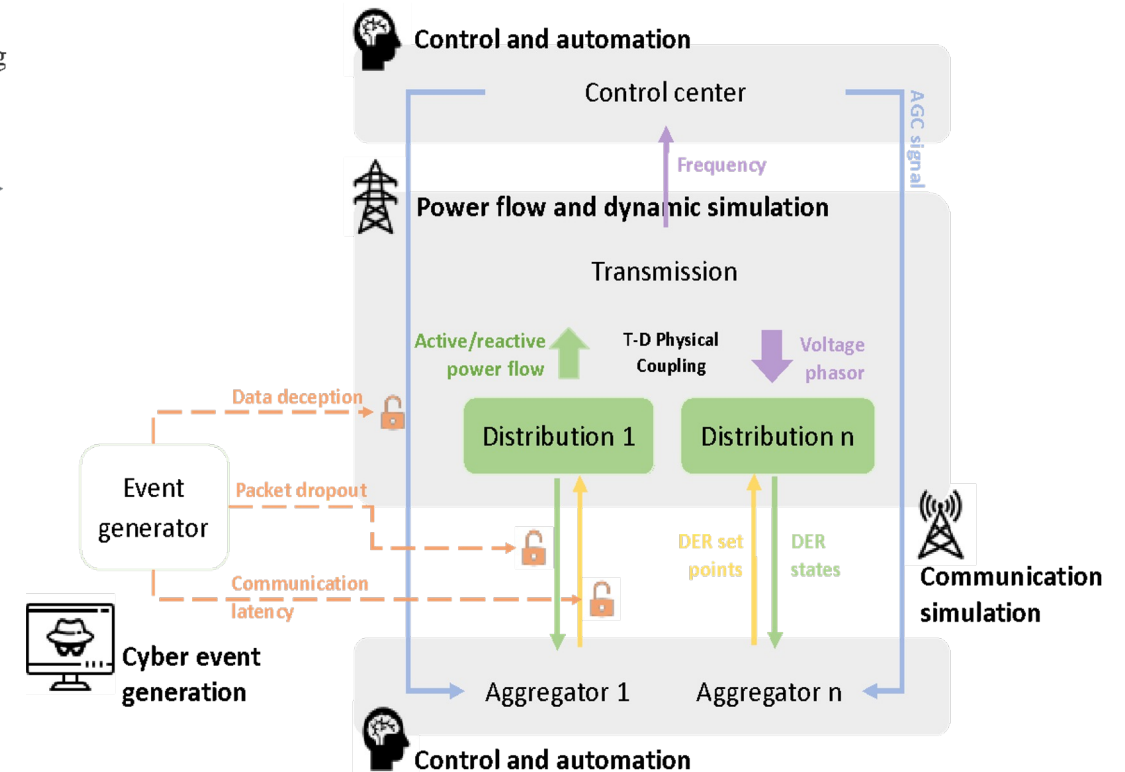


Illustration of the co-simulation architecture

# QUESTIONS @ PANEL A:

## SIMULATION AND SECURITY ASSESSMENT IN ICS



### Question 1:

Do we need simulations for security assessment in ICS?

- How can we evaluate ICS cyber threats?
- What is your approach to risk assessment?
- Is there a difference between simulations for assessing security tools vs assessing the infrastructure?

# QUESTIONS @ PANEL A:

## SIMULATION AND SECURITY ASSESSMENT IN ICS



### Question 2:

## How to simulate attacks for security assessment?

- What approaches are best for legacy environments?
- Is it possible to build a test environment given the high heterogeneity of ICS?
- What is the best strategy to simulate anomalous states?

# QUESTIONS @ PANEL A:

## SIMULATION AND SECURITY ASSESSMENT IN ICS



### Question 3:

How could AI help with the design, development, or operation of simulators?

- Can AI help with generating data for security assessment?
- Could you imagine any use of the advanced language models (e.g. ChatGPT, BARD, BING, or local LLMs)?

# **QUESTIONS @ PANEL A:**

## **SIMULATION AND SECURITY ASSESSMENT IN ICS**



Question 4:

How to validate the effectiveness of machine learning/AI technologies against cyber intrusion?

# **QUESTIONS @ PANEL A:**

## SIMULATION AND SECURITY ASSESSMENT IN ICS



Question 5:

How can simulations help with prioritizing risks in OT networks?