

Distribution Grid Management Using Renewable Technology

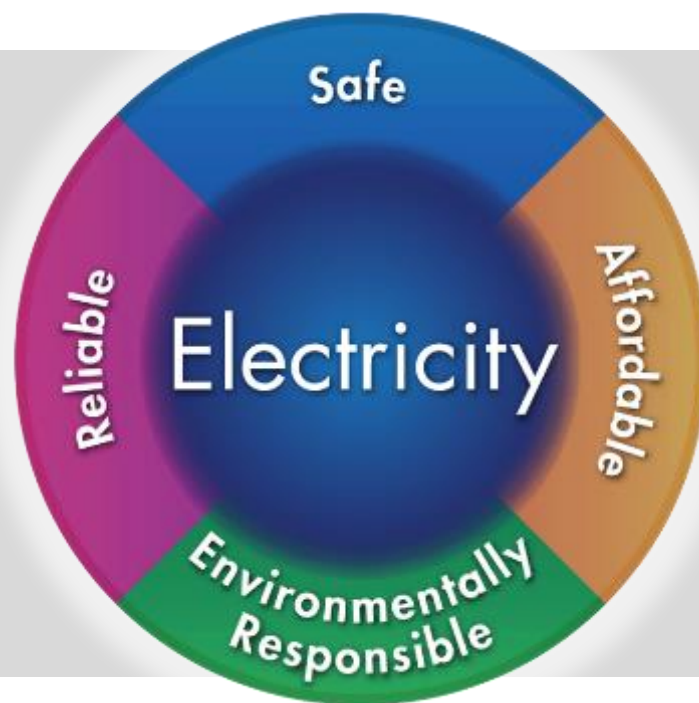
John J. Simmins, Ph.D.
Technical Executive

AI Energy Symposium
October 12, 2018

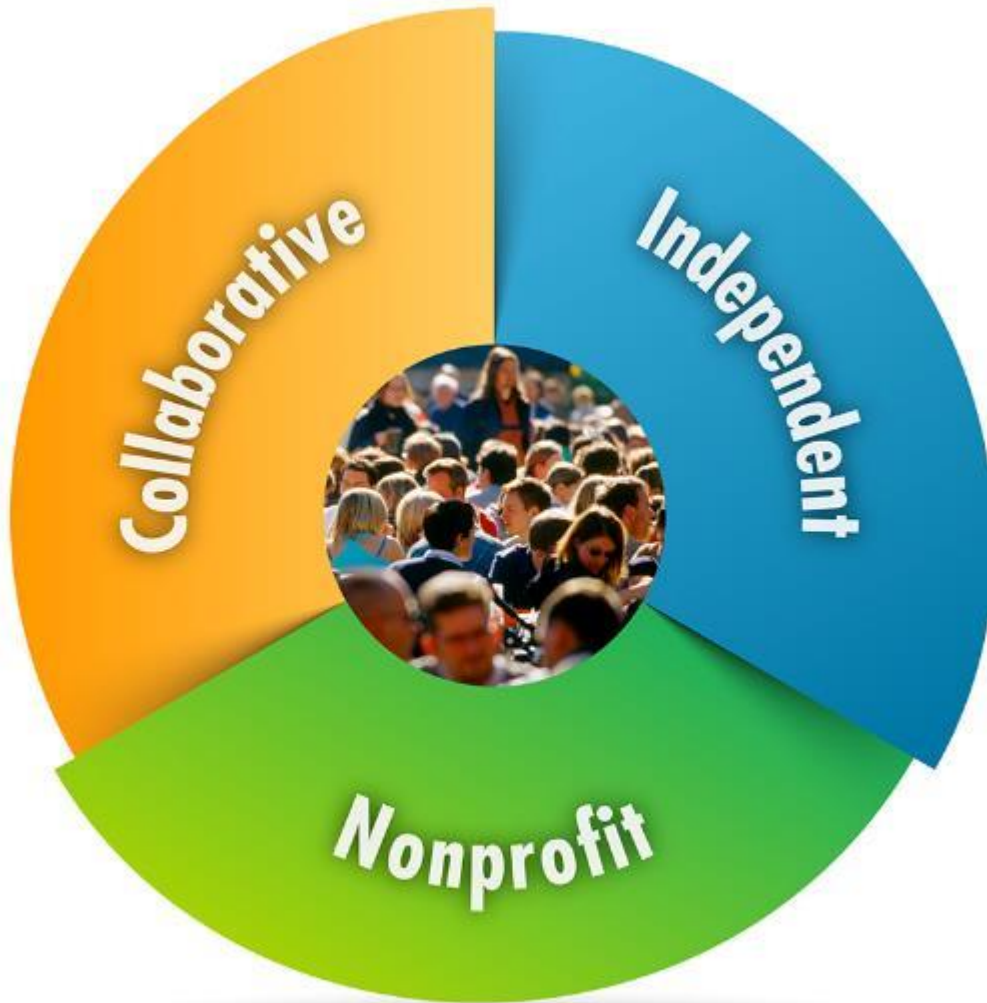


EPRI's Mission

Advancing ***safe, reliable, affordable*** and ***environmentally responsible*** electricity for society through global collaboration, thought leadership and science & technology innovation



Three Key Aspects of EPRI



Independent

Objective, scientifically based results address reliability, efficiency, affordability, health, safety, and the environment

Nonprofit

Chartered to serve the public benefit

Collaborative

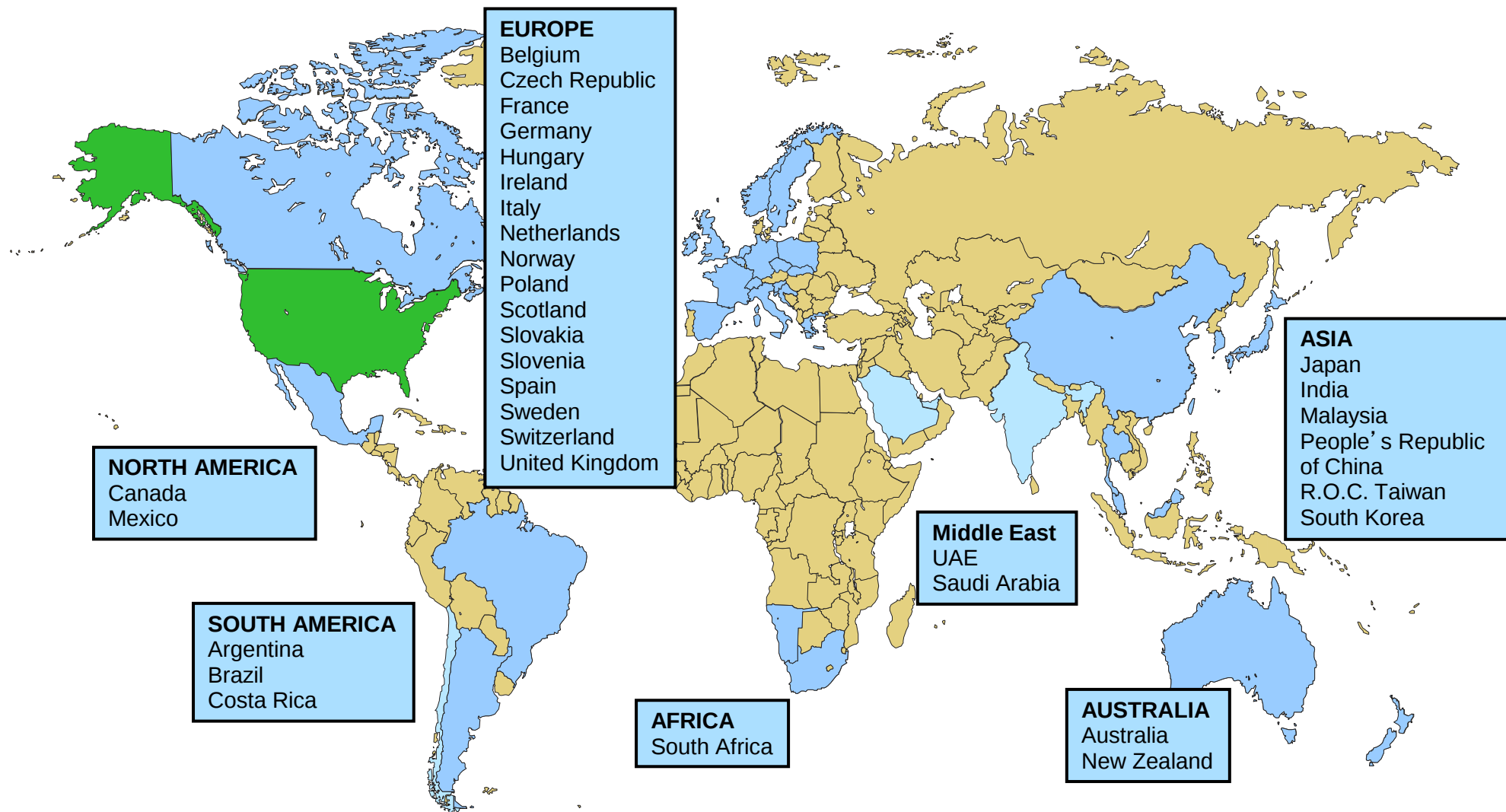
Bring together scientists, engineers, academic researchers, and industry experts

Our Members...

- 450+ participants in more than 30 countries
- EPRI members generate approximately 90% of the electricity in the United States
- International funding – nearly 25% of EPRI's research, development, and demonstrations



International EPRI R&D Collaboration



Over 25% of EPRI Collaboration Membership is International

John J. Simmins, Ph.D.

Dr. John J. Simmins is a Technical Executive at the Electric Power Research Institute (EPRI). His current research focuses in the use of augmented reality, artificial intelligence, data analytics, and visualization to improve grid resilience.

Prior to joining EPRI Dr. Simmins was with Southern Maryland Electric Cooperative where he managed the engineering and operations applications. He received his B.S. and a Ph.D. in Ceramic Science from Alfred University.



EPRI's Long-Term DR-DER-Distribution Research

- Demand Response
- Smart Functions of Inverters
- Aggregated Functions
 - **Groups**
 - Prediction
 - Status
 - Shed/Create Load
 - Dispatch Real/Reactive Power
- Distributed Intelligence
 - Meters
 - Smart Devices
- Neural Network - AI
 - Distributed Super-Computer
 - Machine Learning



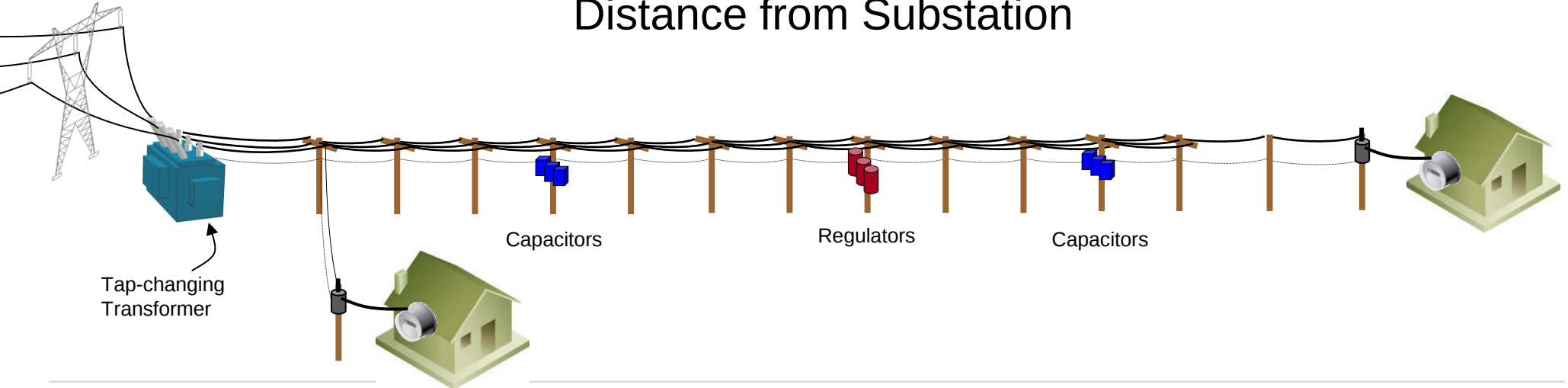
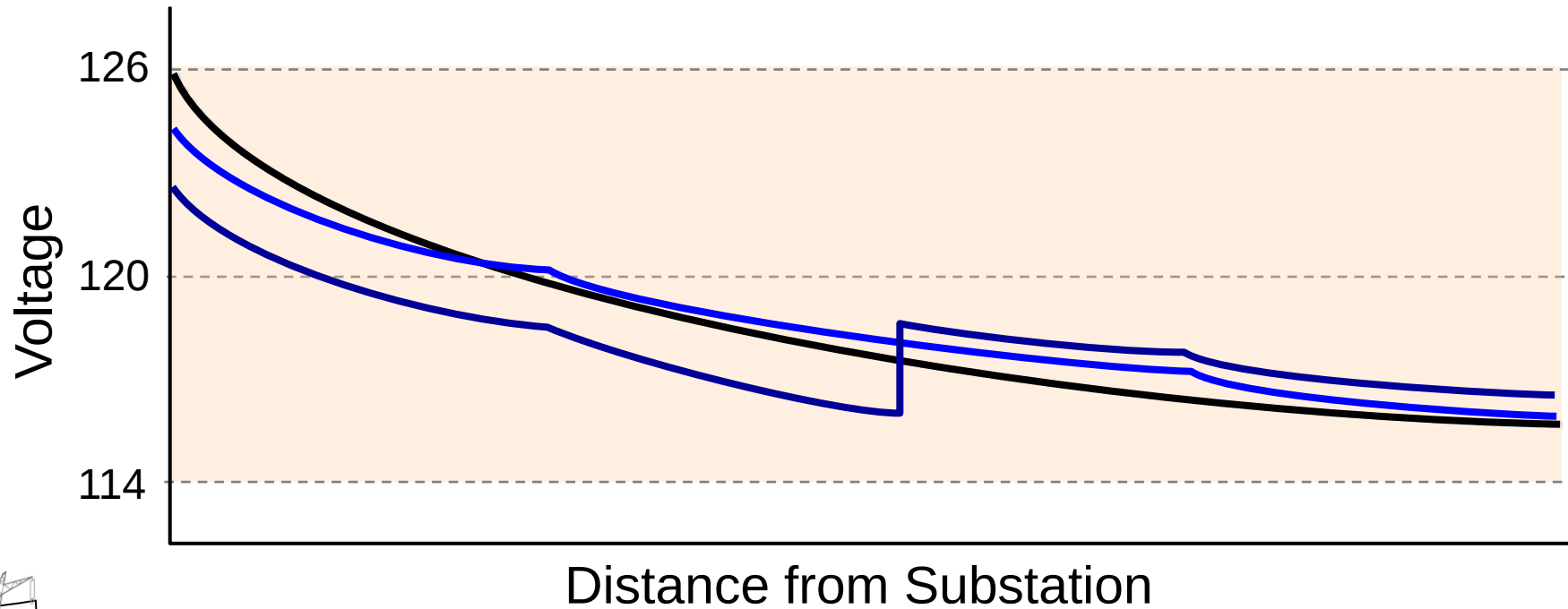
Goals:

- Ad-Hoc Microgrids
- New Business Models
- Self-Sustaining Distribution Grid
- Self-Aware Distribution Grid

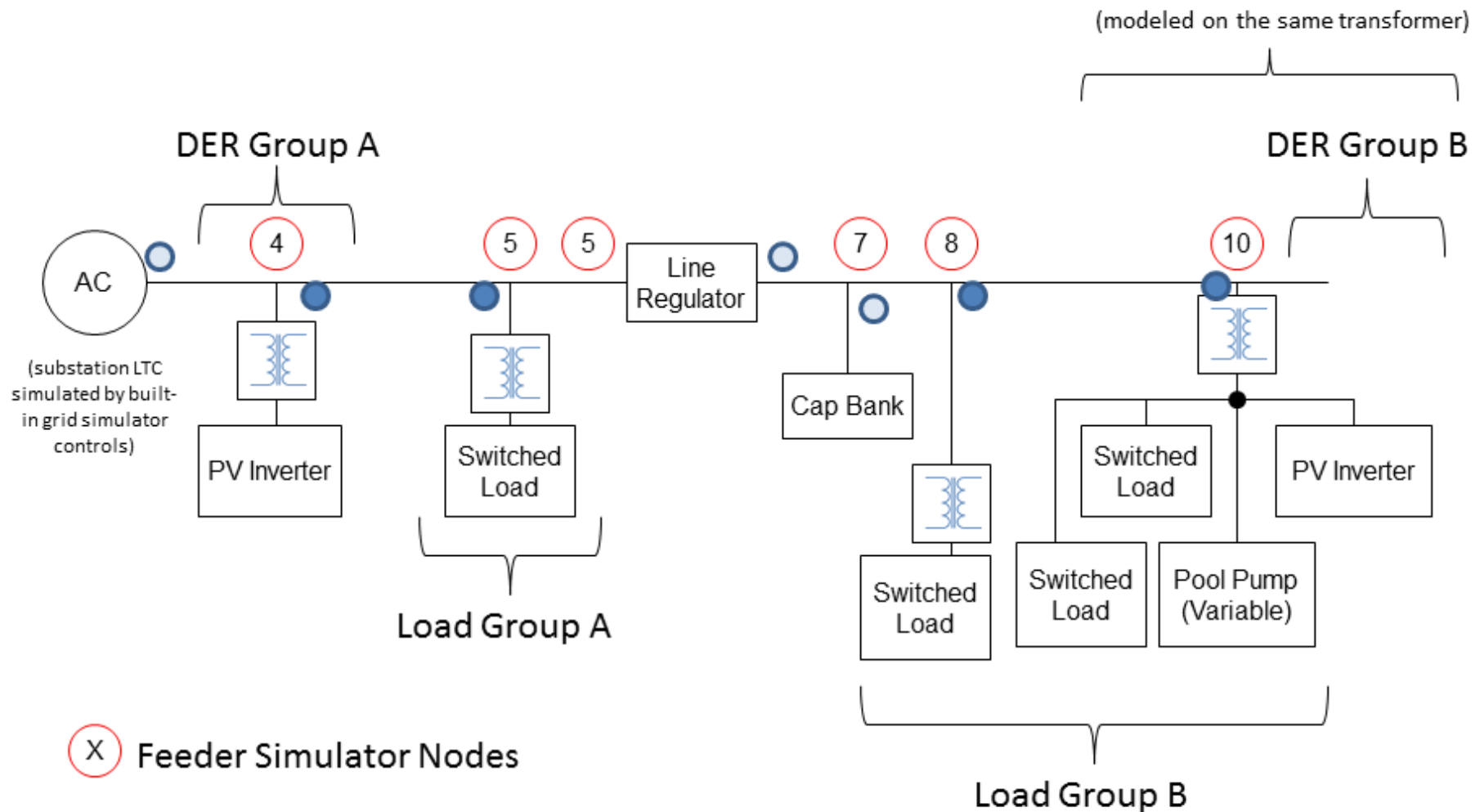
The INTEGRATE Task 2 Project in a Nutshell

This project will provide and demonstrate an end-to-end framework of communication, information, and computation (CIC) technologies, suited for the integration and evaluation of high penetration, clean energy technologies.

Basics of Distribution Grid Management



DR/DER on a Typical Distribution Feeder

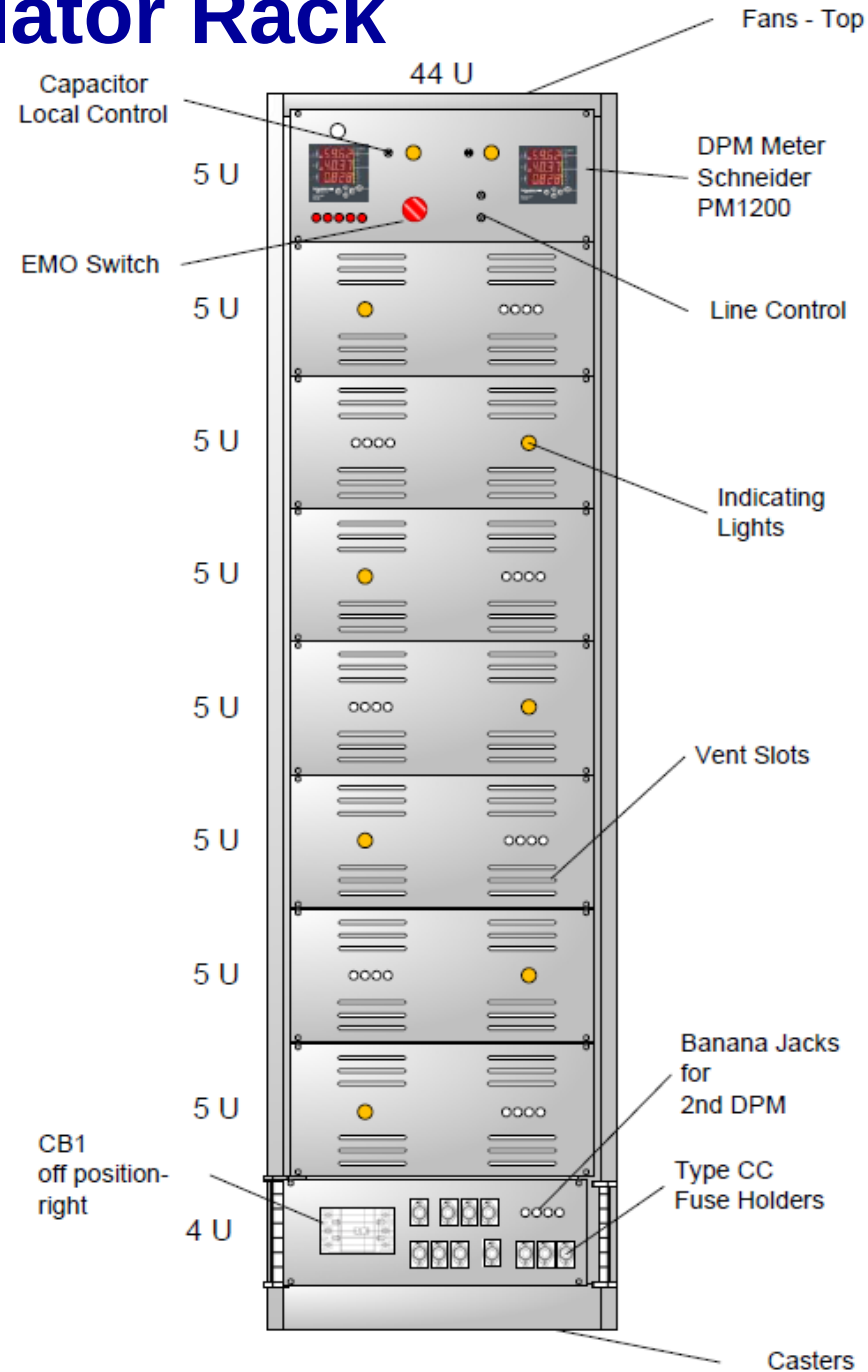


(X) Feeder Simulator Nodes

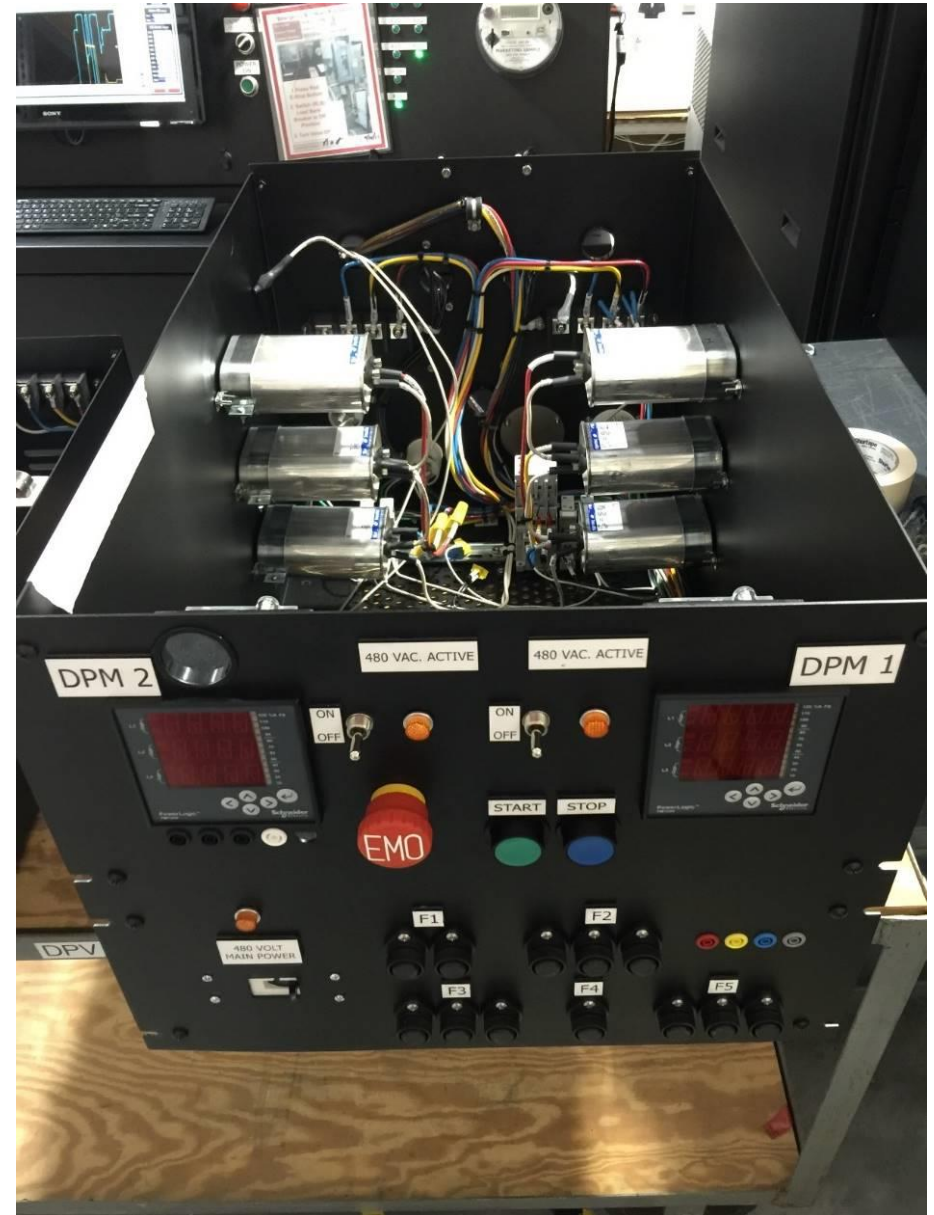
● DMS – Individual SCADA Metering Points

○ Sensing Integrated in Equipment

Feeder Simulator Rack

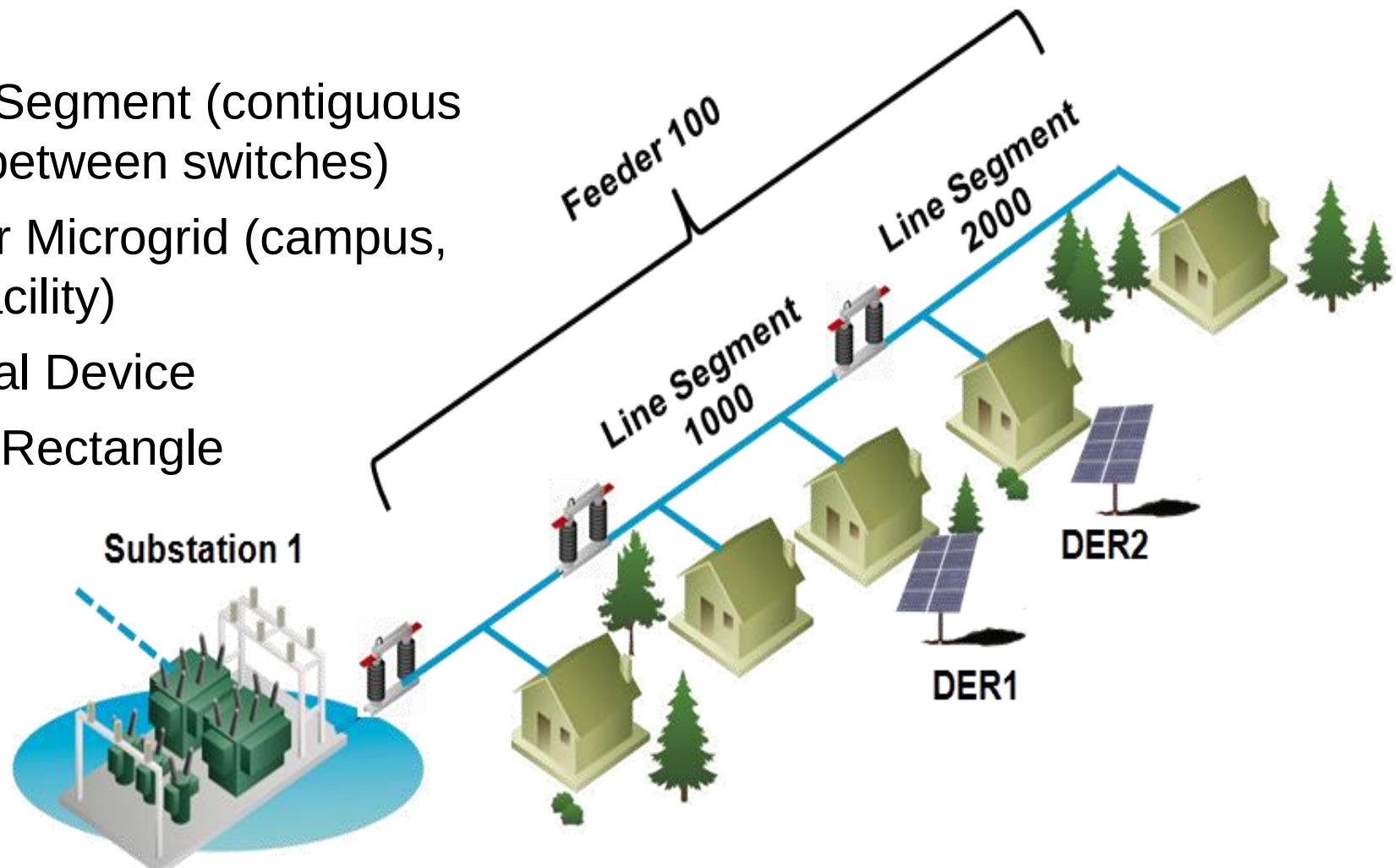


Feeder Simulator Rack



The Concept of a DER Group

- By Substation
- By Circuit/Bus
- By Feeder
- By Feeder Segment (contiguous conductor between switches)
- By Island or Microgrid (campus, industrial facility)
- By Individual Device
- By Lat/Lon Rectangle

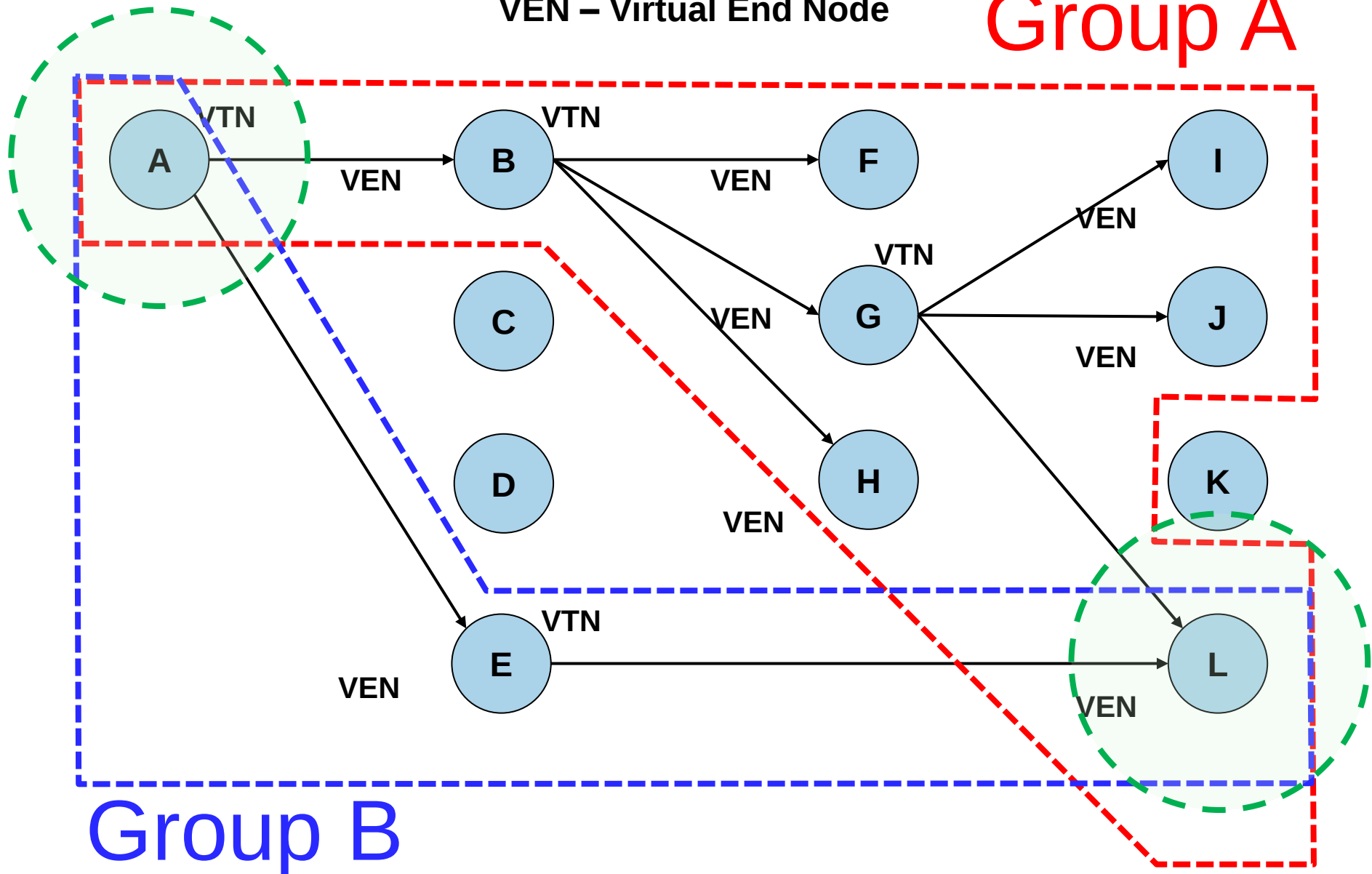


Recursive Architecture

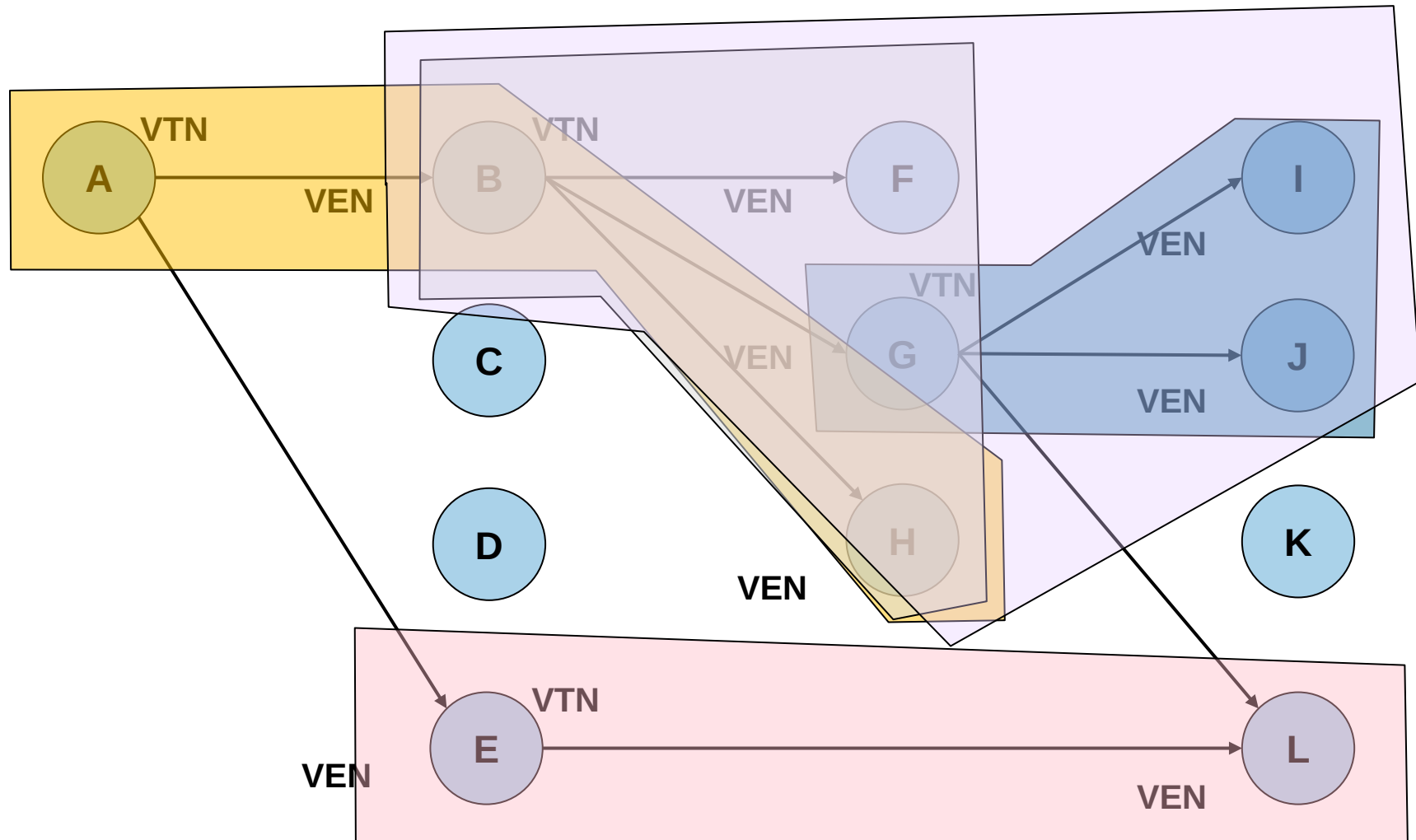
- VTN controls VENs and lower VTNs.
- Each node can be in a group.
- A node can be in multiple groups.

VTN – Virtual Top Node
VEN – Virtual End Node

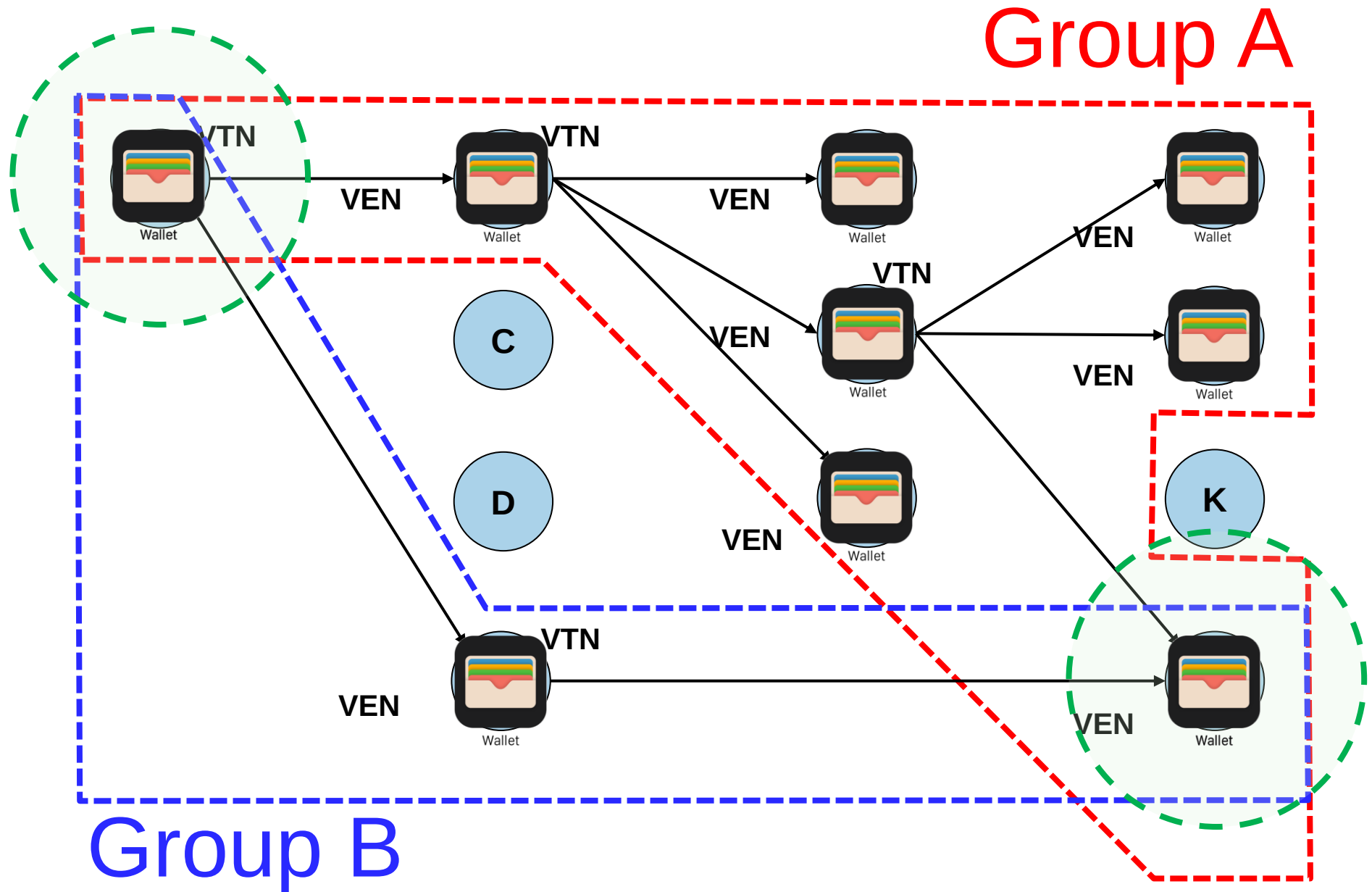
Group A



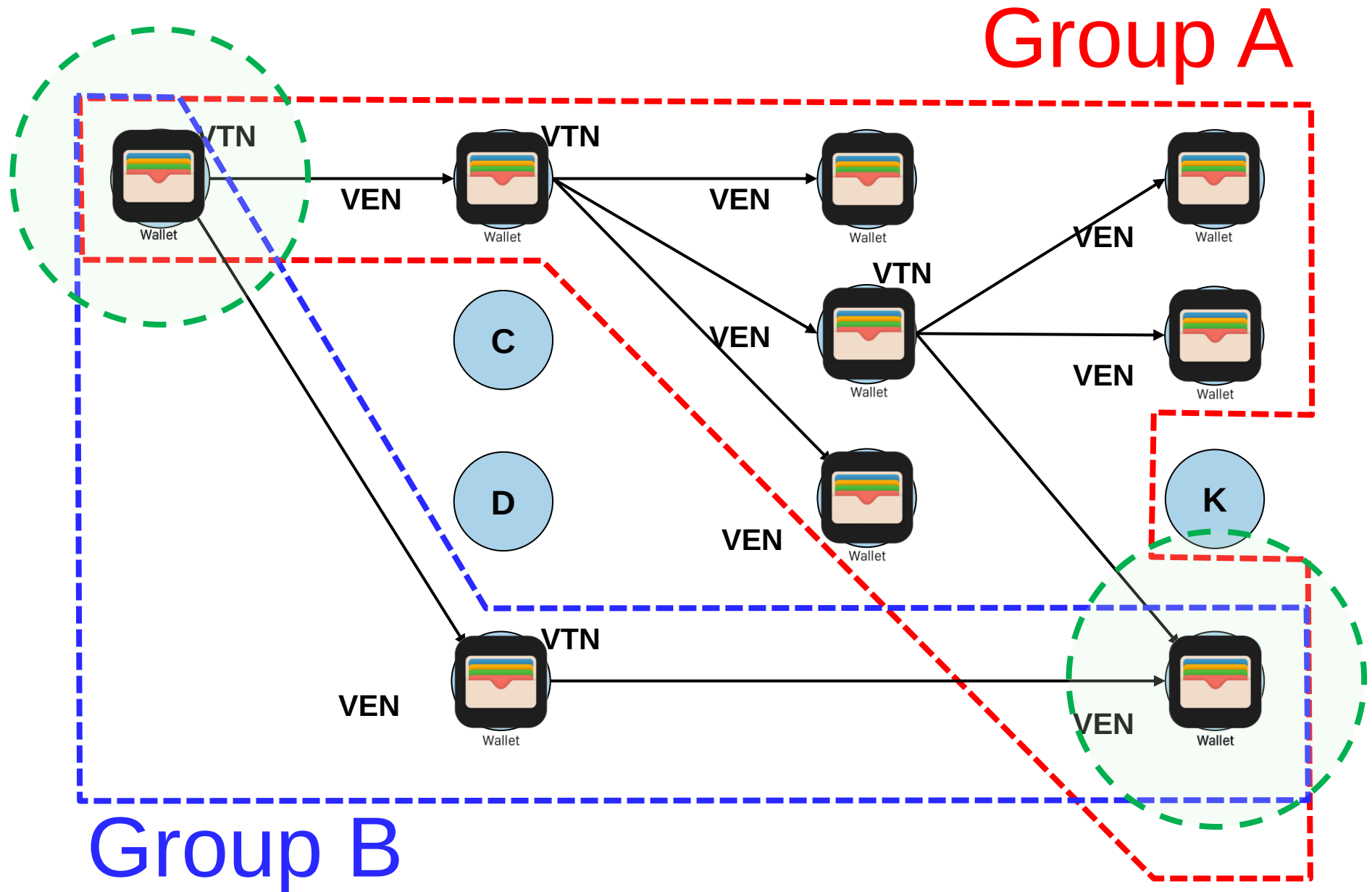
Ad Hoc Microgrids



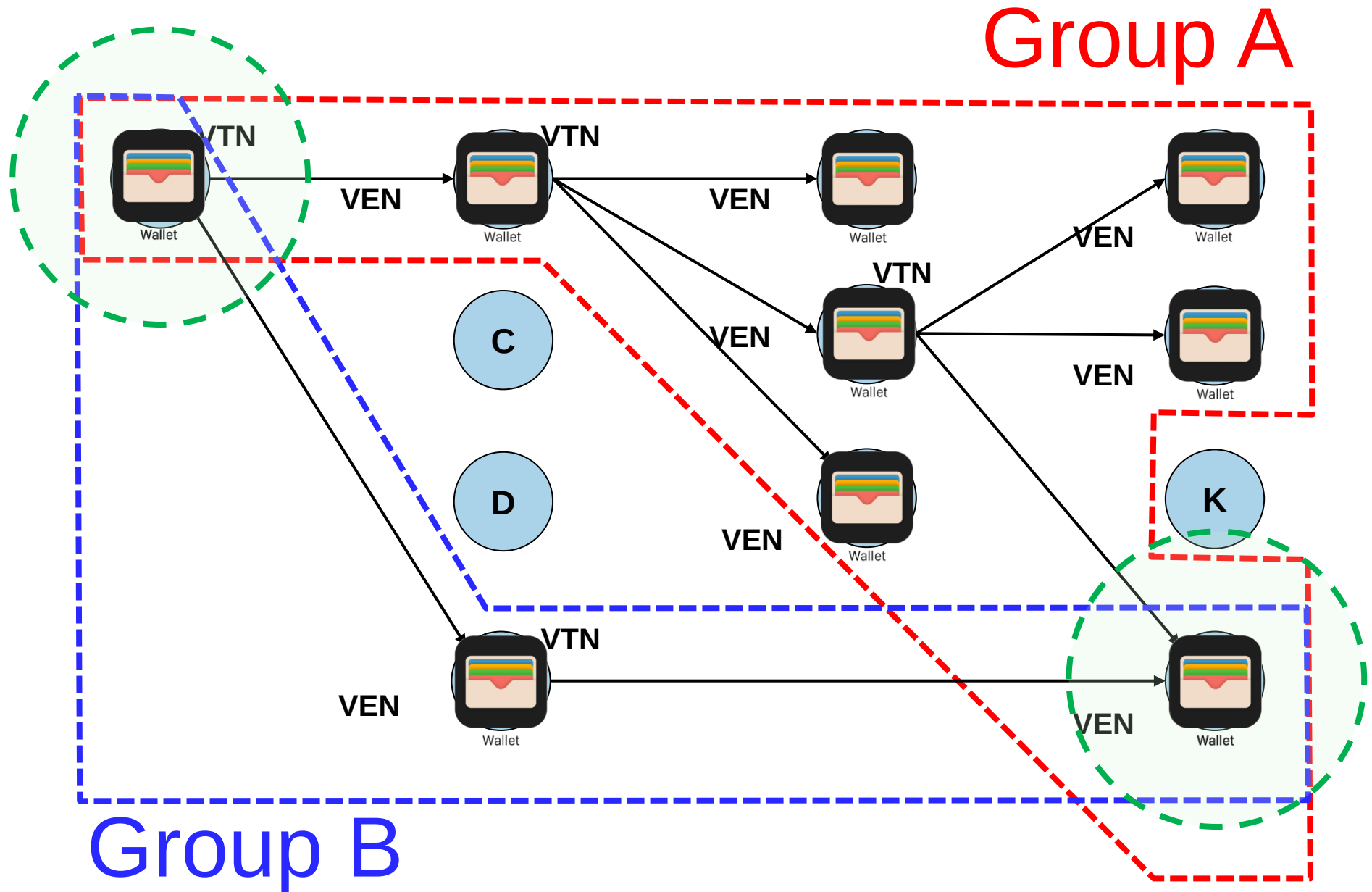
New Business Models – Blockchain



New Business Models – Blockchain



New Business Models – Blockchain





Together...Shaping the Future of Electricity
jsimmins@epri.com