MICROGRID KNOWLEDGE
CONFERENCE SERIES

Microgrid 2019
CONFERENCE

Self-Aware Microgrid Controls

Scott Manson
Schweitzer Engineering Laboratories, Inc.

MICROGRID KNOWLEDGE CONFERENCE SERIES

Microgrid 2019 CONFERENCE

Self-Driving Power System?

Isaac Asimov's Three Laws of Robotics (1942)

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.

Isaac Asimov's Three Laws of Robotics (1942)

1. An ***autonomous power system*** may not injure a human being or, through inaction, allow a human being to come to harm.
2. An ***autonomous power system*** must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. An ***autonomous power system*** must protect its own existence as long as such protection does not conflict with the First or Second Laws.

Superior Protection

Protect Assets, Environment, and People

Simple and Dependable

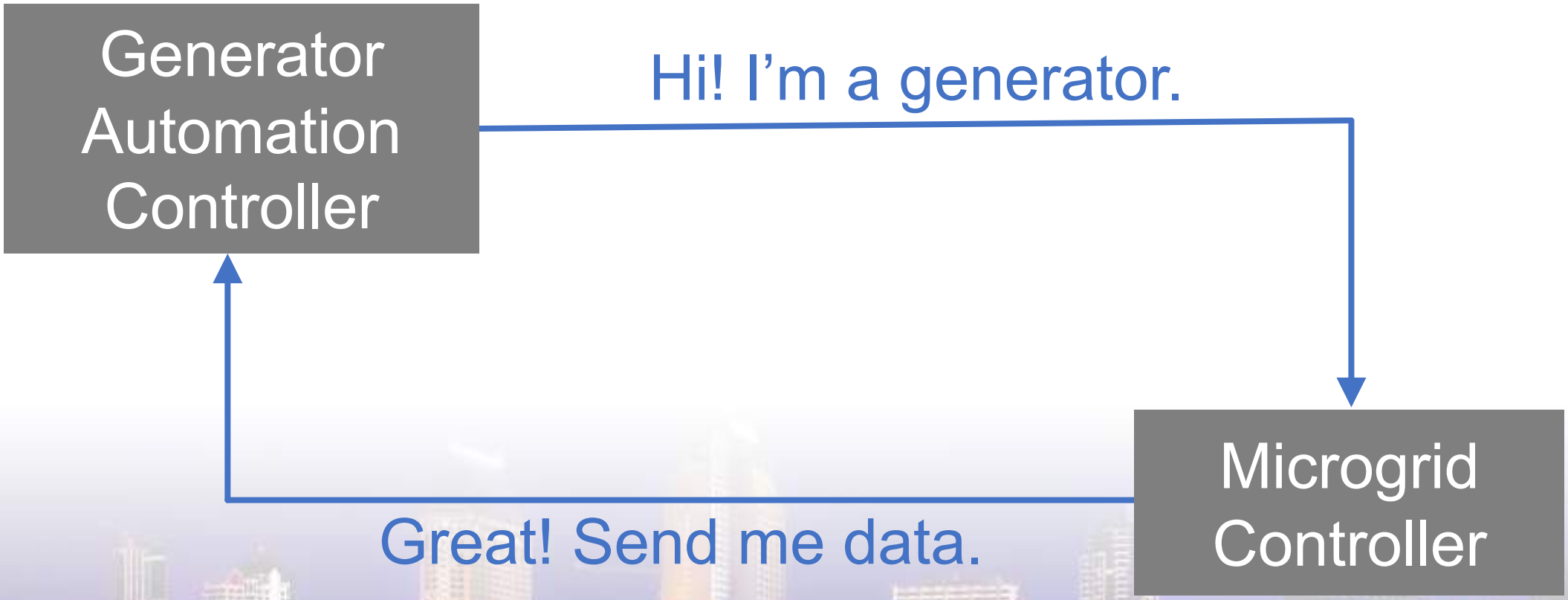
Improving Reliability and Reducing Part Count

60 kW Diesel Genset

32 lb of Electronics

3 lb Relay Replacement

Autonomous Learning
Humans Out of the Loop



Interoperability

Making All DERs Play Nicely Together

30 kW Taylor

100 kW CAT

60 kW TQG

30 kW Gillette

Loads

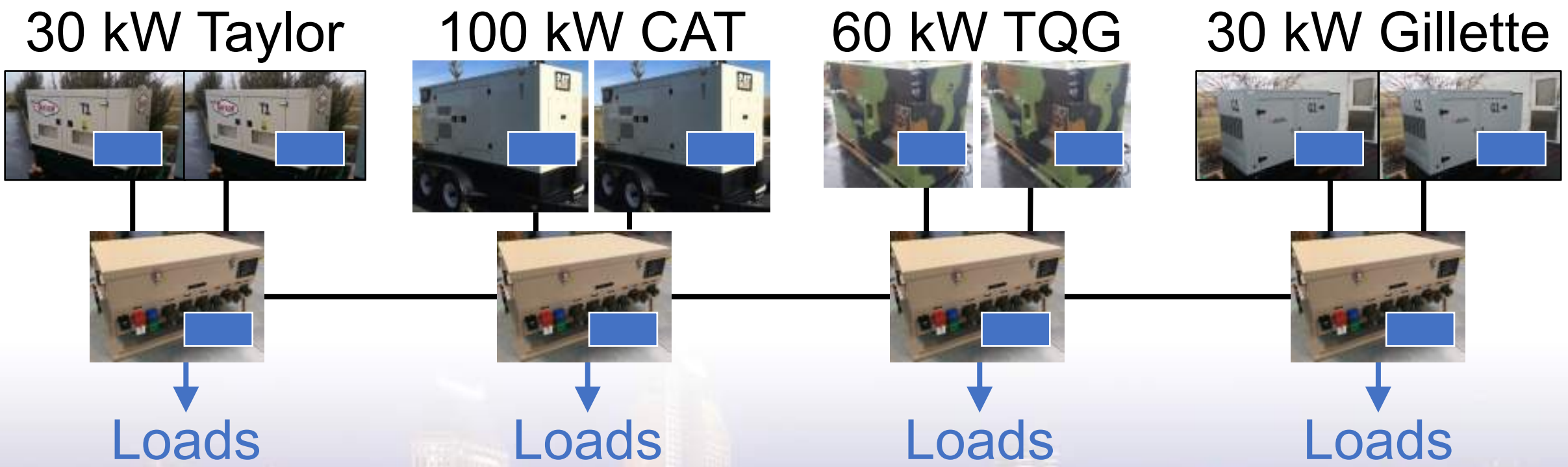
Loads

Loads

Loads

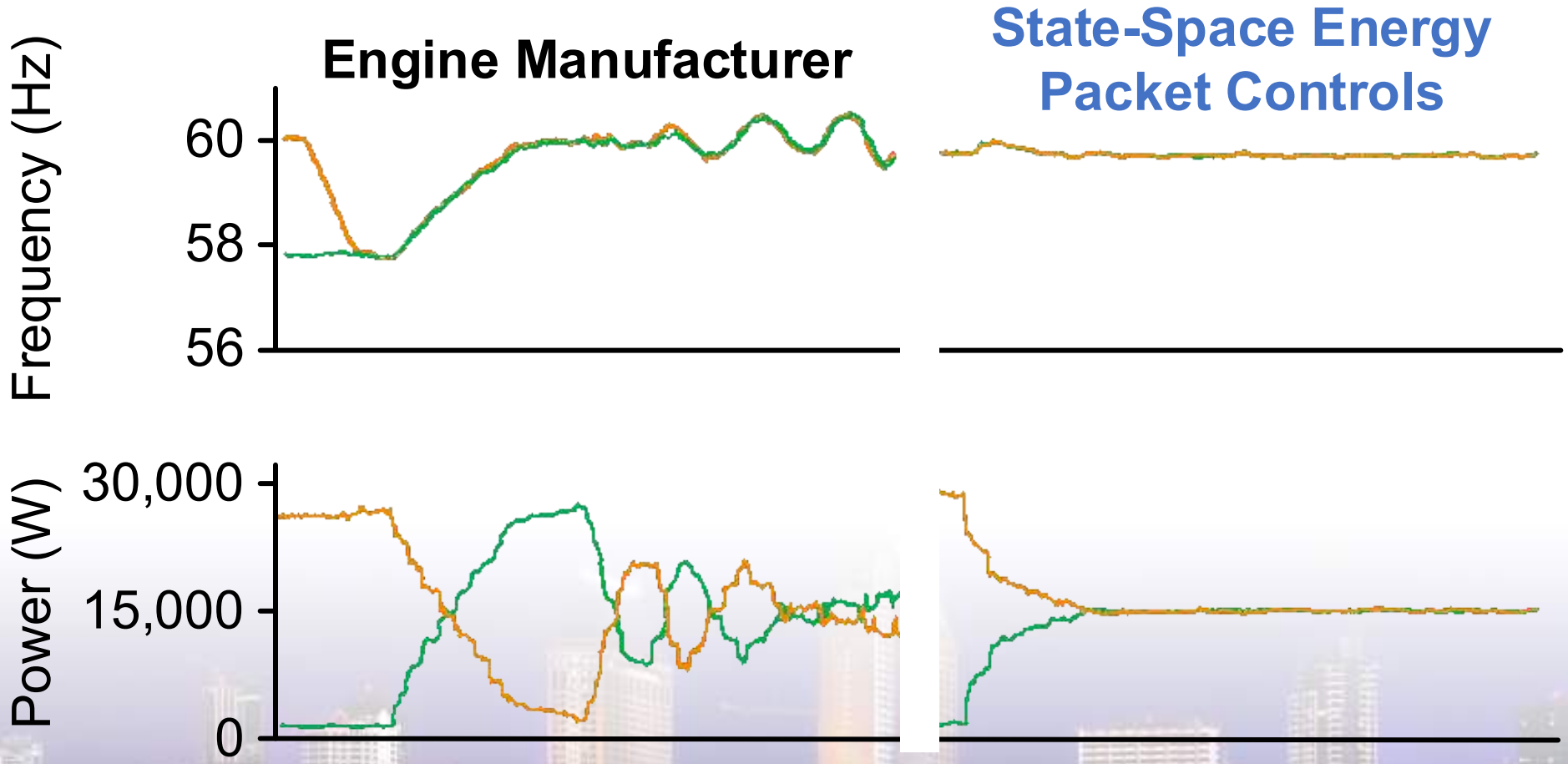
Adapts to the Mission

Same Hardware for Every DER



Resilience Mode

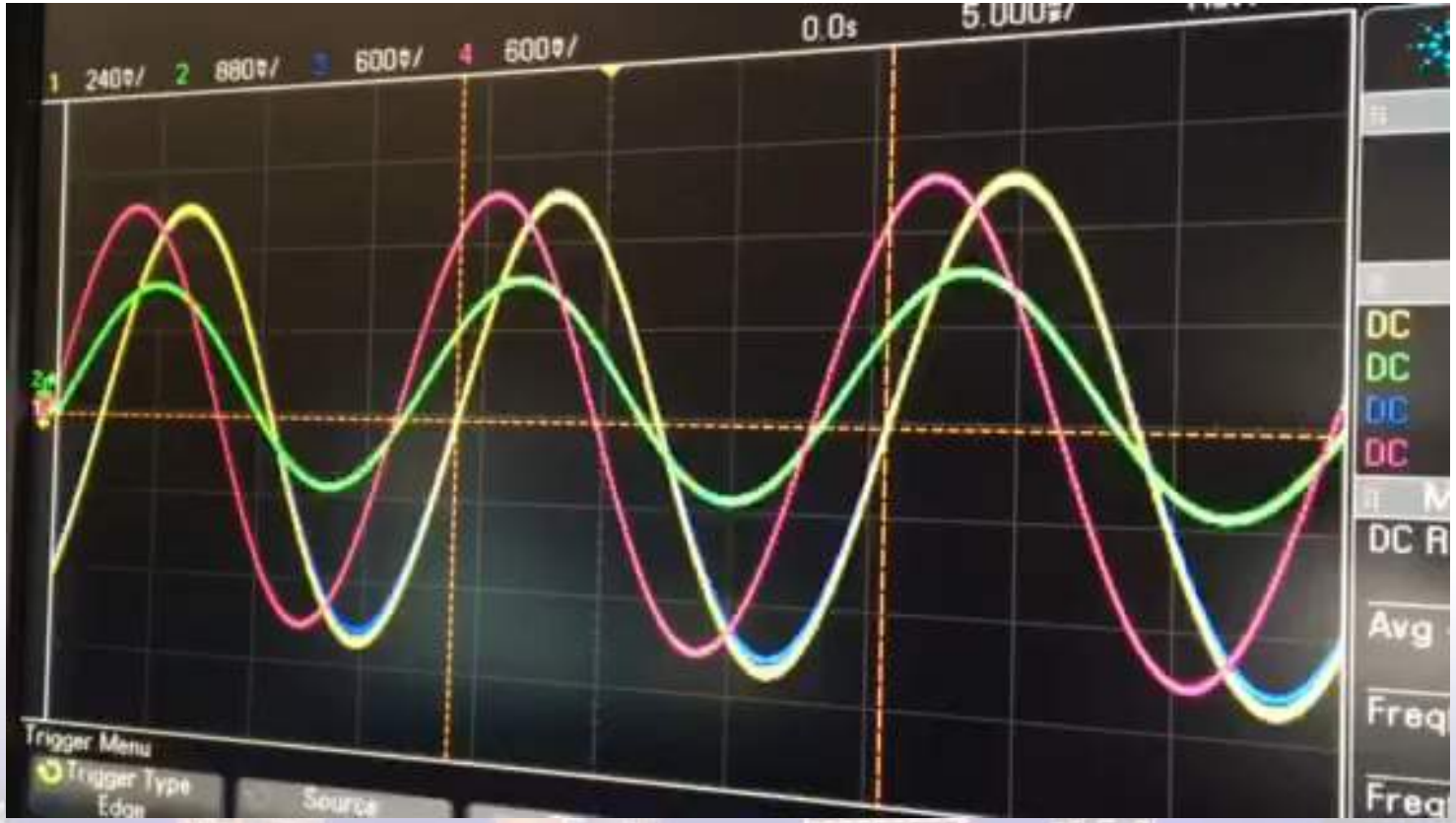
Superior Load Sharing and Frequency Control Performance



- No overshoot
- No integral windup
- No oscillations
- No tuning
- Full interoperability

Humans Out of the Loop

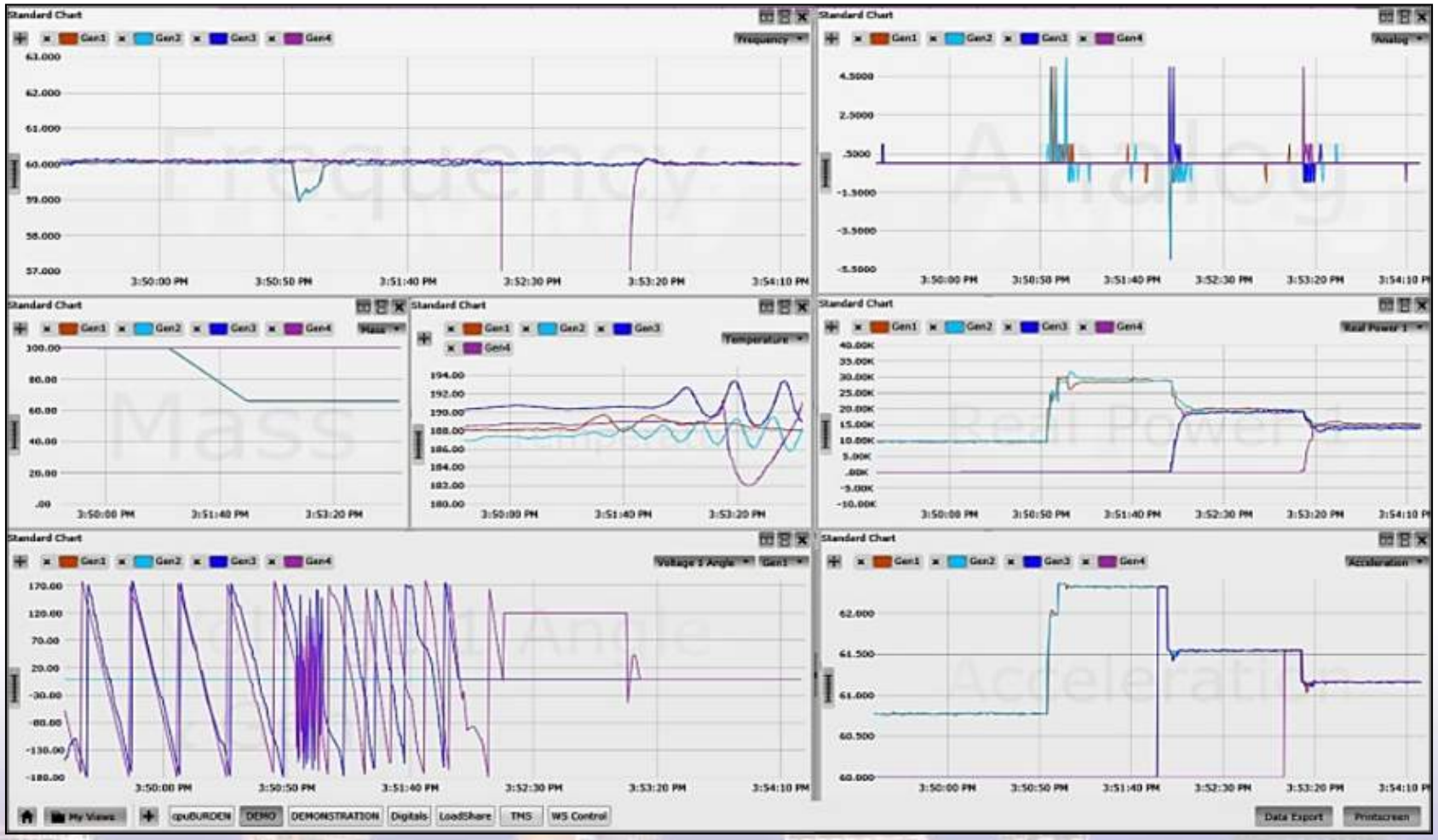
Fully Autonomous Start and Synchronization



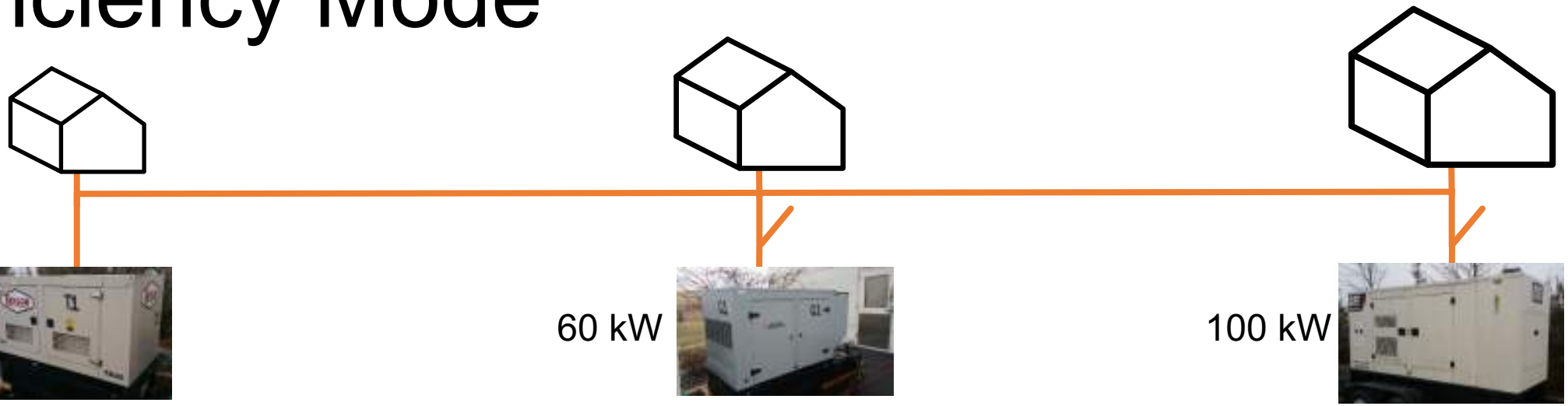
Maintenance Mode

Prolong the Life of Your Engines

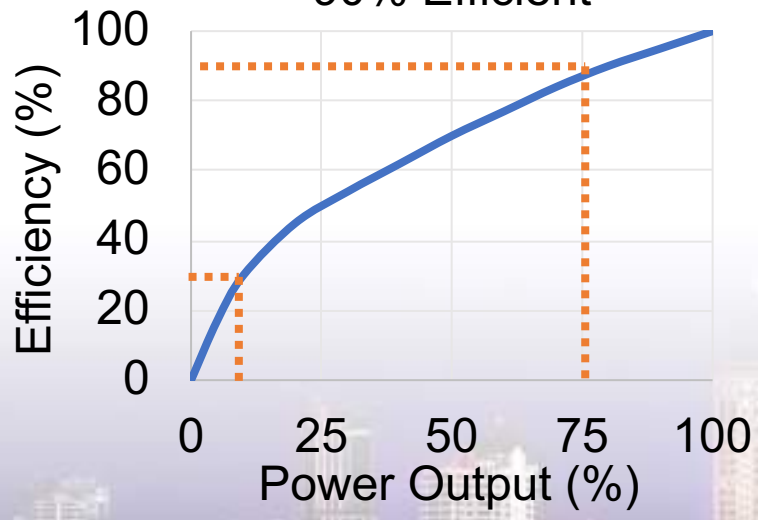
Time-Synchronized Condition Monitoring



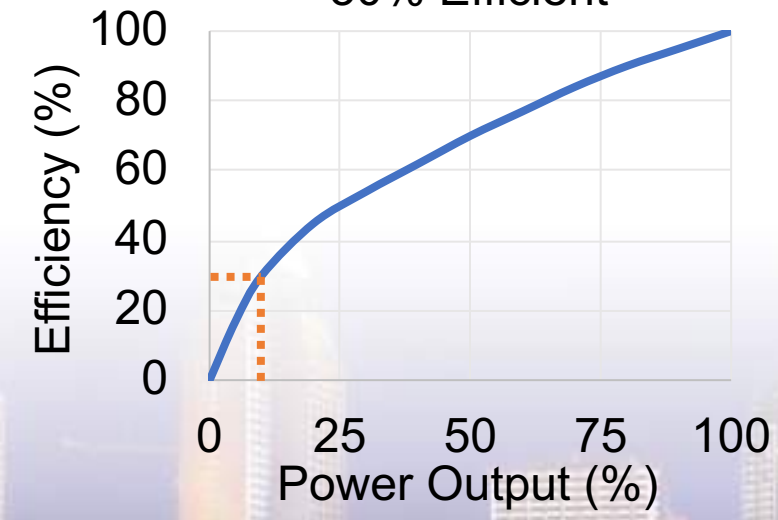
Efficiency Mode



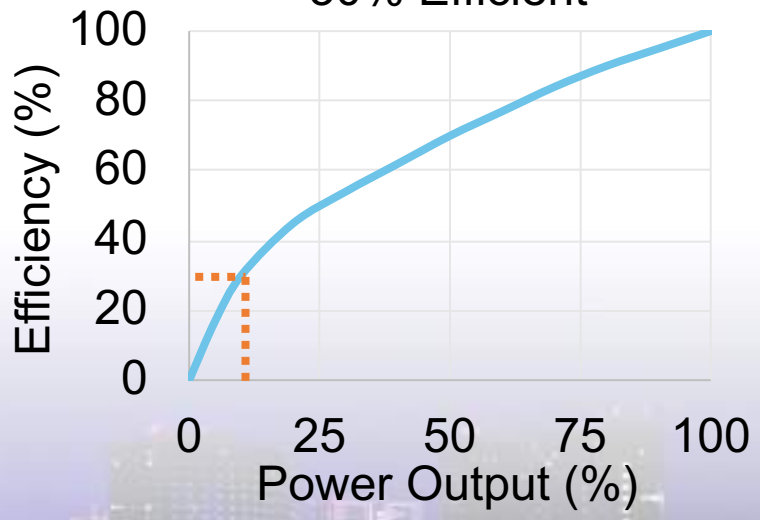
90% Efficient



30% Efficient

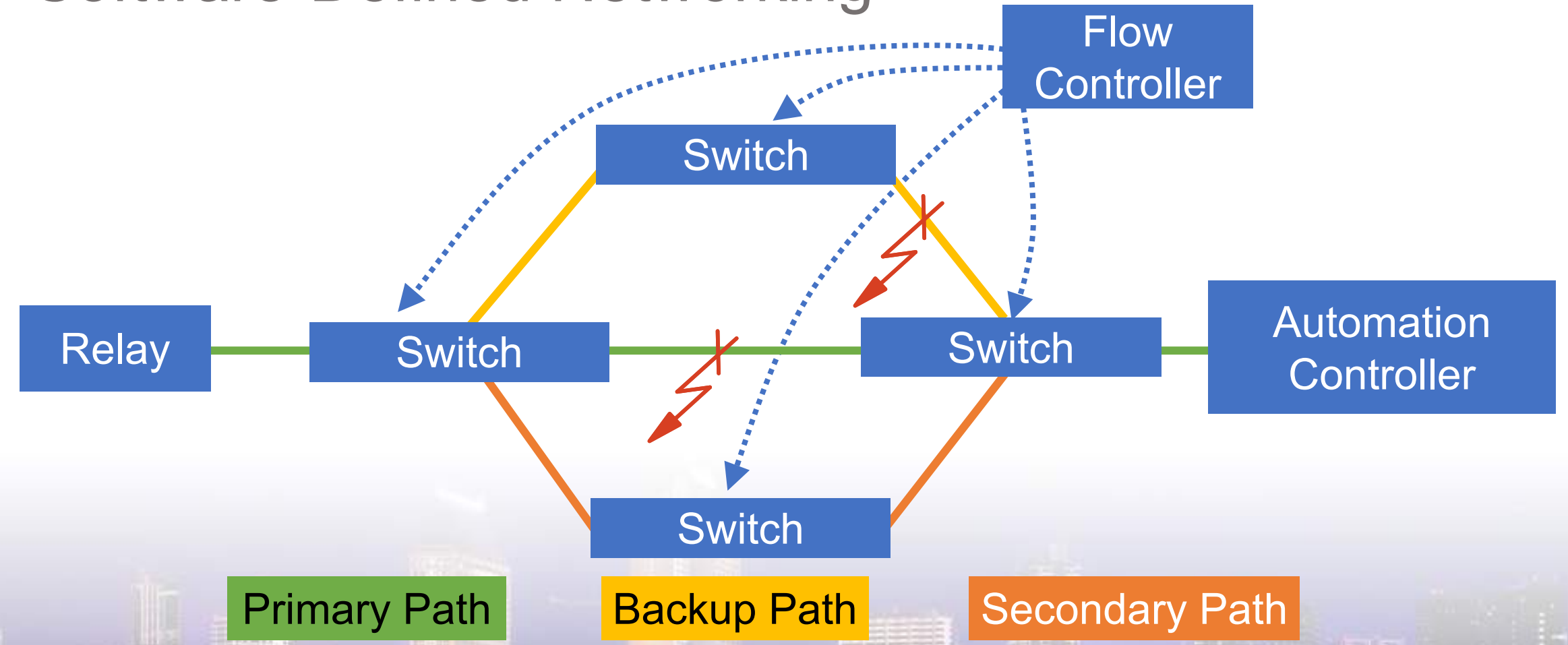


30% Efficient



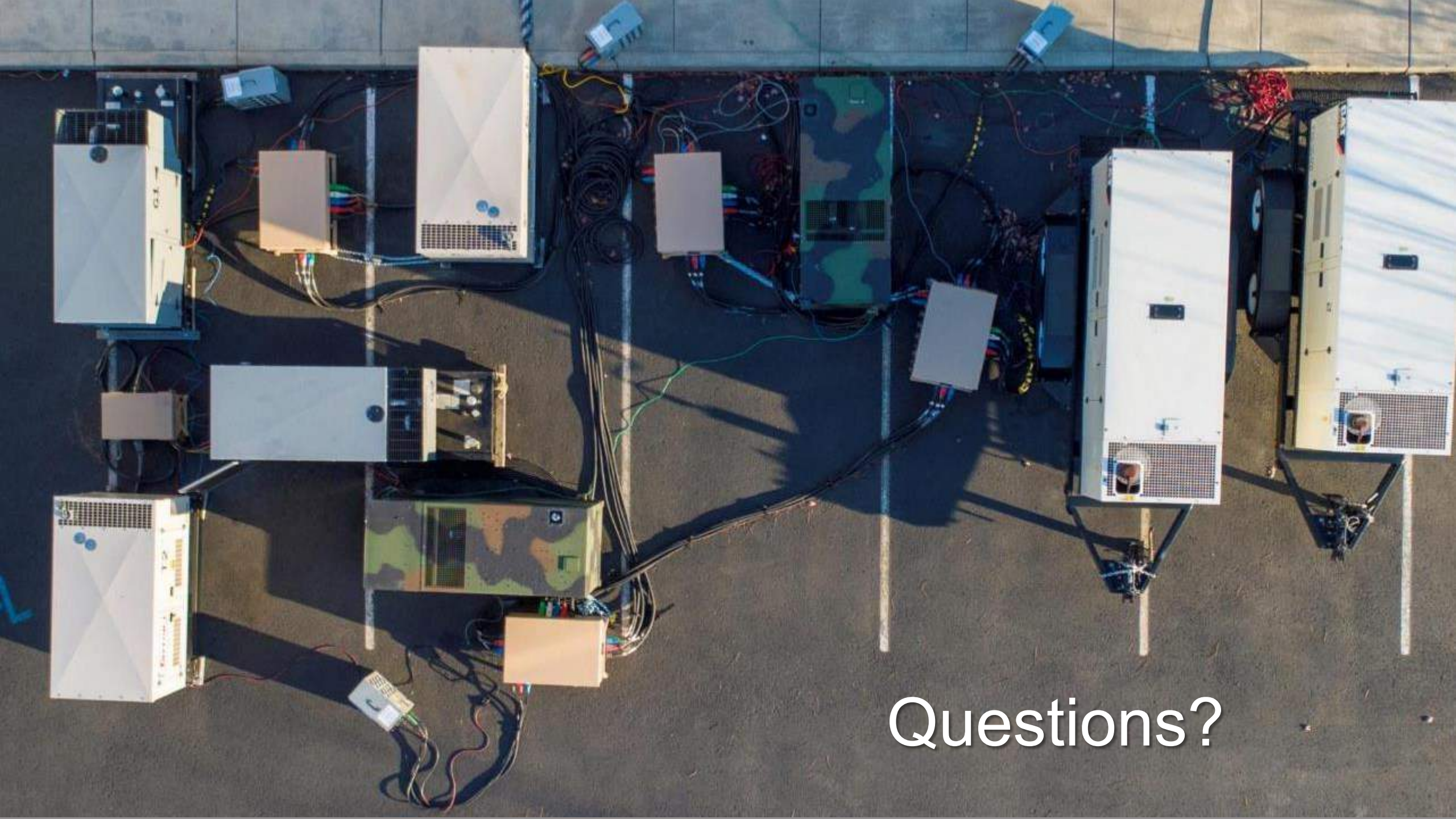
Reliable and Cybersecure Networks and Systems

Software-Defined Networking



Edmund O. Schweitzer, III, Ph.D. (1982)

- Safer—superior protection, dependability, simplicity, and cybersecurity
- More reliable—high-speed autonomous actions, interoperability, resilience mode, and humans out of the loop
- More economical—adaptability for the mission, maintenance mode, efficiency mode, and upgrades for existing systems


Questions?