Distributed secondary controls in IEC 61850-based microgrids

Hao (Max) Liu and Matt Backes, University of Illinois at Urbana-Champaign and the Information Trust Institute

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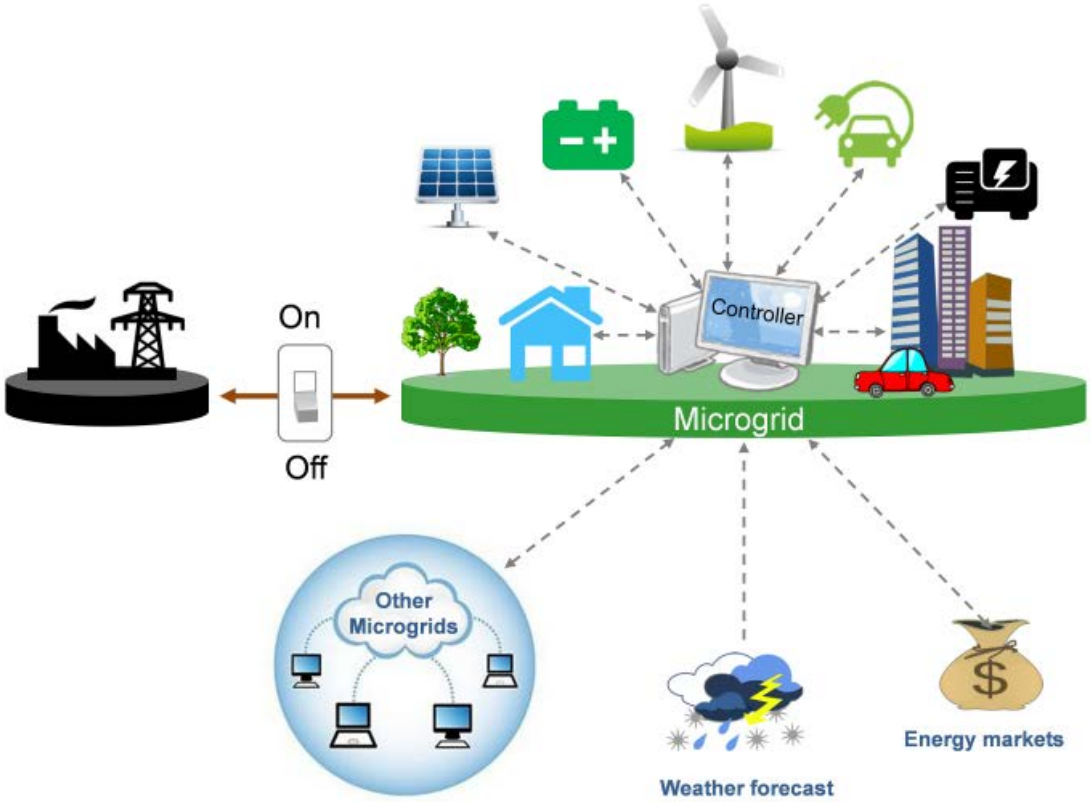
Overview

- Microgrids
- IEC 61850
- Distributed secondary control
- Round-Robin-based intrusion detection

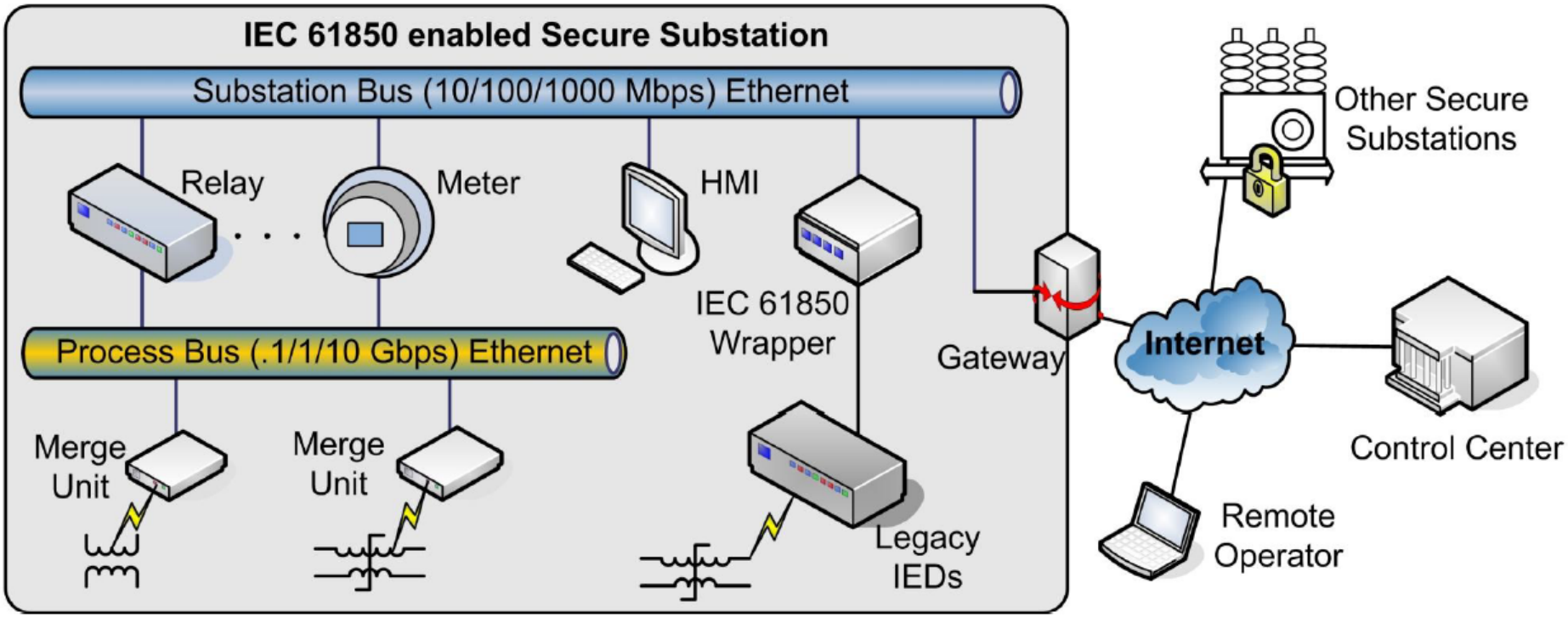
Microgrids



IEC 61850 Standard – Core Components

- An object model describing the information available from equipment
- A specification of the communication between the IEDs
- A configuration language
- Originally conceived for substation automation, but increasingly seeing expanded uses

IEC 61850 Architecture



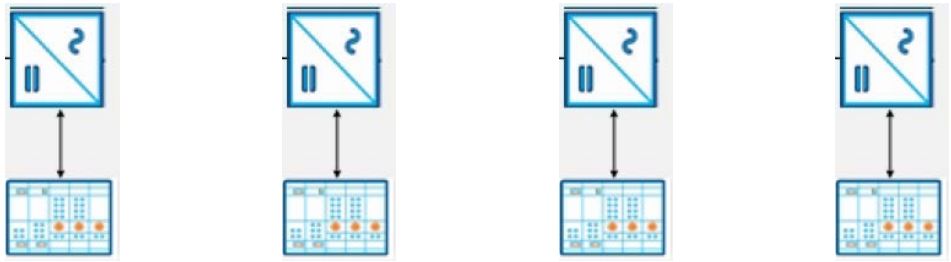
Distributed secondary control

Master Microgrid Controller

$$z = \frac{\sum_{i=1}^{4} x_i}{4}$$

Station Bus

Power Electronic-interfaced DER



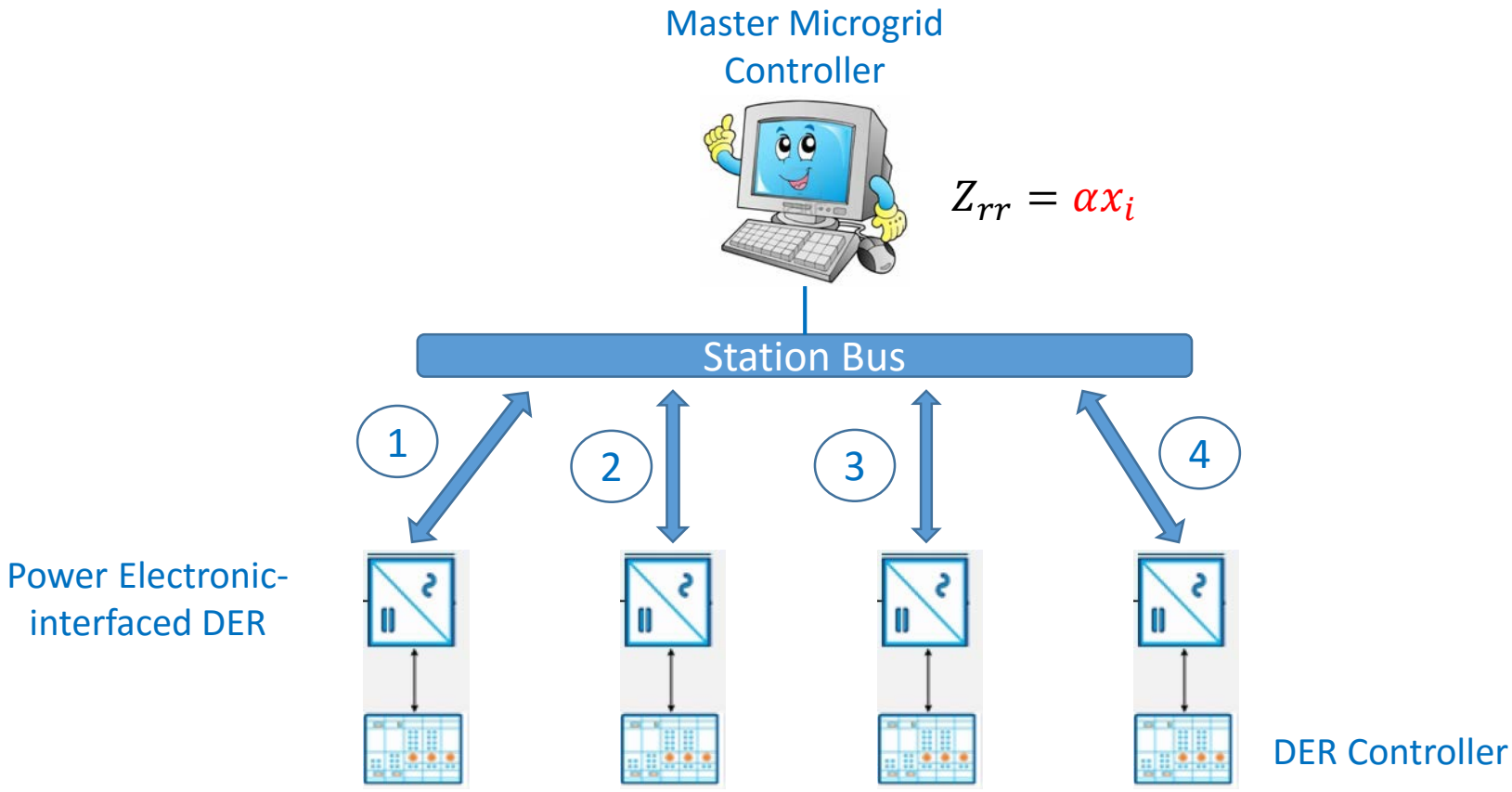
DER Controller

$\min\|x_1 - c_1\|^2$
$s.t. x_1 = z$

...

$\min\|x_1 - c_1\|^2$
$s.t. x_1 = z$

Round-Robin-based intrusion detection



Conclusion

- Microgrids can enhance resiliency
- IEC 61850 architecture can be leveraged to provide additional monitoring and control capabilities
  - In addition to microgrid interoperability
- Round Robin technique is adapted to identify malicious intrusion within individual microgrids

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