DDS Foundation

Webinar Series

www.dds-foundation.org

OBJECT MANAGEMENT GROUP®

Speakers

	**Meg Duncan**	Marketing Manager, Object Management Group
	**Lynne Canavan**	Director of Ecosystems at Real-Time Innovations and VP of Marketing at the DDS Foundation
	**Daniel Herring**	Associate Staff at MIT Lincoln Laboratory, and TMS Lead Engineer

About the DDS Foundation

- Mission: To advance the use of DDS in complex, high-performance, distributed applications
- Nonprofit organization of DDS users, government institutions, researchers, universities and technology companies
- Goals:
  - Drive future requirements for the DDS standard
  - Define industry-specific data models and adaptations of DDS
  - Vendor interoperability
  - Support industry-specific adaptations and implementations of DDS
  - Industry education: Build a library of use cases, data models, application software, and system architectures
- Managed by the Object Management Group® (OMG)

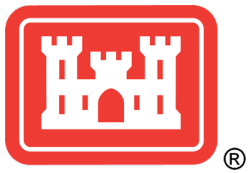
Tactical Microgrid Standard (TMS)

Using DDS for Secure Communications

DDS Foundation Webinar

Daniel Herring

May 2020



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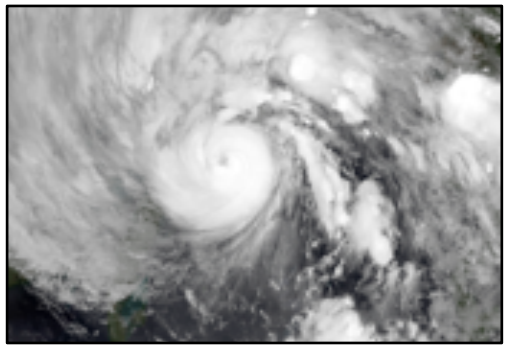
The Need for New Power System Architectures

Disasters



Attacks

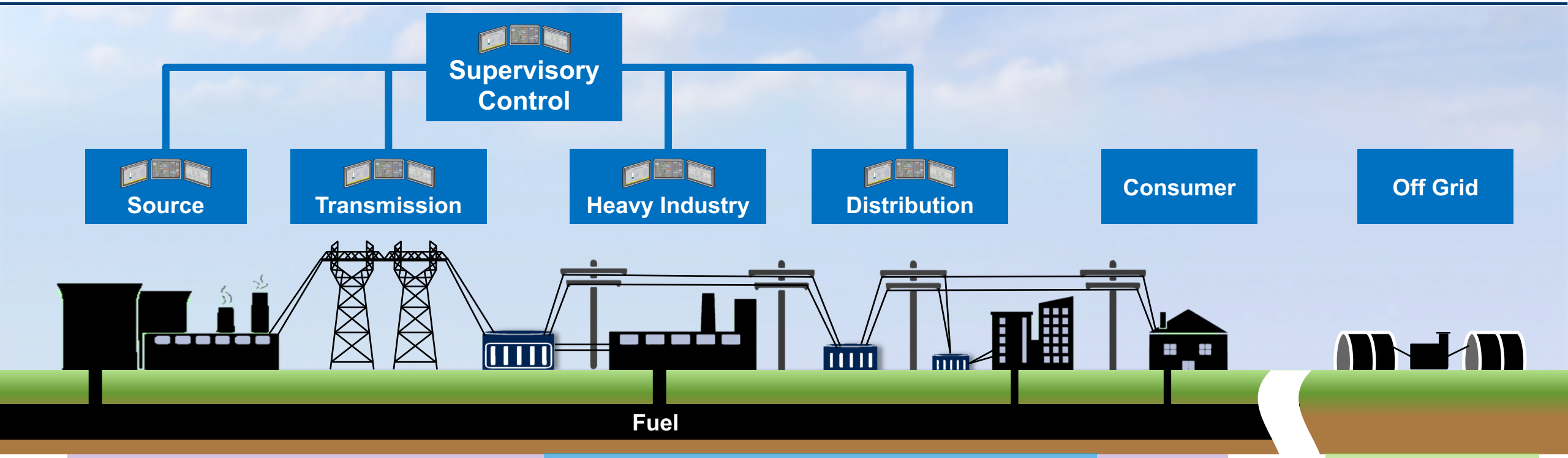
Simple
Efficient
Resilient
Modular
Scalable
Extensible

Open Architecture

New Technologies

Better Integration

Canonical Power System Architecture and Example Power Missions



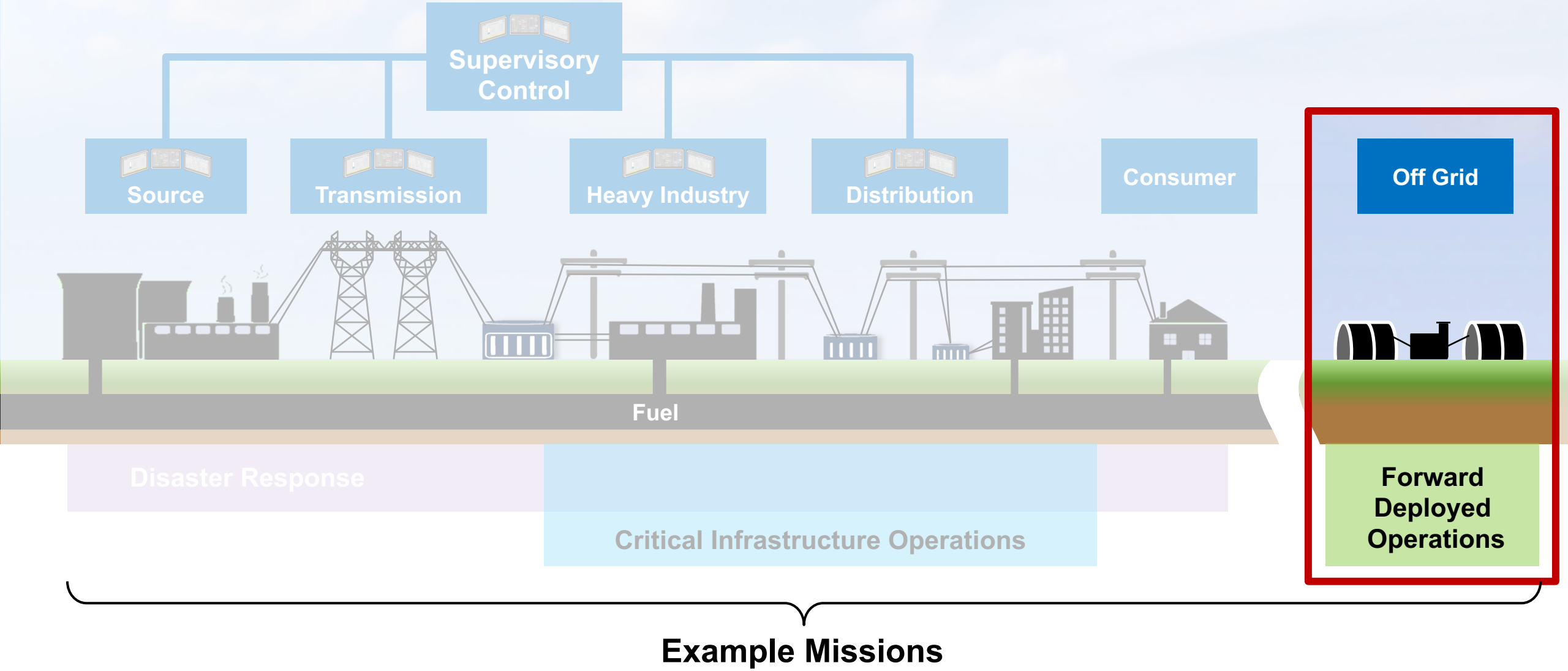
Disaster Response

Critical Infrastructure Operations

Forward Deployed Operations

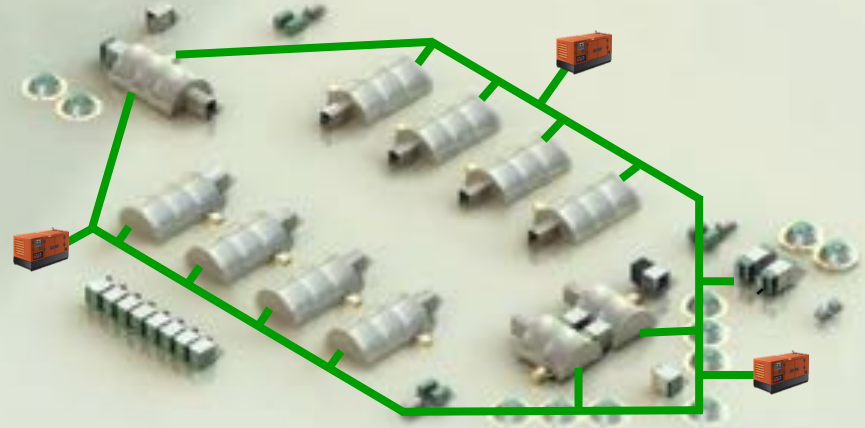
Example Missions

Canonical Power System Architecture and Example Power Missions



Microgrids Power DoD Forward Deployed Operations

Example Forward Operating Base



Source
Distribution
Load

- Self-sufficient power
- Warfighter owned and operated
- Thousands of sites
- Each site unique

Supporting Missions

Communications

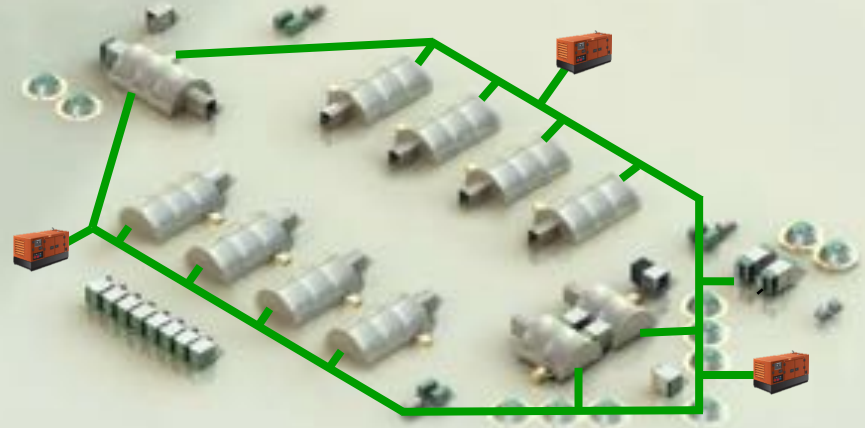
Sensors

Weapons

Climate Control

Microgrids Power DoD Forward Deployed Operations

Example Forward Operating Base



Source
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Load

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Supporting Missions


Communications


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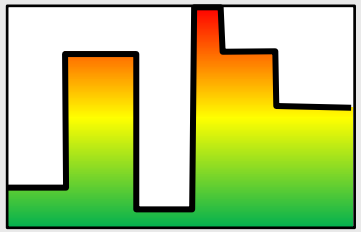
Climate Control

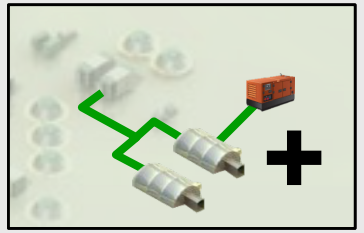
Operational Challenges


Rapid Deployment


Operator Training


Dynamic Loads

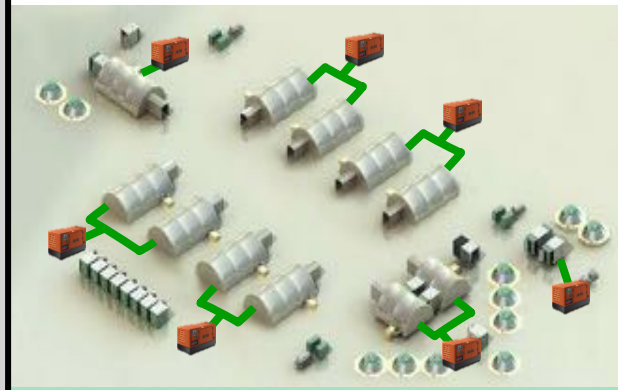
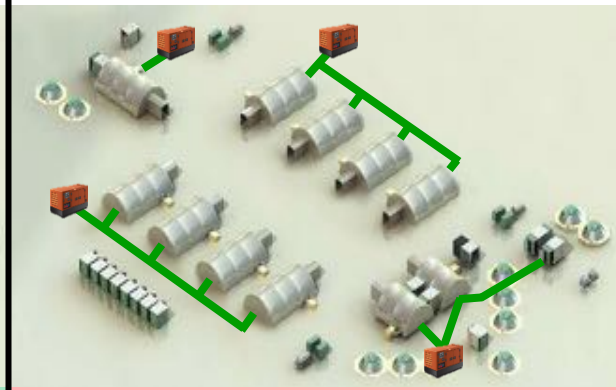
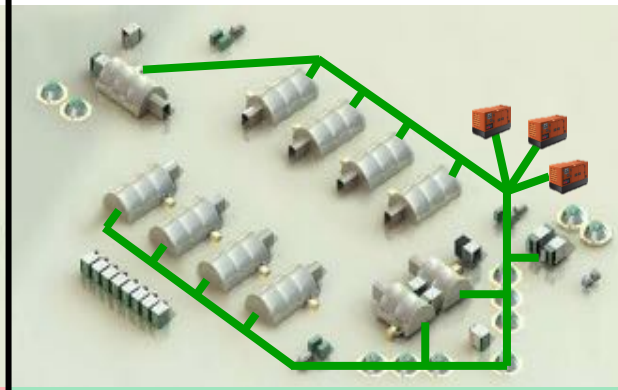
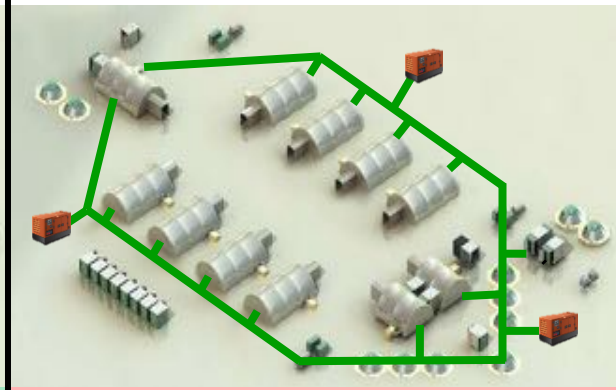

Equipment Failures


Organic Growth

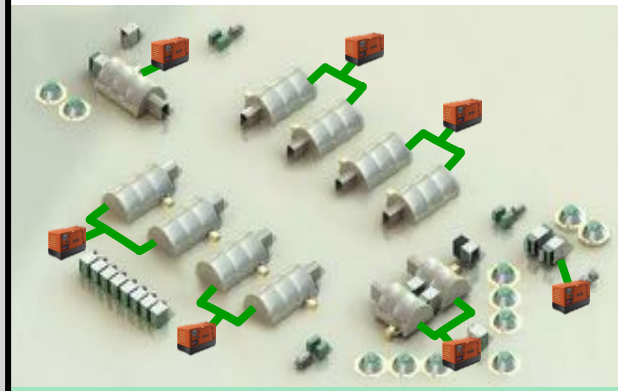
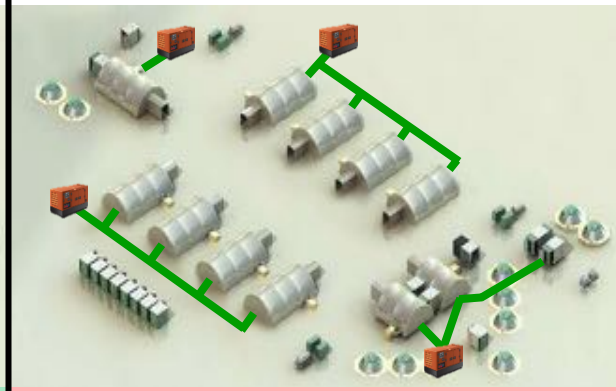
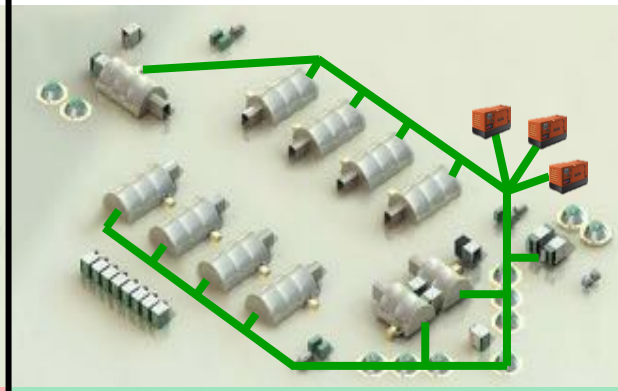
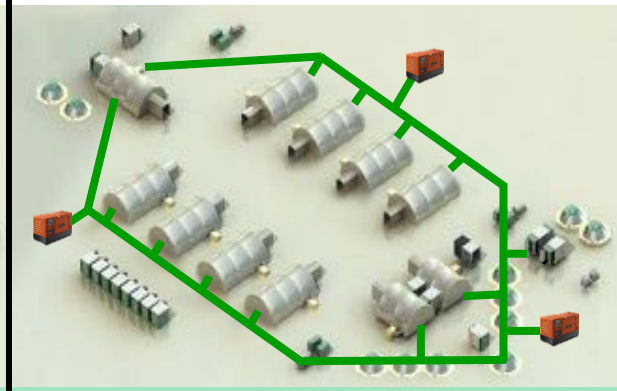

Insert New Tech

Tactical Microgrid Architecture Options

Before TMS

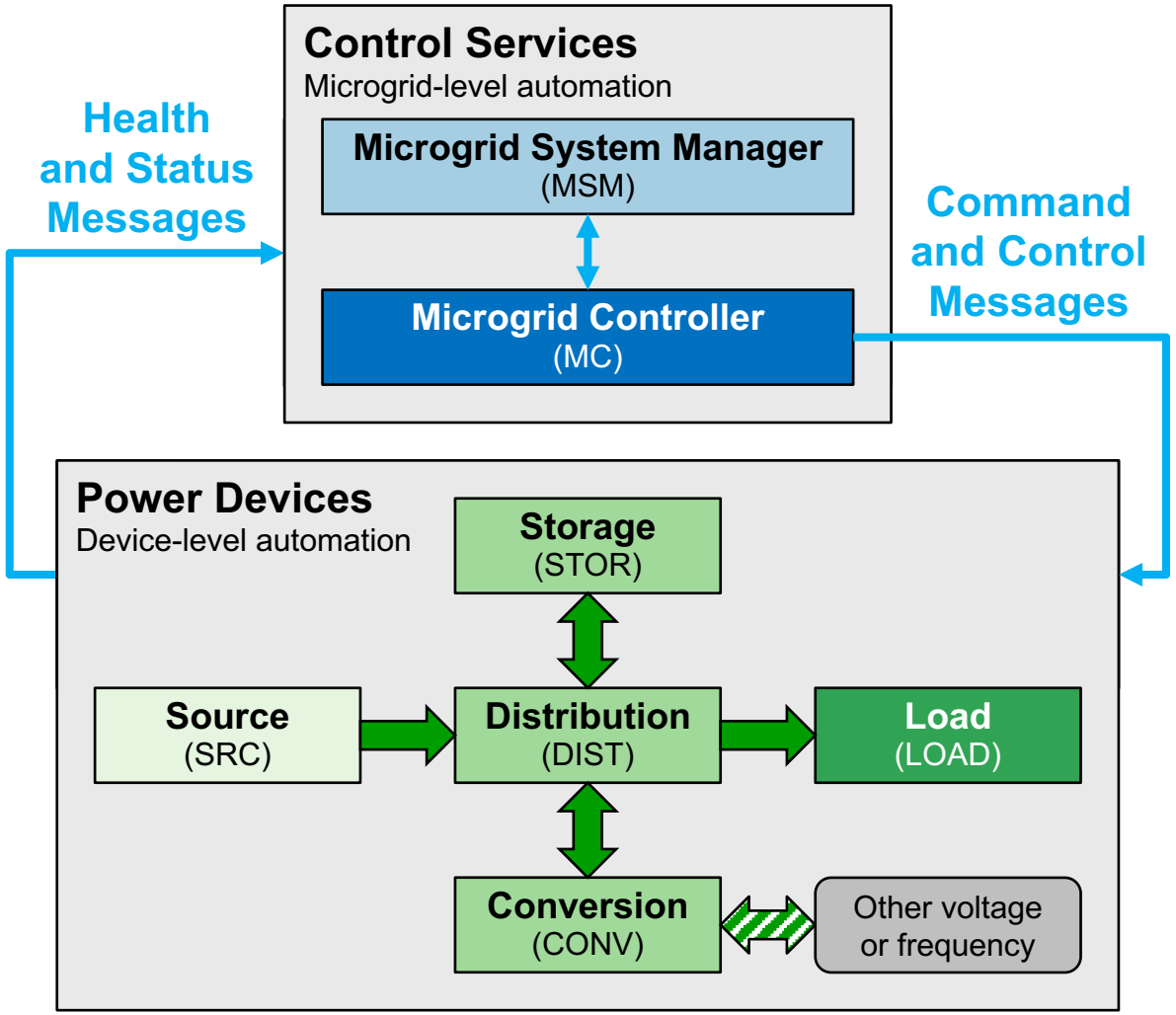
Spot Generation	Consolidated Generation	Central Microgrid	Distributed Microgrid
			
• Simple setup	• Complex setup	• Simple setup	❑ Very complex setup
• Inefficient	• Efficient	• Efficient	• Efficient
• Fragile generation	• Fragile generation	• Backup generation	❑ Spread out generation
• Minimal distribution	• Fragile distribution	• Fragile distribution	• Resilient distribution
• Extensible, modular	• Extensible, modular	❑ Proprietary vendor lock	❑ Proprietary vendor lock
Typical DoD Approach	**Limited Use**	**Initial Deployment**	**Prototyping Today**

Tactical Microgrid Architecture Options
With TMS

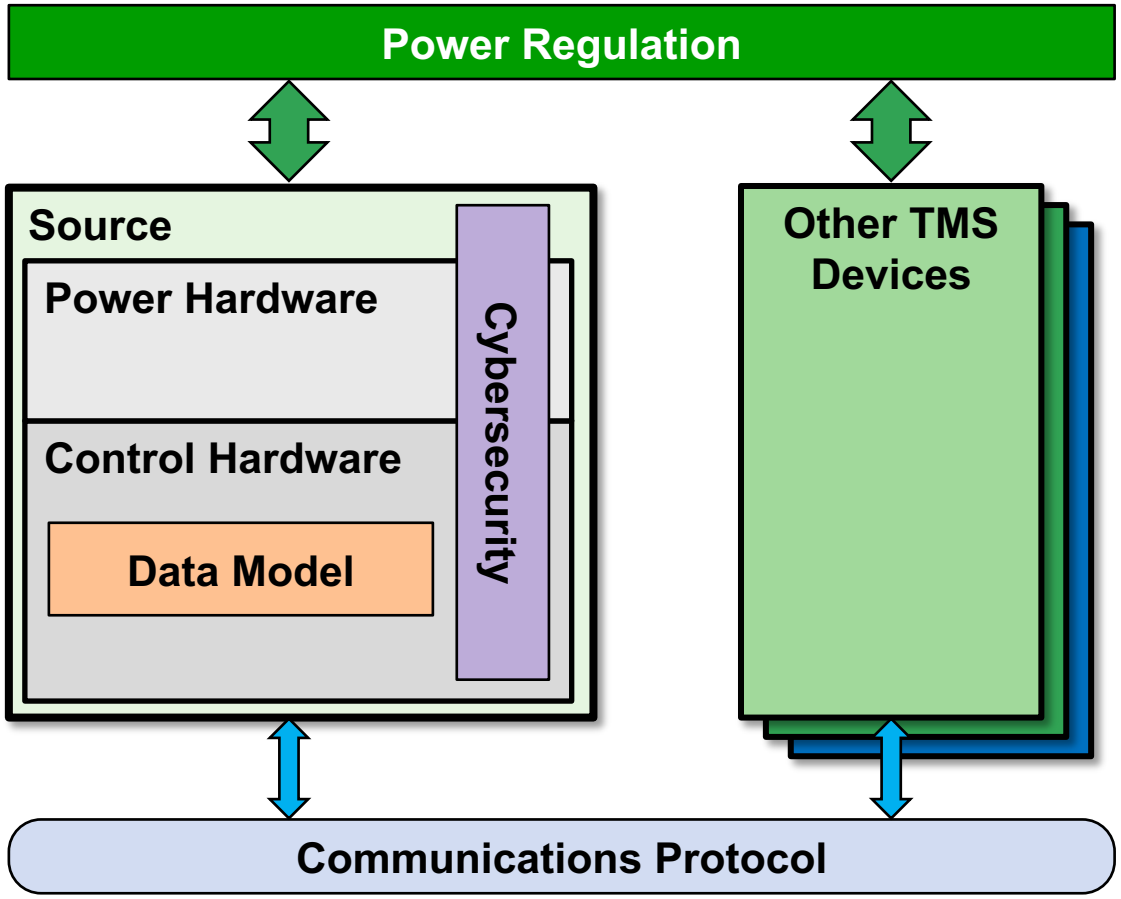
Spot Generation	Consolidated Generation	Central Microgrid	Distributed Microgrid
			
• Simple setup	• Complex setup	• Simple setup	✓ Simple Setup
• Inefficient	• Efficient	• Efficient	• Efficient
• Fragile generation	• Fragile generation	• Backup generation	✓ Resilient generation
• Minimal distribution	• Fragile distribution	• Fragile distribution	• Resilient distribution
• Extensible, modular	• Extensible, modular	✓ Open Architecture	✓ Open Architecture
Typical DoD Approach	**Limited Use**	**Initial Deployment**	**Prototyping Today**

Tactical Microgrid Standard (TMS) Open Architecture Defines

Components



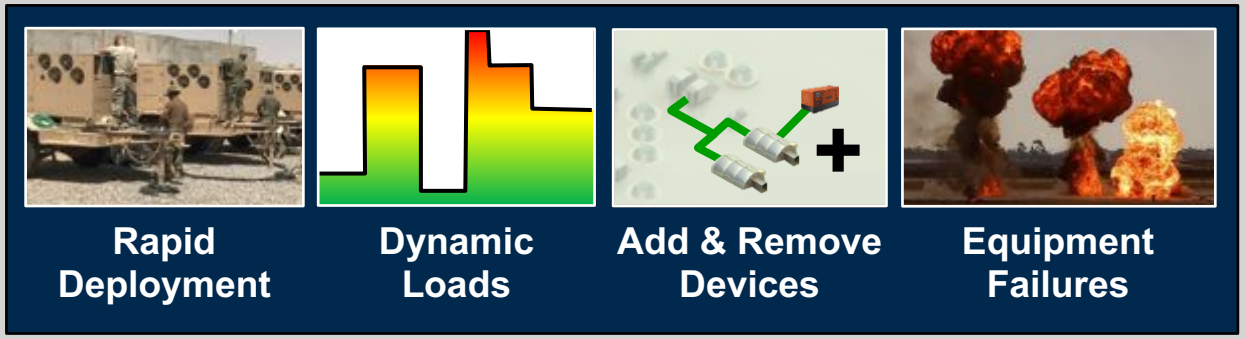
Interfaces



Tactical Microgrid Standard (TMS) in Operation

DoD & Commercial Equipment … Upgraded with TMS

Input Test Disturbances



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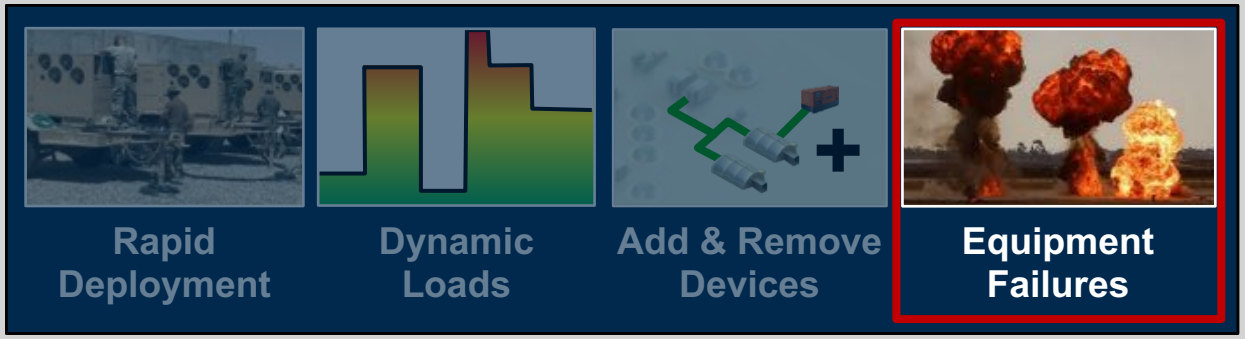
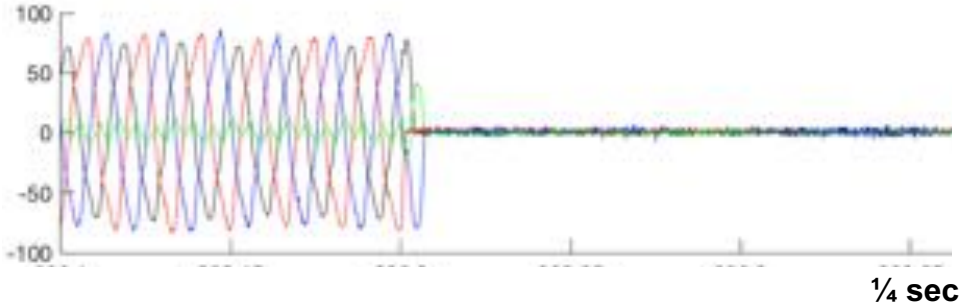


Generator Current



(3-phase, 120/208 V, 60 Hz AC)

Tactical Microgrid Standard (TMS) in Operation

DoD & Commercial Equipment … Upgraded with TMS

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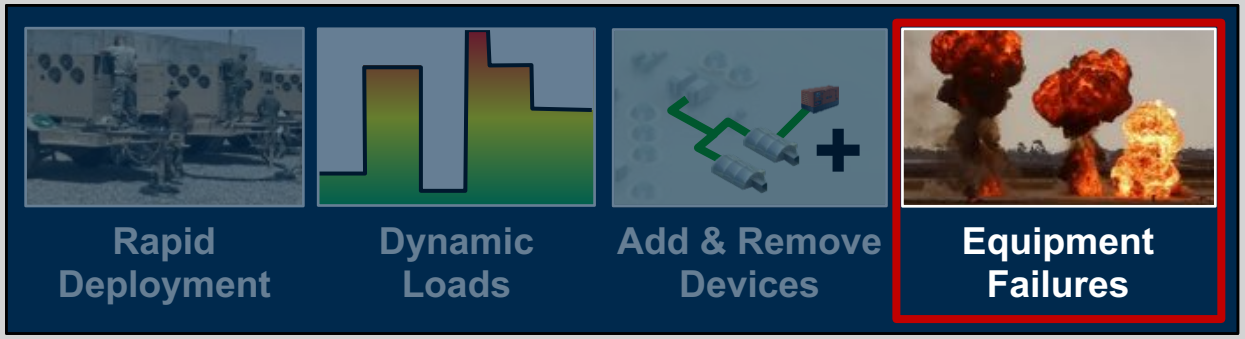
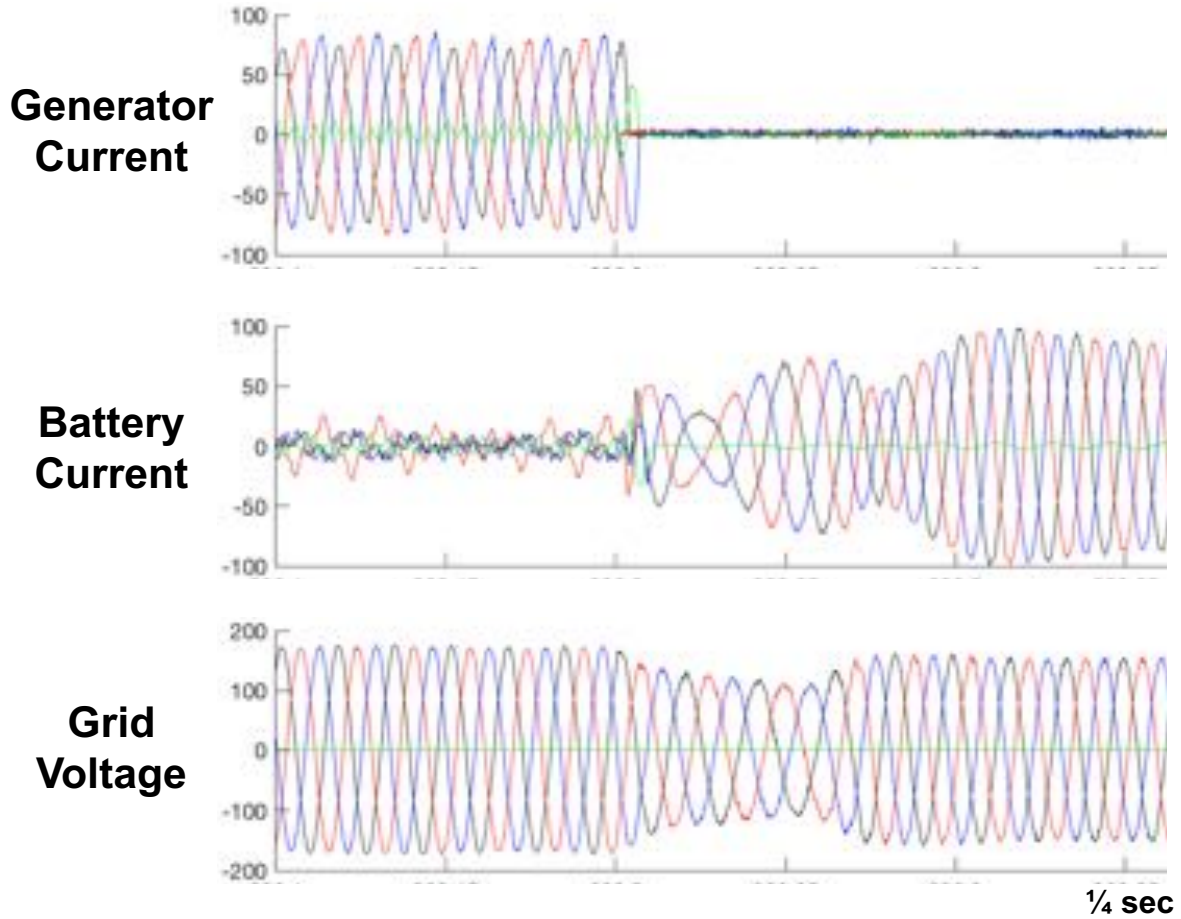


Example: Resilient Power Sharing

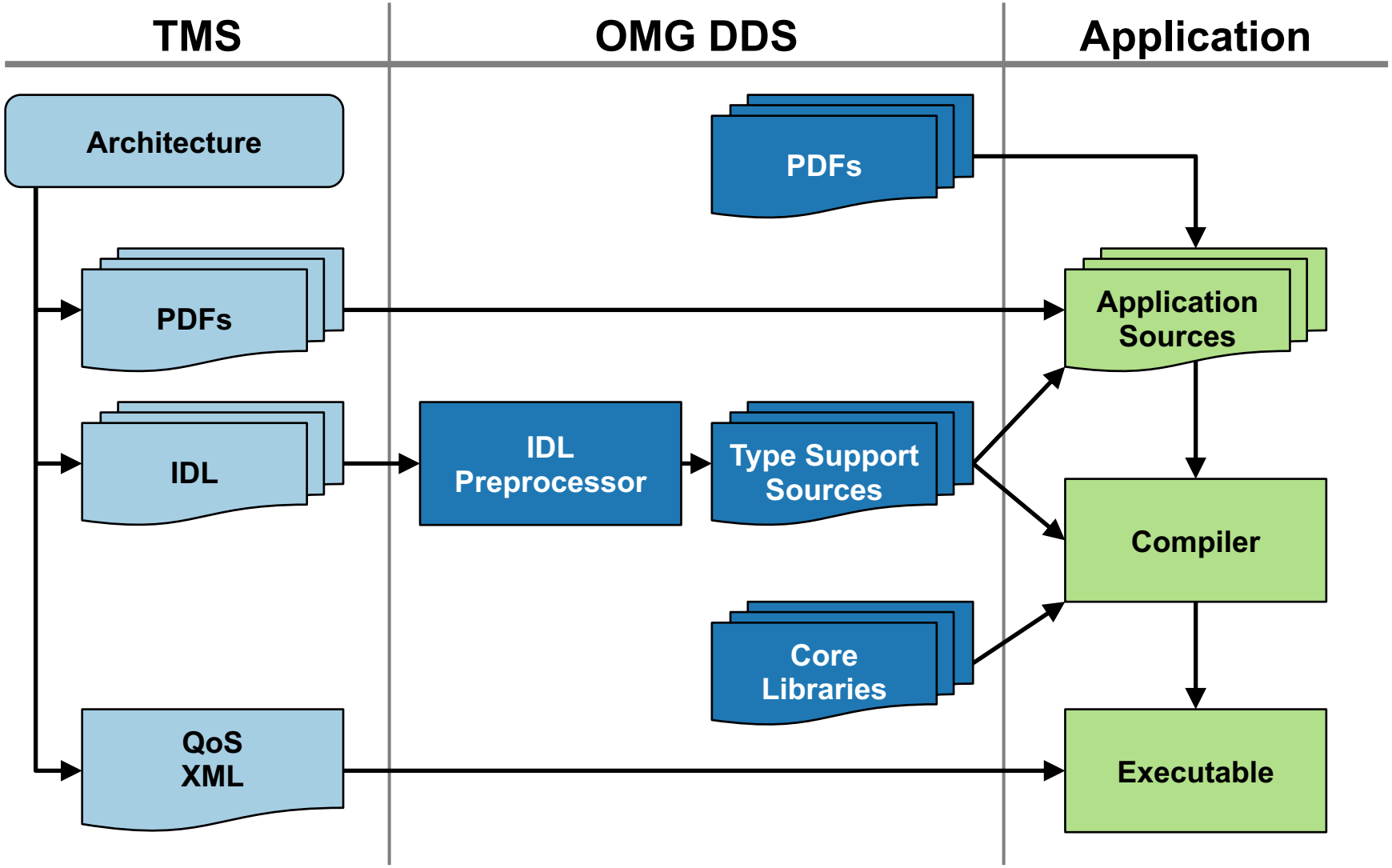


(3-phase, 120/208 V, 60 Hz AC)

Why Data Distribution Service? (OMG DDS)

- OMG DDS is a communications middleware ➔ modular software re-use.
- Strong Technology
  - Fully distributed publish/subscribe (pub/sub)
  - Machine-readable Interface Definition Language (IDL)
  - Rich Quality of Service (QoS)
  - Portable API
  - Interoperable wire protocol
  - Security architecture
- Healthy Ecosystem
  - Open standard
  - Stable governance
  - Multiple independent commercial implementations
  - Continuous innovation
  - Used across multiple industries

TMS Software Integration



OMG DDS Adoption Experience

Challenges

- Planning requirements
  - Hardware: CPU, memory, and network
  - Software: language, OS, …
- Getting started
  - Choosing an implementation
  - Finding beginner documents
- Navigating all the options
  - Terminology, DCPS object model
  - Samples, keys, filters, buffers
  - Event handling
  - Topics, IDL, and QoS
- Debug and testing tools
- Optional parts of the standard

Takeaways

- Beginners surprised by
  - Imposing size
  - Steep learning curve
  - Cost to start (time, effort, and money)
- TMS provides domain-specific
  - Documentation, FAQ
  - Topics, IDL, and QoS
  - Tools
- Beginner response after code works
  - Powerful capability
  - Easy to extend and maintain
  - Long path to mastery
  - Plan to use DDS even more

Questions?

For more information,

- DDS Foundation
  - https://www.dds-foundation.org/join-dds-foundation/
  - https://www.dds-foundation.org/join-dds-foundation/#faq
  - email ddsfoundation@omg.org
- TMS
  - email dherring@ll.mit.edu