The Energy Systems Integration Facility (ESIF) at NREL

A Smart Power Platform for Product Interoperability Development, Test, and Evaluation

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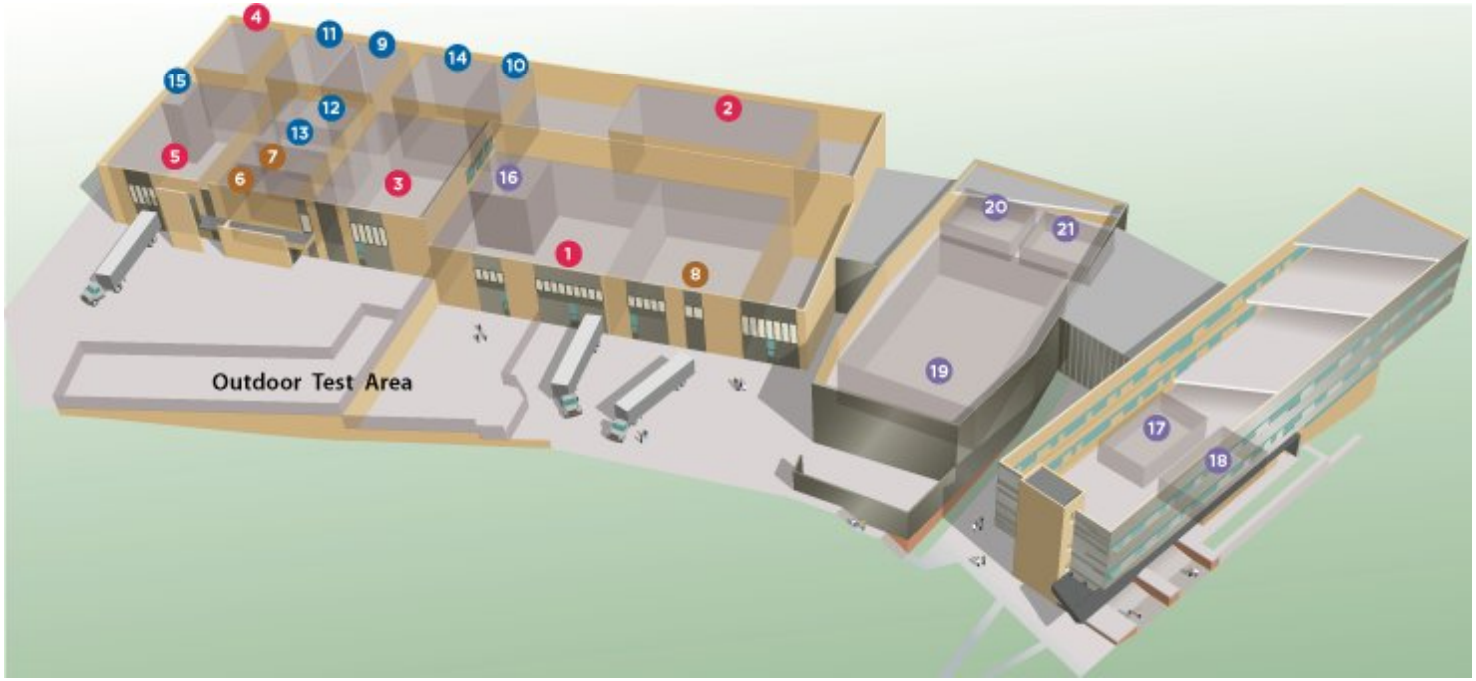
Grid-Interop 2012

Energy Systems Integration Facility

- Purpose of the Energy Systems Integration Facility (ESIF)
  - Research and test integrated energy systems, devices, and concepts for electric supply and demand systems
  - Interconnection of distributed energy systems and the integration of renewable energy into the electricity grid



Energy Systems Integration Facility

- The Smart Power Laboratory at ESIF
  - Part of the new NREL campus in Golden, Colorado
  - 5,300 sq. ft. laboratory under construction

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Energy Systems Integration Facility

- The Smart Power Laboratory at ESIF
  - Enable the development, testing, and evaluation of premises-based energy systems and equipment.
  - Facilitate the commoditization of energy-related appliances as commercial/consumer products and their integration with the local electricity supply grid
  - Smart power applications
    - advanced inverters and power converters/conditioners
    - residential and commercial scale appliances
    - home automation systems, HVAC, lighting controls, energy management systems, meters, and other control technologies.

Energy Systems Integration Facility

- The Smart Power Platform
  - A standards-based and open source hardware/software platform
  - For the testing and evaluation of multiple vendor's products within a common framework or system for the home or small building environment.
  - Platform based on new international standards:
    - ISO/IEC 15045-2 Gateway
    - ISO/IEC 18012-2 Guidelines for product interoperability
    - ISO/IEC 15067-3 Model for energy management
  - Open Source metadata libraries and registries
    - client network protocol stacks and interface code
    - basic application objects and object types
    - for developers wishing to code modular test or service apps using the platform and its resources.

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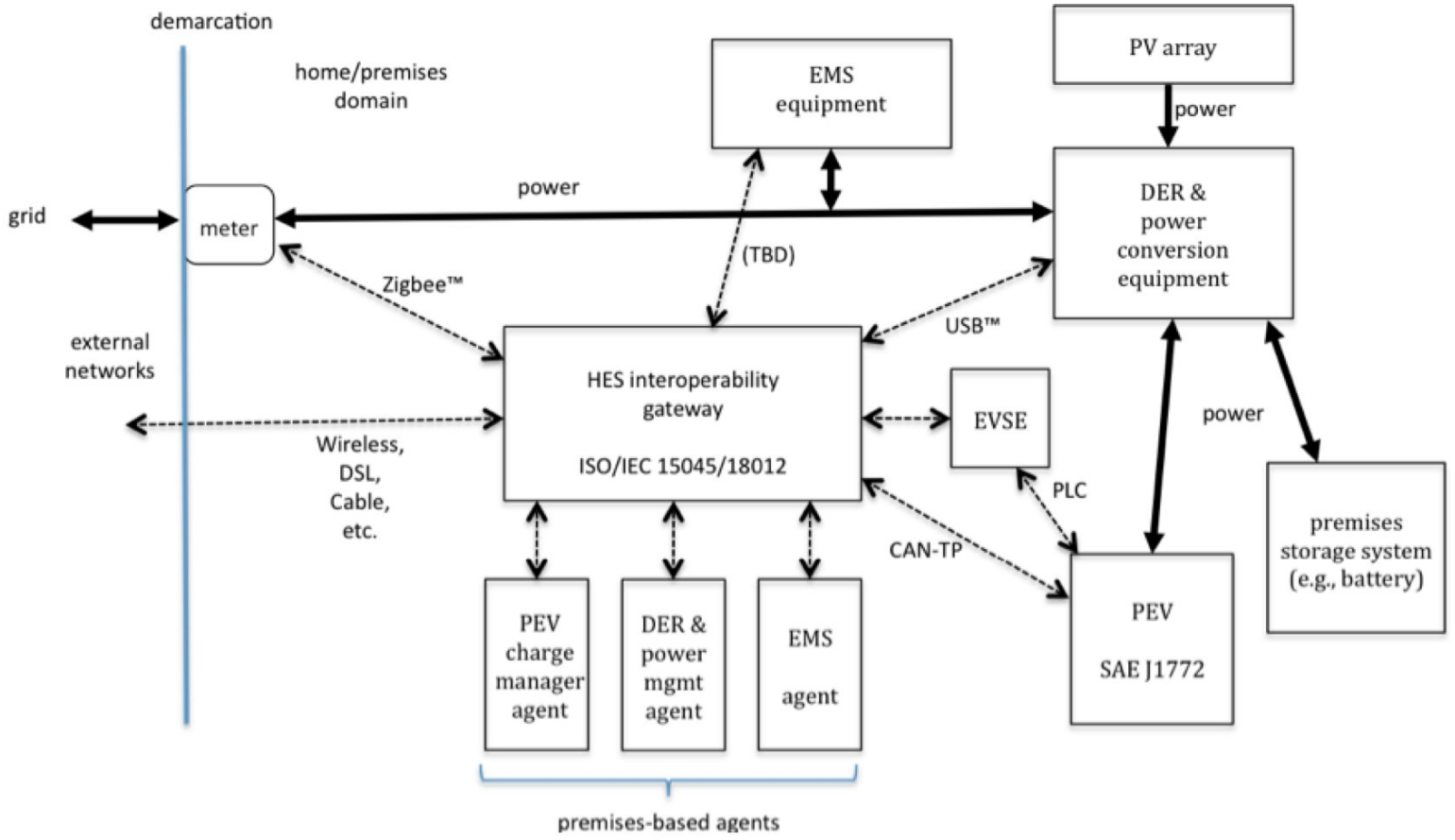
- Energy management model



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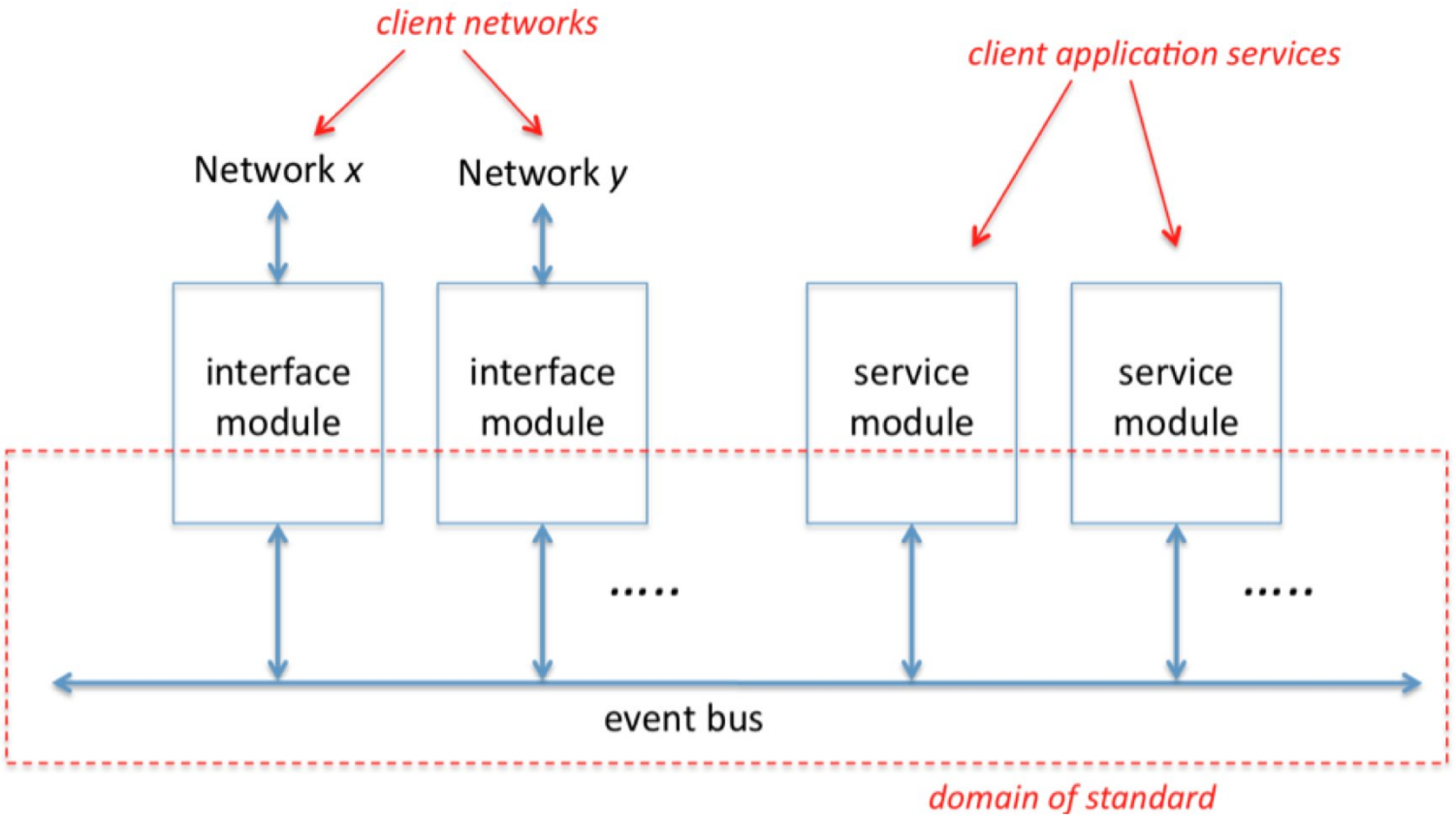
- Gateway platform architecture



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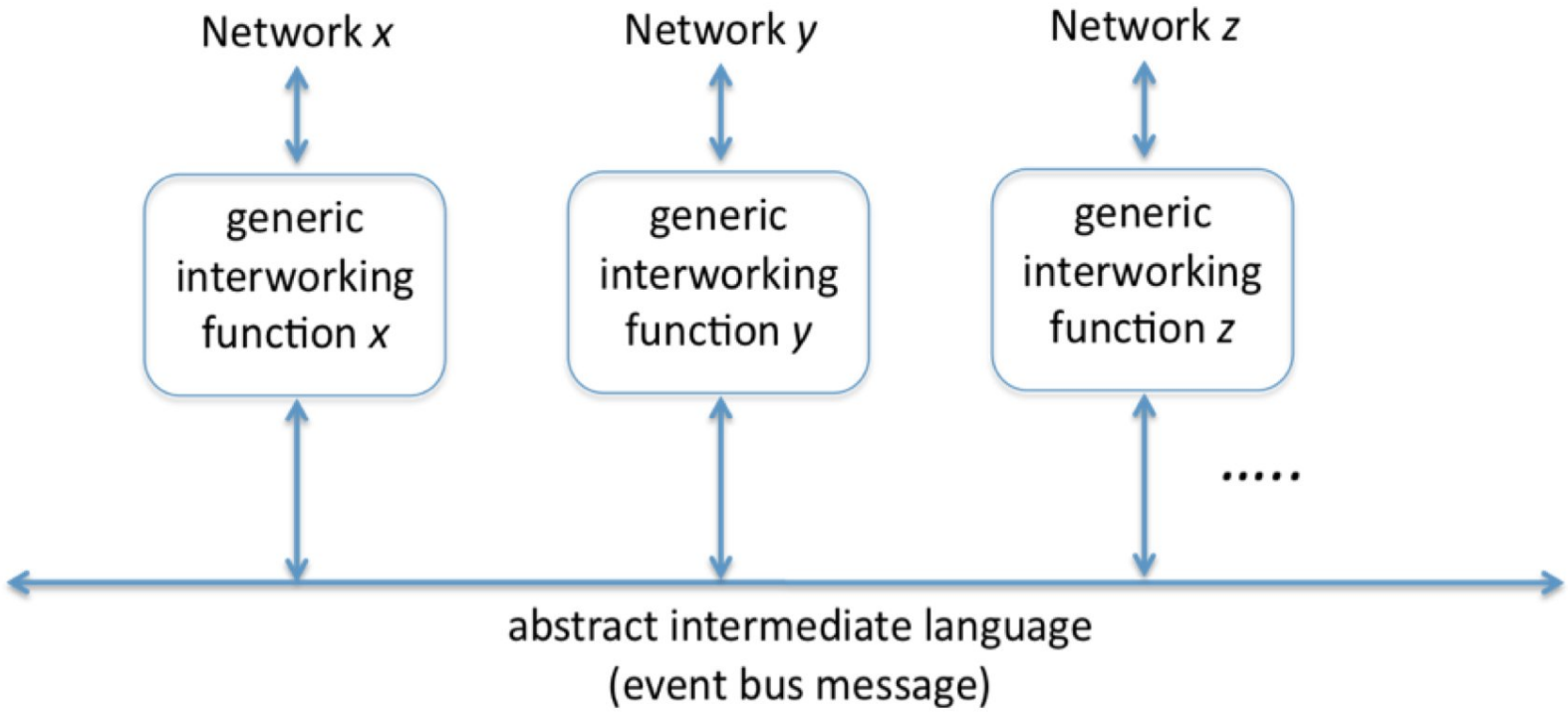
- Interoperability architecture
  - Translation process is performed by a network-specific generic interworking function in each interface module



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- Typical client network interface module examples

Commercial & Industrial LAN/WAN	Home & building/LAN/HAN
BACnet	ZigBee™
LonWorks	SEP 1, SEP 2
Modbus	WiFi™
Ethernet	WiBEEM
CAN bus	HomePlug™
KNX™	KNX™
WSP	Z-Wave™
DSL (many varieties)	Echonet
LR/WPANs	Ethernet
DOCSIS™	UPnP™
GPRS	IGRS™

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- The Smart Power Lab Operations
- Vendor interoperability development and testing process
  - Initial development and ongoing maintenance of the metadata libraries and registries
    - for client networks and
    - for application services.
  - Testing and evaluation of multiple vendor's products
  - Lab will host these libraries and provide maintenance and support
- With experience Lab will implement programs for validation and product certification.

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- Goal of the ESIF and Smart Power Lab
  - to enable and foster the growth of an ecosystem of interoperable “plug and play” in-home devices and software applications to support distributed renewable energy use, generation, and storage within homes and small buildings
- Typical devices/applications include
  - Solar PV systems, micro-turbines
  - Smart inverters, power conditioners/converters
  - Smart batteries
  - Smart appliances, HVAC, etc.
  - Energy management systems
  - Smart thermostats
  - Metering devices
  - Electric vehicles and charging systems

Energy Systems Integration Facility

- Goal of the ESIF and Smart Power Lab
  - To play a significant role in advancing the practical understanding of how to take maximum advantage of distributed energy resources on a highly localized basis
- contribute to enabling a new electricity economy
  - Enable commoditization of smart grid related products
  - Improve grid security and energy security in general
  - Integrate renewables with electric vehicles and transportation

Thank you!

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