The Smart Grid

NIST Role in the Smart Grid

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Drivers for the Smart Grid

Achieving Changes in…

- Generation
  - Renewables
  - Variability
  - Storage
  - Distributed resources
- Load
  - Reduce peaking
  - Energy management
  - Plug in vehicles
- Reliability and Security
  - Improved measurement and control
  - Risk-based approach

- Require
  - Automated management, operation, control
  - 2-way flow of power and information
  - Interoperability at many levels
  - Standards

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Key Industry Players in Smart Grid

Utilities

- American Electric Power
- CenterPoint Energy
- Consolidated Edison
- Constellation
- Duke Energy
- Exelon
- Florida Power & Light
- MidAmerican Energy
- National Grid USA
- Pacific Gas and Electric
- PEPCO
- Sempra Energy
- Southern California Edison
- Southern Companies
- Xcel Energy
- Bonneville Power Admin.*
- Tennessee Valley Authority*

Electric Industry Suppliers

- ABB
- Beacon Power Systems
- Eaton
- Elster
- Emerson
- GE
- Gridpoint
- Landis+Gyr
- Itron
- S&C
- Schneider Electric
- Siemens
- SmartSync
- Southwire
- Thomas & Betts
- TIAX

Industry Associations

- American Public Power Association
- Association of Edison Illuminating Companies
- Edison Electric Institute
- Electric Power Research Institute
- National Electric Manufacturers Association
- National Rural Electric Cooperative Association

* Federal entities

Independent System Operators and Regional Transmission Organizations

- California ISO
- Electric Reliability Council of Texas
- Florida Reliability Coordinating Council
- ISO New England
- Midwest Independent Transmission System Operator
- New York ISO
- PJM Interconnection
- Southwest Power Pool

IT and Telecom

- Accenture
- Boeing
- Cisco
- Google
- IBM
- Intel
- Microsoft
- Silver Spring
- AT&T
- Verizon

Standards Organizations

- American National Standards Institute
- American Society of Heating, Refrigerating and Air-Conditioning Engineers
- International Electrotechnical Commission
- IEEE
- International Society of Automation
- National Electrical Manufacturers Association
- National Fire Protection Association
- North American Electric Reliability Corp.
- North American Energy Standards Board
- Organization for Advancement of Structured Information Systems
- Society of Automotive Engieers
- Underwriters Laboratories

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The NIST Role

Energy Independence and Security Act (EISA) of 2007
Title XIII, Section 1305.
Smart Grid Interoperability Framework

In cooperation with the DoE, NEMA, IEEE, GWAC, and other stakeholders, **NIST** has “primary responsibility to **coordinate development of a framework** that includes protocols and model standards for information management **to achieve interoperability of smart grid devices and systems**…”

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Why NIST?

- Smart Grid standards require integration of many NIST skills:
- Electric utility industry measurement research
- Advanced network technology
- Industrial controls and interfaces
- Buildings and electrical infrastructure
- Computer and network security
- Documentary standards expertise
- Testing and certification experience
- Reputation as a neutral “honest broker”, facilitator, and convener

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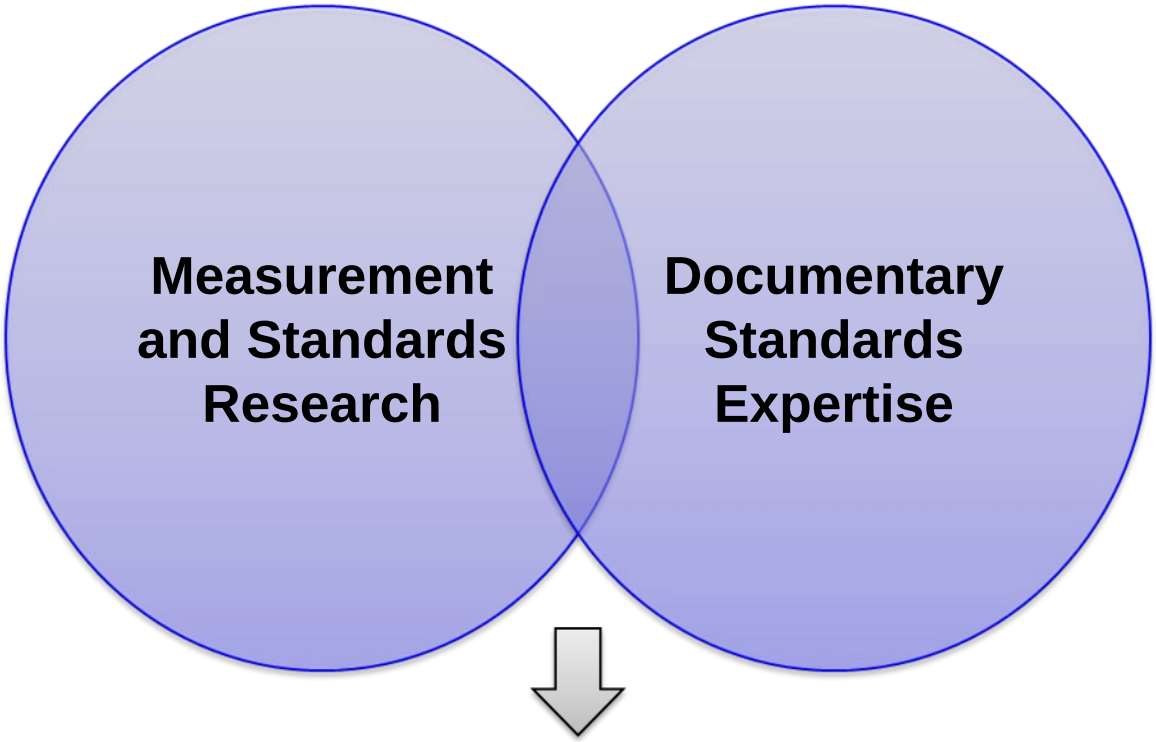
NIST Has Dual Roles



Strong leadership in coordinating documentary standards development

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The Need for Standards is Urgent

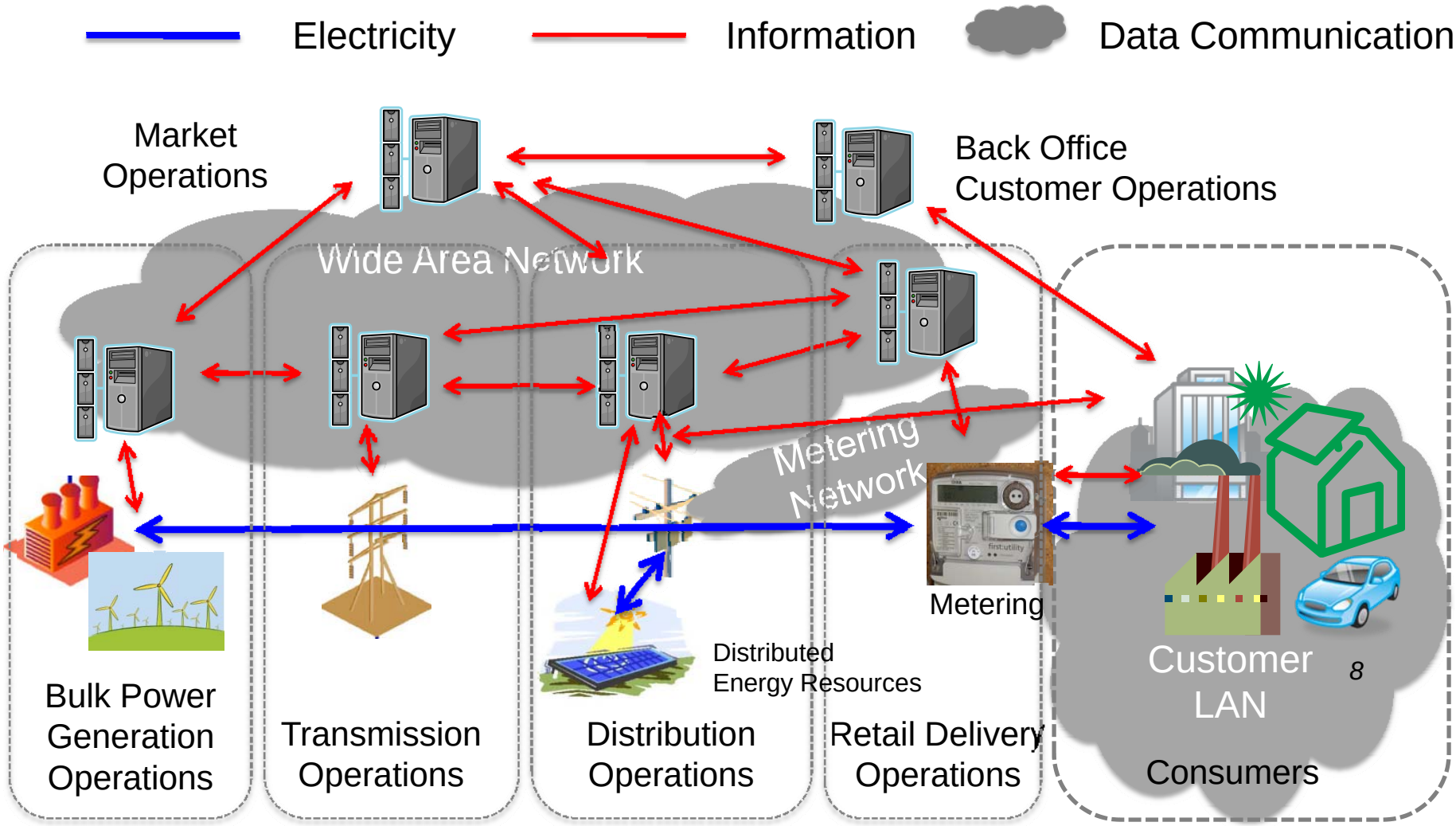
Example: Smart Meters

- $40 - $50 billion dollar deployment nationwide
- Underway now
- ARRA will acclerate
- Rapid technology evolution
- Absence of firm standards

Source: Congressional Research Service Report

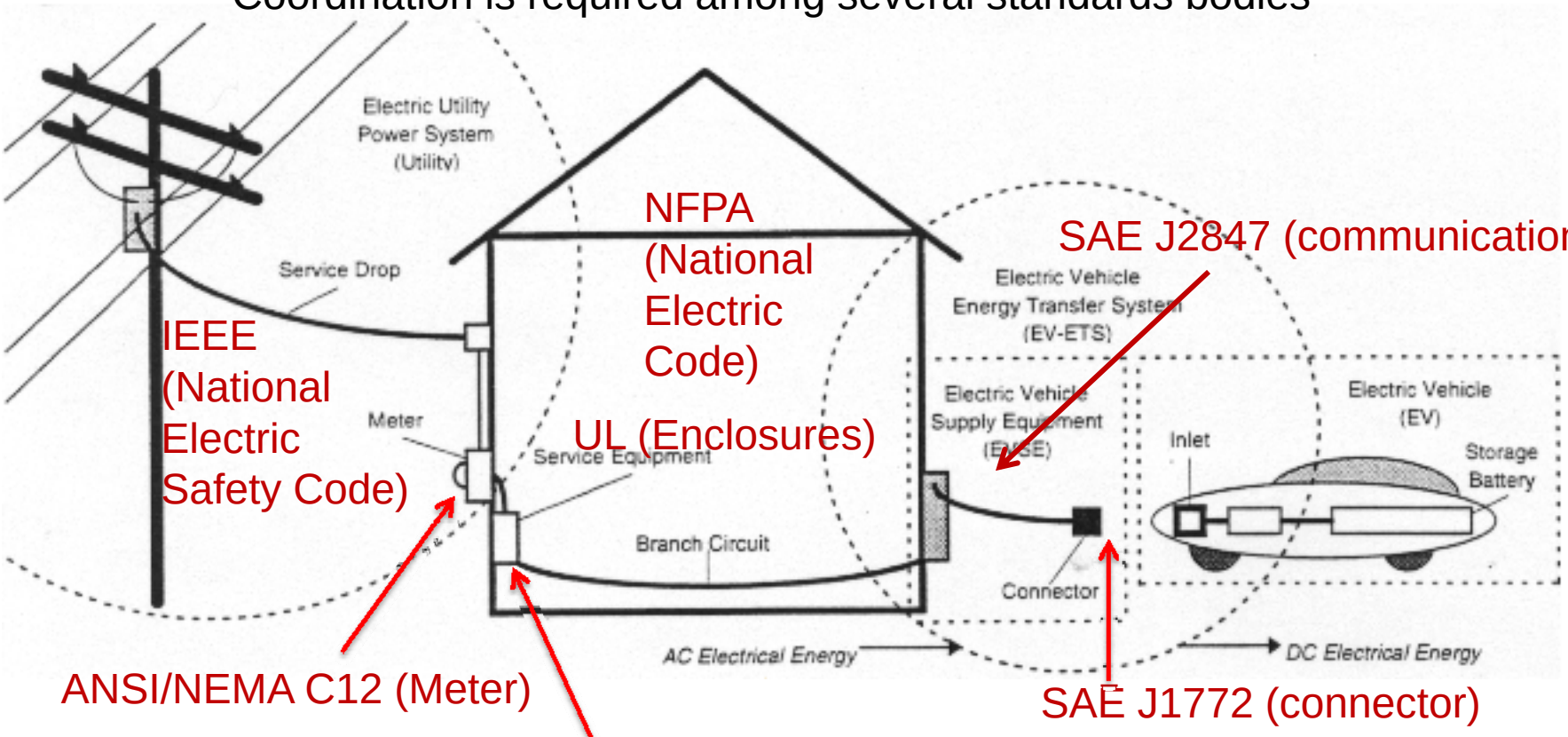
What Interoperability Standards are Needed?

Standards are needed for each of the interfaces shown to support many different smart grid applications. Standards are also needed for data networking and cybersecurity



Example: Plug-in Hybrid Electric Vehicle – Grid Interface

Coordination is required among several standards bodies



Additional standards will be needed for: communications/Information protocols for charge management, power injection management, operations and maintenance, metering, roaming.

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We Need A Standards Roadmap

- Capabilities
- Priorities
- Reference Model
- Standards
- Release Plan
- Responsibilities
- Governance
- Testing and Certification

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Comparison of Smart Grid with Next Generation Telecom Network

	Telecom Next Generation Network	Smart Grid
Real-world examples	Verizon FiOS, AT&T Uverse	Xcel Boulder, Colorado
First trials	2004	2008
Standards coordination started	2003	2008
# key standards bodies	3	12
Release 1 standards issued	2005	2009
Release 2 issued	2008	Will be issued on rolling basis
# standards documents	~600 so far	Will be hundreds
Nature of standards	Mostly mix & match of existing standards	Mix & match of existing standards and many new

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NIST Three Phase Plan

PHASE 1
Identify an initial set of existing consensus standards and develop a roadmap to fill gaps

PHASE 2
Establish public/private Standards Panel to provide ongoing recommendations for new/revised standards for inclusion in NIST framework

PHASE 3
Testing and Certification Framework

2009 — 2010

March — September

Initial Standards Identified for Inclusion in NIST Interoperability Framework Release 1.0

Standard	Application
AMI-SEC System Security Requirements	Advanced metering infrastructure (AMI) and Smart Grid end-to-end security
ANSI C12.19/MC1219	Revenue metering information model
BACnet ANSI ASHRAE 135-2008/ISO 16484-5	Building automation
DNP3	Substation and feeder device automation
IEC 60870-6 / TASE.2	Inter-control center communications
IEC 61850	Substation automation and protection
IEC 61968/61970	Application level energy management system interfaces
IEC 62351 Parts 1-8	Information security for power system control operations
IEEE C37.118	Phasor measurement unit (PMU) communications
IEEE 1547	Physical and electrical interconnections between utility and distributed generation (DG)
IEEE 1686-2007	Security for intelligent electronic devices (IEDs)
NERC CIP 002-009	Cyber security standards for the bulk power system
NIST Special Publication (SP) 800-53, NIST SP 800-82	Cyber security standards and guidelines for federal information systems, including those for the bulk power system
Open Automated Demand Response (Open ADR)	Price responsive and direct load control
OpenHAN	Home Area Network device communication, measurement, and control
ZigBee/HomePlug Smart Energy Profile	Home Area Network (HAN) Device Communications and Information Model

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Roadmap Focus Areas

- FERC-identified priority applications:
  - Demand Response
  - Wide-Area Situational Awareness
  - Electric Storage
  - Electric Transportation
- Additional priority applications:
  - Advanced Metering Infrastructure
  - Distribution Grid, including Distributed Energy Resource Integration
- Cross-cutting priorities
  - Cybersecurity
  - Data networking

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Phase 2: Standards Panel

- Launch Smart Grid Interoperability Standards Panel by Year End 2009
- Representation from all stakeholder groups
- Administered by private sector organization
- RFP in May 2009
- Functions:
  - Evolve Roadmap
  - Ongoing coordination
  - Recommend new or revised standards for NIST framework
  - Monitor implementation

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A Once In A Lifetime Opportunity!