NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 2.0

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Electric Grid Modernization (Smart Grid) – Current Standards Development & Cyber Security Work
October 17, 2011
Topics for Today

• Energy Independence and Security Act (EISA) Mandate
• SGIP
• Draft NIST Framework and Roadmap, Release 2.0
Smart Grid – A U.S. National Priority

“"It is the policy of the United States to support the modernization of the Nation's electricity [system]... to achieve...a Smart Grid.” Congress, Energy Independence and Security Act of 2007

“We’ll fund a better, smarter electricity grid and train workers to build it...” President Barack Obama

“To meet the energy challenge and create a 21st century energy economy, we need a 21st century electric grid...” Secretary of Energy Steven Chu

“A smart electricity grid will revolutionize the way we use energy, but we need standards ...” Former Secretary of Commerce Gary Locke, now U.S. Ambassador to China
The Smart Grid integrates information technology and advanced communications into the power system in order to:

- Increase system efficiency and cost effectiveness
- Provide customers tools to manage energy use
- Improve reliability, resiliency and power quality
- Enable use of innovative technologies including renewables, storage and electric vehicles
NIST Roles in the Smart Grid

Measurement research
- Power and Energy Measurements (Meters)
- Wide area monitoring (synchrophasors)
- Power conditioning (power electronics)
- Building energy management (EMS)
- Electricity storage (ultracapacitors)

Standards (EISA role)
- Interoperability
- Cybersecurity
Smart Grid – A U.S. National Policy

• The 2007 Energy Independence and Security Act (EISA) lays out a national policy for the Smart Grid in the U.S.
  – The Act assigned NIST the primary responsibility to coordinate development of standards for the Smart Grid

• The White House National Science and Technology Council has established a Smart Grid Subcommittee
  – The Subcommittee produced a report that lays out the Administration’s policy on Smart Grid

• Key Federal policy recommendations:
  – Enable cost-effective smart grid investments
  – Unlock innovation
  – Empower and inform consumers
  – Secure the grid
National Institute of Standards and Technology Role: Coordination of Interoperability Standards in U.S.

*U.S. Energy Independence and Security Act (EISA) of 2007 Title XIII, Section 1305.*

In cooperation with [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…”
National Institute of Standards and Technology Role: Coordination of Interoperability Standards in U.S.


In cooperation with [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…”

… after [NIST]’s work has led to sufficient consensus in [FERC]’s judgment, the Commission shall institute a rulemaking proceeding to adopt such standards and protocols as may be necessary to insure smart-grid functionality and interoperability …
NIST Three Phase Plan for Smart Grid Interoperability

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

- Summer 2009 Workshops
- Draft Framework Sept 2009
- Smart Grid Interoperability Panel Established Nov 2009
- NIST Interoperability Framework 1.0 Released Jan 2010

PHASE 2
Establish Smart Grid Interoperability Panel (SGIP) public-private forum with governance for ongoing efforts

- SGIP meetings
- Technical information to support regulators
- Draft NIST Interoperability Framework 2.0

PHASE 3
Conformity Framework (includes Testing and Certification)

- NIST Interoperability Framework 1.0
- NIST Interoperability Framework 2.0

Smart Grid Interoperability Panel (SGIP)

*SGIP GB and SGIP Charter*

“The Smart Grid Interoperability Panel (SGIP) is a membership-based organization ... to provide an open process for stakeholders to participate in providing input and cooperating with NIST in the ongoing coordination, acceleration and harmonization of Standards Development for the Smart Grid. “
Smart Grid Interoperability Panel

Public-private partnership created in Nov. 2009
Over 700 member organizations, 1700 participants
Open, public process with international participation
Coordinates standards development
- Identifies Requirements
- Prioritizes standards development programs
- Works with over 20 SDOs including IEC, ISO, ITU, IEEE, ...

Web-based participation

SGIP Twiki:
http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/SGIP
### SGIP Stakeholder Categories

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<th>1</th>
<th>Appliance and consumer electronics providers</th>
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<td>Commercial and industrial equipment manufacturers and automation vendors</td>
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<td>Consumers – Residential, commercial, and industrial</td>
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<td>7</td>
<td>Electric utility companies - Rural Electric Association (REA)</td>
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<td>8</td>
<td>Electricity and financial market traders (includes aggregators)</td>
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<td>Independent power producers</td>
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<td>10</td>
<td>Information and communication technologies (ICT) Infrastructure and Service Providers</td>
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<td>Information technology (IT) application developers and integrators</td>
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<td>Power equipment manufacturers and vendors</td>
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<td>Professional societies, users groups, and industry consortia</td>
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<td>Retail Service Providers</td>
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<td>Standard and specification development organizations (SDOs)</td>
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<td>20</td>
<td>Testing and Certification Vendors</td>
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<td>Venture Capital</td>
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NIST Smart Grid Federal Advisory Committee

Dan Sheflin, Chair
Chief Technology Officer
Honeywell Automation and Control Systems

David Owens, Vice-Chair
Executive Vice President Business Operations
Edison Electric Institute

Jon Arnold
Managing Director, Worldwide Power & Utilities Industry
Microsoft Corporation

William O. Ball
Executive Vice President and Chief Transmission Officer
Southern Company

Lynne Ellyn
Senior Vice President and Chief Information Officer
DTE Energy

Evan R. Gaddis
President and Chief Executive Officer
National Electrical Manufacturers Association (NEMA)

Lawrence E. Jones
Director, Strategy and Special Projects Worldwide
ALSTOM Grid

Sueeen G. Kelly
Partner
Patton Boggs, LLP

Susan M. Miller
President and Chief Executive Officer
Alliance for Telecommunications Industry Solutions (ATIS)

Terry Mohn
Founder and Chief Strategy Officer
General MicroGrids, Inc.

Kevin F. Nolan
Vice President of Technology
GE Appliances

Simon Pontin
Vice President for Development
Itron

William H. Sanders
Director, Information Trust Institute and
Donald Biggar Willett Professor of Engineering
University of Illinois at Urbana-Champaign

Thomas J. Tobin
Vice President - R&D
S&C Electric Company

David Vieau
Chief Executive Officer and President
A123 Systems
NIST Framework and Roadmap, Release 1.0

Revised version Jan 19, 2010
Smart Grid Vision / Model
75 key standards identified
- IEC, IEEE, …
16 Priority Action Plans to fill gaps (one completed)
Cyber security strategy
- Companion document NISTIR 7628
Next steps – keep standards acceleration going strong!
Public comments reviewed and addressed

http://www.nist.gov/smartgrid/NIST Special Publication 1108
NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0

Conceptual Reference Model

NIST Smart Grid Framework 1.0 January 2010
# Filling Gaps in the Standards

## Priority Action Plans (led by NIST staff)

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8. Next Steps
9. List of Acronyms
   Appendix – Specific Domain Diagrams

http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/IKBFramework
Use of the Framework Document

- **Utilities and suppliers**
  - Conceptual Architectural Framework (Chapter 3), compendium of reference standards (Chapter 4), Smart Grid privacy and security (Chapter 6); a taxonomy of the various Smart Grid domains (Appendix)
- **Testing laboratories and certification organizations**
  - New T&C (Chapter 7)
- **Academia**
  - Next Steps (Chapter 8) and summaries of various Priority Action Plan (PAP) subgroups’ efforts in Chapter 5
- **Regulators**
  - a general introduction to the SG (Executive Summary and Chapter 1), a guide to workable standards (Chapter 4), Smart Grid privacy and security matters (Chapter 6)
NIST Framework, Release 2.0, Chapter 1. Purpose & Scope, Chapter 2. Smart Grid Visions

Smart Grid - a national policy goal

- EISA
  - NIST 3-phase plan; NIST Framework, R1.0; SGIP

  - greater focus on standards achieve innovation.

International Cooperation

- International Smart Grid Action Network (ISGAN)
- ARCAM
  - Provide recommendations for actions APEC members to prevent trade barriers related to Smart Grid interoperability standards.
NIST Framework, Release 2.0, Chapter 3. Conceptual Architecture Framework

*Used for two important purposes:*  
- to provide stakeholders a common understanding of the elements that make up the Smart Grid and their relationships  
- to guide the various architectures, systems, subsystems, and supporting standards that make up the Smart Grid

*The architectural framework includes:*  
- *Architectural Goals for the Smart Grid* – options, interoperability, maintainability, upgradeability, innovation, etc.  
- *Conceptual Reference Model*  
- *Models for Smart Grid Information Networks*  
  - Information Networks  
  - IP-Based Networks  
  - Standards Technologies for Smart Grid Communication Infrastructure  
- *Smart Grid Interface to the Customer Domain*  
- *Use Cases*
FERC Order

  - Is there consensus on SG interoperability standards (five families of IEC standards from NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0)?
  - IEC 61850, 61968, 61970, 60870-6, 62351
  - public comment period

FERC Order, July 20, 2011

- will not institute a rulemaking on standards:
  - lack of consensus, cyber security concerns, risk of unanticipated consequences of premature implementation
- supports the NIST interoperability framework process, including the work done by SGIP, for development of smart grid interoperability standards.
- cites the NIST Framework as comprehensive and representing the best vehicle for developing standards for the smart grid.
- encourages SG stakeholders to actively participate in and look to the NIST-coordinated process for guidance on smart grid standards.
Update on work being done by the SGAC:

- Standards Review by the Smart Grid Architecture Committee
- Legacy Integration and Legacy Migration
- Common Understanding of Information
- Conceptual Business Services
NIST Framework, Release 2.0, Chapter 4. Standards Identified for Implementation

Updates to Table 4-1

- Standards moved from Table 4-2, (for further review) to Table 4-1 (identified standards).
  - emerged from the PAPs, recommended by the SGIP GB, and approved by the SGIP plenary for the SGIP CoS:
    - IETF Internet Protocol Standards for Smart Grid – RFC 6272 (PAP1)
    - NAESB WEQ19, REQ18, Energy Usage Information (PAP10)
    - SAE J1772, J2836 EV Standards (PAP11)
    - NEMA Smart Meter Upgradeability Standard SG-AMI 1 (PAP0)
    - Guidelines for Assessing Wireless Standards for for SG Applications, NIST IR 7761 (PAP02)

- Guidelines from SGIP Committees
  - SGTCC Interoperability Process Reference Manual (IPRM)
  - NISTIR 7628 Guidelines for SG Cybersecurity
NIST Framework, Release 2.0, Chapter 4. Standards Identified for Implementation

Updates to Table 4-2

- Standards that did not exist in January 2010
  - OASIS Energy Interoperation (EI) (PAP9)
  - ASHRAE 201P Facility Smart Grid Information Model (PAP17)

- Standards recommended for review by SGIP WGs
  - EMI and EMC standards from EMI WG

- Future additions/changes:
  - Using the CoS as a major source of input for the NIST Framework
Guide to the SGIP

- Purpose and structure
  - SGAC, SGTCC, CSWG, DEWGs
- PAPs
  - 19 and counting
- Future changes to SGIP
  - Reliability, safety, and implementability reviews for CoS under discussion/development
NIST Framework, Release 2.0, Chapter 6. *Cybersecurity*

**CSWG**

- Structure, subgroups, major outputs and activities
  - NISTIR 7628
  - CoS Standards Reviews
  - CSWG 3-year plan

- Future activities
  - Risk management framework
NIST Framework, Release 2.0, Chapter 7. Testing and Certification

Framework for SG Interoperability T&C

• Phase III of NIST plan

• Major efforts:
  • Existing Conformity Assessment Program Landscape
    • evaluated testing and conformity assessment programs for 31 SG standards
  • SG T&C framework development guide
    • presents scope, rationale, and need for developing a comprehensive framework and action plan for SG interoperability T&C

• IPRM – for adoption by ITCAs
  • specifies the mandatory T&C and certification processes for achieving interoperability
NIST Framework, Release 2.0, Chapter 8. Next Steps

Framework and Interoperability Standards Evolution

• The framework will continue to evolve as Smart Grid deployments are rolled out, innovative technologies emerge, and new standards needs and issues are identified.

• Support the implementation of the policies set out in the NSTC report by continuing to catalyze the development and adoption of open standards.

• Take "lessons learned" from DoE SGIG deployments to further identify standards needs, and work with SGIP, SSOs, and other stakeholders to fill the gaps and improve the standards that form the foundation of the Smart Grid.

• Continue efforts in coordination of development of international standards with organizations.
Input from the SG Stakeholders IP

- Draft Release 2.0 Framework & Roadmap document now posted
  
  http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/IKBFramework

- FRN for public comment solicitation in next few weeks

- Comments received will be reviewed with SGIP

- Release 2.0 Framework posted in late Fall
Thank You!


NIST Interoperability Framework, Release 2.0:

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- Telephone: +1.301.975.8922