Report to NIST on the Smart Grid Interoperability Standards Roadmap:

Priority Action Plans – Post Workshop Versions

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0 Overview

On the basis of stakeholder input received at two public workshops as well as its reviews of research reports and other relevant literature, the National Institute of Standards and Technology (NIST) is proposing a set of priorities for developing standards necessary to build an interoperable Smart Grid. Among the criteria for inclusion on this initial list were immediacy of need, relevance to high-priority Smart Grid functionalities,[1] availability of existing standards to respond to the need, state of the deployment of affected technologies, and estimated time frame to achieve an effective solution.

To facilitate timely and effective responses to these needs, NIST has drafted a preliminary Priority Action Plan (PAP) for each need. The PAPs are intended to scope out problem areas and to begin clarifying the steps required for achieving solutions.

The President's recently issued *Cyberspace Policy Review* recognizes that "as the United States deploys new Smart Grid technology, the Federal government must ensure that security standards are developed and adopted to avoid creating unexpected opportunities for adversaries to penetrate these systems or conduct large-scale attacks." As part of efforts coordinated by the National Institute of Standards and Technology to achieve Smart Grid interoperability, NIST has established a Cyber Security Coordination Task Group. Cyber security is being addressed in a complementary and integral process that will result in a comprehensive set of cyber security requirements. These requirements will be developed using a high-level risk assessment process that is defined in the cyber security strategy for the Smart Grid. All of the documents produced from the risk assessment process, and the cyber security requirements will be included in a separate document that will be published by NIST. Therefore, cyber security is not the explicit focus of a particular priority application plan in this document. However, its importance is recognized as implicit in all.

The plans are preliminary; they are not prescriptive. However, some PAPs focus on standards developed under the auspices of specific organizations. In such instances, these organizations are identified in the plan--but not to the exclusion of other organizations, nor with the intention to dismiss alternative responses to particular standards needs. For the purpose of stimulating discussion and expediting action and depending on the maturity of the requirements addressed in the PAP, several plans also list options for responding. These do not preclude other actions.

In short, the PAPs are intended to facilitate progress, which includes more detailed definition of needs and identifying the appropriate actions and actors for accomplishing modifications or enhancements to standards as well as the harmonization required. These are key objectives of August 3-4, 2009, workshop convened by NIST, with assistance from the Electric Power Research Institute.

Establishing an initial set of standards-related priorities for building the Smart Grid infrastructure is an important first step. However, the PAPs listed in the table below are just the beginning of what will be a sustained standardization effort spanning a number of years. The list does not encompass the entire scope of standardization efforts that will be required as the nation pursues the vision of a fully interoperable Smart Grid.

[1] NIST's initial framework and roadmap for Smart Grid interoperability standards is focusing on six Smart Grid functionalities: wide-area situational awareness; demand response; electric storage; electric transportation; advanced metering infrastructure; and distribution grid management.

0.1 Priority Action Plan (PAP) Scopes May Use Similar Standards

It should be noted that the PAP scopes are not orthogonal with respect to the standards that may be applied in the Smart Grid. Advanced "field equipment" communications, for example, are involved in several PAPs that ultimately may converge on standards targeted for field equipment and real-time operations in transmission and distribution (T&D) environments. Similarly, some customer equipment integration communications may also integrate with T&D operation standards as well as standards relevant to market operation and e-commerce. Some PAPs may use standards developed for back-office systems or information- technology environments. In some cases more than one standard addresses the applications or domain suggested by the PAP. Discussions may also note where there is a need to integrate or harmonize across environments. Integration and/or "harmonization" of key standards are topics that are likely to come up in several of the PAP discussions. These action plans can help to identify current and planned work that can be directly applied to the PAP as well as that needed to address future systems. Discussions are encouraged to identify synergies with existing and ongoing standards work.

0.2 Next Steps

As noted, key aims of the August 3-4 workshop are to further distill and define problems, determine follow-up actions, and develop the necessary processes to achieve effective solutions in a timely manner. Workshop discussions may lead to identification of additional priorities and action plans. Others may be added as the PAPs undergo refinement and improvement following the workshop. All interested stakeholders are encouraged to review and comment on the PAPs, which are posted on the Smart Grid Interim Roadmap TWIKI (http://collaborate.nist.gov/twiki-sggrid/bin/view/ SmartGridInterimRoadmap/PriorityActionPlans). Each PAP page has a form at the bottom, where reviewers can comment and make recommendations.

The following table lists the initial PAPs and the technical leaders for each. Where applicable, the PAPs reference relevant sections in the Report to NIST on the Smart Grid Interoperability Standards Roadmap (http://www.nist.gov/smartgrid/InterimSmartGridRoadmapNISTRestructure.pdf)

Table 1: Priority Action Plans

#	Priority Action Plan	NIST Lead	EPRI Lead
1	IP for the Smart Grid	David Su	Joe Hughes
2	Wireless Communications for the Smart Grid	David Su	Joe Hughes
3	Common Pricing Model	David Holmberg	Toby Considine
4	Common Scheduling Mechanism	David Holmberg	Toby Considine
5	Standard Meter Data Profiles	Tom Nelson	Aaron Snyder
6	Common Semantic Model for Meter Data Tables	Tom Nelson	Erich Gunther
7	Electric Storage Interconnection Guidelines	Al Hefner	Frances Cleveland
8	CIM for Distribution Grid Management	Jerry FitzPatrick	Grant Gilchrist
9	Standard DR Signals	David Holmberg	Bill Cox

#	Priority Action Plan	NIST Lead	EPRI Lead
10	Standard Energy Usage Information	David Wollman, Tom Nelson	Marty Burns
11	Common Object Models for Electric Transportation	Eric Simmon	Stuart McCafferty
12	IEC 61850 Objects/DNP3 Mapping	Jerry FitzPatrick	Grant Gilchrist
13	Time Synchronization, IEC 61850 Objects/IEEE C37.118 Harmonization	Jerry FitzPatrick	Christoph Brunner
14	Transmission and Distribution Power Systems Model Mapping	Jerry FitzPatrick	Christoph Brunner

Note that this document is a composite of fourteen plans that are "works-in-progress". All the acronyms and standards referenced are defined and described in the Interim Roadmap document on which these were based. Please refer to the referenced report for these definitions.

0.3 Priority Action Plan Template

The plans in this draft follow a template, as follows:

What: [Title: Name of standard/need/gap (with, where applicable, to parenthetical reference to discussion of this topic in the *Report to NIST on the Smart Grid Interoperability Standards Roadmap,* which can be downloaded from: http://www.nist.gov/smartgrid/InterimSmartGridRoadmapNISTRestructure.pdf)]

Abstract: [One- or two-sentence summary.]

Description: [Distillation of key elements.]

Objectives: [High level objectives / requirements for the goals of the plan.]

Why: [Why is it important? What does it enable? What are the consequences of not developing this standard/filling this gap? Which stakeholder group is most affected? . . .]

Where: [Where does it fit in the framework or architecture? Interfaces with what layers, domains, uses, etc.? . . .]

How: [How to get the job done (e.g., level of effort, stakeholder groups to engage, and other important procedural considerations)? What harmonization is needed?]

Who: [Suggestions on project planning team.]

When: [Timeline for deliverables.]

1 What: Role of Internet Protocol (IP) in the Smart Grid (6.1.4)

1.1 Abstract:

For interoperable networks it is important to study the suitability of Internet networking technologies for smart grid applications. This work area investigates the capabilities of protocols and technologies in the Internet Protocol Suite by working with key SDO committees to determine the characteristics of each protocol for smart grid application areas and types.

1.2 Description:

The Internet technologies consist of a set of protocols to network and transport data messages using IP packets, as well as a set of protocols to manage and control the network, such as routing, mapping of IP addresses, device management, etc. This protocol suite enables distributed applications to run over a set of interconnected networks. It also includes session- and transaction-oriented security mechanisms to provide security services.

1.3 Objectives:

- Review the communications networks and domains identified in the Smart Grid conceptual model and determine whether they are discussed in fine enough granularity to discuss the application of the Internet protocol suite
- Define the approach for fully defining the network and systems management requirements for Smart Grid networking infrastructures
- Define a set of standards profiles required for Smart Grid networks
- Identify key networking profiles issues including issues surrounding IPv4 vs. IPv6
- Determine the key remaining issues surrounding adoption of standardized networking profiles
- Determine appropriate Smart Grid network architectures and technologies appropriate for basic transport and security requirements (e.g., shared IP networks, virtual private networks, MPLS switching, traffic engineering and resource control mechanisms)
- Determine which transport layer security protocol(s) (e.g., TLS, DTLS, SCTP, and IPsec) are most appropriate for securing Smart Grid applications.
- Identify higher layer security mechanisms (e.g., XML, S/MIME) to secure transactions.
- Develop an action plan for development of necessary usage guides, profiles and remaining work.

1.4 Why:

The Smart Grid will need a comprehensive mapping of smart grid application requirements to the capabilities of protocols and technologies in a well define set of Internet Protocol Suite(s) or Profiles. This should be defined by experts well versed in the applications and protocols including management and security. A set of well-defined networking profiles can be tested for consistency and interoperability to help ensure systems integration as appropriate across the Smart Grid. A set of consistent and testable protocol profiles is also necessary to ensure that the combination of technologies can meet not only today's requirements but meet future application needs as well.

The networking profiles defined by this work will define a significant portion of the interfaces to Smart Grid equipment and systems. Most notably the interfaces that integrate systems over Wide Area Networks and large geographical areas will need to be defined in part by these profiles. The networking profiles will define networking functions such as addressing and the integration of concepts such as multihoming and other key functions necessary for the Smart Grid.

1.5 Where:

The Smart Grid will use a variety of different networking environments across smart grid domains and sub-domains as identified in the smart grid applications and conceptual models. The suitability of the proposed protocol suites or profiles in specific application contexts should be analyzed against the requirements emerging for Smart Grid applications and the proposed scale and scope of Smart Grid networks. The analysis should identify which protocols are clearly applicable in specific application contexts (e.g. use of TCP/IP, UDP, TLS/SSL, IPsec , IPV4/IPV6, MPLS) and protocols for network control, management and security, in addition to identifying any existing gaps.

1.6 How:

This task will require the development of a combination of networking standards into well defined sets known as profiles. Working from existing and proposed Smart Grid applications and use cases the approach will require the distillation of Smart Grid applications and requirements into sets of networking profiles. These profiles will need to be developed into designs and implementations that can then be tested against the requirements. The communities that need to be involved include those within the Internet Engineering Task Force as well as other research communities that are working on networking technology.

1.6.1 Task Descriptions

Develop along with project team.

1.6.2 Deliverables

Develop along with project team.

1.7 Who:

Project Team
NIST Lead: David Su, david.su@nist.gov
EPRI Leads: Joe Hughes jhughes@epri.com , Erich Gunther, erich@enernex.com
SDO Leads (IETF): Leslie Daigle, ISOC and IETF; Ralph Droms, IETF; Russ Housley, IETF chair; Dave Oran, IETF (Architecture); Henning Schulzrinne, Columbia U. and IETF; Richard Shockey, IETF (ENUM, SIP); Sean Turner, IETF; Geoff Mulligan, IETF (6LOWPAN); Jeff McCullough, IETF.
Other SDOs: ATIS , IEEE, TIA
Users Groups:

Project Team
Technical Team:

1.8 When:

Task	Responsible	Date	1.9 Notes
Task 1: Develop a clear set of requirements for specific Smart Grid application areas (include key non-functional requirements with fine enough granularity). Include power engineering applications, as well as the network / communications requirements.	Key group of domain experts (IEEE P2030, Dick DeBlasio; NAESB, ?;Zigbee, Bob Heile; UCAiug, Chris Knudsen;…)		Include regulatory and other external sources of requirements. International perspectives included.
Task 2: Definition of terms (where they need to be understood in context). Define "profile" in terms of applicability.	Key domain experts		Need to define domains and merge/integrate terms, i.e. reliability, security, transport, profile, etc.
Task 3: Define specific Smart Grid (SG) applications that define distinct networking infrastructures. Define the set of RFC's /supporting documents that establish an interoperable network.			Design decisions need to be made on defining the core set of RFC's and supporting documents.
Task 4: Identify a core set of Internet protocol suite supporting documents.	NAESB, ? ;IETF, Russ Housley; IPSO, ?; NIST, David Su; UCAiug Open SG, Chris Knudsen.		Beware of legacy issues.
Task 5: Application taxonomy to be created. Define well specified environments even within NIST Domains.	IPSO, Doug Houseman., Fred Baker, NAESB		Use cases can be used to describe applications. (Example contributed: CIPs/Real Time, Emergencies, Low Bandwidth/Home, Rest of World)
Task 6: Develop proposed models for key implementations (e.g. outage management); include Engineering Analysis.	UCAiug, NEMA, Sonoma Innovation (hosting mtgs), others.		Work the design to completion and evaluate. Look to bound the problem

			space. Get a good interdisciplinary team. Address an architecturally significant set of issues.
Task 7: Identify lessons learned from networking community that could impact SG. This would include critical infrastructure issues.			Functions such as broadcasting are not done well…other issues need to be identified…multicast.
Task 8: Identify application use cases that IP protocol suite doesn't do well and hence requires investigating something else.	Outcome of defining use cases…		Be careful of IP vs. something new. The trust domain is an emerging concern.
Task 9: Testing and Certification for Suites of Standards. Identify plausible approaches, define types of testing needed.	TNIST, UCAiug Open SG		IETF doesn't do. NAESB is involved with testing assurance. Define who defines the tests and who implements testing. Include Quality Assurance.

2 What: Wireless Communications for the Smart Grid (6.1.5)

2.1 Abstract:

This work area investigates the strengths, weaknesses, capabilities, and constraints of existing and emerging standards-based physical media for wireless communications. The approach is to work with the appropriate standard development organizations (SDOs) to determine the characteristics of each technology for Smart Grid application areas and types. Results are used to assess the appropriateness of wireless communications technologies for meeting Smart Grid applications.

2.2 Description:

Review existing documentation and ongoing work to assess the capabilities and weaknesses of wireless technologies operating in both licensed and unlicensed bands and to develop guidelines on their use for different Smart Grid application requirements.

2.3 Objectives:

- Identify requirements for use of wireless technologies for the Smart Grid.
- Identify guidelines for effectively, safely, and securely employing wireless technologies for the Smart Grid.
- Identify approaches to define the strengths and weaknesses of candidate wireless technologies to assist Smart Grid design decisions.
- Analyze co-channel interference issues and develop coexistence guidelines for operation in unlicensed bands.
- Identify key issues to be addressed in wireless assessments and development for the Smart Grid.

2.4 Why:

Wireless technologies are one of many types of media that could meet many Smart Grid requirements by enabling access where other media are too costly or otherwise not workable. However, different types of wireless technologies also have different availability, time-sensitivity, and security characteristics that may constrain what applications they are suitable for. Therefore, different wireless technologies must be used with knowledge of their varying capabilities and weaknesses in all plausible conditions of operation. This work provides objective information on the appropriateness of use.

2.5 Where:

Wireless can be used in field environments across the Smart Grid including generation plants, transmission systems, substations, distribution systems, and customer premises communications. The choice of wireless or non-wireless, as well as type of wireless must be made with knowledge of the appropriate use of the technology.

2.6 How:

2.6.1 Task Descriptions

Develop along with project team.

2.6.2 Deliverables

Develop along with project team.

2.7 Who:

Project Team
NIST Lead: David Su
EPRI Leads: Joe Hughes jhughes@epri.com , Frances Cleveland fcleve@xanthus-consulting.com
SDO Leads: ISA SP100: Wayne Manges IEEE Phil Beecher, Mark Klerer, Roger Marks, Steve Shellhammer, Bob Heile ZigBee Alliance Skip Ashton WiFi: Greg Ennis IETF: Geoffrey Mulligan TIA: Grant Seiffert
Other SDOs: ATIS,
Users Groups: Utility Telecom Council (UTC)
Technical Team:

2.8 When:

Task Description	Completion Date
Task 1: Segment the smart grid and wireless environments into a minimal set of categories for which individual wireless requirements can be identified. - With support from P2030, OpenSG as reviewer.	TBD IEEE 802 as organizer
Task 2: Terminology and definitions. - With support from P2030, OpenSG as reviewer.	TBD IEEE 802 as organizer
Task 3: Compile & communicate use cases and develop requirements for all smart grid domains in terms that all parties can understand (based on task 1 - coordination with EPRI repository and DOE clearinghouse) • Need in a standardized format (Intelligrid / IECSA) • With review by P2030, etc. • To include security, interference, QoS, etc, etc, etc.	TBD OpenSG
Task 4: Compile and communicate a list of capabilities, performance metrics, etc. in a way that all parties can understand. - Not quantifying any standard, just defining the set of metrics.	TBD IEEE 802
Task 5: Create an inventory of wireless standards and their	TBD

associated characteristics (defined in previous task) for the environments in task 1. • Tasks 5 and 6 should also be done for wired technologies. • With input from each SDO. • www.ucaiug.org	OpenSG to coordinate (domain expertise is no will recruit from the other SDOs)
Task 6: Do the mapping from SG domain requirements to wireless standards. – Gaps to be identified.	TBD OpenSG to coordinate

3 What: Develop Common Specification for Price and Product Definition (6.1.1)

3.1 Abstract:

Price is more than a number. Price is a number associated with product characteristics. Already identified product characteristics include delivery schedule, quality, environmental characteristics, and regulatory characteristics. A common specification for price is a precursor to new market developments, to demand response, to distributed energy resources, to understanding meter information, and to every other hand-off between domains.

3.2 Description:

Shared responsibility for balancing energy production and consumption requires shared access to information about energy markets and actual use. Price is a common abstraction for market conditions including abundance, scarcity, and quality. Energy quality may include reliability, power quality, and source. Energy source may be as a important as energy price to influencing consumption decisions in some scenarios.

A common price model will define how to exchange energy characteristics, availability, and schedules to support free and effective exchange of information in any market. In financial markets, this type of description is called product definition. Although today's energy markets are almost exclusively wholesale, the product definition will be usable in other scenarios including retail markets and "prices to devices" scenarios. The completed price model will be used in Demand Response (DR) communications, in usage sharing between the meter and the premises Energy Service Interface, and in potential market operations

Today's large-scale trading systems are built using the FIX (Financial Information) Protocol. The FIX product attribute dictionary already includes many elements used in today's wholesale energy markets; this plan's work can be completed more quickly if it re-uses this work. A common product profile compatible with FIX is a secondary deliverable of this plan.

Energy prices and energy products are closely tied to schedules and intervals. Building systems and enterprise activities must share an understanding of those schedules for effective collaborative energy. Product definitions must include schedule information.

3.3 Objectives:

1. Develop a summary of product characteristics of interest to energy consumers.
2. Develop summary of power reliability and quality characteristics that affect price and availability (supply side) and desirability (demand side).
3. Develop and implement a plan to expedite harmonized standards development and adoption within the associated standards bodies.

3.4 Why:

Coordination of energy supply and demand requires a common understanding of supply and demand. Future energy markets will see greater variability than today. Consumer interests in green power, parallel markets for energy, and carbon regulations may create increased interest in energy sources. Distributed energy resources introduce new market focuses and new market sources.

Better communication of actionable energy prices will help enable and expand efficient markets (including forward or futures markets) that satisfy growing demand for lower-carbon, lower-energy buildings, net zero-energy systems, and supply-demand integration that take advantage of dynamic pricing. Local generation and local storage require that the consumer (in today's situation) make investments in technology and infrastructure including electric charging and thermal storage systems. Businesses, homes, electric vehicles and the power grid will benefit from automated and timely communication of energy pricing, characteristics, quantities, and related information.

A consistent model for market information exchange can be applied, with elaboration or use of defined subsets, to allow essentially the same information communication for homes, individual appliances, electric vehicles, small businesses, commercial buildings, office parks, neighborhood grids, and industrial facilities, simplifying communication flow and improving the quality of actions taken across the broad range of energy providers, distributors, and consumers. A consistent information model will reduce costs for implementation.

Price and characteristics of energy are not necessarily simple. Retail markets typically have simple actionable information, in large measure because the retail markets combined with distribution are defined with clear and specific prices; wholesale markets are more complex, with transactions subject to later adjustments, e.g. for balancing costs, as well as the complexities of tariff market definitions. This work does not intend to address those complexities, rather to define a means for effective information exchange that permits immediate decisions—wholesale market participants must independently understand the complexities of the markets in which they operate. But a simple quotation of price, quantity, and characteristics in a consistent way across markets has significant value, even though the participants must understand and anticipate later adjustments.

Without transparency and common formats, energy markets, as with other markets, are prone to manipulation and gaming. Pricing and product definition are the key to transparent market accounting. Commonly agreed upon schedule and interval information is essential to developing forward markets.

3.5 Where:

Price and product definition is a common component of information exchange across almost every domain. In the evolving transactive power grid market communications will involve energy consumers, producers, transmission and distribution systems, and must enable aggregation for both consumption and curtailment resources. Market makers, such as Independent System Operators (ISOs), Regional Transmission Operators (RTOs), utilities, and other evolving mechanisms need to deliver actionable information in consistent formats as the Smart Grid evolves. With information in consistent formats, building and facility agents can make decisions on energy sale, purchase, and use that fit the goals and requirements of their home, business, or industrial facility.

Price and product definition are critical to open market operations. Machine understandable product definitions will be included in any retail forward markets. Wherever a decision to use or not use energy is made, energy product definition and price are potential decision points.

Common price and product definitions are critical across the GWAC stack. Product definition is the core of Semantic Understanding (level 4) and setting Business Context (level 5). As price is an abstraction for scarcity and value, reliance on price reduces the complexity required to achieve syntactic interoperability (3). Price is the primary means for sharing objectives between businesses (7). Today, prices are determined largely by regulatory policy (8); because product definitions enable multiple clearing markets over the same wired, future economic and regulatory policies will be affected by these definitions.

3.6 How:

- Engage today's market makers in energy (ISO/RTOs) to better support today's markets
- Select common models and delivery format for specifications to support 1-n relationships among domains.
- Develop semantic mapping between scheduling in energy and in other domains and within energy between supply and demand..
- Use interval and schedule formats from other domains, especially the WS-Calendar (PAP 04) specifications.
- Develop cross-reference between market terms in energy and in financial markets.
- Engage FIX Protocol organization to supply those attributes and definitions already in use in commodity and energy markets. Extend FIX attributes as needed.
- Engage NAESB to formulate market rules for FIX profiles.
- Engage Regulatory entities to determine model product representations of existing tariffed products.

3.6.1 Task Descriptions

(These task descriptions are a starting point for discussion within the workshop process on August 3 & 4, 2009)

- Engage today's market makers in energy (ISO/RTOs) to better support today's markets
- Select common models and delivery format for specifications to support 1-n relationships among domains.
- Develop semantic mapping between scheduling in energy and in other domains and within energy between supply and demand..
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- Engage NAESB to formulate market rules for FIX profiles.
- Engage Regulatory entities to determine model product representations of existing tariffed products.

3.7 Deliverables

Develop along with project team.

3.8 Who:

Project Team
NIST Lead: Dave Holmberg david.holmberg@nist.gov
EPRI Lead: Toby Considine Toby.Considine@gmail.com William Cox wtcox@coxsoftwarearchitects.com
SDO Lead: OASIS Laurent Liscia laurent.liscia@oasis-open.org
Other SDOs: FIX Protocol, Ryan Pierce, FIX Protocol, ryan.pierce@fixprotocol.org FIX Protocol, Jim Northey, FIX Protocol, jimn@lasalletech.com NAESB, Jonathan Booe, NAESB, jbooe@naesb.org NAESB, Joelle Ogg, Ogg@bc-law.net IEC,Jim Waight, Siemens, jim.waight@siemens.com ISO,Tim Schoeckle, ISO, schoechl@colorado.edu ISO/IEC, Ron Ambrosio,(GWAC) IBM,rfa@us.ibm.com ISO/IEC, Kenneth Wacks,(GWAC) GridPlex. Inc, kenn@alum.mit.edu PNL, Ron Melton, Pacific Northwest National Laboratories, ron.melton@pnl.gov
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3.9 When:

Task	Responsible	Due Date	Notes
Convene Cross-Domain Group Price+	OASIS, NAESB	200911	DEWGs, FIX, others
--High level concept of operation	BAE (volunteer)	200911	DEWGs, No Magic, Ron Melton
--Survey existing price communication	FIX, NAESB	200910	FIX, JPM, FISD, NARUC/NAESB, ISO/RTO CTO, EEI, AHAM, ZigBee, OpenHAN, OASIS
--Data model	OASIS IEC TC57 CIM WG	ongoing	EMIX; FIX; IEC/CIM
--Draft pricing specification	OASIS	201004	data model, XML expression?, No Magic Review by IEC, FIX, CalConnect, NAESB, FIATECH, NIBS, DEWGs, others
Continued coordination		ongoing	
Convene Schedule Group	CalConnect	200912 out for review	OASIS, NAESB Review DEWGs, FIATECH, others
Attributes	Defer/convene		

Task	Responsible	Due Date	Notes
	rs		
SHARE EVERYTHING AT GRID-INTEROP			

Issues, Comments, or Observations of Note
• Look to areas of coordination (DR & PEV for example) • IEC TC57 Use Cases to Harvest • FIX futures contract information (fidelity of information?) • Forward and future contracts? Consumer/participation? • Standard modeling interface (Jay) • Aggregation points above devices, participate in markets; real-time expensive. • Identity (security) • Get out of the weeds ☺ / • Make it simple and understandable • Simplicity is a security feature • Align pricing with NAESB Pricing Model • ISO / RTO Participation • Implementation Testing • Simplify to meet Needs of Customer • Each group pull out pricing model, pricing information and submit to (SDO working on it) • Start with End User Price? Working backward, what does the supplier need to know? • Use Composable model

4 What: Common Scheduling Mechanism (6.1.3.2)

4.1 Abstract:

The coordination of supply and demand is already of critical importance on the grid; tomorrow, with the increase of distributed energy resources, this coordination becomes more critical. The coordination must involve more than electromechanical coordination; it also involves enterprise activities, home operations and family schedules, and market operations. A common specification, developed for other domains as well as in smart grid, would better support interactions with those other domains and get broader adoption.

4.2 Description:

For human interactions and human scheduling, the well-known ICalendar format is used. There is no equivalent standard for web services. As an increasing number of physical processes are managed by web services, the lack of a similar standard for calendaring of services becomes critical.

The goal of this action plan is to survey the existing specifications for calendaring and develop a standard for how schedule and event information is passed between and within services. The standard should support all of the functionality currently supported by ICalendar for application to the completion of a web service contract.

The scheduling specification will be a micro-specification, and then a micro-standard. A calendar event without associated contract is of little use. The micro-specification can then be incorporated into other specifications through composition, bringing a common scheduling operation to diverse contracts in different domains.

4.3 Objectives:

- Survey work to date and determine short-list precursors.
- Determine plan to expedite development of specifications to standards.
- Develop a plan for cross-referencing schedules and other documents/contracts in a message.

4.4 Why:

One of the most fundamental components of negotiating services is agreeing when something should occur. Short-running services have traditionally been handled as if they were instantaneous, and thereby dodged this requirement through just-in-time requests. Longer-running processes may require significant lead times. When multiple long-running services participate in the same business process, it may be more important to negotiate a common completion time than a common start time. Central coordination of such services reduces interoperability as it requires the coordinating agent to know the lead time of each service. As we reach out to multiple processes with the span of the grid, coordination must take into account local time zones as well.

A growing number of specifications envision synchronization of processes through broadcast scheduling. The Smart Grid relies on coordinating processes in homes, offices, and industry with projected and actual power availability, including different prices at different times. Weather reports including time are becoming increasingly important to projecting energy availability. Emergency management coordinators wish to inform geographic regions of future events, such as a projected tornado touchdown. These efforts would benefit from a common standard for transmitting calendaring.

Web services are meeting increased acceptance to interact with the low-level [control] systems world. Business systems can interact with building systems using web services specifications, such as oBIX, BACnet/WS, and a number of proprietary specifications including LON-WS, TAC-WS, and others. Energy use in buildings can be reduced while improving performance if building system operation is coordinated with the schedules of the buildings occupants.

Coordination of energy supply and demand requires a common understanding of supply and demand. Future energy markets will see greater variability than today. Consumer interests in green power, parallel markets for energy, and carbon regulations may create increased interest in energy sources. Distributed energy resources introduce new market focuses and new market sources. A scheduling component within energy market operations coordinates both short-lead and long-lead-time activities. This will promote the development of autonomous agents to drive performance while reducing costs for implementation.

4.5 Where:

Coordination is a common component of information exchange across almost every domain. In the evolving transactive power grid market communications will involve energy consumers, producers, transmission and distribution systems, and must enable aggregation for both consumption and curtailment resources. Market makers, such as Independent System Operators (ISOs), Regional Transmission Operators (RTOs), utilities, and other energy services providers. With information in consistent formats, building and facility agents can make decisions on energy production, sale, purchase, and use that fit the goals and requirements of their home, business, or industrial facility.

4.6 How:

- Identify pre-existing work from enterprise domains. The Calendar Consortium(www.calconnect.org) and the ISO20022 financial schedule elements are likely candidates..
- Seek agreement from those who have existing work as to completion, submission as a standard, IP assertions, etc.
- Expedite completion to deliver as component of developing specifications for DR (Energy Interoperation), Market Information (EMIX) and other specifications

- Explore how existing standards for scheduling sequences in BPEL and other well known standards can interact with calendar-oriented standards to solve other problems on the grid.

4.6.1 Task Descriptions

This Project Plan was developed in conjunction with PAP03, Price and Product Definition.

- The Calendar Consortium will complete its current work of XML serialization of ICalendar into a web-service component (WS-Calendar) by the end of 2009, probably within the IETF.
- ISO20022 will comment on and coordinate with the Calendar Consortium and on an agreed upon schedule semantics across enterprise, energy, and financial information.
- Ongoing work in Product Definition (OASIS EMIX) and in grid—end node interactions (OASIS Energy Interoperability) will leave place-holders for a schedule component pending completion of this work.

4.6.2 Deliverables

The Deliverable will be the WS-Calendar standard and associated semantics for schedule perforoamnce.

4.7 Who:

Project Team
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4.8 When:

Task Description	Completion Date
WS-Calendar Specification ready for review:	200912
WS-Calendar Semantic Review completed (ISO 20022, oBIX)	201001
WS-Calendar Incorporated into EMIX:	201004

5 What: Standard Meter Data Profiles (6.2.5)

5.1 Abstract:

NIST should work with NEMA to utilize EDL ANSI C12.19-2008 data models to represent one or more meter profiles with distinct information locations and formats to simplify client access to commonly shared information (6.2.5).

NOTE: “data models”: Section 5, Annex H, Annex J, Annex K, Annex L

5.2 Description:

ANSI C12.19-2008 contains four default fallback profiles, known in its nomenclature as “DEFAULT_SET_USED” in Section 9.1.1, Table 00:

> **DEFAULT_SET_USED** Indicates which, if any, default sets are used.
> See Annex C, “Default Sets for Decade Tables”, for the default set definitions.
>
> | | |
> |---|---|
> | 0 | Default sets are not used. See Section 4.1, “Standard Tables”, Figure 4.1, conditions C through H for more detail. |
> | 1 | Default set #1, Simple Meter Register, in use. |
> | 2 | Default set #2, Simple Demand Meter, in use. |
> | 3 | Default set #3, Simple TOU Meter, in use. |
> | 4 | Default set #4, Simple Profile Recorder, in use. |
> | 5..255 | Reserved. |

The values for the “default sets” are contained in the referenced Annex C.

Despite these definitions, there may be misconceptions about the “default sets” as well as a misalignment of those sets with utility requirements. It is possible to define and publish new device classes (in simple terms, a “tag” that identifies a specific data model).

5.3 Objectives

- Develop strong stakeholder team to define utility requirements. [OB1]
- Express requirements in Standard Table language and publish “EDL Form” default sets Express AEIC Guidelines v2.0 in terms of one or more additional Device Classes (ANSI C12.19-2008 Annex J XML Form, see Section 3.41 and I.1). [OB2]
- Prepare and deliver the additional Device Classes for (freely downloadable and in the public domain) publication on the OID website (www.naedra.org) and to ANSI C12 SC17 WG2 an amendment to ANSI C12.19-2008 containing requested changes in Standard Form in a “contribution”.[OB3]
- Minimize variations in data types (down to one) transported from End Devices. Note: this may be a profile of data types for a specific use case.[OB4]
- Socialize existence of Tables in ANSI C12.21-2006 and ANSI C12.22-2008. [OB5]
- Socialize existence and application of existing and definition of new default sets, Device Classes, and “profiles”. [OB6]
- Socialize extension method for definining new default sets.

- Proactive ‘marketing’ plan. [OB7]

5.4 Why:

The Smart Grid recognizes that several clients may require local access to meter data and these may be on the same order of complexity as the meter itself. Such potential clients might range from thermostats to building automation systems. Other potential clients will exist inside and outside of the customer premises.

5.5 Where:

Meter interface with: Metering System (28 – Operations Domain), Customer EMS (32 – Customer), Submeter (37 – Customer), Workforce Tool (39 – Distribution), Field Devices (41 – Distribution); Semantics layer

5.6 How:

1. Formulate team
2. Find an entity willing to provide the four default set definitions in EDL form and publish
3. Create and publish a “how to develop” guide with respect to this topic.
4. Develop a strategy to publish and maintain EDL default sets via an SDO and/or user’s groups.
5. Identify sets of meter attributes that should be able to be acquired simply based on known meter profile adoption, i.e. new “default set” definitions.
6. Implement the description in EDL Form the “default sets”.
7. Investigate potential integration challenges (e.g., with MultiSpeak and IEC 61968-9) and create roadmap to minimize or eliminate those challenges.
8. Produce descriptions and example messaging scenarios to illustrate how meters can be read by simple clients to obtain commonly requested information.
9. Identify and Socialize a “recipe” for getting a candidate set of meter information that is not part of a default set.

5.6.1 Task Descriptions

- Map utility requirements expressed via AEIC Guidelines v2.0 to device class(es) [OB1]. AEIC AMITIT, Dependent upon completion of AEIC Guidelines v2.0. 1/2010Develop along with project team.
- Express AEIC Guidelines in terms of one or more additional Device Classes (XML Form). [OB2] [OB3] AEIC AMITIT 5/2010
- Complete AEIC Guidelines v2.0, AEIC Ad hoc WG via AEIC AMITIT, 12/2009
- Minimize the variations in data types (down to one) transported from End Devices. Note: this may be a profile of data types for a specific use case. [OB4], AEIC+Other Stakeholders, AEIC AMITIT, 12/2009

- Plan for socializing existence of Tables within ANSI C12.21-2006 and ANSI C12.22-2008. [OB5] NIST, Q4-2009.
- Socialize existence and application of existing and definition of new default sets, Device Classes, and "profiles" via web conferences, NIST, [OB6] Q4-2009, Q1-2010
- Socialize existence of Tables within ANSI C12.21-2006 and ANSI C12.22-2008. [OB5] NIST, NIST Knowledge Base, Q4-2009, Q1-2010.
- Develop proactive marketing plan. [OB7] NEMA and NIST, Q3-2009

5.6.2 Deliverables

Develop along with project team.

5.7 Who:

Project Team
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Other SDOs: Measurement Canada: Vuong Nguyen nguyen.vuongt@ic.gc.ca
Stakeholder Leads:David Haynes – Technical Expert, ANSI/IEC/MultiSpeak →Software Vendor (Customer EMS)?? →Software Vendor (MDMS) – representative from AMI-MDM?

5.8 When:

Task Description	Completion Date
Task 1: Map utility requirements expressed via AEIC Guidelines v2.0 to Device Classes.	01/2010
Task 2: Express AEIC Guidelines v2.0 in terms of one or more additional Device Classes	05/2010
Task 3: Complete AEIC Guidelines v2.0.	12/2009
Task 4: Minimize the variations in data types (down to one ?) transported from end devices. Note: this might be a profile of data types for a specific use case.	12/2009
Task 5: Socialize the existence of additional Tables within ANSI C12.21-2006 and C12.22-2008	Q1-2010
Task 6: Socialize the existence and application of existing and the definition of new default sets, Device Classes, and profiles via web conferences.	Q1-2010

6 What: Demonstrate Common Semantic Model Translations for End Device Data (6.2.5)

6.1 Abstract:

NIST should work with NEMA to translate the ANSI C12.19 End Device (meter) data model into a common form that will allow the semantics of this and End Device models in other standards to be more readily harmonized. The objective is to allow the lossless translation from the common form to the various syntactic representations prevalent in each Domain. Details will include the representation of the Decade/Table/Element model, as well as, the Table-independent representation of key measurements of a revenue meter. (**6.2.5**)

6.2 Description:

ANSI C12.19-2008 standard organizes metering (and other end device) data and operating criteria to be conveyed into and out of those devices into defined groupings of information called ”Tables”. A large number of Tables are supported to allow representation of many types of data in numerous formats for "standard" or common data elements as well as manufacturer specific data. A high degree of flexibility in formats for time, integer values, data order, character formats, and data access are provided for. This flexibility has also resulted in some difficulties in determining what elements should be expected to be used-- a minimum set of expected functionality. Individual utilities and organizations, such as the AEIC, have attempted to develop implementation guidelines. A criticism of ANSI C12.19 has been its continued use of Tables to represent information rather than more "modern" methods of representing semantic models and implementation syntax.

6.3 Objectives

- Identify key use cases [OB1]
- Define mapping between ANSI C12.19-2008 and MultiSpeak v4 [OB2]
- Define mapping between ANSI C12.19-2008 and IEC 61968-9 [OB3].

6.4 Why:

This work has the potential to substantially reduce the labor costs of integrating large-scale systems that use metering data. By reducing or eliminating the amount of human intervention required, utilities can focus on products and services that provide benefit to the organization and to the customer, rather than spending extensive effort on simply achieving connectivity between computer systems.

The ability to share the resources represented by metering can greatly enhance the operation of the energy generation and delivery operations as well as opening up new ways to serve customers. This work can enable enterprise level sharing and support a variety of new applications.

6.5 Where:

Meter interface with: Metering System (28 – Operations Domain), Customer EMS (32 – Customer), Submeter (37 – Customer), Workforce Tool (39 – Distribution), Field Devices (41 – Distribution); Semantics layer

6.6 How:

1. Formulate team.
2. Leverage the significant published work that already exists on this topic - specifically EPRI Report 1012651 - *"IntelliGrid Metering Objects Integration for Customer Communications"*.
3. Create and publish a "how to develop" guide with respect to this topic.
4. Develop a strategy to fully capture and embody in the semantic model the more than 20 years of data modeling effort and participation by all major North American meter manufacturers, numerous utilities, and communications companies, that defines what data is produced by customer meters.
5. Implement the description in some form based on XML, XML Schema, and/or UML.
6. Investigate potential integration and harmonization challenges (*e.g.*, with MultiSpeak, IEC 61968-9, IEC 61850, IEC 60256 COSEM, etc.) and create roadmap to minimize or eliminate those challenges.
7. Transfer the results to ANSI and other relevant standards groups

6.6.1 Previous Work:

- EPRI Report 1012651 - *"IntelliGrid Metering Objects Integration for Customer Communications"*. The primary source work for this effort since it has a very similar scope.
- ASHRAE Research Project RP-1011. Was intended to propose use cases and object models for applications dependent on the interaction of the commercial building and utility industry.
- Association of Edison Illuminating Companies Guidelines v1.0 – placed boundaries on implementations of ANSI C12.19-1997 to ensure that features of the standard that encourage interoperability, such as the agreement to use "big-endian" data representation, were implemented by all who comply. Version 2.0 is under development to match the recently published ANSI C12.19-2008.
- IEC 60256 COSEM object model for ANSI C12 – permits ANSI C12 Tables to be viewed through specific objects defined in the COSEM standard.

6.6.2 Task Descriptions

Identify key use cases [OB1] AMI-NET TF, AMI-ENT TF, CIMug, WHEN

Put together team and define mapping between ANSI C12.19-2008 and MultiSpeak v4 for the key use cases [OB2] AMI-NET TF, AMI-ENT TF, CIMug WHEN

Put together team and define mapping between ANSI C12.19-2008 and IEC 61968-9 for the key use cases [OB3] AMI-NET TF, AMI-ENT TF, CIMug WHEN

6.6.3 Deliverables

1. Key use case list

2. Mapping definition between ANSI C12.19-2008 and MultiSpeak v4

3. Mapping definition between ANSI C12.19-2008 and IEC 61968-9

6.7 Who:

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6.8 When:

Task Description	Completion Date
Task 1: Identify key use cases	TBD
Task 2: Put together team and define mapping between ANSI C12.19-2008 and MultiSpeak v4 for the key use cases.	TBD

Task 3: Put together team and define mapping between ANSI C12.19-2008 and IEC 61968-9 for the key use cases.	TBD

7 What: Electric Storage Interconnection Guidelines (6.2.3)

7.1 Abstract:

Energy storage is expected to play an increasingly important role in the evolution of the power grid particularly to accommodate increasing penetration of intermittent renewable energy resources and to improve electrical power system (EPS) performance. Coordinated, consistent, interconnection standards, communication standards, and implementation guidelines are required for energy storage devices (ES), power electronics connected distributed energy resources (DER), hybrid generation-storage systems (ES-DER), and plug-in electric vehicles (PEV).

A broad set of stakeholders and SDOs are needed to address this coordination and evolution in order to update or augment the 1547 standards series as appropriate to accommodate Smart Grid requirements and ES-DER object models in IEC 61850-7-420. Coordination with UL, SAE, NEC-NFPA70, and CSA will be required to ensure safe and reliable implementation. This effort will need to address residential, commercial, and industrial applications at the grid distribution level and utility/RTO applications at the grid transmission level.

7.2 Description:

Electrical interconnection guidelines and standards for energy storage, hybrid generation-storage, and other power electronics-based ES-DER equipment need to be developed along with the ES-DER object models for power system operational requirements.

7.3 Objectives:

- Involve a broad set of stakeholders to address ES-DER electric interconnection issues, including utilities from different regions, the international community, groups addressing similar issues (such as wind turbine interconnection), vendors, researchers, and others.
- Develop Scoping Document to identify the ES-DER interconnection and operational interface requirements for the full spectrum of application issues: high penetration of ES-DER, ride-through of power system anomalies, plug-in electric vehicles, and all sizes of ES-DER systems, including those at customer sites, within distribution systems, and at transmission level . These may end up with multiple projects, some of which may be done in parallel, and may lead to a planning guideline.
- Develop Use Cases to identify interconnection and object modeling requirements for ES-DER before electrical connectivity standards are developed. These Use Cases would include coordination with PEV and Wind Use Cases.
- Update or augment the IEEE 1547 distribution level standards series as appropriate to accommodate the wide range of ES-DER system requirements.
- Augment the IEC 61850-7-420 object models for ES-DER through IEC TC57 WG17.

- Initiate development of transmission level standards for ES-DER. These should build on the FERC wind plant interconnect guidelines and European practice (e.g. e-on, ESB). These will be needed to extend to utility scale PV and energy storage systems.

7.4 Why:

Energy storage, by itself and in combination with distributed generation (termed ES-DER), is a new and emerging technology that has been identified by FERC as a key functionality of the smart grid, and standards related to storage should be treated as a key priority by the Institute and industry in the interoperability standards development process, subject to certain reservations. Coupled with inverter-based technology, these systems can be used to improve EPS performance. Due to the infancy of the use of storage and inverter technologies as a grid-integrated operational asset there are few standards that exist to capture how it could or should be utilized on the legacy grid and Smart Grid. For example, to date there exist no guidance or standards to address grid-specific aspects of aggregating large or small mobile storage, such as Plug-in Hybrid Electric Vehicles (PHEVs). ES-DER is treated as a distributed energy resource in some standards, but there may be distinctions between electric storage and connected generation. In particular, storage-based systems may function as a load more than 50% of the time.

At the same time, we are moving towards large penetration of renewables into the Grid, which could be destabilizing, but should, in the context of the Smart Grid, allow these renewables to be true utility assets. The potential for instability is twofold; first, due to the intermittent nature of renewables and therefore their unsuitability to be dispatchable resources, and second, due to the interconnection regulations themselves that can lead the electronic interconnection interface (the inverter) to trip off in response to minor variations in grid voltage or frequency. As low frequency is the result of insufficient generation, tripping a high level of inverter based systems would contribute to the problem and cause possible stability issues in response to a relatively minor disturbance. Appropriate interconnection standards, smart grid devices, and storage are all key elements of the solution.

In addition, ES-DER systems based on photovoltaic, wind, and other renewable, intermittent sources of energy are also exploring the use of storage to help smooth their intermittency, augment their ability to respond to distribution power grid management requirements, such as avoiding back-flow on networked power grids, and enhance commercial output by shifting when the energy is delivered. Eventually electric storage will play a larger role in islanded systems by helping to stabilize generation and load variations. Island system applications do provide some early examples of the stabilizing support needed when renewable are added to islanded (weak electrical) systems.

Various types of ES-DER systems are emerging. Each type will have different ranges of abilities to respond to power grid management requests, and will use different system parameters and technology specific constraints for forecasting their availability. Furthermore, the storage needs (power, energy, duty cycle, and functionality) will also depend on the grid domain where the storage is used (e.g., transmission, distribution, consumer, etc.). These considerations should be included in the storage and hybrid generation-storage connectivity and information model standards.

Examples of the different storage requirements for grid services include:

- Ancillary Services – including load following, operational reserve, frequency regulation, and 15 minutes fast response.
- Peak shaving
- Black start, islanding
- Renewables integration: ramp rate control, solar cloud ride thru
- Managing diurnal cycles for wind/solar: large energy capacity, peak shift
- Relieving congestion and constraints: short-duration (power application, stability) and long-duration (energy application, relieve thermal loading).

Examples of storage technologies being considered include:

- Pumped Hydro
- Compressed Air Energy Storage (CAES)
- Flywheels
- Batteries
- Super-Capacitors (SuperCaps)
- Superconducting Magnetics
- Thermal Storage
- Fuel Cells (reversible)
- Hydrogen Storage

Currently, IEEE 1547 defines the interconnection of distributed energy resources (DER) rated 10 MVA and less with the electric power system.[2] This standard defines DER as a small-scale electric generator located in and connected to the local electric power system (e.g., the customer facility), near the loads being served with an electric grid interconnection. The standard does not specify a distinction between energy storage devices and generators within the DER portfolio. However, there is no standardization for functioning during islanding (P1547.4 is still a draft), there are no ramp rate specifications that would enable hybrid generation-storage to mitigate intermittency of renewables, the trip point specifications do not enable renewables or storage to avoid tripling under moderate grid transients, there are no voltage support specifications, and there are inconsistencies between the anti-islanding requirements of IEEE 1547 and the ride through requirements defined by FERC's Large Generator Interconnection Procedure (LGIP), depending on interpretation and application. In particular, the standards that cover the period between event onset and when a resource must stay on or must disconnect from the grid can have conflicting time requirements, and the FERC LGIP ride through requirements extend beyond the 1547 default values for DR ceasing to energize the point of common coupling with the grid.

[2] Note – DOE uses the term DER, IEEE 1547 refers to DR, but that is confusing due to the increased use of demand response.

Regulatory issues also need to coordination. FERC Order 719 currently prohibits generation of power within islanding. Distribution systems are beyond the purview of FERC and regulation does not exist for authorizing the application and dispatch of storage. ISOs and regulatory bodies today have a tendency to treat storage as a generation device and struggle with seeing transmission or distribution entities owning storage. Revision or augmentation of IEEE 1547 will need to be closely coordinated with FERC. FERC has requested that the individual specification of IEEE 1547 be itemized (e.g., 1547.8.1) so that they can be adopted individually as FERC requirements.

IEEE 1547 was developed for interconnected systems of limited DER and renewable energy system penetration levels. The proposed new IEEE SCC21 P1547.8.x Standards are needed to enable the grid to accommodate increased renewable penetration levels, systems greater than 10 MVA, and to get value from inverter based systems to improve EPS performance, and further address end-use operational support, applications and regulatory technical needs.

7.5 Where:

The primary requirement is for P1547.8x's to develop appropriate electrical interconnection standards for electric storage and hybrid generation/storage that will enable substantial grid stability and security enhancements and permit a larger penetration of renewable energy resources and PHEVs, and further address end-use operational support, applications and regulatory technical needs.

Additional efforts will include validating and enhancing the IEC 61850-7-420 semantic layer object model standard for storage devices and hybrid generation-storage systems, including covering more storage devices than just batteries. PHEV object modeling will be handled by a different PAP.

IEEE 1679, that is standardizing the characterization of grid storage units, can coordinate efforts to assure object models for storage are consistent with a common basis for characterizing the underlying performance attributes of grid connected storage systems.

7.6 How:

The key stakeholder groups are: IEEE SCC21 P1547 WGs, IEEE P2030 and IEEE P1679; UL, SAE NEC-NFPA70, and CSA for PEV storage issues; IEC TC8; and IEC TC57 WG17 and ZigBee Smart Energy Profile efforts for semantic object models.

7.6.1 Task Descriptions

Task Description	Completion Date
Task 0: Develop Scoping Document to identify range of applications to be addressed and standards that already address these applications (and gaps). • Create broad set of stakeholders as part of this effort o Utilities	

Task Description	Completion Date
o ISO/RTO o Vendors o Research o Regulators o Etc. • Coordinated with Use Case development (may be part of Task 1) o Identifies applications that require more effort for the actual use cases • Gaps that need to be addressed in the short term • Provide input to the subsequent tasks defined • Presentations for industry feedback o ESA Meeting o EESAT Who – (NIST/EPRI to lead effort – target document by Oct 31) • IEEE Energy Storage Subcommittee in P2030, TF1 – Alex Takahashi • IEEE Distribution Automation WG – Georges Simard • IEEE 1547.2 – Bob Saint • NEMA Energy Storage Council (Aug 11 meeting) – Ben Biroschak, Brad Roberts • EPRI – Smart Grid Demo Initiative – Matt Wakefield, Dan Rastler • Electricity Storage Association – Rahul Walawalker, Ali Nourai, Brad Roberts • ISO/RTO Council – Ken Huber • Technology Representative (Power Conditioning System (PCS) and inverter vendor community) – Leo Casey, Le Tang • DOE – Dick DeBlasio, Imre Gyuk, Dan Ton (SEGIS/ES), John Boyes (Sandia), NETL • DOE Office of Vehicle Technologies – Sue Rogers • SAE – George Bellino	

Task Description	Completion Date
• NERC/FERC – Stan Johnson, Bob Cummings, Mark Lauby • EEI – Raj Patel (Transmission and Substations systems), Greg Obenchain (Distribution Systems), Mike Oldak • NRECA – Bob Saint • UL Safety Standards to assure that smart grid interfaces do not create safety problems– Tim Zgonena (wind, inverters, engine generators), Lauri Florence (batteries, ultra-capacitors, fuel cells), Ken Donahue (electric vehicles) • IBEW – • NEC/NFPA – Kathleen Almand • CSA Standards – Julie Cairns • DTE – Hawk Asgeirsson • UCI – Nokhum Markushevich	
Task 1: Develop (possibly within IEEE SCC21 P2030) Use Case scenarios and business processes to define the different requirements for electrical interconnections, focusing on scenarios involving high penetration of DER, potential microgrid formation, aggregated DER/Storage/PEVs in neighborhoods with no clearly defined Point of Common Coupling (PCC), grid operations with significant market involvement of aggregated DER systems, and adequate responses to frequency and voltage anomalies to avoid power system instabilities. These Use Cases will be recommended to be used as inputs for additions and modifications of the IEEE 1547 series of standard and the IEC object modeling standards. The Use Cases should look at • Systems of different sizes kw-100s MW • Connection at D, T or at the customer (greater than 20 MVA is the threshold for more complex LGIP, treat as a separate case) • Some voltages fall under NEC (34.5 kV). No rules for applications above 34.5 kV • Grid connected, islanded and consumer stand alone operation • Inverter and traditional based generation • Aggregation issues • ES-DER as a load • ES-DER for frequency regulation • (Consistent definition of actors and applications) • Opportunity to use stimulus projects and other deployments as a basis for collecting use cases, application descriptions,	December 2009

Task Description	Completion Date
example specifications, etc. – need a coordination of input from these projects	
Task 2: Complete the development of IEEE 1547-4 for island applications and 1547-6 for distribution secondary grid networks. – ballot ready drafts.	Spring 2010
Task 3: Develop a PAR that can be used to define a new SCC21 standard project (e.g., 1547.8 including subtask elements/parts described in tasks 3a through 3e below, i.e., 1547.8.1 through 1547.8.5). The P1547.8 will address the definition of unified methods for interconnection and further address end-use operational support, applications and regulatory technical needs for generic generation systems, storage systems, and hybrid generation-storage systems. This would define dispatchable service types that might be of value for the utility or local EMS; define generic generation/storage system type specification including power capacity for generation, power and energy capacities for storage, grid services capabilities and types of intermittency; and define methods for specifying generic generation/storage status parameters including probabilistic representation of availability (capacity versus time within percent certainty), and cost of providing each service type including impact of equipment wear-out (e.g., impact of battery cycling). Promote accelerated timeframe development and initiate the project concurrent with IEEE approval.	Spring 2010
Task 3a: Complete the proposal to develop new SCC21 standard project (e.g., 1547.8.1 for example) to represent methods for interconnection of generic generation/storage systems (developed in Task 3) as itemized individual requirements for interconnection of specific system types in specific domains (e.g., VAR support specification of storage system within distribution domain) so that they can be referenced as individual requirements by FERC etc.). Promote accelerated timeframe development and initiate the project concurrent with IEEE approval.	Spring 2010
Task 3b: Complete the proposal to develop new SCC21 project for itemized requirements for interconnection of STORAGE energy systems (without net generation capability) in specific domains so that they can be referenced as individual requirements by FERC etc. (itemize as 1547.8.2 for example). Promote accelerated timeframe development and initiate the project concurrent with IEEE approval	Spring 2010
Task 3c: Complete the proposal to develop new SCC21 project for itemized requirements for interconnection of PHOTOVOLTAIC energy systems with storage in specific domains so that they can be referenced as individual requirements by FERC etc. (itemize as 1547.8.3 for example). Promote accelerated timeframe development and initiate the project concurrent with IEEE approval	Spring 2010

Task Description	Completion Date
Task 3d: Complete the proposal to develop itemized requirements for interconnection of WIND energy systems with storage in specific domains so that they can be referenced as individual requirements by FERC etc. (itemize as 1547.8.4 for example). Promote accelerated timeframe development and initiate the project concurrent with IEEE approval	Spring 2010
Task 3e: Complete the proposal to develop new SCC21 project for itemized requirements for interconnection of PHEV energy systems with storage in specific domains so that they can be referenced as individual requirements by FERC etc. (itemize as 1547.8.5 for example). Promote accelerated timeframe development and initiate project concurrent with IEEE approval.	Spring 2010
Task 4: Continue development of object model standards for distributed energy resources (e.g., IEC TC57 WG17 to enhance IEC61850-7-420 and IEC TC57 WG14 to develop DER models in IEC 61968 CIM), including object models for managing generic storage/generation systems. In addition, these abstract object models will require mapping to the ZigBee Smart Energy Profile (SEP), to Web Services, and potentially to other standard protocols as appropriate for different configurations, environments, and migration from legacy systems. Object models developed under this task should be coordinated with IEEE Std P1679 - Recommended Practice for the Characterization and Evaluation of Emerging Battery Technologies in Stationary Applications.	Developed with continuous information exchange from Task 3. Each subtask completed within 3 months after the completion of the respective subtasks of Task 3. A TC57 WG17 CDV (Committee draft for vote) may meet this schedule.
Task 5: UL, NEC-NFPA70, SAE, and CSA will develop codes and test methods to ensure safe and reliable implementation of Tasks 3 within the residential-consumer, and commercial building-consumer domains.	Developed with continuous information exchange from Task 3. Each subtask would be completed within 6 months after the completion of the respective subtasks of Task 3.

7.6.2 Deliverables

Develop along with project team.

7.7 Who:

Project Team			
NIST Lead: Al Hefner			
EPRI Leads: Frances Cleveland, Mark McGranaghan			
SDO Leads:			
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Technical Team: …			

8 What: CIM for Distribution Grid Management (6.2.6, 11.6.1)

8.1 Abstract:

This work defines strategies for integrating standards for distribution operations across different environments. Strategies call for defining key applications and evaluating the available standards for meeting the applications. Field equipment can supply the raw data for objects and measured parameters used across the enterprise.

8.2 Description:

This work develops an approach for integrating the application level communications from three standards. The IEC 61968 and Multispeak provide the structure and semantics for integrating a variety of back office applications. The IEC 61850 standard provides a basis for field equipment communications and provides semantics for communications with field equipment including both real time operations as well as non-operational data such as condition monitoring. Integrating these standards provides a basis for powerful integration for both real time operations as well as support for a variety of back office applications.

8.3 Objectives:

- Develop strategies to integrate and expand IEC 61970-301, IEC 61968, Multispeak and IEC 61850 for Smart Grid applications
- Scalable strategy to integrate other identified standards
- Evaluate the contents of each standards for a Best fit to meet the requirements of key applications that span the environments of these standards
- Agree on an approach to integrate domain knowledge represented in each standard

8.4 Why:

This work can enable the effective integration of field equipment data and information with that used for enterprise back office systems. This integration can enable many new applications that may not be possible by just operating in one environment.

8.5 Where:

The integration of these standards would take place across the enterprise where field equipment operations need to integrate with back office systems. Several interfaces will be involved through the development of the standards that are targeted for their environment.

8.6 How:

The task will identify and/or develop key requirements and use cases that define the type of integration needed across these standards. This work is followed by analysis of the standards developed to date as well as work items in progress. This analysis should be used to identify synergy with the other standards and propose to build either a mapping or new extensions to existing standards. Preferable pathways are to minimize translation and reach agreement on shared or similar terms.

8.6.1 Task Descriptions

8.6.1.1 Task 1

Create UML model for MultiSpeak; but first, resources need to be indentified. The task has to be done by a MultiSpeak UML expert.

8.6.1.2 Task 2

Develop a team to investigate / develop tools to generate flexible messages / schemas from UML. That needs to be done by CIMIug CIM Tools WG and by MultiSpeak.

8.6.1.3 Task 3

Develop interoperability testing team. Needs to be done by UCAIug CIMug compliance and testing TF.

8.6.1.4 Task 4

CIM Modeling team (T. Kostic) will host a webcast for those interested to present status.

8.6.1.5 Task 5

Create a team to identify and develop Smart Grid focused master list of critical use cases. This shall be done by the T&D DEWG.

8.6.1.6 Task 6

The team created as result of task 5 shall create Smart Grid focused master list of critical Use Cases with suggested priority.

8.6.1.7 Task 7

The team shall based on the list and priorities defined in task 6 create and/or refined the Smart Grid use cases.

8.6.1.8 Task 8

WG19 Smart Grid TF shall review the use cases from task 7, confirm the priority and shall assign them to the appropriate WGs or other entities.

8.6.1.9 Task 9

The appropriate WG shall develop the requirements and build the models for the use cases assigned from Task 8. It is important that, in the case that a use case requires updates and extensions of models in e.g. both CIM and IEC 61850, that these updates are done in parallel and coordinated.

8.6.2 Deliverables

The deliverables are the following:

- UML model for MultiSpeak as result of task 1

- Master list of critical use cases as result of task 6
- New / refined use cases as result of task 7
- Updates of models as result of task 9

8.7 Who:

Project Team
NIST Lead: Jerry Fitzpatrick
EPRI Lead: ChristophBrunner, Grant Gilchrist, Frances Cleveland
SDO Leads: Greg Robinson, Gary McNaughton, Frank Goodman/Jean Goulet
SDOs: IEC TC57 WG10: Christoph Brunner, UTInnovation IEC TC57 WG13: Terry Saxton IEC TC57 WG14: Greg Robinson, Xtensible Solutions IEC TC57 WG17: Frank Goodman, SDG&E IEC TC57 WG19: Paul Skare, Siemens Paul.Skare@siemens.com IEC TC57 WG15: Frances Cleveland, Xanthus fcleve@xanthus-consulting.com IEEE Power Systems Relay Communications Committee: Miriam Sanders T&D DEWG: Joe Bucciero IEEE PES DAWG: Larry Clark, Georges Simard OGC: Louis Hecht MultiSpeak: Gary McNaughton
Users Groups: UCAIug: Mark Adamiak USB: Forrest Small
Technical Team:

8.8 When:

Task Description	Completion Date
Task 1: UML model for MultiSpeak	Q2-2010
Task 2: Team for UML tools	10/11-2009
Task 3: Team for interoperability testing	10/11-2009
Task 4: Webconference CIM Modeling team	Aug 12, 2009
Task 5: Create SG use case team	09-2009
Task 6: Use case master list	Q4-2009
Task 7: Use cases refined	Q2-2010
Task 8: Review and assign use cases	Q2-2010
Task 9: Develop models	continuous; all by Q4-2010

9 What: Standard DR Signals (6.2.1)

9.1 Abstract:

Develop or adopt standard DR and DER signals – NIST shall organize a meeting with IEC TC57, OASIS, NAESB, and AMI-ENT to specify a process for developing a common semantic model for standard DR signals. The effort shall ensure DR signal standards support load control, supply control, and environmental signals.

9.2 Description:

The semantics of Demand Response are generally well understood, but the information that is conveyed varies. Signals range from price, optionally with time of effectiveness, grid integrity, to proposed environmental signals (e.g. air quality).

Defining consistent signals for Demand Response will make the information conveyed more consistent as a signal flows from grid management through aggregators to customers and within premises networks. Some of the standards define business processes, while others define XML or other data models with a variety of delivery mechanisms.

The semantics for Distributed Energy Resources should fit into the same sort of signaling framework. This group will also develop a plan for DER signal definition.

9.3 Objectives:

Define a framework and common terminology for:

- Price communication,
- Grid safety or integrity signals,
- DER support, and
- Other signals and/or an extensibility mechanism.

9.4 Why:

Demand Response has evolved over the years; previous mechanisms included phone calls, pagers, and other messaging to plant managers; current mechanisms support varying levels of automation.

As technologies, such as Open Automated Demand Response, allow rapid and un-attended automation of curtailment based on price or grid integrity, consistent signals across the entire Demand Response signaling and validation chain have raised in importance. Consistent signals will allow further automation of the Demand Response chain, and improve the responsiveness as well as the value to all stakeholders.

Renewable and other intermittent resource integration increases the need for balancing reserve, spinning reserve, and other techniques for successful integration to take advantage of lower operating cost for renewables. However, the responsiveness of the entire power generation and delivery system needs to improve in correspondence with the extent and degree of intermittency.

Distributed Energy Resource integration raises interoperation issues related to distribution automation, signals and information exchanges, and profiles; some of these (e.g. storage) are being addressed specifically in other action plans.

Markets, Operations, Distribution, distribution-related capital costs, and the Customer domain are the primary areas affected, though all are affected to some extent.

9.5 Where:

This is primarily levels 4 (Semantic Understanding), 5 (Business Context) and 6 (Business Procedures) of the GWAC stack, though it involves most of the cross-cutting issues.

Security and privacy can be composed in; the focus of this activity is consistent semantics that work with business processes of today and those we cannot specify that may develop in the future.

9.6 How:

A broad range of stakeholders need to be involved, broadly from the distribution management and markets area, building automation, industrial automation, home automation and energy management, and vehicles.[3]

There are several formalized or standardized specifications in these areas that need to share common semantics where they overlap; we should aim at a high level rather than details that may not be relevant in cross-domain interactions and interoperation.

Since there are a number of existing bodies of work, a survey of relevant efforts and their overlap and gaps relative to DR/DER signaling would seem to be a good starting point.

Other issues:

- Should requirements analysis—what information needs to be exchanged for which use cases—be done as part of this process?
- When do we need a high-level light interface, versus deep integration?
- What are differences between ISO/RTO Demand Response and Distributed Energy Resource integration and the local utility counterparts?
- Can we incorporate ancillary (fast-DR) services in the signaling approach? Or is fast DR only applicable to deep integration that will support the short time scales?
- Measurement and verification need to be addressed for both curtailment and DER. How should we address in this process?

[3] Vehicles may interact with DR and DER signals primarily through their charging stations, but the characteristics will likely need to be expressed in profiles that include decision information for the vehicle owner, e.g., amortized cost of battery use to sell energy to the grid or a microgrid.

9.6.1 Task Descriptions

Developed along with project team and summarized in the following table. Dates are at the end of the indicated month.

Task	Responsible	Date	Notes
Define proper DER Interaction, Scope	Lunch table discussion; later readout to Action Team List	Input before 2009-10	x2G DEWGs, IEC TC57. Storage Models IEEE1547.3, NAESB PAP07 Outcome, PAP11 Elec Trans
Collect, Analyze, and Consolidate Use Cases and deliver UML (inc DER)	UCAIug, NAESB	2009-10	Incorporating OpenADR (Starting point for OASIS EITC). No Magic.
Message Semantics Work DR	OASIS EITC	Underway	Starting from OpenADR. Review by UNCIug, 1377, NAESB, BAE, SEP, TC57 CIM, Multispeak, others
Message Semantics Work DER	OASIS EITC	Convene by 2009-10	Input expected by 2009-10-31
Message Semantics Calendar, Price	OASIS EITC	2010-04	Output from PAP03, PAP04
Delver Semantics, Interactions for Initial review	OASIS EITC	2010-01	Leave hole for Price, Calendar
Downstream user requirements/engagement	LonMark, BACnet, ZigBee SEP2	2009-10	BACnet, LonMark, HES, x2G, UpnP, OpenHAN, ZigBee, SEP, oBIX, AHAM, UCAIug, NEMA
Additional message requirements for Distribution	MultiSpeak	2009-10	
Resale and process for safety and interconnection and resale	NAESB	2009-10	UL
Vocabulary	NAESB, UCAig, BACnet, LonMark	TWIKI ASAP 2009-09 to [UML]	Normalize OpenADR, NAESB, UCAIG, Place on TWIKI Deliver to OASIS EITC

9.6.2 Deliverables

Developed along with project team and summarized in the previous table.

9.7 Who:

The Task Leads (in alphabetical order by organization) are

Organization	*Contact*	*Email*
BACnet/ASHRAE	Sharon Dinges	sdinges@trane.com
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NAESB	Jonathan Booe	jbooe@naesb.org
OASIS	Laurent Liscia	Laurent.Liscia@oasis-open.org
UCAIug	Wayne Longcore	wrlongcore@cmsenergy.com
ZigBee SEP2	Robby Simpson	robby.simpson@ge.com

Other organizations identified, members of which suggested or committed to participation in the Action Plan:

AHAM	HES	NEMA	OpenHAN
B2G DEWG	I2G DEWG	No Magic, Inc	PAPs 3, 4, 7, 11
BAE Systems	IEC TC57	oBIX	Underwriters Laboratory
H2G DEWG	IEEE 1547.3, 1377	OpenADR/LBL	UpnP/WS-DD/DP

Invitees to the workshop breakout session included the following:

	Project Team	
Role	**Organization**	**Name**
NIST Lead	David Holmberg	David Holmberg David.Holmberg@NIST.gov
EPRI Support	Cox Software Architects TC9 Inc	William Cox wtcox@CoxSoftwareArchitects.com Toby Considine Toby.Considine@gmail.com
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9.8 When:

Schedules are indicated in the previous table. Most deliverables are input to the responsible organizations by the end of October 2009; others are as indicated.

10 What: Standard Energy Usage Information (11.1.1)

10.1 Abstract:

Customers will benefit from energy usage information that enables them to make better decisions about energy use and take other actions consistent with the goals of Section 1301 of EISA. In particular, consumers could make better decisions about emerging energy conservation/efficiency applications, including whether to change DR plans, or to take specific actions now in anticipation of future DR events. Distributed energy resources (DER), including energy storage, make timely information more important; bidirectional energy flows will make it critical. Unfortunately, today there is limited provision to share energy (electricity and gas) usage information directly with the residential, commercial, and industrial consumer. There are two dimensions to energy usage that include information/data and the dialogue/interaction where all interactions are based on the same representation of data. There are two different audiences for the data, which include humans and machines. The data is limited to energy consumption and does not include firmware configuration management. Additionally, there are no provisions that would make it possible for consumers to delegate access to their meter information to third parties for value-added services. Energy sales and purchases, including the non-price attributes of that energy, are the basic components of transactional aspects of the Smart Grid. A common, shared understanding of each transaction is essential to realizing he anticipated benefits of the Smart Grid. This information is fundamental to innovation in the use and management of energy in the industrial, commercial building, and residential sectors. This PAP addresses the definition and standardization of this information.

10.2 Description:

Shared responsibility for balancing energy production and consumption requires shared access to information about energy markets and actual use. Price is a common abstraction for market conditions, including abundance, scarcity, and quality. Energy qualities include reliability, power quality and source (hydro-electric, wind, solar, coal …).

Sharing present information with the energy consumer makes energy use real in a way that after-the-fact billing never can. Customer-focused energy management is hindered by limited access to information and this, in turn, by the lack of information standards. National information standards will create worthwhile markets and automation of energy-use decisions. This automation will be a platform for innovation in energy use.

In the near future, energy source may be as important as energy price in influencing consumption decisions in some scenarios. Consumers may wish to make decisions based upon the energy source or to qualify for carbon credits. As these markets develop, the variability of product availability will increase, the complexity of decision-making will increase, and the value of products that personalize, visualize, and automate responsive energy use will grow.

The official recorder of market transactions is the meter. Information about consumption of energy can be provided from the meter, but is also available at other points such as energy delivery systems, such as the utility or aggregating service provider, and consumer devices[4].

[4] All communications with the meter must be limited or constrained to preclude any inappropriate interactions or effects on the underlying systems.

Well defined information models are essential to establish the basis for services and behaviors based on the content of these models.

It is anticipated that initial uses of this information model will come from the utility service provider to the consumer via the worldwide web, or public Internet, and approaches to accessing information directly from meters. However, as the Smart Grid develops, new opportunities will leverage real-time information on energy use and energy pricing. A robust model of such information should be invariant and scalable and extensible to the mechanism and timing of acquisition. Hence, this plan envisions development of such a flexible model as can be exposed via the communications standards in place in the home, business, distribution system, and enterprise.

Hence, this plan envisions development of such a flexible model as can be exposed via the communications standards in place in the residential, commercial, and industrial, distribution system, and enterprise.

This effort will overlap with and support information standards for load curtailment, load shaping, and energy market operations.

10.3 Objectives:

- Develop a summary of information needs for various means of customer information access about metering and billing.
- Develop short term plans for near-term customer access to usage data based upon today's installed meters.
- Develop composite information model that can be easily transformed without loss for transport via standards in OASIS, IEC61970/61968, IEC61850, ANSI C12.19/22, AHRAE 135, and ZigBee.
- Development and implement a plan to expedite harmonized standards development and adoption within the associated standards bodies.

10.4 Why:

Attempts at encouraging consumers of electricity to conserve are greatly assisted by providing feedback as to actual energy use. Energy consumers will more accurately respond to curtailment signals if they can track actual energy use while testing scenarios in advance. Consumers may need to observe actual usage at intervals shorter than are maintained within provider billing systems. Premises-based distributed energy resources will require transparent common metrics on both sides of the meter.

Today, curtailment and peak prices are computed and presented a limited number of times each year. As the proportion of alternative energy sources on the grid rises, and as more energy comes from intermittent sources, the desirable frequency and scale of these events will increase. New electric loads, such as electric vehicles, will increase the need for and benefits of coordinating electricity use and introduce new load characteristics and timing.

Shared access to live energy transactions, both usage and price, is an enabler of many aspects of the Smart Grid. A common information exchange model for usage, price, and other energy information would enable consumers, building-based systems, and third parties to collaborate with energy suppliers.

The Smart Grid anticipates new business models that will increase the importance of sharing energy usage information. Premises-based, distributed energy resources may change the net flow of energy from moment to moment. Retail resale of energy may be part of future green leases and plug-in electric vehicle (PEV) support.

There are many competing standards efforts already under way in this area. ANSI C12.19 (2008) has a new "decade"[5] that supports pricing information at the meter. The OASIS Energy Interoperability TC looks to build upon the California Energy Commission (CEC) OpenADR specification to create data and communications models for the interoperable exchange of dynamic price, reliability, and emergency signals as well as informationon on market participation and load predictability and generation. IEC 61850-7-420 has pricing and consumption models for use in distributed energy resources (DER). Without coordination, there will be multiple dissimilar standards and limited interoperability. Incompatible data models can result in information loss when translated or mapped between standard representations. Additionally, duplicative complexity will add to costs borne by consumers and providers of energy management services. Limited interoperability will hinder the development of markets impede innovation.

10.5 Where:

The energy transaction is the informational hand-off within and between adjacent domains in the Smart Grid, just as the meter is the hand-off within and between domains. Shared energy-transaction information is essential to interactions between:

- Distribution and the industrial, commercial, and home premise;
- The service provider and industrial, commercial, and home premises;
- Distributed energy resources and all other domains; and
- Plug-in electric vehicles.

10.6 Who:

Project Team Leads
NIST Leads: David Wollman david.wollman@nist.gov Tom Nelson thomas.nelson@nist.gov
Action Plan SDO/User Groups Leads: OASIS: James Bryce Clark jamie.clark@oasis-open.org IEC TC57 WG14: Greg Robinson Xtensible Solutions grobinson@xtensible.net IEC TC57 WG15: Frances Cleveland, Xanthus fcleve@xanthus-consulting.com ANSI C12.19: Paul Orr, NEMA pau_orr@nema.org ZigBee/HomePlug Alliance – SEP Michael Stuber, ITRON michael.stuber@itron.com ASHRAE BACnet. Dave Robin, Automated Logic drobin@automatedlogic.com UCAIug, OpenADE Committee, Dave Mollerstuen dmollerstuen@tendrilinc.com – dmollerstuen@tendrilinc.com, UCAIug, OpenSG Chris Knudsen, PGE • Convener volunteer
Stakeholder Leads

[5] ANSI C12.19 groups information available from the meter into "decades" of tables of detail on an individual subject area such as measurements, load profile, pricing, etc…

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10.7 How/When:

Task	Responsible	Date	Notes
OBJECTIVE 1: Develop a summary of information needs for various means of customer information access about metering and billing. Develop requirements as quickly as possible, then reach out to SDOs to vet them and look for harmonization.	UCAIug – OpenSG, Smart Grid Enterprise (Chris Knudsen)	October, 2009	6 months for requirements with UCAIug, map models (ADR, SEP) against CIM. OpenSG has done a lot of this. SGEnterprise is the lead group within OpenSG for consistent usage of information across different domains. All documents are open and free, but there is a membership/participation fee. Participation fee is $200 individual, $5k corporate. High

			vendor/utility participation ratio. October release is first complete draft of requirements. Requirements are close to complete and there is a document available for comment now. Issued under “Creative Commons License” (royalty free)
Reach out to ANSI C12, IEC (61850), ZigBee, and OASIS SDOs to get them formally involved in the existing UCAIug process as members of the “Tiger Team”	UCAIug – OpenSG, Smart Grid Enterprise	Immediate	Already have IEC, Zigbee, and some OASIS members that are part of the UCAIug. Need to get affirmative involvement of PAP target SDOs – OASIS, IEC 61850, IEC 61968, ANSI C12.19, ZigBee SEP 2
Have meeting in October with all the different stakeholders	NIST	October, 2009	NIST meeting to check on progress of this effort against PAP10.
Develop a statement of support for extending their process to incorporate inclusion of additional stakeholders into their existing process.	UCAIug – OpenSG, Smart Grid Enterprise	Immediate	
OBJECTIVE 2: Develop short term plans for near-term customer access to usage data based upon today’s installed meters.	UCAIug	January, 2010	Work to be done such that at least minimal definitions are stable at this date.
Manage under same ground rules as Objective 1 tasks.	UCAIug		
OBJECTIVE 3: Develop composite information model that	UCAIug - OpenSG	January, 2010	There is some homework that needs to be done. 61850 being looked at to be

can be easily transformed without loss for transport via standards in OASIS, IEC61970/61968, IEC61850, ANSI C12.19/22, AHRAE 135, and ZigBee SEP 2			put in UML. Don't have the details of this right now. The extended CIM is being developed with the WSDLs by January.
Manage under same ground rules as Objective 1 tasks.	UCAIug		
OBJECTIVE 4: Development and implement a plan to expedite harmonized standards development and adoption within the associated standards bodies.	TBD		Need to wait on this until requirements are defined and it has been discussed within the PAP10 group.
For each SDO and the PAP stakeholders, UCAIug will provide a proposed plan for conveying the result of Objective 3 to the SDOs – CIM, 61850, OASIS, ANSI C12.19, ZigBee SEP 2	UCAIug	October, 2009	

11 What: Common Object Models for Electric Transportation (6.2.4)

11.1 Abstract:

The introduction of mobile Plug-in Electric Vehicles (PEVs) to the grid creates some interoperability challenges around exchanging price, Demand Response (DR), and settlement information. The impact of PEVs on the grid is expected to be significant, and the ability to control the charging profiles through price or direct control, the possibility of allowing customers to sell PEV electricity back into the grid, and complexity of providing fair settlement to everyone in the value chain when vehicles charge away from their home base, requires common object models to manage all these aspects of mobile bi-directional charging devices.

11.2 Description:

As PEVs move from area to area, a common interoperable model for price, DR events, energy characteristics for dynamic pricing across markets, signals for curtailment, and distributed generation resources will allow information supporting these uses to flow through the smart grid. In addition, a system is needed to determine how costs and payments for PEV are settled.

Several critical points are listed below:

1) PEV mobile loads will stress the existing distribution infrastructure. By using PEVs as electric storage during high demand periods, some of this stress can be offset. Models will resemble the existing electric storage models with the addition of parameters related to the mobile nature of EVs. Similar approaches to those used for non-mobile loads point to two related gaps: a common model for Demand-Response signals (grid safety, and pricing for demand shaping), and a common model for price, energy characteristics, and time for use. There are alternatives, including very specific demand control mechanisms, but the benefits of applying economic demand shaping appear to be much greater, particularly given the growth of Demand-Response use in other customer areas.

2) PEVs can act as both a load and power source. The impact of PEVs on planning and managing the distribution system and the potential impact of mass numbers of PEVs on system protection must be considered.

3) Models for settlement of PEV energy costs and payments are developing slowly, and there are technical and policy/regulatory barriers. Some proposals support billing the PEV owner's home utility. Others suggest a simpler model similar to current gasoline stations. Still others suggest a mixture of prepaid and billed services, similar to cellular phone payment models.

11.3 Objectives:

1) Extract interface requirements from enhanced and polished use cases (based on SAE and NIST workshop Use Cases). This includes recognizing the architecture of actors and messaging, settlement mechanism.
   a) What is the appropriate mechanism for PEV settlement? Is it similar to the clearinghouse concept used by banks and media, where a third party batches orders each evening and divides the transaction values across all the parties

involved? Is the transaction tied to the PEV owner or the vehicle? Or, is the traditional gas station model using credit cards a process to build a model around?

b) Distribution Management Systems (DMS) must be able to communicate with PEVs to influence charging profiles and discharging incentives through price signals or direct control signals.

c) Determine whether vehicle needs to explicitly send charging requirements information to the "grid".

d) Architectural decisions should be flexible enough to accommodate varying regulatory requirements. E.g. PEVs may require sub-meters for roaming or if tariffs are developed that treat them separately from the rest of customer loads. This would involve policies, regulations, and testing and a decision whether existing standards for metering and retrieving metered data are adequate for PEVs. Note that ANSI C12.19 has a robust metering model.

2) Draft high level information model in UML.
3) SAE is developing the PEV information exchange requirements, but will look to other SDOs to develop the object models to reflect these requirements. Therefore, IEC 61850-7-420 for Distributed Energy Resource (DER) equipment should be extended to include PEV object models, as well as other related object models. IEC 61850-7-420 for DER currently addresses photovoltaic systems, fuel cells, diesel generators, batteries, and combined heat and power (CHP), with wind covered by IEC 61400-25. ANSI C12.19/22 defines object models for revenue quality metering. ZigBee SEP 2 defines models for HAN environment.
4) IEC 61968 (Distribution CIM) needs DER and PEV information models, but should be harmonized with the existing DER object models in IEC 61850-7-420, as well as all on-going DER 61850 development such as with PEV object models. In addition, IEC 61850-7-420 has architectural issues to be addressed and then needs to be described via System Configuration Language (SCL) specifications for PEVs.
5) The Regulators should be asked to review the current regulatory electricity resale rules and metering requirements that will be impacted by roaming and ancillary service market support. Current regulations do not permit the resale of electricity as it is received in real-time by a customer, but if stored electric energy could be resold later, then this would open a new market. In addition, the current regulations would require that all accounting and cross-utility settlement issues would have to be managed by utilities or energy service providers, thus posing an enormous burden on them to manage these new complex accounting and settlement processes. On the other hand, if regulations were to change, the accounting model could change dramatically, and normal retail methods could be used or outsourced to credit card companies and other retail accounting providers.
6) Similar to the IEEE 1547 electrical interconnection standards for DER, there may be a need for electrical interconnection and safety standards for chargers and discharging, as well as a weights and standards certification and seal for charging/discharging.

11.4 Why:

One of the key cornerstones of the current administration's energy opinion is to encourage PEV manufacturing and use to reduce the degree of dependence on foreign oil. In order for this to occur at the levels being discussed and support DR functions, PEVs need to interoperate with the grid's distribution system and have a mechanism for allowing mobile consumers to pay the appropriate electricity vendors for energy.

If the common object model development are not resolved in short order, the speed of PEV charging infrastructure build out (and therefore PEV adoption) will be reduced as, the ability to drive and charge/discharge across utility boundaries will be complex or impossible, and the ability to incorporate PEVs into the overall distribution management strategy will be speculation. This affects a broad number of stakeholder groups including consumers, utilities, regulators, and environmental NGOs.

If the speed of PEV adoption is stymied, goals for PEV use to reduce foreign oil dependence and greenhouse gas emission reductions may not be met.

If mass numbers of PEVs enter the market due to government pressure on American automakers without proper standards in place, it is hard to predict what effect it will have on the management of distribution activities. At the best, it will be difficult to manage charging (and possibly discharging) profiles. At the worst, it could negatively impact grid reliability and consumer prices for electricity. Also the ability for consumers to purchase electricity for a vehicle when they are outside their utility's jurisdiction could be quite problematic, discouraging consumers from purchasing PEVs and promoting electricity theft when there are no standard (legal) means for getting it.

11.5 Where:

System interactions:

- Demand Response
- Operations
- Markets

11.6 How:

11.6.1 Task Descriptions

Develop along with project team.

11.6.2 Deliverables

Develop along with project team.

11.7 Who:

Project Team
Project Team Leads
NIST Leads: Eric Simmon NIST eric.simmon@nist.gov
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Action Plan SDO Leads: SAE George Bellino General Motors george.bellino@gm.com ANSI C12.19 Ed Beroset ABB edward.j.beroset@us.abb.com NEMA Ben Biroschak NEMA IEEE John Boot Current Group jboot@currentgroup.com SAE, ZigBee SEP Mike Bourton Grid2Home mikebourton@grid2home.com IEC TC57 WG19 Jay Britton Areva jay.britton@areva-td.com IEC TC57 WG17 Jean Goulet Hydro Quebec / IREQgoulet.jean@ireq.ca SAE Liang Huang Pacific Gas & ElectricL1Hg@pge.com SAE Michael Kitner-Meyer Pacific Northwest Labmichael.kitner-meyer@pnl.gov SAE Arindam Maitra EPRI AMaitra@epri.com SAE Dan Mepham GM dan.mepham@gm.com IEC TC57 WG14 Greg Robinson Xtensible grobinson@xtensible.net SAE Jose Salazar SCE Jose.Salazar@sce.com SAE 2293 Rich Scholer Ford rscholer@ford.com SAE Efrain Ornelas Pacific Gas & ElectricExO1@pge.com Zigbee SEP Robby Simpson General Electric Energy robby.simpson@ge.com IEC Paul Skare Siemens Paul.Skare@siemens.com SAE Nathan Tenney Pacific Northwest LabNathan.Tenney@pnl.gov
Stakeholder Leads
Other SDO Representatives:
Users Groups: UCAIug Wayne Longcore, Consumers Energy wrlongcore@cmsenergy.com Service Providers: Utilities & Energy Services:

11.8 When:

Task Description	Completion Date
Task 1: Extract interface requirements from enhanced and polished use cases (based on SAE and NIST workshop Use Cases). This includes recognizing the architecture of actors and messaging, settlement mechanism. (12/09) • List all use cases and aggregate in common format. (09/09) • Sort between near term and longer term (09/09)	12/09 EPRI (Arindam Maitra)

• Polish use cases (09/09) • Complete set of use cases (12/09)	
Task 2: Draft high level harmonized (CIM/61850) information model in UML (2/10) • Base line Object Model (10/09) - Already in process in ZigBee SEP 2 • Evolve robust Object models after use cases and requirements are resolved (2/10) – Dependent on Task 1 completion	02/10 ZigBee SEP (Greg Robinson / Robby Simpson)
Task 3: Overcome collaborative impediments between standards bodies. (8/24/09) - Need to involve stakeholder SDOs in this process affirmatively. Involve Mathew Ulsar (OPUS) / Greg Robinson from WG 14 who is responsible for integrated DER into CIM. Accellerate these existing processes. TC57 WG17 (Jean Goulet). ANSI C12.19 (Ed Beroset). • Get SAE / SEP 2 into a collaboration meeting to plan the CIM / 61850 PEV. (8/24/09) - Need to resolve IP policy issues that currently precludes sharing of information from ZigBee to SAE prior to meeting.	08/24/09 SAE (Jose Salazar)
Task 4: Take the UML model and create a standards specific view of the model for 61968/61850. They will form the basis of the standards documents. (12/10) - Involve Mathew Ulsar (OPUS) / Greg Robinson from WG 14 who is responsible for integrated DER into CIM. Accellerate these existing processes. TC57 WG17 (Jean Goulet). • Produce 61968 and 61850 documents for circulation at IEC (12/10) - May need to assess / refine UML model as needed	12/10 TC57 WG 14,17,19
Task 5: Review the current regulations / use case conflicts to determine areas where they need to be changed. Interface with regulators to discuss barriers observed. • NIST may need to help facilitate. (George Bellino)	TBD NEMA (Ben Biroschak)
Task 6: Coordinate standards activities for electrical interconnection and safety standards for chargers and discharging, as well as a weights and standards certification and seal for charging/discharging. - UL, SAE, IEEE, NEC,NEMA	TBD SAE (Efrain Ornelas)

12 What: IEC 61850 Objects/DNP3 Mapping (6.2.2)

12.1 Abstract:

DNP3 is the de facto communication protocol used at the distribution and transmission level. However, DNP3 does not possess all of the desirable attributes for use in the Smart Grid. A means must be found to enable transport of Smart Grid management functions over these legacy DNP3 networks.

12.2 Description:

The DNP3 protocol was designed for low-bandwidth SCADA operations. Data acquisition consists of anonymous instances from three object classes: binary inputs, analog inputs, and counters. Supervisory control consists of commands to instances of the classes of binary points and analog points. Although this protocol allows any DNP data to be transported between any two points, the semantic content of the messages depends upon lists of tables, which are not machine readable.

The desire is to ensure that seamless transport of situational semantics can flow between devices, even when the communication is constrained by the DNP3 protocol.

Mapping of objects in each direction presents different challenges.

12.3 Objectives:

- Agree upon a consistent algorithm to map a selected subset of IEC 61850 object to a corresponding DNP3 object.
- Provide a method to map between DNP3 objects and IEC 61850 objects. Because DNP3 uses less-specific semantics than IEC 61850, this is only an approximate mapping. The DNP3 specification (Volume 8 clause 8.4 and its Appendix 1 clause 2) presents the approach recommended by the DNP3 Technical Committee, which uses XML to perform this mapping. This DNP mapping approach is referenced in Annex E of IEC 61400-25-4.

12.4 Why:

Although DNP3 is the dominant SCADA communication protocol in the USA, it lacks some of the features envisioned for the Smart Grid. A mapping between 61850 and DNP3 will allow presently communicated SCADA information to be used in new ways, while also providing the ability to create new applications while using the existing DNP3 infrastructure.

This will enable the addition of new control and monitoring functions to be used with legacy DNP3 equipment while still providing a solid path to a full IEC 61850-based communications system in the future. Furthermore, the integration issues between the two types of systems will be minimized by a consistent mapping solution.

If a mapping between these two protocols is not accomplished, then existing DNP3 systems will need to be modified in an ad-hoc fashion to integrate each new control and monitoring function. If the legacy DNP3 system is ever replaced with a IEC 61850 system, then the entire

communication network would need to be replaced at the same time. This would cause enormous additional expense and disruption to any existing applications.

The impact of the mapping will affect all users of data presently sourced by DNP3 devices. System planners and grid operations management would be among the stakeholders most affected.

12.5 Where:

Transmission and distribution domains at the application layer.

12.6 How:

The integration of DNP3 and IEC 61850 systems will be accomplished by the insertion of protocol translators at the Master/Client side. In general, these protocol translators will consist of a configurable software module.

The key problem is that this configuration must be made as automatically as possible in order to reduce the possibility of injection of translation errors into the system.

Both DNP3 and 61850 use XML files for configuration, but these files contain different types of information. On the DNP3 side, the XML file contains a one-to-one mapping of DNP3 objects to 61850 object attributes. On the IEC side, there is also a one-to-one mapping of the data attributes to a (type-less) “short address”. The missing piece is the algorithm needed to transfer the data value and data semantic between the system.

Adding the information to DNP3 XML files is a possibility, although the DNP3 XML format forbids extensions which are not built into the DNP3 specification. Here DNP3 has the advantage wherein the specification can be extended without lengthy balloting reviews.

Adding the information to the IEC XML file is actually much simpler because multiple extension rules are built into the 61850 System Configuration Language (SCL) standard. One set of extension rules, known as “private data”, allows new (usually vendor-specific) information to be added almost anywhere within SCL. Another set of rules, “extension schemas”, allows more targeted extensions.

It is unknown at this time which extensions to each of the XML file format will yield the optimal object transfer mechanism.

12.6.1 Task Descriptions

12.6.1.1 Task 1

Define the Use Cases for transfer of information. The Use Cases will begin with DNP devices throughout the system and add 61850 devices at various points in the system. Data transfer needs will be developed for each Use Case

12.6.1.2 Task 2

Gap Analysis: Identify to what extent DNP XML supports the use cases and what the gaps are. It is understood at the outset that 61850 supports much richer data semantics which will not be transferrable to a 61850 system

12.6.1.3 Task 3

Identify how 61850 SCL can make the external reference to DNP3 objects. 61850 presently support a “sAddr” field, but this might not be able to contain enough information to provide a complete mapping to DNP3

12.6.1.4 Task 4

Gap Analysis: Verify how SCL could support all use cases. Verify that SCL mechanisms exist to perform the entire mapping of semantics to DNP3

12.6.1.5 Task 5

Define rules for associating DNP XML and 61850 SCL in supporting use cases. External reference to DNP Objects (Mapping points in DNP up to 61850 object models, so we don’t duplicate that file in the SCL file). Ensure that mapping in both directions is complete.

12.6.1.6 Task 6

Develop Guidelines for use of 61850 and DNP integration strategies. Need to provide guidance to users on how to choose optimal migration straegies.

12.6.1.7 Task 7

Create Example DNP XML file mappings. The example DNP XML file will illustrate most of the object conversion issues as possible in a single file.

12.6.2 Deliverables

The following deliverables are identified as result of these activities:

- Use case diagram
- Gap analysis in the existing XML file formats
- Extension rules and needs for both XML files
- Guidelines on integration strategies
- Example DNP (and SCL) configuration files

12.7 Who:

Project Team Leads
NIST Lead: Jerry FitzPatrick gerald.fitzpatrick@nist.gov Tom Nelson thomas.nelson@nist.gov
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Stakeholder Leads
Other SDO Representatives: DNP Technical Committee: Barry Shephard barry.shephard@grontmij.co.uk UCAIug Testing Committee: Bruce Muschlitz bruce@EnerNex.com IEC TC57 WG10 Barry Shephard barry.shephard@grontmij.co.uk IEC TC57 WG03: Wolfgang Brodt wolfgang.brodt@siemens.com UCAIug 61850 Technical Group: George Schimmel gs@trianglemicroworks.com
Users Group Leaders: DNP User Group: Jim Coats jcoats@trianglemicroworks.com UCA International Users Group: Kay Clinard Clinardkay@aol.com Utility Representatives: Rick Murphy murphyr@FirstEnergyCorp.com

12.8 When:

Task Description	Completion Date
Task 1: Define Use Cases	2009-10
Task 2: Gap Analysis: Identify to what extent DNP XML supports the use cases and what the gaps are	2009-12
Task 3: Identify how 61850 SCL can make the external reference	2009-12
Task 4: Gap Analysis: Verify how SCL could support all use cases	2009-12
Task 5: Define rules for associating DNP XML and 61850 SCL in supporting use cases?	2010-03
Task 6: Create Example DNP XML file mappings	2010-05
Task 7: Develop Guidelines for use of 61850 and DNP integration strategies	2010-06

13 What: Time Synchronization, IEC 61850 Objects/IEEE C37.118 Harmonization (6.1.2, 6.2.2)

13.1 Abstract:

IEC 61850 has been substantially developed for substations but is seen as a key standard for all field equipment operating under both real-time and non-real time applications. It shall be possible in the future to use IEC 61850 as well to transmit Phasor Measurement Unit data and information according to IEEE C37.118 standard.

Common time synchronization will be a key for many Smart Grid applications. Guidelines on how to achieve that synchronization and addressing different issues related to that synchronization are required. The IEEE 1588 standard will be a key element to achieve that synchronization.

13.2 Description:

Two Standards are related to communications of phasor measurement unit (PMU) data and information. IEEE C37.118 was published in 2005 for PMUs. IEC 61850 has been substantially developed for substations but is seen as a key standard for all field equipment operating under both real-time and non-real time applications. The use of IEC 61850 for wide-area communication is already discussed in IEC 61850-90-1 (Draft technical report) in the context of communication between substations; it is only a small step to use it as well for transmission of PMU data. The models for PMU data need to be defined in IEC 61850. This work item seeks to assist and accelerate the integration of standards that can impact phasor measurement and applications depending on PMU-based data and information.

With IEEE 1588, a standard is available to achieve highly accurate synchronization over a communication network. Several applications related to Smart Grid require time synchronization. Several aspects need to be considered like loss of synchronization, dealing with synchronization islands and resynchronization. Calendar models are required. Check for alignment with 8601. Also, other mechanisms for time synchronization such as GPS or IRIG-B are discussed.

13.3 Objectives:

- Develop contributing technical work to integrate IEEE C37.118 and IEC 61850 under a Dual Logo Standard.
- Participate with SDO working groups to work out technical issues related to the standard integration.
- Support prototyping activities
- Interoperability demonstrations of prototypes (plugfest)
- Validate detailed requirements from Smart Grid applications using common time synchronization and time management.
- Develop, in cooperation with SDO working groups, guidelines for application and role-based time synchronization.

- Develop contributing technical work to prepare standard profiles for IEEE 1588.
- Ensure NASPI-NET and NERC timing requirements are encompassed by work of this group
- Resolve differences between time stamp format and time semantic of C37.118 and 61850 (perhaps add a second timestamp to message)

13.4 Why:

Integrating IEEE C37.118 with IEC 61850 will help to remove overlaps between the standards, which may impede development of interoperable equipment and systems.

IEEE C37.118 is intended to support applications, for example, protection, etc. IEC 61850 is suitable for system-wide applications that require higher publishing rates.

A standards-based approach for time synchronization that addresses the requirements from all applications will support interoperability and facilitate implementation of new Smart Grid applications.

13.5 Where:

IEC 61850 supporting PMU data based on C37.118 will be used between devices exchanging phasor measurement data. The interfaces are within PMU's, relays, master stations, and other equipment involved in phasor measurement monitoring and/or applications based on PMU measurements.

Time synchronization is required across all applications for a Smart Grid.

13.6 How:

For the integration of PMU data based on IEEE C37.118 into IEC 61850, a new work item has already been issued as a joint work item for IEEE and IEC. The work has been circulated within IEC TC57. It is assumed that within IEC, a task force as part of working group 10 will be created to support that work from the IEC side. In IEEE, the PSRC H11 WG is responsible for C37.118. These will be the key SDOs for that part of the work.

From a procedural viewpoint, the integration of PMU data into IEC 61850 cannot be considered as a independent standard. Integration will affect several parts of the existing IEC 61850 standard. Therefore, it is recommended to develop in a first step a technical report (similar to IEC 61850-90-1) that addresses all the issued related to the problem.

While the final responsibility of the work will be in the joint IEEE/IEC task force, this work can contribute technical work to the SDO, can interact with the stakeholders like NASPI, and can support demonstration activities.

For the time synchronization, the IEEE PSRC WG H7 is already working on developing a profile for accurate time synchronization for power system applications. This work is supported by IEC TC57 WG10, so no harmonization is required here. The current activities in the WG are driven on one side by the requirements from PMU and on the other sides by the requirements fro an accurate synchronization of instrument transformers in a substation that are transmitting sampled values as stream of data towards protection and control applications.

This work shall interact with the IEEE working group by developing the requirements for the different applications of Smart Grid, by contributing technical work and by supporting demonstration activities.

13.6.1 Task Descriptions

13.6.1.1 Task 1

Create a document discussing the requirements to transport synchrophasor data including NASPI-NET requirements. This shall be an input for the first meeting of the IEC / IEEE task force to harmonize IEEE C37.118 with IEC 61850. The document will be prepared by Mark Adamiak.

13.6.1.2 Task 2

Prepare a report with IEC 61850-90-x "Using IEC 61850 to transmit synchrophasor data according to IEEE C37.118". The report shall include the following chapters:

- Requirements / Use case
- Impact on models (IEC 61850-7-4x)
- Impact on communication services (IEC 61850-7-2, -8-1, -9-2)
- Impact on engineering

That report will be prepared by the joint task force IEC / IEEE under the lead of Ken Martin.

13.6.1.3 Task 3

Organize rapid prototyping efforts for synchrophasors and interoperability demos. This shall be done during a NIST meeting.

13.6.1.4 Task 4

Finish within IEEE PSRC working group H7 the IEEE PC 37.238, IEEE 1588 (Precision Time Protocol) profile for power systems.

13.6.1.5 Task 5

Do Interoperability demos of products following the IEEE 1588 profile defined by IEEE PSRC H7. This is planned for the next PSRC Meeting in September 2009 as well as for the January 2010 PSRC meeting.

13.6.1.6 Task 6

Validate the detailed requirements from Smart Grid applications on common time synchronization and time management and verify, that they are covered by IEEE PSRC H7 work. The responsibility for this task is NIST.

13.6.1.7 Task 7

Resolve the differences between timestamp formats of 61850 and C37.118. The result shall go in the report according to task 2. Responsible for this task is IEC TC57, WG10.

13.6.1.8 Task 8

Create amendments to IEC 61850 based on the results from report IEC 61850-90-x that is the result of task 2. This will be done by IEC TC57 / WG10.

13.6.1.9 Task 9

Create a testbed for IEEE 1588 and Synchrophasor communication at NIST.

13.6.2 Deliverables

The following deliverables are identified as result of these activities:

- a report IEC 61850-90-x as result of task 1, 2 and 7
- demonstrations of prototypes for synchrophasor transmission using IEC 61850 and of time synchronization (task 3 and task 5)
- IEEE PC37.238 as result of task 4; consider possible updates from task 6
- Amendments to IEC 61850, Edition 2 as result of task 8
- Testbed for IEEE 1588 and synchrophasors at NIST

13.7 Who:

Project Team
NIST Lead: Jerry Fitzpatrick
EPRI Lead: Christoph Brunner
SDO Lead: Christoph Brunner Convenor IEC TC 57 WG 10 (IEC 61850)
Other SDOs: IEEE PSRC H11 Committee Chair Ken Martin kemartin8421@comcast.net. IEEE PSRC H7 Committee Chair Bill Dickerson and Galina Antinova IEEE PSRC H3 Committee Chair Bill Dickerson IEEE Power Systems Relay Committee, Communications Subcommittee: Veselin Skendzic IEC TC57 WG19: Paul Skare Paul.Skare@siemens.com IEC TC57 WG15: Frances Cleveland, Xanthus fcleve@xanthus-consulting.com IEC TC38 WG37: Pascal Tantin IEEE PSRC H4 C37.111 COMTRADE: Ratan Das NERC CSSWG: Mark Engels
Users Groups: UCAIug: Mark Adamiak
Technical Team:

NASPI, Performance and Standards Committee, Vahid Madani, VxM6@pge.com NASPI, Alison Silverstein Alex Apostolov (Member IEC TC57, WG10, 19, IEEE PSRC H7)

13.8 When:

Task Description	Completion Date
Task 1: Requirement document for Synchrophasors	September 7, 2009
Task 2: IEC 61850-90-x	Draft DC 2010-01 Draft DTR 2010-05
Task 3: Synchrophasor demo	July 2010
Task 4: IEEE PSRC H7 guideline	Jan 2010 ready for balloting
Task 5: Interop demo 1588	Sept 2009
Task 6: Validate time synchronization requirements	Oct 2009
Task 7: Differences in time stamps C37.118 / IEC 61850	Nov 2009
Task 8: Amendments to IEC 61850	Jan 2011
Task 9: NIST Testbed	Mar 2010

14 What: Transmission and Distribution Power Systems Model Mapping (11.2.1)

14.1 Abstract:

This work defines strategies for integrating standards across different environments to support different real-time and back-office applications. Strategies call for defining key applications and evaluating the available standards for meeting the requirements of such applications. Modeling of the electric power system, multifunctional IEDs, and definition of standard methods for reporting events and exchanging relay settings will meet the requirements for improvements of the efficiency of many protection, control, engineering, commissioning and analysis tasks. Field equipment can supply the raw data for objects and measured parameters used across the enterprise based on the standard models and file formats defined.

14.2 Description:

Advanced protection, automation, and control applications will benefit from a utility-wide communication infrastructure. The information requiorements of these Smart Grid applications must be identified and standardized to the level required to achieve interoperability. Use cases describing the application are the basis for this. Information needs then must be mapped to the existing transmission and distribution power system models. The existing models need to be extended where required.

This work develops an approach for integrating the application-level communications from several standards. The IEC 61850 standard provides a basis for field equipment communications and provides semantics for communications with field equipment, including real- time operations as well as non-operational data, such as condition monitoring. The IEC 61968 and IEC 61970 provide the structure and semantics for integrating a variety of back office applications. The models of the transmission and distribution power system are available in IEC 61970 and IEC 61968-11. Some of the information to be added may be retrieved from devices supporting IEC 61850. Some of the Smart Grid applications that need this information may reside in devices supporting IEC 61850. Therefore, an extension of the IEC 61850 models may be required as well.

An automated verification of the different settings of the components of a power system will be essential in the future to prevent system failures due to misconfiguration that may lead to blackouts. In order to make these applications possible across the power system, standardization of the setting information is required. In addition to setting information of the individual devices, these applications also may require enhanced information about the power network, such asline characteristics or topology. IEEE PES PSRC Working group H5 is in the process of completing the protection settings object models and defining a common data format for exchange between applications.

Other standards to be considered are IEEE PC37.239, whichhat defines a Standard Common Format for Event Data Exchange (COMFEDE) for Power Systems, and IEEE PC37.237, which defines a Recommended Practice for Time Tagging of Power System Protection Events.

14.3 Objectives:

- Develop strategies to expand and integrate MultiSpeak, IEC 61850, IEC 61968, IEC 61970, IEEE PC37.237 (Time Tagging), IEEE PC37.239 (COMFEDE) and the future IEEE Common Settings file format for Smart Grid Applications.
- Develop a summary of information required from the power system for various Smart Grid applications. – covered by PAP 08 Tasks
- Map that information with the already defined models from MultiSpeak, IEC 61970, IEC 61968-11, and IEC 61850. – covered by PAP 08 Tasks
- Coordinate with the SDO to extend the existing models. – covered by PAP08 Tasks
- Identify setting information that is required to perform an automatic verification of the power system configuration to prevent failures due to mis configurations. This information shall include both settings in the devices as well as parameters of the power network that need to be available for verification. – long-term issue (two-year effort) and is Use Case-based; step one: IEEE group work PSRC H5; key: how can we do setting verification?
- Coordinate with the SDO to extend the existing standards with that information.

14.4 Why:

This work can enable the effective integration of field-equipment data and information with that used for enterprise back-office systems. Many existing applications require manual conversion between different proprietary formats. A standards-based approach for system models, protection settings, and event-reporting data exchange will improve the efficiency of many Smart Grid-related tasks. This integration can enable many new applications that may not be possible by just operating in one environment.

14.5 Where:

The integration of these standards would take place across the enterprise where field equipment operations need to integrate with back-office systems. Models and settings will be implemented in multifunctional IEDs at different levels of the substation and electric power system hierarchy. They will be used also in analysis, testing, commissioning, asset management, automatic analysis, and protection coordination tools. Several interfaces will be involved through the development of the standards that are targeted for their environment.

14.6 How:

The activities related to this task will require coordination with many SDOs. Strategies for integration of the different standards shall be developed in cooperation with the SDOs involved.

This work shall identify and/or develop key requirements and use cases that define the type of integration needed across these standards. Information requirements for the different Smart Grid applications need to be identified. Thist work needs to involve the different stakeholders and domain experts.

The mapping of that information on the existing models as well as the extension needs to be done by the relevant working groups (IEC TC57 WG10, 13, 14 and 19). This work shall contribute technical support to the SDOs.

The completion of the settings data objects in protection logical nodes will be done in working group H5 of the IEEE PSRC (Juergen Holbach, Chairman). Following the completion of this work, the logical nodes in IEC 61850 will be updated. A PAR will then be submitted to define a file format for setting data exchange based on the IEC 61850 substation configuration language. The work based on this action plan shall contribute technical input.

Other SDOs involved are IEEE PSRC WG H3 (IEEE PC37.237) and H16 (IEEE PC37.239).

14.6.1 Task Descriptions

The task 5 to 9 identified are the same tasks as identified already in PAP 08. While in PAP 08 the focus for the use cases shall be on Distribution grid management, here the focus of the use cases shall be on transmission and distribution models.

14.6.1.1 Task 1

Investigate impact of IEEE PC37.239 (COMFEDE) on CIM and 61850. This shall be done together by the CIM/IEC 61850 harmonization task force of WG19 (M. Goodrich) and by IEEE PSRC H16 (Pierre Martin).

14.6.1.2 Task 2

Create team to identify Use Cases for setting information that is required to perform an automatic verification of the power system configuration. This shall be done by IEEE PSRC.

14.6.1.3 Task 5

Create a team to identify and develop Smart Grid focused master list of critical use cases. This shall be done by the T&D DEWG.

14.6.1.4 Task 6

The team created as result of task 5 shall create Smart Grid focused master list of critical Use Cases with suggested priority.

14.6.1.5 Task 7

The team shall based on the list and priorities defined in task 6 create and/or refined the Smart Grid use cases.

14.6.1.6 Task 8

WG19 Smart Grid TF shall review the use cases from task 7, confirm the priority and shall assign them to the appropriate WGs or other entities.

14.6.1.7 Task 9

The appropriate WG shall develop the requirements and build the models for the use cases assigned from Task 8. It is important that, in the case that a use case requires updates and extensions of models in e.g. both CIM and IEC 61850, that these updates are done in parallel and coordinated.

14.6.2 Deliverables

The following deliverables will be prepared:

- A report stating the impact of PC37.239 on CIM and IEC 61850
- Master list of critical use cases as result of task 6
- New / refined use cases as result of task 7
- Updates of models as result of task 9

In addition, the team set up as task 2 will create use cases for automatic verification of settings.

14.7 Who:

Project Team
NIST Lead: Jerry Fitzpatrick
EPRI Lead: Christoph Brunner
SDO Lead: Christoph Brunner Convenor IEC TC57, WG10
Other SDOs: IEEE PSRC H3 Committee Chair Bill Dickerson IEEE PSRC H5 Committee Chair Jürgen Holbach IEEE PSRC H16 Committee Chair Mark Adamiak IEEE Power Systems Relay Committee, Communications Subcommittee: Veselin Skendzic IEC WG13 Convenor Terry Saxton IEC WG14 Convenor Greg Robinson
Users Groups: UCAIug Mark Adamiak
Technical Team: Alex Apostolov (Member IEC TC57, WG10, 19, IEEE PSRC H3, H5 and H16)

14.7.1 When:

Task Description	Completion Date
Task 1: Impact of IEEE PC37.239	Q4-2009
Task 2: Team to investigate setting information	tbd
Task 5: Create SG use case team	09-2009
Task 6: Use case master list	Q4-2009
Task 7: Use cases refined	Q2-2010
Task 8: Review and assign use cases	Q2-2010
Task 9: Develop models	continuous; all by Q4-2010