11 Appendix C: Requirements, Standards Gaps, and Discussion Issues for the Action Plan

The following tables of requirements and standards gaps were derived primarily from the results of the Smart Grid Workshop #2, with clarifications, edits, and a few additions from the Project Team. These tables form the basis for the NIST Action Plan described in Section **Error! Reference source not found.** and provides the detailed actions that NIST should promote. In addition to the specific requirements and standards gaps, some issues were identified that need further discussion before concrete actions on standards can be taken.

The complete results from the Workshop #2 are shown in the Gaps Assessment Spreadsheet in a separate annex to this document.

11.1 Action Items Related to Demand Response and Markets

11.1.1 Requirements and Standards Gaps Related to Demand Response and Markets

The following requirements and related gaps in standards were identified, where the activities can be commenced (or have already commenced) relatively quickly, after brief discussions with the organizations identified.

Requirements	Standards	Gaps	Who
Common Model for Price As PEVs move from area to area, a common interoperable model for price and energy characteristics and time for dynamic pricing across areas, markets, providing a consistent integration model.	NAESB, EMIX, OpenADR, IEC 61850-7-420, others	Common interoperable price formats, characteristics, time, and units are needed to abstract away the complexities of markets to actionable information for the PEV.	SAE, IEC, NEMA, NAESB, OASIS
Provide energy usage information to Customer EMS: Customers and/or their energy management systems would like or require energy usage information in order to help make decisions, such as what parameters to set for demand response, whether to change DR plans, or whether to take specific actions now in anticipation of future DR events.	OpenHAN Smart Energy Profile ANSI C12.19	Open access protocol needed for timely access to metering information by the premises management system	OpenHAN, ZigBee/HomePlug Alliance, NEMA

Requirements	Standards	Gaps	Who
Extend IEC 61850-7-420 standard for additional DER: In order for DR signals to interact appropriately with all types of DER devices, additional types of DER equipment need to be modeled. These models will need to take into account how the DER could be used for demand response and/or load management, which DER information can be simple extensions to existing DER models, and which need new development.	IEC 61850-7-420, OpenADR, Smart Energy Profile	Currently IEC 61850-7-420 for DER covers wind (actually IEC 62400-25), photovoltaic systems, fuel cells, diesel generators, batteries, and combined heat and power (CHP). These models need to be extended to include updates or new models of DER devices.	IEC TC57 WG17, NEMA, OASIS, ZigBee, Policy
Extend IEC 61968 standard for DER: IEC 61968 needs DER 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. IEC 61850-7-420 has architectural issues to be addressed.	IEC 61968-xx, eBusiness, others TBD	IEC 61968 needs DER models to carry the IEC 61850-7-420 models of DER and PEV to integrate with the enterprise. Address issues in IEC 61850-7-420,	IEC TC57 WG14, NEMA

11.1.2 Discussion Issues Related to Demand Response and Markets

The following table lists the topics that need to be discussed and resolved before the appropriate standards can be developed or extended, usually to ensure that standards which were already developed are used (rather than re-inventing the wheel) or that the most appropriate standard is selected to extend.

Domain	Discussion Issues	Standards Potentia
Customer	**Make available pricing and market information**: Market information must be delivered across all domains: Generation, market, DER, T&D, customer, etc. (Wholesale and retail real-time pricing available to everyone.) IEC 61970, IEC 61968, and IEC 61850-7-420 need updates for handling prices. OpenADR needs to be vetted as if it becomes a standard, Smart Energy Profile provides communications at the Customer site.	FERC's OASIS, IEC CIM 61850-7-420, OpenADR, Profile
Customer	**Consumer registration of out-of-the-box appliances**;: open up and authenticate on someone's smart home network; how to authenticate – how will this happen in future	IEC 61850-7-420, OpenA Profile

11.2 Action Items for Wide Area Situational Awareness

11.2.1 Requirements and Standards Gaps Related to Wide Area Situational Awareness

The following requirements and related gaps in standards were identified, where the activities can be commenced (or have already commenced) relatively quickly, after brief discussions with the organizations identified.

Requirements	Standards	Gaps	Who	
Extend IEC 61850 standard from substation to control center: Since the data in the substation uses the IEC 61850 information model, this data should be reported to the control center using the same information model. This will also simplify the harmonization efforts between the models of data collected from the field and the CIM.	IEC 61850	IEC 61850 models all the equipment and functions in the substation. If those models could be brought back to the control center, then this same powerful information model would be used for SCADA and other applications, thus minimizing translations and expensive and data maintenance activities that sometimes lead to insecure and/or unsafe situations.	IEC TC57 WG10 & WG19, NEMA	C M M

Requirements	Standards	Gaps	Who	
Extend IEC 61850 standard between substations: Some protective relaying and certain other functions require communications between substations, but still rely on legacy, or proprietary protocols. Since IEC 61850 is used within substations, the same protocol should be used between substations.	IEC 61850	IEC 61850 needs to be expanded to handling substation-to-substation protective relaying and other information exchanges.	IEC TC57 WG10, NEMA	M N g
Develop interoperable messaging standards for the IEC 61970 (CIM): The CIM for transmission (IEC 61970) does not specify formats or messaging methods for exchanging CIM information, thereby requiring many implementation to develop their own formats and messaging requirements. There is no interoperability between implementations unless they have explicitly worked together.	IEC 61970	If CIM format and messaging standards were developed, then CIM implementations could be interoperable without custom development by vendors and lengthy interoperability tests for each implementation..	IEC TC57 WG13, NEMA	M
Extend the time synchronization standard: Time synchronization to millisecond based on GPS clock is needed by Phasor Measurement Units (PMUs) for accurate timestamping. Specifically IEEE 1588, Network Time Protocol (NTP), and IRIG-B need to ensure they can handle this time synchronization, and mappings to IEC 61850 and DNP3 need to ensure they can transport the results.	IEEE 1588, Network Time Protocol, IRIG-B	Timestamps at the accuracy required for PMU's are not specifically covered in the time protocols.	NASPI-PSTT IEC TC57 WG10, NEMA, IEEE PSRC H7	T S S
Develop calibration rules for PMUs: Standard rules for calibration & update of measurement devices, common tolerances, depending on application	No Standards Exist	Standard Needed for PMU, Real Time Rating System	NASPI/NERC/ NIST IEEE/IEC TC95	E C
Map IEC 61850 objects to DNP3 for legacy interfaces: For transition between using DNP3 and converting to IEC 61850, the IEC 61850 object models need to be mapped to DNP3	DNP3 - Application Layer	IEC 61850 object models need to be mapped to DNP objects	IEC TC57 WG03, NEMA	C M
Exchanging both transmission and distribution power system models: As it becomes increasingly critical for transmission and distribution operations to have clear and accurate information about the status and situations of each other, they need to be able to exchange their respective T&D power system models including the merging of relevant databases for interconnected power systems.	IEC 61970 & IEC 61968-11	Both transmission (IEC 61970) and distribution (IEC 61968-11) are being developed for exchanging power system models. They need to include messaging standards to be truly interoperable. No specific standards exist for merging power system databases.	IEC TC57 WG13 & WG14, NEMA, IEEE/ NASPI/ NERC/ FERC	C M M

Requirements	Standards	Gaps	Who	
Broad discussion on functional integration of EMS, DMS, & MOS: As transmission operations and distribution operations become increasingly intermeshed with electricity markets, both to set prices and to respond to prices, there needs to be functional integration of EMS and DMS functions and market operations systems (MOS) and corresponding information exchange. At the same time, rules and regulations for these information exchanges between unbundled entities need to be established and monitored.	IEC 61970, IEC 61968, IEC61850, DNP3, ANSI C37.1, ANSI C37.118, ANSI C12.19-12.22, IEC 60870-6 (ICCP)	There is a lack of coordination or understanding on to achieve functional integration of EMS, DMS, and MOS systems.	IEC TC57 WG13 & WG14 & WG16, NEMA	
Integration of the relay settings and other field component management functions: Applications that perform 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 miss configurations that may create blackouts.	IEC 61850	One of the required pieces to enable such applications is the standardization of relay settings and other field component management functions. One first step in that direction is the work currently done within IEEE PSRC, H5a working group.	IEEE PSRC, IEC TC57, NEMA	
Object models of bulk generation plants: Due to the fact that IEC 61850 is today and for the foreseeable future the communications protocol for integration of power system equipment, object models of power plants will need to be developed**.**	IEC 61850	Bulk generation plants are not modeled in IEC 61850. Workshops with power plant domain experts from utilities involved in Smart Grid development projects and IEC 61850 modeling experts can be used in order to determine and document the functional and modeling requirements.	IEC TC57, NEMA, bulk generation experts	

11.2.2 Discussion Issues for Wide Area Situational Awareness

The following table identifies the issues that require further discussion before any specific work on the relevant standards can be undertaken. Often this discussion involves the identification and agreement on exactly which of the existing standards should be extended to cover the issue, while other discussions reflect resolving issues in on-going standards activities.

Domain	Discussion Issues	Standards Potenti
Operations	**Discuss cross-utility handling of major events:** Major events, like the blackout of August 2003, could have been avoided if adequate event information had been provided to the right place within the appropriate time frame. If (and when) a major event does occur, there is an additional need to have a mechanism or system to support the restoration of communication systems across utilities, to federal and state agencies, and to first responder organizations.	NASPInet, ANSI C37.118 IEC 62351-7, NEMA

Domain	Discussion Issues	Standards Potentia
All Domains	**Systems and Network Management Infrastructure Development for the Smart Grid** The Smart Grid represents a System of Systems/Networks of Networks that must be able to operate across traditional industry boundaries such as States, Service Territories, and Consumers. Development of an open systems based infrastructure that can effectively manage the envisioned networks of systems is a significant challenge that has not been resolved. The Architecture of the networks is intimately connected with its management infrastructure and this issue needs to be investigated systematically. The experts from the fields of networking, systems management, cyber security, and communications technology need to investigate Smart Grid requirements emerging from the NIST Roadmap and Workshops and industry projects as a starting place to examine the issues surrounding Management infrastructure. The topic is multidisciplinary and will take in depth work to fully understand the plausible Smart Grid build out and the scenarios for network scaling and growth. The management functions include but are not limited to Fault, Configuration, Accounting, Performance, Security, and Applications. The topic overlaps significantly with Security issues but it includes many functions that are not directly security.	OSI Management Standar Internet Based Manageme SNMP Vx Data Management and Di Standards Distributed Desktop Mana Force Standards: Commo Model Applications Managemen Related IEC and IEEE Ma Standards associated with and end device communic Other
Operations Customer	**Detailed architecture to be used for T&D operations, down to the customer:** A high level architecture was identified in this NIST roadmap document, but it needs to be extended to the actual transmission and distribution operations, including the interactions with customers who are participating in demand response, own DER units, operate PEVs, and may have electric storage facilities..What additional standards need to be developed or extended in order for systems and tools to process and aggregate data from across the grid to make it actionable? What information exchanges are needed to coordinate across all levels of the energy system, behavioral models and data sharing (i.e. between transmission, distribution, consumer, system planning, etc. including commercial data, i.e. AMI data)	Although applications sho standardized, the input/ou provided by many standar there are both too few and standards to chose from. W used for which functions?
Operations	**Development of a common weather information model:** A common weather information model needs to be developed that includes a format for observations as well as for forecasts. This model could be used when querying local weather stations and even personal weather systems. The Digital Weather Markup Language (DWML) is an existing specification developed by the National Oceanic and Atmospheric Administration (NOAA). IEC 61850 has models for retrieving weather data from field equipment.	DWML, IEC 61850
Operations Customer	**Clarification of standards to be used for data management.** What additional standards need to be developed or extended for supporting efficient data management, farming, analysis and reporting? Hierarchical aggregation of data; down and up the hierarchy. User-specific object models	Applications should not b input/output can be provid and CIM
Operations	**Transmission transfer capacity (TTC) information to Distribution Operations and C&I Customers.** What additional standards need to be developed or extended in order for Transmission Transfer capacity to be available to T&D operation (and major customers) in real time? There is a need to know impact of distribution activities on the capacity issues and deliver this knowledge to transmission.	Guide in Process: CIGRE Applications should not b input/output could be prov 61850 and CIM

Domain	Discussion Issues	Standards Potentia
Operations	**What should the continuing role of DNP be:** DNP does not support CIM or network management functions. Should it?	DNP3
Operations	**Discussions are needed on the integration of COMTRADE and PQDIF**	COMTRADE
Operations	**Harmonize IEC 61850 with IEEE C37.118**	IEC 61850 IEEE C37.118

11.3 Action Items Related to Electric Storage

11.3.1 Requirements and Standards Gaps Related to Electric Storage

The following requirements and related gaps in standards were identified, where the activities can be started (or have already started) relatively quickly, after focused discussions among the organizations identified.

Requirements	Standards	Gaps	Who	L
Extend IEEE 1547 standard for Electric Storage if necessary: IEEE SCC21 needs to review whether any changes are needed in the IEEE 1547 standards for static and mobile electric storage, including both small and large electric storage facilities. In particular, the management of storage in islands needs to be studied.	IEEE 1547	Need to extend the IEEE 1547 standards as necessary to include the electrical interconnection of electric storage	IEEE Standards Coordinating Committee 21 (SCC21)	Se U in Sy In ili

11.3.2 Discussion Issues Related to Electric Storage

The following table lists the topics that need to be discussed and resolved to guide standards work, primarily to ensure that standards which are appropriate and already developed are used (rather than re-inventing the wheel) or to select

Domain	Discussion Issues	Standards Potentia
Operations Customer	**What standards and models are needed for distribution management system (DMS) to send appropriate signals to electric storage?** Distribution management systems must be able to influence charging profiles and discharging incentives of electric storage, either through price signals or through direct control signals to energy service interfaces, to help manage the distribution system, especially during reconfiguration, unusual loading conditions, and emergencies.	IEC 61850, ANSI C12.19 OpenADR, ANSI C12.22 Smart Energy Profile, etc

Action Items Related to Electric Transportation

11.3.3 Requirements and Standards Gaps Related to Electric Transportation

The following requirements and related gaps in standards were identified, where the activities can be started (or have already started) relatively quickly, after focused discussions among the organizations identified.

Requirements	Standards	Gaps	Who	L
Common Model for Price+: As PEVs move from area to area, a common interoperable model for price and energy characteristics and time for dynamic pricing across areas, markets, providing a consistent integration model.	NAESB, EMIX, OpenADR, IEC 61850-7-420, others	Common interoperable price formats, characteristics, time, and units are needed to abstract away the complexities of markets to actionable information for the PEV.	SAE, IEC, NEMA, NAESB, OASIS	Se Sy
Common Model for DR Signals: As PEVs move from area to area, a common model for signaling DR events in addition to price is needed. This model should address signaling to other curtailment & generation resources. Must be able to influence charge profiles and discharge incentives.	IEC 61850-7-420, OpenADR Smart Energy Profile, SAE J2836, Price+	Common model for DR signals, including grid safety, environmental, and price is needed to broaden markets and decrease customization. Premises Management Systems are important partners in collaboration.	SAE, IEC, NEMA, ZigBee/Home Plug Alliance, OASIS, NAESB	Se Sy
Mobile Generation/Load Accounting: Determine how costs and payments for PEV are settled.	SAE J2847, OpenADR, SEP Advice of Charge (Cell phone)	Mobility introduces billing model issues; similarity to gasoline purchase may be useful.	SAE, ANSI, Policy, IEC TC57, NEMA	Po bu ob
Extend IEC 61850-7-420 standard for additional DER, including PEV, Storage, and Renewables: Need to extend IEC 61850-7-420 for more Distributed Energy Resource (DER) equipment. Currently IEC 61850-7-420 for DER covers wind (actually IEC 62400-25), photovoltaic systems, fuel cells, diesel generators, batteries, and combined heat and power (CHP). Needs extension to PEV, additional storage devices, microturbines, gas turbines, etc., including operations and for dynamic and flexible protection systems.	IEC 61850-7-420, OpenADR, Smart Energy Profile	Need to extend IEC 61850 for more Distributed Energy Resource (DER) equipment such as Storage and PEVs, and to cover additional functions, such as dynamic protection settings, load shedding, etc.	IEC TC57 WG17, NEMA, OASIS, ZigBee, Policy	Po Se Sy In ili

Requirements	Standards	Gaps	Who	L
Extend IEC 61968 standard for DER: IEC 61968 needs DER and PEV 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. IEC 61850-7-420 has architectural issues to be addressed.	IEC 61968-xx, eBusiness, others TBD	IEC 61968 needs DER models to carry the IEC 61850-7-420 models of DER and PEV to integrate with the enterprise. Address issues in IEC 61850-7-420,	IEC TC57 WG14, NEMA, others TBD	Se Sy in ili N

11.3.4 Discussion Issues Related to Electric Transportation

The following table lists the topics that need to be discussed and resolved to guide standards work, primarily to ensure that standards which are appropriate and already developed are used (rather than re-inventing the wheel) or to select to extend.

Domain	Discussion Issues	Standards Potentia
Operations Customer	**What standards and models are needed for DMS to send appropriate signals to PEVs and other DR devices?** Distribution management systems must be able to influence charging profiles and discharging incentives (through price signals or direct control signals to energy service interfaces) to help manage the distribution system, especially during reconfiguration, unusual loading conditions, etc.	IEC 61850, ANSI C12.19 OpenADR, ANSI C12.22 Smart Energy Profile, EM etc.
Customer Operations	**Which standards should be used for information models of PEV?** A decision needs to be made on which information modeling standards should be used to model PEVs, and in which domains. Then they could be tasked to develop those models. In all cases, need harmonization across domains for PEVs	IEC 61850, IEC 61968, S Profile, OpenADR, ANSI eBusiness integration
Market	**If regulations change, there is a need to develop new Use Cases** and the standards that would be derived from them if reselling stored retail power were permitted by regulators	SAE J 2836 ™, markets
Distribution	**PEV accounting and settlements:** Currently regulations do not permit electricity to be resold. This means that all the accounting and settlement issues must be handled by utilities (or energy service providers) without the middleman reseller as is the normal market method. This puts the burden on the utility or ESP to manage the complex accounting and settlement processes usually handled by credit card companies or other retail accounting providers. However, if regulations were to change to allow the unbundling of electricity so that stored electricity could be resold, then the accounting model would change dramatically, since normal retail methods could be used. Models for the settlement of PEV charging and discharging pricing, costs, and cross-utility payments are developing slowly, with significant technical and policy/regulatory unknowns. Proposals range from complex schemes for billing back to the driver's (or the owner's) home utility, simple charging as with current gasoline stations, to mixtures of prepaid and billed services as with cellular phones. When charging stations are ubiquitous, these issues will become even more important.	SAE J 2847, others
Customer	**PEV charging/discharging constraints and regulations.** May need some type of weights and standards seal for charging/discharging *(issue needs clarification)*	SAE J 1772 ™
Distribution	**Submetering for PEV.** May need submetering standard for non-utilities, so need policies, regulations, and testing as well as understanding whether existing standards for metering and retrieving metered data are adequate	ANSI C12.19
Customer	**Role of government and emergency responders with PEV:** There is a missing actor, or even domain – the government agencies (state or federal); as they'll be playing active role with respect to PEVs; emergency, disaster response; charge rates, giving first-responders with priority. Elevating ability to charge PEVs. Government access in bidirectional way – getting information from, or sending information down through the system	SAE J 1772, IEC 61968

11.4 Action Items Related to AMI Systems

11.4.1 Requirements and Standards Gaps Related to AMI Systems

The following requirements and related gaps in standards were identified, where the activities can be commenced (or have already commenced) relatively quickly, after brief discussions with the organizations identified.

Requirements	Standards	Gaps	Who	GWAC Layer
Interoperability of ANSI C12.19: ANSI C12.19 has too much flexibility, so that implementations of different meters are often not interoperable. Some standard meter profiles need to be developed to constrain that flexibility for common types of meters and metering requirements.	ANSI C12.19-2008 Exchange Data Language	One or more standard meter profiles need to be defined using the ANSI C12.19 Exchange Data Language.	NEMA	Object Modelin
ANSI C12.22 not meeting future requirements: ANSI C12.22 is viewed as mixing the roles of various communications layers for functionality beyond what is traditionally the application layer. Extremely detailed knowledge of the standard is required to recognize where the boundaries exist for the application layer and, perhaps, where it replicates the functions of lower layer functionalities.	ANSI C12.22	A conformance classification for ANSI C12.22 needs to be defined to constrain its scope	NEMA	Messagi
IEC 61968 Testing: Interoperability testing, along with conformance testing, is the best method for confirming that a standard is performing correctly and actually doing what it is supposed to do. These tests can also feed back to the standards group on issues where the standards are unclear, missing, or incorrect.	IEC 61968-9	Interoperability testing for IEC 61968-9 needs to be performed (this is expected to take place in late 2009).	IEC TC57 WG14, NEMA	Testing

11.4.2 Discussion Issues for AMI Systems

The following table lists the topics that need to be discussed and resolved before the appropriate standards can be developed or extended, usually to ensure that standards which were already developed are used (rather than re-inventing the wheel) or that the most appropriate standard is selected to extend.

Domain	Discussion Issues	Standards Potenti
Customer	**Should the Internet Protocol (IPv4 or IPv6) be mandated for all protocols:** Assuming that the issue is whether or not IPv4/v6 (rather than whether the Internet Protocol Suite of hundreds of protocols) should be specified for all protocols, what are the requirements? For instance, should ZigBee and all AMI and HAN protocols be required to use IPv4/v6? Can certain protocols get exemptions for specific justifiable reasons? What about IPv4 versus IPv6? What about IPsec?	ANSI C12.22, ZigBe Smart Energy Profile
Customer	**Coordination and Future-proofing AMI Systems:** Since AMI systems are going to become widespread, they will inevitably want to be used for more than meter reading or other purely metering functions. They could be used for monitoring DER at the customer site, for DA monitoring and possibly control, for access by third parties to gateways into the customer HAN, etc. The AMI systems should be able to handle, at a minimum, the IEC 61850 object models mapped to an "appropriate" protocol (possibly IEC 61850-lite when it is developed). Need to ensure AMI communications systems use open standards capable of interfacing to DER and distribution automation equipment. ANSI C12.22 is being revised, Europe uses DLMS/COSEM, and AMI vendors are developing their systems over a wide range of media, from PLC, to BPL, to ZigBee meshed radios, to UtiliNet radios, to GPRS, etc.	Smart Energy Profile C12.22-2008, DLMS
Customer	**Concerns about unlicensed spectrum in AMI systems:** Use of unlicensed spectrum leaves utilities competing with other industries for bandwidth. There is risk of non-utility applications emerging that would greatly increase the utilization of unlicensed spectrum. This could result in reduction of performance of utility systems with little warning or recourse. Does the "critical infrastructure" aspect of utility systems justify the allocation of dedicated spectrum with bandwidth comparable to the unlicensed ISM bands?	AMI meshed radio sy Smart Energy Profile C12.22-2008
Customer	**Should ANSI C12.19 be expanded for DER?** ANSI C12.19 may have extension requirements for distributed resource information, forecasts, etc. But should ANSI C12.19 be extended for non-metering devices or should IEC 61850-7-420 objects be used?	ANSI C12.19, IEC 6
Service Provider	**Discussion on which standards third party energy providers should use.** What additional standards need to be developed or extended in order to transfer data across various energy providers?	No specific standard and/or IEC 61850 co
Customer Market	**Which standards should be used or extended with pricing models?** Ability to include real time pricing information and other pricing models in both information model standards and information transfer standards	OpenADR, IEC 6185
Customer	**Should standard physical and mac layers be defined for AMI systems?** This would include standards for the common AMI approaches: wireless mesh, wireless star (point to point), and long range power line carrier. Do the benefits of vendor interoperability outweigh the risk of stifling creativity?	IEEE 802.15.TG4g Other IEEE standards
Customer	**Should an open standard be developed for routing and connectivity in wireless AMI networks?** Notionally, such a standard would be built upon open standard phy/macs and would be a necessary part of allowing devices from multiple vendors interoperate and exchange data as part of a single network.	ANSI C12, IEEE?, Z

11.5 Action Items Related to Distribution Management

11.5.1 Requirements and Standards Gaps Related to Distribution Management

The following requirements and related gaps in standards were identified, where the activities can be commenced (or have already commenced) relatively quickly, after brief discussions with the organizations identified.

Requirements	Standards	Gaps	Who	G La
ICCP legacy transition: ICCP standard may need information models for interaction with aggregators of distributed resources and even distributed resources directly	IEC 60870-6 (ICCP), IEC 61850-7-420	Decision by IEC TC57 needs to be made on whether ICCP or IEC 61850-7-420 should be used for DER information exchanges with Service Providers	IEC TC57 WG19, NEMA	Sem Synt Netw
Extend IEC 61850-6 standard: The System Configuration Language (SCL) that is used for configuring the communication networks and systems for substations is not yet capable of configuring DER or distribution automation networks and systems.	IEC 61850 WS-DD WS-DP	IEC 61850-6 SCL needs expansion to distribution automation and DER, possibly in coordination with WS-DD/WS-DP	IEC TC57 WG10 & WG17, NEMA, OASIS	Disc and conf n
Extend IEC 61850 standard for Distribution Automation: IEC 61850 has been selected by the IEC for all field communications with power system equipment. It currently has models for substation equipment, large hydro power plants, and many types of DER. However, it does not yet have object models for distribution automation equipment	IEC 61850-7-xxx	Object models for Distribution Automation equipment need to be added.	IEC TC57 WG17, NEMA	Sem

Requirements	Standards	Gaps	Who	G La
Harmonize IEC 61968 and MultiSpeak: MultiSpeak and IEC 61968 overlap in many areas, but not in all areas. MultiSpeak already has a wide base of implementations, primarily with small utilities, while IEC 61968 is designed for larger utilities, but has not yet become a standard nor been implemented anywhere. MultiSpeak is working closely with the IEC 61968 effort on the overlapping areas, but further harmonization is necessary. As the IEC 61968 CIM profiles become available as standards, it will be important to minimize any conflicts with MultiSpeak and to develop mappings between the existing MultiSpeak interfaces and the new IEC 61968 interfaces so that products and software developed to be compatible with the different standards can interoperate.	IEC 61968, MultiSpeak	The gaps and overlaps between MultiSpeak and the IEC 61968 standards under development need to be minimized and harmonized.	IEC TC57 WG14, NEMA, NRECA MultiSpea k	Sem
Revise and update IEC 61968 standard: The IEC 61968 CIM for distribution is currently not usable except for the very latest part (Part 9), since the messaging schemes and the CIM model for the earlier parts were not well enough defined to allow vendors to implement them. However, if these older parts are revised, then interoperability of the messages may be achieved. These revisions are in the IEC TC57 WG14 roadmap, but will need significant effort to be achieved.	IEC 61968	Some of the earlier parts of the IEC 61968 standards are not implementable and do not yet specify the types of interoperable messaging schemes being developed. The roadmap is expected to take a long time to achieve and could benefit from significant support.	IEC TC57 WG14, NEMA	Sem Synt Netw
Extend IEEE 1547 standard: Voltage support specifications (electrical interconnections) for distributed resources need to be defined for scenarios where such voltage support is needed or permitted.	IEEE 1547	The IEEE 1547 standard currently states that "The DER shall not actively regulate the voltage at the PCC." However, for islanded systems or for Area-EPS operations-approved actions, voltage support should be permitted, and specifications for these situations should be developed..	IEEE 1547, IEEE P2030	Poli Busi obje
Map IEC 61850 object models to AMI system protocols: If IEC 61850 object models are going to be used to exchange information with equipment (such as DERs) at customer sites, then these models need to be mapped to AMI communications protocols	IEC 61850, ANSI C12.22, DLMS/COS EM, Smart Energy Profile	IEC 61850 objects need to be mapped to AMI communications such as ANSI C12.22. This may or may not be the same solution as IEC 61850-lite.	IEC TC57, NEMA, IEC TC13	Sem Synt Netw

Requirements	Standards	Gaps	Who	G La
MultiSpeak and IEC 61968 Interoperability Testing: Once a mapping between MultiSpeak V4 and IEC61968, Part 9 has been finalized (planned for late 2009), then it will be critical to test for interoperability between appropriate profiles of the two standards.	IEC 61968, MultiSpeak	Perform interoperability testing on harmonized profiles between MultiSpeak and IEC 61968.	IEC TC57 WG14, NEMA, NRECA MultiSpea k	Inter Test

11.5.2 Discussion Issues for Distribution Operations and Management

The following table lists the topics that need to be discussed and resolved before the appropriate standards can be developed or extended, usually to ensure that standards which were already developed are used (rather than re-inventing the wheel) or that the most appropriate standard is selected to extend.

Domain	Discussion Issues	Standards Potentia
Operations Customer	**Develop IEC 61850-lite as efficient, compact protocol:** Since many communications systems still have limited bandwidth, such as those used in rural environments and/or to wide-spread distribution automation devices, one or more efficient, compact communication protocol profiles need to be specified for IEC 61850 and other object models to be mapped to. Therefore, there is a need to develop "IEC 61850-lite" profile to which these object models can be mapped. In addition, some inexpensive devices (e.g. sensors, collectors, or "software agents") may not want or need to implement the full IEC 61850 capabilities, in order to minimize compute constraints or development costs.	IEC 61850, Smart Energy C12.22, and other compac
Distribution	**What GIS standards should be specified, developed, or extended?** The status of GIS standards not clear.	GIS standards, IEC 61968
Distribution	**What standards should be developed or extended for Work Order management?** Could include IEC61334, IEC61968, or MultiSpeak	IEC 61968, MultiSpeak
Operations Customer	**What standards should be used or need extensions to provide distribution operations with information about customer behavior and response to prices?** This information must be available to distribution management systems for development of accurate models that can be used to manage voltage, component loading, etc.	IEC 61850, ANSI C12.19 OpenADR, ANSI C12.22 Smart Energy Profile, SA
Operations	**Transmission operations access to DER information.** What additional standards need to be developed or extended in order to use distribution resources in the bulk electric system infrastructure for contingency analysis, mitigation and control (incl. Restoration)?	CIM, IEC61850, DNP3, 3 C12.19, 12.21, 12.22, ICC IEC 61850-7-420
Operations	**Distribution operations access to bulk generation information.** What additional standards need to be developed or extended in order for bulk generation to be available to T&D operation (and major customers) in real time. Need to know impact of distribution activities on the capacity issues and deliver this knowledge to transmission.	CIM, IEC61850, DNP3, 3 C12.19, 12.21, 12.22, ICC IEC 61850-7-420
Operations Customer	**Discussions needed on modeling loads, given DER and mobile PEV.** Need to develop behavioral models to plan for diversity and allocation of loads. The aggregated model will be used in T&D. Base load profiles may be required to define benefits for demand response and alternate load profiles associated with PEV charging. This requires accurate definition of customer loads as a function of parameters. The information is needed from AMI systems and must be provided to system models and model management systems.	Load models themselves s standardized, but the infor could involve IEC 61850, BACnet, OpenADR, ANS DLMS/COSEM, Smart E SAE Jxxxx etc.