Smart Grid Standards Information

Version 1.7
Friday, August 20, 2010

Section I: Use and Application of the Standard

Identification and Affiliation

	Number of the standard	IEEE C37.1-2, IEEE Std C37.1™-2007
	Title of the standard	IEEE Standard for SCADA and Automation Systems
	Name of owner organization	IEEE Power Engineering Society
	Latest versions, stages, dates	2007 Version, Approved 5 December 2007 This document is a significant revision of IEEE Std C37.1-1994. This revision reflects current technology that is generally being provided to meet the requirements of utilities.
	URL(s) for the standard	
	Working group / committee	Electric Network Control Standards Working Group of the Data Acquisition, Processing, and Control Systems Subcommittee of the IEEE Power Engineering Society Substations Committee
	Original source of the content (if applicable)	ANSI C37.2-1970 was revised into two standards: IEEE Std C37.1-1979, IEEE Standard Definition, Specification, and Analysis of Manual, Automatic, and Supervisory Station Control and Data Acquisition, and IEEE Std C37.2™-1979, IEEE Electric Power System Device Numbers. Previous editions were approved by the IEEE in 1962, 1956, 1945, and 1937. The original work on this subject was done by the American Institute of Electrical Engineers (now the Institute of Electrical and Electronic Engineers) and published in 1928 as AIEE No 26.
	Brief description of scope	The requirements for SCADA and automation systems in substations are defined. This standard defines the process of substation integration as the design process that is the foundation for substation automation. Functional and environmental requirements are provided for all IEDs located in the system. Tutorial material is included in the annexes to address common issues with systems without introducing requirements. Information is also presented in the annexes regarding SCADA masters.

Level of Standardization

1.	Names of standards development organizations that recognize this standard and/or accredit the owner organization	IEEE Power Engineering Society Substations Committee
	Has this standard been adopted in regulation or legislation, or is it under consideration for adoption?	☐ Yes ☒ No

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	Has it been endorsed or recommended by any level of government? If "Yes", please describe	☐ Yes ☒ No
	Level of Standard (check all that apply)	☐ International ☒ National ☐ Industry ☐ de Facto ☐ Single Company
	Type of document	☒ Standard ☐ Report ☐ Guide ☐ Technical Specification
	Level of Release	☒ Released ☐ In Development ☐ Proposed

Areas of Use

1.	Currently used in which domains? (check all that apply)	☐ Markets ☒ Operations ☐ Service Providers ☒ Generation ☒ Transmission ☐ Distribution ☐ Customer
	Planned for use in which domains? (check all that apply)	☐ Markets ☐ Operations ☐ Service Providers ☐ Generation ☐ Transmission ☐ Distribution ☐ Customer
	Please describe the Smart Grid systems and equipment to which this standard is applied	Applies broadly to the definition, specification, performance analysis, and application of SCADA and automation systems in electric substations, including those associated with generating stations and power utilization and conversion facilities.

Relationship to Other Standards or Specifications

1.	Which standards or specifications are referenced by this standard?	Numerous international and national electrical and communications standards.
	Which standards or specifications are related to this standard?	IEC 60870-5, DNP3, and IEC 61850
	Which standards or specifications cover similar areas (may overlap)?	
	What activities are building on this work?	Substation automation

Dept of Energy Smart Grid Characteristics

Please describe how this standard may encourage each of the following:

1.	Enables informed participation by customers	☐ Yes ☒ No
2.	Accommodates all generation and storage options	☒ Yes ☐ No
3.	Enables new products, services and markets	☒ Yes ☐ No
4.	Provides the power quality for a range of needs	☒ Yes ☐ No
5.	Optimizes asset utilization and operating efficiency	☒ Yes ☐ No
6.	Operates resiliently to disturbances, attacks, and natural disasters	☒ Yes ☐ No

Priority Areas Previously Mentioned by FERC and NIST

Please describe if and how this standard may be applied in each of the following areas. Note that there is space in section Error: Reference source not found to discuss any other significant areas where the standard may be applied.

1.	Cybersecurity and physical security	☒ Yes ☐ No
2.	Communicating and coordinating across inter-system interfaces	☒ Yes ☐ No
3.	Wide area situational awareness	☒ Yes ☐ No
4.	Smart grid-enabled response for energy demand	☒ Yes ☐ No
5.	Electric storage	☒ Yes ☐ No
6.	Electric vehicle transportation	☐ Yes ☒ No
7.	Advanced metering infrastructure	☐ Yes ☒ No
8.	Distribution grid management	☒ Yes ☐ No

Openness

1.	Amount of fee (if any) for the documentation	$125.00
2.	Amount of fee (if any) for implementing the standard	None
3.	Amount of fee (if any) to participate in updating the standard	None
4.	Is the standard documentation available online?	☒ Yes ☐ No URL: http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=4518930
5.	Are there open-source or reference implementations?	☐ Yes ☐ No
6.	Are there open-source test tools?	☐ Yes ☐ No
7.	Would open-source implementations be permitted?	☒ Yes ☐ No
8.	Approximately how many implementers are there?	
9.	Approximately how many users are there?	
10.	Where is the standard used outside of the USA?	
11.	Is the standard free of references to patented technology?	☐ Yes ☒ No
12.	If patented technology is used, does the holder provide a royalty-free license to users of the standard?	☐ Yes ☐ No ☒ Not Patented
13.	Can an implementer use the standard without signing a license agreement?	☒ Yes ☐ No
14.	Are draft documents available to the public at no cost?	☐ Yes ☐ No
15.	How does one join the working group or committee that controls the standard?	
16.	Is voting used to decide whether to modify the standard? If Yes, explain who is permitted to vote.	☒ Yes ☐ No IEEE-SA Standards Board members are eligible to vote
17.	Is an ANSI-accredited process used to develop the standard?	☒ Yes ☐ No
18.	What countries are represented in the working group or committee that controls the standard?	

Support, Conformance, Certification and Testing

1.	Is there a users group or manufacturers group to support this standard?	☐ Yes ☐ No
2.	What is the name of the users group or manufacturers group (if any)?	
3.	What type of test procedures are used to test this standard? (please check all that apply)	☐ Internal to the lab ☒ Published by standards organization ☐ Published by users group ☐ No procedures, informal testing
4.	Are there test vectors (pre-prepared data) used in testing? (please check all that apply)	☐ Internal to the lab ☐ Published by standards organization ☐ Published by users group ☐ No procedures, informal testing
5.	What types of testing programs exist? (check all that apply)	☐ Interoperability Testing ☐ Conformance Testing ☐ Security Testing ☐ No Testing
6.	What types of certificates are issued? (check all that apply)	☐ Interoperability Certificate ☐ Conformance Certificate ☐ Security Certificate (text document) ☐ No Certificates
7.	Are there rules controlling how and when to use the logo?	☐ Yes ☐ No ☒ Standard has no logo
8.	Is there a program to approve test labs?	☐ Yes ☐ No
9.	Approximately how many test labs are approved (if any)?	
10.	Is there a defined process for users to make technical comments on the standard or propose changes to the standard and have these issues resolved?	☐ Yes ☐ No
11.	Is there a published conformance checklist or table?	☐ Yes ☐ No
12.	Are there defined conformance blocks or subsets?	☐ Yes ☐ No
13.	Approximately how many vendors provide test tools?	
14.	Are there tools for pre-certification prior to testing?	☐ Yes ☐ No
15.	Can vendors self-certify their implementations?	☐ Yes ☐ No
16.	Is there application testing for specific uses?	☐ Yes ☐ No ☐ Not applicable
17.	Is there a “golden” or “reference” implementation to test against?	☐ Yes ☐ No
18.	Who typically funds the testing? (check all that apply)	☐ User ☐ Users Group ☐ Vendor ☐ Confidential
19.	Is there a method for users and implementers to ask questions about the standard and have them answered? (check all that apply)	☒ Yes, official interpretations ☐ Yes, informal opinions ☐ No
20.	Does the users’ group (or some other group) fund specific tasks in the evolution of the standard?	☐ Yes ☐ No
21.	Is the users’ group working on integration, harmonization or unification with other similar standards?	☐ Yes ☐ No

22.	What other standards is this standard being integrated, harmonized, or unified with (if any)?	
23.	Are there application notes, implementation agreements, or guidelines available describing specific uses of the standard?	☐ Yes ☐ No ☐ Not applicable

J. Notes

Please present here any additional information about the standard that might be useful:

1.	

Section II: Functional Description of the Standard

GridWise Architecture: Layers

Please identify which layers this standard specifies, as described in http://www.gridwiseac.org/pdfs/interopframework_v1_1.pdf, and the applicable section of the standard. Note the mapping to the Open Systems Interconnect (OSI) model is approximate.

1.	**Layer 8: Policy**	☐ Yes ☒ No
2.	**Layer 7: Business Objectives**	☐ Yes ☒ No
3.	**Layer 6: Business Procedures**	☐ Yes ☒ No
4.	**Layer 5: Business Context**	☐ Yes ☒ No
5.	**Layer 4: Semantic Understanding (object model)**	☒ Yes ☐ No
6.	**Layer 3: Syntactic Interoperability (OSI layers 5-7)**	☒ Yes ☐ No
7.	**Layer 2: Network Interoperability (OSI layers 3-4)**	☒ Yes ☐ No
8.	**Layer 1: Basic Connectivity (OSI layers 1-2)**	☒ Yes ☐ No

GridWise Architecture: Cross-Cutting Issues

Please provide an explanation in the box beside the heading for any questions answered "Not applicable". If the question is not applicable because the function is provided in another layer or standard, please suggest any likely candidates. Note that "the standard" refers to the technology specified by the standard, not the documents themselves.

	Shared Meaning of Content	
1.	Do all implementations share a common information model?	☒ Yes ☐ No ☐ Not applicable
2.	Can data be arranged and accessed in groups or structures?	☐ Yes ☐ No ☐ Not applicable
3.	Can implementers extend the information model?	☒ Yes ☐ No ☐ Not applicable
4.	Can implementers use a subset of the information model?	☒ Yes ☐ No ☐ Not applicable
	Resource Identification	
5.	Can data be located using human-readable names?	☐ Yes ☐ No ☒ Not applicable
6.	Can names and addresses be centrally managed without human intervention?	☐ Yes ☐ No ☒ Not applicable
	Time Synchronization and Sequencing	
7.	Can the standard remotely synchronize time?	☒ Yes ☐ No ☐ Provided in another layer
8.	Can the standard indicate the quality of timestamps?	☒ Yes ☐ No ☐ Provided in another layer
	Security and Privacy	
9.	Where is security provided for this standard?	☐ Within this standard ☒ By other standards
10.	Does the standard provide authentication?	☐ Yes ☒ No
11.	Does the standard permit role-based access control?	☒ Yes ☐ No

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12.	Does the standard provide encryption?	☐ Yes ☒ No
13.	Does the standard detect intrusions or attacks?	☐ Yes ☒ No
14.	Does the standard facilitate logging and auditing of security events?	☐ Yes ☒ No
15.	Can the security credentials be upgraded remotely?	☐ Yes ☐ No ☒ No Credentials
16.	Can the security credentials be managed centrally?	☐ Yes ☐ No ☒ No Credentials
17.	Please list any security algorithms and standards used	
18.	Please provide additional information on how the standard addresses any “Yes” answers above	
19.	Please provide additional information about why any of the questions listed above do not apply to this standard	
	Logging and Auditing	
20.	Does the standard facilitate logging and auditing of critical operations and events?	☐ Yes ☒ No
21.	Can the standard gather statistics on its operation?	☒ Yes ☐ No ☐ Not applicable
22.	Can the standard report alerts and warnings?	☒ Yes ☐ No ☐ Not applicable
	Transaction State Management	
23.	Can the standard remotely enable or disable devices or functions?	☒ Yes ☐ No ☐ Not applicable
	System Preservation	
24.	Can the standard automatically recover from failed devices or links?	☐ Yes ☐ No ☐ Not applicable ☐ Provided in another layer
25.	Can the standard automatically re-route messages?	☐ Yes ☐ No ☒ Not applicable ☐ Provided in another layer
26.	Can the standard remotely determine the health (as opposed to just connectivity) of devices or software?	☒ Yes ☐ No ☐ Not applicable
	Other Management Capabilities	
	Please describe any other system or network management capabilities the standard provides.	
	Quality of Service	
27.	Is data transfer bi-directional?	☒ Yes ☐ No
28.	Can data be prioritized?	☐ Yes ☒ No ☐ Not applicable
29.	What types of reliability are provided?	☐ Reliable ☐ Non-guaranteed ☐ Both ☐ Either ☐ Provided in another layer
30.	Can information be broadcast to many locations with a single transmission?	☐ Yes ☐ No ☐ Not applicable
	Please describe any other methods the standard uses to manage quality of service.	
	Discovery and Configuration	
31.	Can the software or firmware be upgraded remotely?	☐ Yes ☐ No ☒ Not applicable

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32.	Can configuration or settings be upgraded remotely?	☐ Yes ☐ No ☐ Not applicable
33.	Can implementations announce when they have joined the system?	☐ Yes ☐ No ☐ Not applicable
34.	Can implementations electronically describe the data they provide?	☐ Yes ☐ No ☐ Not applicable
	System Evolution and Scalability	
35.	What factors could limit the number of places the standard could be applied?	None.
36.	What steps are required to increase the size of a system deploying this standard?	
37.	Is the information model separate from the transport method?	☐ Yes ☐ No
38.	Does the standard support alternate choices in the layers(s) below it?	☒ Yes ☐ No ☐ No layers below
39.	List the most common technology choices for layers implemented below this standard	
40.	Does the standard support multiple technology choices in the layers above it?	☒ Yes ☐ No ☐ No layers above
41.	List the technologies or entities that would most commonly use this standard in the layer above	
42.	Please describe any mechanism or plan to ensure the standard is as backward-compatible as possible with previous versions	Standard includes design guidelines which should help ensure compatibility previous version.
43.	Please describe how the design of this standard permits it to be used together with older or legacy technologies	Standard includes design guidelines which should help ensure compatibility with legacy systems.
44.	Please describe how the design of this standard permits it to co-exist on the same network or in the same geographic area with similar technologies, and give examples	Standard specifies standard control function performance requirements which should increase compatibility with other systems.
45.	**Electromechanical**	

Architectural Principles

Please describe how this standard may apply any of these principles:

1.	Symmetry – facilitates bi-directional flow of energy and information	
2.	Transparency – supports a transparent and auditable chain of transactions	
3.	Composition – facilitates the building of complex interfaces from simpler ones	
4.	Loose coupling – can support bilateral and multilateral transactions without elaborate pre-arrangement	
5.	Shallow integration – does not require detailed mutual information to interact with other components	

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6.	Please list any other architectural models, reference architectures or frameworks this standard was designed to be compliant with, e.g. W3C, IEC TC57, OSI and how it fits those models	