MultiSpeak® and IEC 61968 CIM: Moving Towards Interoperability

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Abstract

One of the goals of the GridWise Interoperability Framework [1] that is clearly identified in the interoperability framework is the ability to "bridge between communities with independently evolved understandings". There is a clear need for building a semantic bridge between the two most widely implemented standard data models in the electric utility industry, MultiSpeak® and the International Electrotechnical Commission (IEC) Common Information Model (CIM). Creating such a bridge will eventually permit interoperation among MultiSpeak- and CIM-compliant applications. Such interoperation will make it easier for electric utilities to build integrated automation systems that make use of the best of both standards.

A recently announced collaboration between MultiSpeak and IEC Technical Committee 57, Working Group 14 (WG14) is designed to build the necessary bridge between the two standards.

The first step in the collaboration is to create a mapping between the data and messaging models so that a two-way electronic conversion can be created between CIM messages with appropriate CIM payloads and MultiSpeak web service method calls with corresponding MultiSpeak data payloads. A set of IEC standards will be issued to document the mapping. The second step in the collaboration is to create a set of CIM profiles that will implement the capabilities inherent in MultiSpeak.

The authors will discuss the planned technical approach to achieve the goal of interoperation and illustrate the approach with examples.

1. BACKGROUND

Utilities continue to seek standards-based integration to limit the cost and risk of implementing proprietary automation solutions. The two most commonly applied integration standards in the electric utility industry are the MultiSpeak® specification [2], which has been developed and is maintained by the MultiSpeak Initiative, and the Common Information Model (CIM) [3] [4] [5], which has been developed and is maintained by Technical Committee 57 (TC57) of the International Electrotechnical Commission (IEC). An initial approach to interoperation of systems implementing the two standards was presented in [6].

Up until now, MultiSpeak has focused on integration of applications used in the distribution portion of electric utilities. MultiSpeak interfaces have been available and implemented since 2001. MultiSpeak integration is known to be in operation at over 250 utilities. Adoption of MultiSpeak has been primarily, but not exclusively, in distribution utilities in the United States. Version 4.0 of the specification, which is expected to be issued in early 2009, will add support for transmission system modeling, work management and internationalization of the data model. The MultiSpeak Initiative has supported a robust, independent compliance and interoperability testing program on all defined interfaces since 2001.

The standards family maintained by TC57 covers all aspects of a vertically integrated electric utility. CIM integration is known to have been implemented at dozens of utilities worldwide. TC57 supports interoperability testing on two data exchange profiles: the common power system model (CPSM) [7] for the exchange of transmission system models and the common distribution power system model (CDPSM) for the exchange of distribution power system models. In addition to supporting basic inter-application integration, the CIM is increasingly being used by utilities

as a cornerstone for their Enterprise Information Management programs. [9]

Working Group 13 (WG13) of TC57 maintains the core CIM standard as IEC61970 [3] and focuses on transmission system issues. Working Group 14 (WG14) of TC57 maintains a set of standards, named IEC61968 that extends the CIM core to address distribution issues. The majority of the overlap between MultiSpeak and the CIM standards occurs in those extensions maintained by WG14.

At present, both CIM and MultiSpeak provide useful guidance to utilities wishing to implement integrated automation systems, however neither standard is both comprehensive and sufficiently mature to serve all of the needs of the industry. Some utilities may choose to implement integration solely using MultiSpeak where it provides sufficient coverage; typically these have been smaller utilities. Such utilities typically find the MultiSpeak data model and service definitions adequate to support their business processes without the need for significant extensions. For others, a CIM-only approach may be more appropriate. Utilities taking this approach currently must extend the CIM standards to offer a sufficiently detailed data model and also must establish most of their own service definitions. Typically larger utilities are willing to develop this level of extensive customization to meet their business requirements and have the resources available to do so. Some utilities, typically in the middle size range, will integrate some MultiSpeak-compatible and some CIM-compatible applications and are looking to do so with more limited resources than those currently required for a full CIM implementation.

Medium-to-large sized utilities already have begun to inquire if it is possible to leverage the detailed work done by MultiSpeak, but within the context of the international standards offered by CIM. WG14 and MultiSpeak have begun an effort to harmonize their standards to meet this market need. Initially, this has consisted of a joint agreement to review the work of the other group when entering into a new area of development.

To build on this foundation, the two groups have recently agreed to develop standards leading to a mapping that will permit utilities to gain the capabilities of MultiSpeak but using the CIM data model. The proposed standards will be discussed in Section 2 of this paper; one effort at standards harmonization will be discussed in Section 3.

Several utilities have been unable to wait for the standards bodies to harmonize their specifications and have begun integration efforts that borrow from the MultiSpeak data model and service definitions to extend CIM. One such utility integration effort is described in Section 4.

2. PROPOSED STANDARDS TO DOCUMENT MULTIISPEAK PROFILES USING CIM

In June of 2008 MultiSpeak and WG14 announced an initiative to establish two sets of standards that will lead towards harmonization of their respective specifications. The first set of these joint harmonization standards, when completed, will provide a mapping between the upcoming MultiSpeak Version 4.0 and the upcoming combined release of IEC61970 Version 13 (core CIM) and IEC61968 Version 10 (distribution extensions to CIM). This set of joint harmonization standards will provide guidance to utilities on how MultiSpeak-formatted services and data payloads could be implemented using CIM messages and CIM-formatted data payloads. A side benefit of this mapping effort is that it will permit each standards body to see where the other has implemented functionality and to consider changes in future versions to bring the two standards closer together. The proposed standards to provide a mapping between MultiSpeak and WG14 CIM are summarized in Table 1.

The second set of joint harmonization standards will extend the mapping work outlined in Table 1 by defining a set of detailed guidelines, called profiles, to implement MultiSpeak Version 4.0 capabilities using CIM objects and CIM messaging rules. The proposed profile standards are summarized in Table 2.

Table 1
Proposed IEC Standards to Map
IEC61968 and MultiSpeak® Standards

Standard	Description
61968-14-1-3	Mapping Between MultiSpeak® V4.0 and 61968-3, Interfaces for Network Operation
61968-14-1-4	Mapping Between MultiSpeak® V4.0 and 61968-4, Interfaces for Records and Asset Management
61968-14-1-5	Mapping Between MultiSpeak® V4.0 and 61968-5, Interfaces for Operational Planning and Optimisation
61968-14-1-6	Mapping Between MultiSpeak® V4.0 and 61968-6, Interfaces for Maintenance and Construction
61968-14-1-7	Mapping Between MultiSpeak® V4.0 and 61968-7, Interfaces for Network Extension Planning
61968-14-1-8	Mapping Between MultiSpeak® V4.0 and 61968-8, Interfaces for Customer Inquiry
61968-14-1-9	Mapping Between MultiSpeak® V4.0 and 61968-9, Interfaces for Meter Reading and Control
61968-14-1-10	Mapping Between MultiSpeak® V4.0 and 61968-10, Interfaces for Systems External To, But Supportive Of, Distribution Management

Table 2
Proposed IEC Standards to Create a CIM Profile to Implement MultiSpeak® Functionality

Standard	Description
61968-14-2-3	CIM Profile for 61968-3, Interfaces for Network Operation, Using MultiSpeak® V4.0
61968-14-2-4	CIM Profile for 61968-4, Interfaces for Records and Asset Management, Using MultiSpeak® V4.0
61968-14-2-5	CIM Profile for 61968-5, Interfaces for Operational Planning and Optimisation, Using MultiSpeak® V4.0
61968-14-2-6	CIM Profile for 61968-6, Interfaces for Maintenance and Construction, Using MultiSpeak® V4.0
61968-14-2-7	CIM Profile for 61968-7, Interfaces for Network Extension Planning, Using MultiSpeak® V4.0
61968-14-2-8	CIM Profile for 61968-8, Interfaces for Customer Inquiry, Using MultiSpeak® V4.0
61968-14-2-9	CIM Profile for 61968-9, Interfaces for Meter Reading and Control, Using MultiSpeak® V4.0
61968-14-2-10	CIM Profile for 61968-10, Interfaces for Systems External To, But Supportive Of, Distribution Management, Using MultiSpeak® V4.0

3. INTEGRATION OF THE CIM COMMON POWER SYSTEM MODEL (CPSM) PROFILE INTO MULTISPEAK

MultiSpeak has robustly handled unbalanced distribution power system modeling since its first release in 2001. Transmission systems leading back to an equivalent source could also be modeled in MultiSpeak since its earliest release. Although transmission could be modeled, clearly the emphasis was on the distribution system.

Shortcomings in the MultiSpeak transmission power system model (prior to Version 4.0), included:

- Generation and power production were not modeled in the detail that was needed to map to the CIM CPSM.
- Several equipment types that are required in the CPSM, such as series compensators and static VAr compensators, were not supported explicitly in MultiSpeak.
- MultiSpeak did not support some of the transmission equipment containers (e.g., Bays and Lines) used by the CPSM.
- Values were explicitly expressed in units more appropriate to distribution systems than to transmission area operations (e.g., kW rather than MW; kVAr rather than MVAr).

Recently, utilities sought the addition of transmission power system modeling to the already robust distribution system modeling capabilities of MultiSpeak. Simultaneously, the use of the CPSM had grown, particularly among control area operators. This led to the addition of transmission modeling to MultiSpeak in the upcoming Version 4.0 release (V4.0) by the addition of CPSM functionality.

The approach taken in the addition of CPSM capability in MultiSpeak V4.0 was first to look for existing MultiSpeak objects that could carry the content of the CPSM objects. Those objects were enhanced so as to carry all of the fields required to function properly in either a MultiSpeak or CPSM role. Where objects did not exist to carry the CPSM data, those objects were created using CIM names and naming conventions. Objects added to MultiSpeak V4.0 from CPSM were stored in the cpsm namespace in the MultiSpeak schema to enhance the maintainability of the specification as CIM changes over time.

Other changes in MultiSpeak V4 that lead toward enhanced harmonization with CIM include:

- Support for detailed international addresses.
- Support for international telephone numbers.
- Support for all ISO 4217 currency codes [8] as well as a default currency code for messages to reduce data exchange size where appropriate.
- Support for a wide variety of units of measure.
- All values are now expressed in unit/value pairs where the unit to be applied to the accompanying value is definable on a case-by-case basis to reflect local conventions or domain preferences.

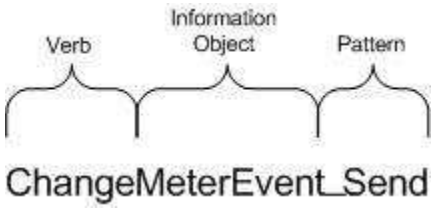
WG14 and the MultiSpeak Initiative are now working towards the culmination of this portion of the harmonization effort which will be an interoperability test between MultiSpeak-compatible applications and CPSM-compatible applications in the fall of 2009. This interoperability test will use the then-current MultiSpeak V4.0 release and the combined IEC61970v13 and IEC61968v10 version of CIM planned to be released by year end 2008.

4. INTEGRATION OF CIM AND MULTISPEAK IN THE AMI IMPLEMENTAION AT CONSUMERS ENERGY

The Advanced Metering Infrastructure (AMI) market is relatively immature and technologies are changing rapidly – and will likely continue to change at an accelerating rate. As a means to mitigate technical risks and lower life-cycle costs, Consumers Energy (CE) is actively involved and making significant contributions to industry standardization efforts impacting their AMI program. CE is not only performing thorough assessments of key technologies, but is considering how each technology and the data fit into the overall integration infrastructure – from interfacing with the Home Area Network (HAN) through to the Meter Data Unification System (MDUS) and then through to the applications supporting business processes. To achieve economies of scale, this data exchange must be based on industry standards that are adequate and supported in the market place.

In reference to Figure 1, through the Service Definitions Team of the AMI-Enterprise Task Force [10], Consumers is leading an effort to examine the CIM and MultiSpeak standards, determine gaps, and make recommendations back to both MultiSpeak and the IEC. As this work is being done in collaboration with utilities and vendors and being tested as part of their AMI program for implementation, artifacts stemming from this team will be of high quality and invaluable in the development of the aforementioned IEC 61968-14 series of standards. Consequently, these IEC standards will already be building substantial momentum while they are still in a draft state.

The process employed by Consumers Energy is to review the content of both the IEC CIM (current draft), and MultiSpeak version 3. MultiSpeak version 4 will be reviewed for the next iteration of the application integration effort once it had been completed. The content review includes the information objects, sequence diagrams, or any services that have been defined in either standard. To identify application integration requirements the team starts with use cases that document the related AMI business processes. Integration requirements are identified where information objects are based from system to system, for example, if information is passed from a Customer Information System (CIS), to a meter data management system. The team has developed a service naming approach that uses a CIM-based verb, then an information object, followed by the pattern name. For example, ChangeMeterSystem_Send, (see figure). The team is then building out a matrix that lists components such as service, source and destination system, and information objects. The team will then build out the content of each information object by reviewing CIM, MultiSpeak, or other vendor sources that have agreed to share information. It is expected that this work will result in a consistent interface, with consistent service definition, and facilitate the capability of systems to interoperate.



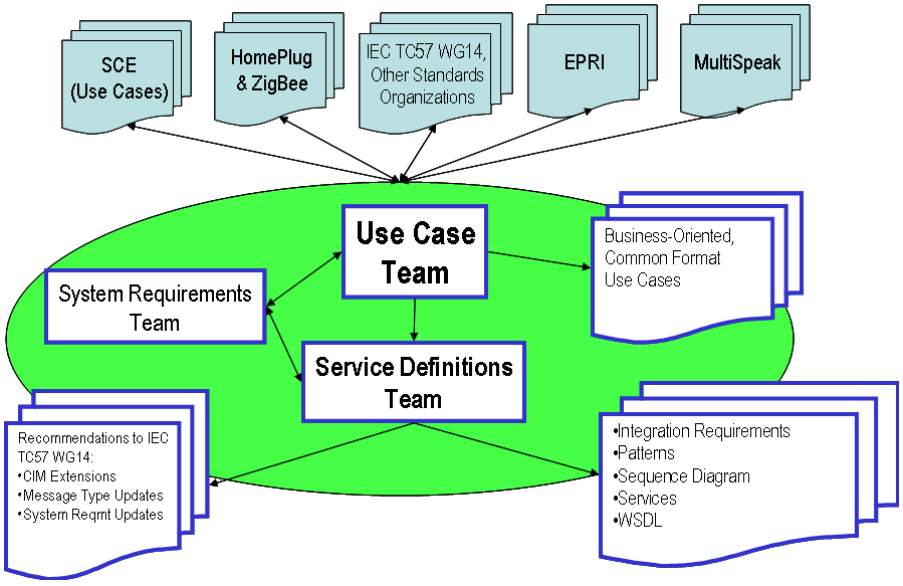


Figure 1: AMI-Enterprise Task Force Overview

5. CONCLUSIONS

MultiSpeak and the CIM are both being used on an increasing basis by utilities and their vendors for inter-application integration. But participants in this market space would rather not have two similar and evolving standards because it adds to their costs to understand, keep up with, and support both. This paper has provided an overview of the work now underway to bring these two popular standards together. As users will no longer need to fear "betting on the wrong horse" and as the quality of these standards continues to improve through collaboration, the authors believe this harmonization effort will break up a significant "log jam" that has been hindering utilities and their vendors in implementing standards-based integration solutions. The authors want to take this opportunity to encourage feedback and participation in this process by any interested parties.

References

[1] GridWise Architecture Council Interoperability Framework Team, "Interoperability Context-Setting Framework", GridWise Architecture Council, July 2007 http://www.gridwiseac.org/pdfs/interopframework_v1.pdf .

[2] MultiSpeak Initiative Participants, *MultiSpeak ® Version 3.0 Specification*, Arlington, VA: National Rural Electric Cooperative Association, 2005. http://www.multispeak.org/About/specifications.htm .

[3] Working Group 13 of Technical Committee 57, Energy Management System Application Program Interface (EMS API) – Common Information Model (CIM), International Standard IEC 61970-301, Geneva, Switzerland, International Electrotechnical Commission, 2003.

[4] Working Group 14 of Technical Committee 57, *System Interfaces for Distribution Management – Part 1: Interface Architecture and General Requirements,* International Standard IEC 61968-1, Geneva, Switzerland, International Electrotechnical Commission, 2002.

[5] Working Group 14 of Technical Committee 57, *System Interfaces for Distribution Management – Part 11: Distribution Information Exchange Model,* International Standard IEC 61968-11, Geneva, Switzerland, International Electrotechnical Commission, 2002.

[6] McNaughton, Gary A. and Robert Saint, "How NRECA's MultiSpeak® Specification Supports Interoperability of Diverse Grid Automation Systems", Proceedings of the 2007 Grid-Interop Forum, November 7-9, 2007, Albuquerque, NM, Gridwise Architecture Council, 2007.

[7] Working Group 13 of Technical Committee 57, Energy Management System Application Program Interface (EMS API) – Part 452: CIM Transmission Network Model Exchange Profile, Draft International Standard IEC 61970-452, Revision 6.05, Based on CIM13v10, Geneva, Switzerland, International Electrotechnical Commission, September 8, 2008.

[8] ISO 4217:2008, "Currency names and code elements", International Organization for Standardization, 2008.

[9] Parekh, Kamal, et al., "Utility Enterprise Information Management Strategies", Grid-Interop Forum 2007 proceedings.

[10] Overview of Status and Plans, AMI Enterprise Task Force of the Utility AMI Working Group, http://osgug.ucaiug.org/utilityami/AMIENT.

Biography

Gary A. McNaughton is the Vice President and Principal Engineer for Cornice Engineering, Inc. He has a B.S.E.E. degree from Kansas State University and an M.S.E.E. degree from the University of Colorado. Prior to joining Cornice in 1995 he worked as a Plant Electrical Engineer for Union Carbide, at the Oak Ridge Gaseous Diffusion Plant, at Oak Ridge, TN, as a Transmission Planning and Protection Engineer for Colorado-Ute Electric Association, a generation and transmission cooperative, located in Montrose, CO, and as Staff Engineer, Manager of Engineering, and Assistant General Manager for Engineering and Operations for La Plata Electric Association, in Durango, CO. Mr. McNaughton currently serves as the Project Technical Coordinator for NRECA's MultiSpeak® Initiative. Mr. McNaughton is a registered professional engineer in the State of Colorado.

Greg Robinson is a co-founder and President/CEO of Xtensible Solutions, which provides enterprise information management and integration solution and services to energy and utility industry. He helps utilities plan and implement semantically coherent application integration infrastructures. Mr. Robinson is convener of IEC TC57 Working Group 14, which is extending the industry standard Common Information Model (CIM) for enterprise-wide messaging. This volunteer work has enabled him to help utilities leverage and drive these industry standards to their benefit while simultaneously aiding the standards development process. He has a BSEE from Georgia Tech and a MBA from the Florida Institute of Technology.

Gerald R. Gray
Mr. Gray is an enterprise architect with Consumers Energy, a combination electric and gas utility serving over two

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