

# Rapidly evolving Smart Grid capabilities overwhelming? Try a CIMple Integration solution

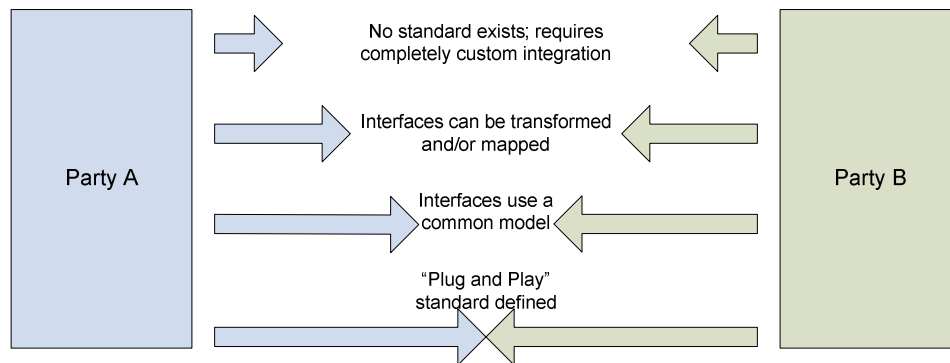
*"Anarchy is the only slight glimmer of hope" – Mick Jagger*

## Standards anarchy

Utility information standards are in a state of rapid change at this point in time. This can lead to confusion regarding how or if an organization should embrace a given standard. Standards are great, but in this period of rapid change, the situation with standards can be frustrating. Which standards are applicable to your situation? How are they applied? Do our Smart Grid investments use them? What about my legacy applications that need the data? Additionally, there is a lack of awareness that there are standards available to reference. Sometimes folks get so "head down" into solving the challenges in front of them they may not even think to look at what might be available.

The fact is, if standards are utilized, they have some obvious benefits. Solutions that utilize the same standard are easier to

integrate, have a lower total cost of ownership, are less brittle when it comes to changing them, and may enable new business processes and capabilities. As figure 1 illustrates, if no standard exists, an organization is forced to develop completely custom interfaces. These take a long time to create and are more expensive to maintain as changes are required, or new products are integrated. If an organization invests in an enterprise application integration (EAI), sometimes called enterprise service bus, this can help as data can be mapped from one system to another. Moving down the scale, if the interface is derived from a common model then each party can anticipate what information will be needed and there may be no need to do a mapping or transformation at all. Finally, a plug and play interface just works. Once an application is plugged in the application is easily integrated with another party's application because everyone has agreed on the standard and on how the standard is implemented.



Adapted from the Gridwise Council: Interoperability Context-Setting Framework V1.0, (2007).

**Figure 1. The Distance to Integrate; It's a long way to plug and play.**

## **Standards Bodies and Interface Development**

The focus of this paper is International Electrotechnical Commission (IEC) 61968 standard and its application within the Open AMI-Enterprise (AMI-ENT). The IEC is a standards development organization (SDO). The IEC as the SDO for metering standards has created a model that identifies relevant objects and their relationship in the enterprise. Open AMI-ENT is a task force under Utility Communication Architecture International Users Group (UCAIug), that has taken the IEC data model (and other inputs) and using a business driven process, has developed a set of artifacts, (XSDs and WSDLs), that move the effort closer to a plug and play footing. AMI-ENT, as a user driven community also can move faster based on the needs of the utilities, and provide feedback into the SDO as to gaps that may exist in the standard so that the standard evolves to meet the needs of its stakeholders. The situation at this point in time is analogous to the browser wars of the late 1990s, in that the situation was one where the W3C, as the standards body, had defined an HTML specification, but Microsoft and Netscape continued to add features that would then be rolled into the next version of the standard. The situation is much the same with standards development at this point in time in the utility industry. IEC as the SDO has defined an information model, but as new capabilities are created by vendors and

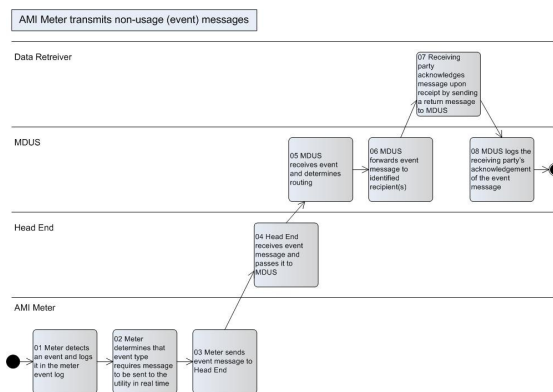
implemented in new business processes by the utilities, this need is fed back into the SDO. AMI-ENT, with participation by over twenty of the largest utilities in the United States, and work products that are vetted by most metering, meter data management, and other vendors, is one of the user communities that provide the business driven feedback into the IEC.

## **The Standards Challenge**

With all of this work the state of standards and their implementation should be all sunshine and rainbows right? Not so much. A standard is not something that is simply included in an RFP as a check-off item. When vendors claim that they support a given standard it is important to understand how they support the standard, which features have been implemented, and which version. The situation with the ANSI C12.19 meter standards is a classic illustration of the problem. There is a core set of 77 meter event codes. If one asks a particular meter vendor if they support ANSI C12.19 invariably the answer will be "yes". If all the meter vendors support ANSI C12.19, if a utility is using more than one type of meter in their AMI deployment, it should be easy to integrate the meter events from different vendors. The reality is a bit different. While most vendors support the basic "power up" and "power down" events, once this core is deviated from things are much different. Many vendors use the manufacturers' tables, which is

a legitimate use of the ANSI C12.19 standard to capture those events that may be specific to a given manufacturer's technology. However, some vendors use different descriptions for the same code, and as of this writing, some vendors even use reserved codes for something completely different in violation of the standard.

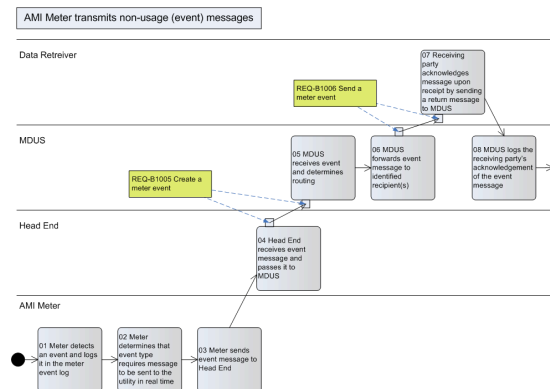
The situation with IEC 61968 is somewhat similar, in that while vendors may claim support for the standard, how the standard is implemented, which features are implemented, and which optional fields are used, all come into play when attempting to integrate products based on the standard. This is why the work that AMI-ENT has done has become so important. AMI-ENT has used a business-driven approach to implementing the standard. Use cases and business process have been identified and vetted by some of the largest utilities in the United States. From these business processes integration requirements have been identified.



**Figure 2. Example Business Process**

These integration requirements are then harmonized and rationalized across the set of

use cases and business processes to eliminate duplication. For example, different business processes may need to pass similar information, only the source and destination of the information has changed.



**Figure 3. Business process with identified integration requirements**

Instead of duplicating a service the information is rationalized so that one service can accommodate multiple uses. Once the core set of integration requirements have been identified a set of services are developed using a standardized naming approach, and finally, a set of XSDs and WSDLs are generated that can be implemented by both the source and consumer of the service, allowing systems to be integrated in a predictable fashion. Additionally, as new business processes are identified, new integration requirements and new services can be developed following the same framework for development, so new features can be added over time. For example, as of this writing automated demand response, automated data exchanged for third parties, and the business processes associated with enabling a utility relationship with customer that have plug-in hybrid electric vehicles (PHEVs),

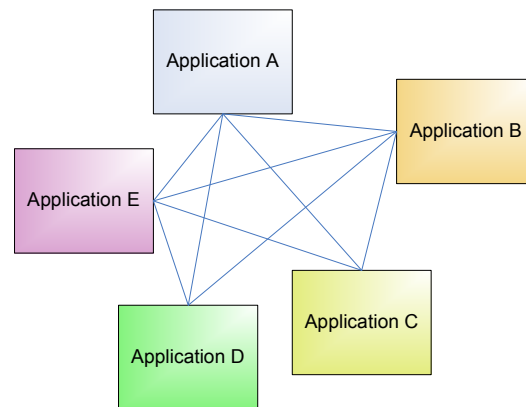
are all being developed with planned future integration into the AMI-ENT standard.

### **Standards get a government boost**

The Energy Independence and Security Act (EISA) merely encouraged utility investment into smart grid, and many utilities did begin projects. Now that initial boost has been augmented by the American Recovery and Reinvestment Act (ARRA) with government funding for green technologies, smart grid infrastructure development, and the development of standards that are required to enable the successful delivery of the smart grid vision. While the rest of the nation has been struggling with a recession, the utility industry has seen an unprecedented period of growth and investment. In addition, the National Institute of Standards and Technology (NIST) have been charged with creating a roadmap for the investment and development of standards, so that standards have the necessary maturity and interoperability to enable the smart grid. NIST, partnering with the Electric Power Research Institute (EPRI) has identified several standards that are considered “low hanging fruit”. IEC 61968 has been identified as one of these standards. This should lead to greater investment and provide greater incentive for vendors to comply with this standard, and by proxy, AMI-ENT going forward.

### **Systems maturity: Where does your organization fit?**

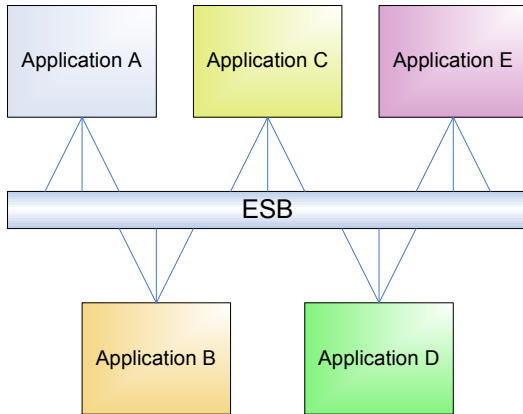
Where does your organization fit into this mix of standards development and industry investment? Large utilities usually have a mix of legacy systems and some silos where some investment has been made from time-to-time. It is not unusual to see systems like figure 4, marked by numerous point-to-point interfaces.



**Figure 4. Point-to-point integration scenario**

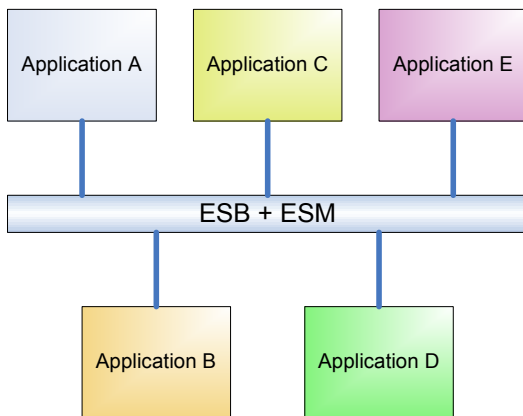
Even if a utility used a “best of breed” approach in their application selection, typically the costs of integrating and maintaining these solutions are more than if a utility utilized a comprehensive enterprise application. Additionally, point-to-point interfaces tend to be brittle, that is, due to their complexity they are more susceptible to errors being introduced if an interface is changed.

If your organization has matured it may have introduced an enterprise service bus and perhaps utilizes some web service technology. This is illustrated by figure 5.



**Figure 5. Applications using an enterprise service bus and web services**

This level of maturity may enable some business processes and begin to see some governance and reuse of services. Typically however the interfaces that existed in the prior scenario have simply been moved to a new technology with no rationalization of harmonization.



**Figure 6. ESB with rationalized interfaces and enterprise semantic model**

In figure 6 the interfaces have been rationalized and harmonized to eliminate duplication. This architecture has greater governance, a lower total cost of ownership and enables new business processes that can be enabled and more rapidly deployed than the earlier scenarios.

Additionally, the organization has developed an enterprise semantic model to ensure that the information that is exchanged adheres to a common vocabulary so that there is a minimum of mapping as information is exchanged between applications.

## Model-Driven Analysis and Design

To increase application integration maturity it is helpful to take a model driven analysis and approach. The approach to developing an open and interoperable development includes the following key components:

- A structured approach for analysis and design using model driven methodology for consistent business semantics and leveraging industry standards such as IEC CIM and MultiSpeak, which drive toward semantic interoperability.
- A set of service-oriented integration patterns and web services standards to drive technical interoperability.

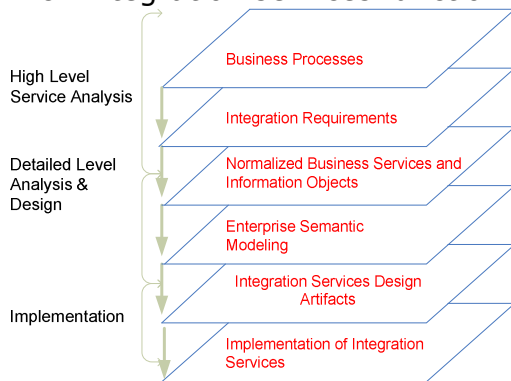
In the high-level service analysis a top-down approach is followed with the major steps listed below and illustrated in figure 7:

- Develop To-Be business process models for AMI
- Review To-Be business processes and conduct gap analysis by utilizing industry standards
- Identify integration requirements (services and information objects) in a context of business process

- Normalize services and information objects for detail design

Business processes provide a collection of activities across multiple systems and applications. These business processes are essential for identifying integration requirements (services and information objects) from a business perspective. Data flows captured in a business process often indicate integration lines. Multiple industry standards such as IEC CIM and MultiSpeak can be used as a basis for developing interoperable solutions. Logical mappings from the business processes to standards are conducted to align with the utilities business needs and with existing industry common practices.

The outcome of the High-Level analysis is the Business Context (see the GridWise Interoperability Framework) within which integration services function.



**Figure 7. Hierarchy of service analysis and design**

Based on data flows between systems and applications, information objects can be identified with a collection of entities and properties unique to a business context. With multiple

business processes, it is possible that an information object is identified in another business process or overlapped with other information objects. Therefore, it is critical to have a normalization process that defines objects at a certain level of granularity based on business needs. The normalization process can help define a relatively accurate scope of the detail design phase with a list of common services and information objects that need to be constructed.

In the detail design phase, a combination of top-down and bottom-up approaches is employed. The steps involved are as follows:

- Review identified data requirements (services and information objects)
- Develop the Enterprise Semantic Model (ESM) for AMI with business context for each integration scenario.
- Deliverable in XML schemas and Web Service Definition Languages (WSDLs)

The outcomes of the Detail Level Analysis provide the Semantic understanding (see the GridWise Interoperability Framework) upon which all integration services design artifacts will be based. The goal of the detail design is to provide sustainable implementation artifacts in terms of performance, reliability, reusability, compliance, and interoperability. For this reason, the identified services and information objects from the high-level gap analysis need to be examined carefully to avoid

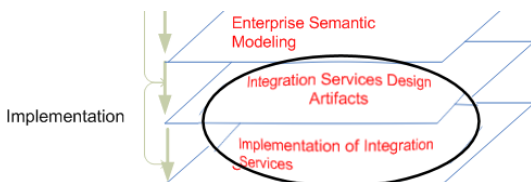
unnecessary rework as much as possible.

Implementation artifacts are delivered in the form of XML schemas (XSD) for information objects and WSDLs for endpoint service definition.

Model-driven methodology is adopted for the detail design process. Information objects are modeled in UML. The objects modeled in UML come from the logical information objects identified from high-level analysis (top-down), data requirements from each systems/applications and industry standard (bottom-up). (*An Approach for Open and Interoperable AMI Integration Solution, 2008*)

### The CIMple Integration solution

CIMple Integrations, is uniquely positioned to meet the demands facing the utility market. CIMple Integrations is a thought leader and contributors in the development of Open AMI-Enterprise and have also been part of the feedback process into IEC 61968 to improve the development of that standard.



**Figure 8. CIMple Integrations value add**

CIMple Integrations also understands the methodologies and can use the tools required to help organizations utilize standards

as inputs into their own enterprise semantic model.

Additionally, looking at figure 8, CIMple Integrations has practical experience with leading industry vendors in making standards actionable and integrating applications in the enterprise, for example integrating head end, meter data management, and back-office solutions. Finally, resources from CIMple Integrations have worked with and evaluated the capabilities of most metering vendors, several of the top meter data management solutions vendors, and back office utility applications. While CIMple Integrations cannot violate NDAs in place with these vendors, CIMple Integrations has the expertise to assist organizations with their own evaluations as they work to understand how any particular vendors offering may fit within their enterprise.

### Summary

The utility industry is going through an unprecedented period of attention, growth, and investment. Standards, although maturing quickly, are also undergoing significant change as new business capabilities are being developed. Vendors that are rapidly developing these capabilities run the gamut from being dedicated to open and interoperable standards, to attempting to lock-in customers as quickly as possible. CIMple Integrations is uniquely positioned to help utilities navigate this period of rapid change by providing a deep understanding of standards coupled with the practical

experience of working with vendors and applying those standards in the enterprise.

**For More Information please contact:**

**Gerald R. Gray, President**

CIMple Integrations, Inc.

PO Box 307

505 N Oakland Dr

Laingsburg, MI 48848

[gerald.gray@cim-ple.com](mailto:gerald.gray@cim-ple.com)

517.977.5016

[www.cim-ple.com](http://www.cim-ple.com)

**References**

Gray, G., Ortiz, M., Hu, S. & Zhou, J. (2008). *An Approach for Open and Interoperable AMI Integration Solution*, Grid Interop Conference.

International Electrotechnical Commission; <http://www.iec.ch/>

Multispeak; [www.multispeak.org](http://www.multispeak.org)

Rahimi, F., & Albuyeh F. (2007). *Application of Gridwise Interoperability Framework to Demand Response*. Gridwise Architecture Council