Implementing the CIM at DTE

An Implementation Methods Committee Case Study

Disclaimers

Acknowledgements

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Executive Summary

This Smart Grid Interoperability Panel (SGIP) document presents a case study of DTE Energy's implementation of the IEC Common Information Model (CIM). This case study is an Interoperability Implementation Experience deliverable, from SGIP's Smart Grid Implementation Methods Committee (SGIMC). DTE Energy embarked upon a journey starting in 2005 to address the limitations of utilizing point-to-point integrations. After this initial awareness of the problem, the need to implement an Advanced Metering Infrastructure (AMI) followed in 2007-8 that would not only meet their business and regulatory requirements, but would also be done in a way that was scalable, maintainable, secure, and able to evolve with technology change. In 2009, the opportunity arose to submit a proposal to DOE to access ARRA program money to accelerate their AMI and Smart Grid program. After submitting a winning proposal and starting the work in earnest in 2010, DTE staff discovered the value of standards based integration using an Enterprise Semantic Model and supporting architectural concepts such as the Enterprise Service Bus (ESB). Along the way they encountered several challenges and opportunities in realizing these goals.

When developing the proposal for the DOE ARRA SmartCurrents project, DTE leadership established three guiding principles:

1. The most significant NIST recommended standard for Smart Grid Interoperability relevant to IT applications is the Common Information Model (CIM) (IEC 61968/61970)

   … *and SmartCurrents IT work shall comply [to the CIM standard – ed.]*

2. SmartCurrents shall develop an Enterprise Semantic Model (ESM) as the basis for all application interfaces
3. SmartCurrents shall have a centralized project team with responsibility to ensure development of ESM-compliant application interfaces

> *"Any single integration that used to take 3-4 weeks now can often be done in 3-4 days"*
>
> *– Jeff Kenward,*
> *DTE Enterprise Architect*

These guidelines set the stage for building an effective team – the Enterprise Services Development (ESD) team – to implement and integrate the myriad of systems needed to scale their AMI system up to full deployment and extract value through application integration elsewhere in the utility.

The success realized by DTE Energy as described in this case study is built incrementally from three distinct but related concepts that build on the aforementioned guiding principles:

1. The adoption of Service Oriented Architecture (SOA) using an Enterprise Service Bus (ESB)

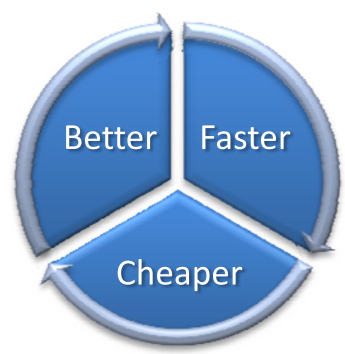
2. The development and pervasive use of an Enterprise Semantic Model (ESM) – standard names for standard things
3. The utilization of the IEC CIM as the basis for their ESM

During the course of our interviews with DTE Energy staff, it became clear that the CIM itself was not the most valuable component – it was the combination of all three of these elements plus the necessary governance including executive support, training, and documentation that resulted in more effective, higher value system integration.

When DTE Energy began implementing the CIM not everything went as expected, especially when considering that the integration guidance at the time that DTE began was somewhat immature. It took time and resources to get support for this effort. There is still some push back on the use of the CIM and the ESB. Changing a fundamental architecture can be as much about changing organizational culture as it is about changing the technology. Changing a culture is difficult and to many people within the organization, this effort seemed like a big change. Every business domain believed that they were different and do not readily fit into a common model. They also had issues with seeing the overall benefit of moving forward with this approach and primarily see the failure points and extra upfront work. Once there were a few interfaces in place (successes) others began to see the benefit and buy into the change - but there is still a lot of work to get everyone comfortable and engaged.

There has been significant value added in the use of the CIM and the ESB by lowering the distance to integrate:

- Time to delivery… cost savings
- Staffing agility... schedule impacts
- Potential external interoperability
- Shared cross-organizational vocabulary through standardized business/IT terms



The enterprise has seen the time to delivery of services using the CIM and the ESM decrease – in many cases by a ratio of 4 or 5 to 1. With an established message structure and cross-organizational vocabulary, time does not need to be spent on developing and obtaining agreement on a message structure. There is an upfront cost to implementing the CIM message for the first time and determining what part fits for that use case ***but the total cost of ownership is less because that initial effort is not repeated for every new interface or change.***

The DTE Energy story on their use of the CIM and the ESB is a very important one. This is because (to paraphrase) prognosticators have often said, “SOA and the use of a common model reduce costs” but there were few business cases that one could point to that validated this claim. The DTE Energy experience is one such case. While there were some challenges in the implementation overall the experience was valuable, provided cost savings; lowered time to delivery and lowered cost of ownership. The use of the CIM within the SOA facilitated the creation of a framework and a foundation for greater integration agility and the ability to leverage reusable integration patterns. In conclusion, specific lessons learned include:

Build out domain areas based on areas of the business - This would allow for the company to identify smaller areas to focus on ESM development and where the CIM fits.

Look at other information models to build out the ESM – The CIM fit many aspects of the DTE Energy business on the electric side but there were gaps identified relating to the business needs of the gas utility.

Dedicate an effort to develop the ESM - DTE Energy has a team dedicated to the development of Enterprise Services but not the overall ESM. This should be a dedicated effort to define the corporation's model instead of piecing it together as they go.

Improve communication on the value of the ESB and CIM - There has been some push back around the use of the ESB and even around the use of the CIM due to a lack of understanding of how both work and the benefits that can be achieved.

Participate more in the CIM User Group - Because the participation has been limited, the company only has a couple of people who know and understand how to use the CIM and can give feedback on future releases.

Take advantage of help from other entities - DTE Energy did not take full advantage of the help that these companies were able and willing to offer. They could have benefitted from the lessons learned around the process of developing an ESM using industry standards such as the CIM.

Develop a maintenance plan - As changes occur in the model and implemented services, there needs to be a strategy and migration plan for applying these changes systematically. DTE Energy does not currently have a strategy for moving to new releases with major changes.

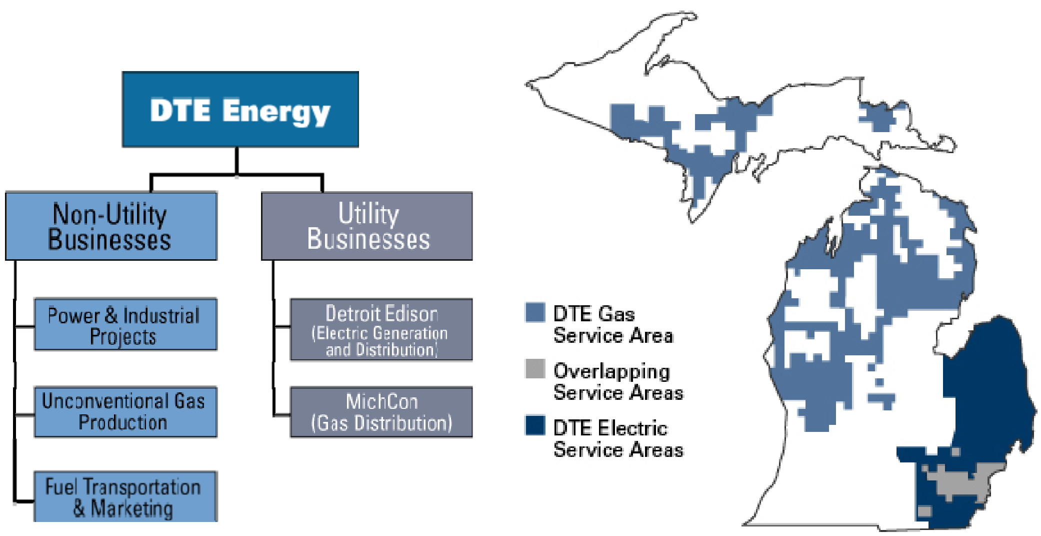
A few specific recommendations for SGIP and the energy industry arise out of the lessons learned noted above. Chief among these is the need for a new/resurrected collaborative effort between the SGIP SGIMC and the Utility Communications Architecture International Users Group (UCAIug), a CIM Users Group and OpenSG EIM group. DTE Energy noted that they extracted significant value from the CIM Users Group but would have benefitted more if a better set of collaboration tools were available (adhoc list servers, SharePoint). Also, organized meetings and events to get multiple utilities in a room to share and develop common requirements and semantic models would have been beneficial. The SGIP SGIMC may be able to serve as a focal point for capturing and prioritizing utility enterprise architecture application requirements – identifying the gaps in the CIM and other models – and working with the UCAIug member groups and the SGIP Smart Grid Testing and Certification Committee (SGTCC) to develop the actual models and the associated test and validation methods.

DTE Overview

DTE Energy Co. (NYSE: DTE) is a diversified energy company involved in the development and management of energy-related businesses and services nationwide.

DTE’s largest operating subsidiaries are DTE Electric and DTE Gas. Together, these regulated utility companies provide electric and/or gas services to more than three million residential, business and industrial customers throughout Michigan.

DTE Electric generates, transmits and distributes electricity to 2.1 million customers in southeastern Michigan. With an 11,084 megawatt system capacity, the company uses coal, nuclear fuel, natural gas, hydroelectric pumped storage and renewable sources to generate its electrical output. Founded in 1903, DTE Electric is the largest electric utility in Michigan and one of the largest in the nation.



At 1.1 million kilowatts, the company's Fermi 2 nuclear power plant represents 30% of Michigan's total nuclear generation capacity. This single plant is capable of producing enough electricity to serve a city of about one million people. Fermi 2 has been providing reliable, cost-effective power to DTE Electric customers for more than 20 years. The plant also has been designated as one of the nation's best-performing nuclear facilities.

DTE Gas is engaged in the purchase, storage, transmission, distribution and sale of natural gas to approximately 1.2 million customers in Michigan. The company owns and operates 278 storage wells representing approximately 34 percent of the underground working capacity in Michigan. There is more gas storage capacity in Michigan than in any other state. Founded in 1849, DTE Gas is one of the nation's largest natural gas utilities. DTE also own Citizens Gas Fuel, a small natural gas utility serving customers in portions of Michigan's Lenawee County.

In April of 2010, DTE Energy and the U.S. Department of Energy (DOE) signed an agreement finalizing a nearly $84 million grant that enabled DTE Energy to accelerate deployment of "Smart Grid" technology in Michigan through the SmartCurrents initiative. The DOE funding was matched by the company and its technology partners, bringing the total investment to accelerate the program to nearly $170 million.

The program serves as a platform to eliminate manual meter reading and provide remote monitoring of the electric distribution system, which will enable faster and more reliable power outage detection and restoration. DTE Energy also has the ability to connect meters remotely. The program also enables customers to manage their bills by tracking their consumption and demand via the DTE Energy Web site.

The SmartCurrents program, besides advanced metering technology, includes technologies that address improved electric distribution service and electric rates that incentivize off-peak electrical usage, web-based customer energy usage presentation and customer outage notification. In addition, certain "smart" appliances can communicate with DTE Energy to provide optimum energy savings.

Enterprise Architecture Team Organization

DTE Energy at one time had a centralized enterprise architecture team but today they are distributed among DTE Energy’s five business areas – Plant, Field, Customer, Information Technology Services (ITS), and Back Office. Each business area has one architect that reports to that business unit’s director. They also have a lead architect, an operations specialist, and an integration specialist for a total of 8 enterprise architects. Each business unit architect is primarily responsible for the needs of that business unit but under the leadership of the current CIO they have strong collaboration processes and maintain a cross enterprise, big picture view.

A unique aspect of the DTE Energy Enterprise Architecture team that came to light during the interview process of this case study was how important the evolution of the relationship between the architects and the CIO was to their past and continuing success. Prior to breaking up into the five business units, all of the architects worked closely with each other and developed strong working relationships. Also, their current CIO was in that group before being promoted. The architects all worked with him for years and everyone had developed a lot of trust in judgment with each other. This is an ideal situation but it may be difficult to duplicate in other utilities through a pure process driven approach to building and governing an enterprise architecture team.

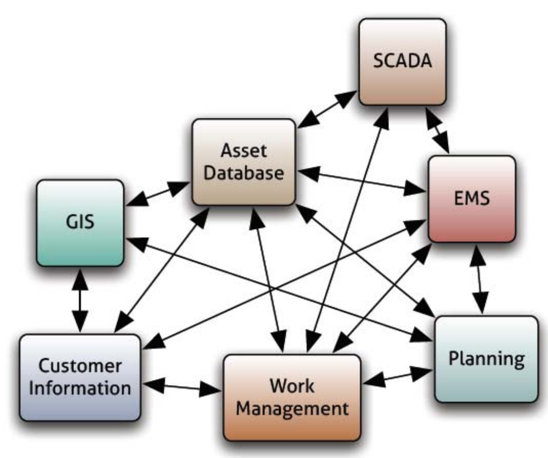
Business Challenge

Like any business, some of the most challenging business problems don't simply appear overnight – they evolve over time. Hardly noticed at first, small individual decisions made without the benefit of a higher level vision can compound, until one day you begin to realize that you are going down a dead end road with barely enough room to turn around or forge a new path. DTE Energy's enterprise architects found themselves in this situation. In this portion of the case study, we will look at how the problem evolved, what some of the key "aha" moments were, and then in the next section how the solution has begun to unfold in an evolutionary manner as well.

In 2005, DTE Energy enterprise architects who were engaged in code reviews began to notice a lot of copied code and started to look at ways to improve reusability and the efficiency that would result. They were also noticing that they had many similar interfaces but the code for each "handshake" had similar components with a minor twist on what data points were being passed back and forth – for one reason or another, each interface was "special".

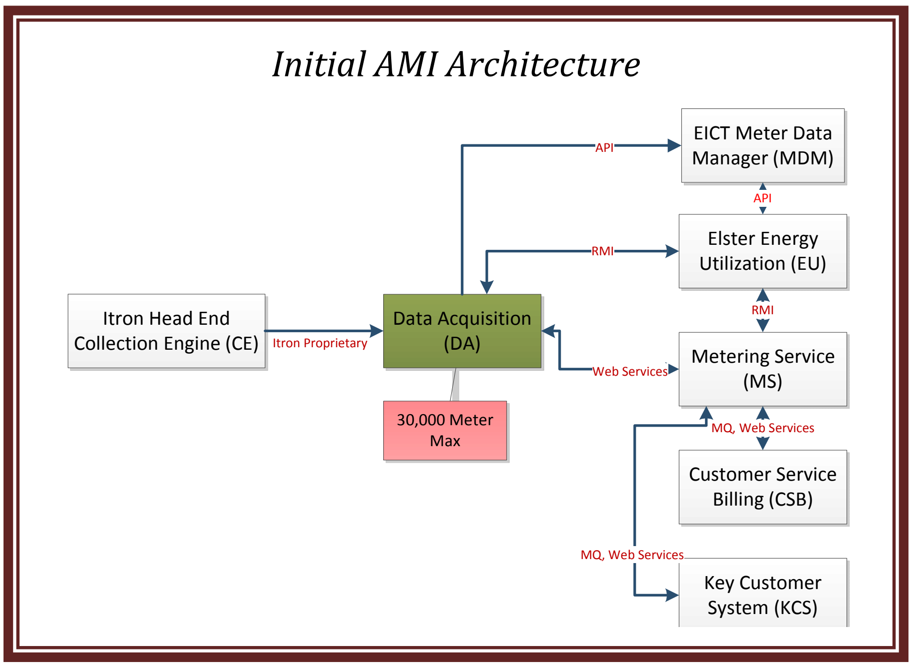
Like any good enterprise architect following evolving best practices in their field, they were moving towards a Service Oriented Architecture (SOA), but some of their legacy systems were making that difficult. They had a lot of point-to-point integration aspects to their implementations such as stored procedures, flat file transfer, database level integration links (dblinks), web services and Remote Method Invocation (RMI) calls and none of it played particularly nice together. Also, client systems needed to have knowledge of what technology was being used – totally counter to a best practice in enterprise architecture known as loose coupling and layering. A lot of times they would just keep things in one monolithic system and copy data around just to avoid integration. System-of-record issues were the result of this non-integration strategy. DTE Energy knew that they needed some intermediary to help manage their application integration environment.

Point-to-Point Integration – Complex and difficult to maintain



As DTE's enterprise architecture group began to become increasingly aware of their looming integration problem and continued to investigate various solutions, they had to move forward with the implementation of their Advanced Metering infrastructure (AMI) program. DTE Energy had to integrate several new systems to support their AMI pilot project. They already had Elster's Energy ICT Meter Data Management (MDM) product in place for their existing metering infrastructure. As the AMI pilot was deployed, the DTE Energy AMI team needed to integrate it with their chosen meter vendors (ITron) head-end collection engine (CE), their billing system, and eventually to several other enterprise systems. Their initial attempt was to use many of the point-to-point integration methods that they had been using for years and were already realizing was not viable in the long term.

DTE's AMI team attempted to build their own Message Bus (MB) to support the system integration through a system they called simple Data Acquisition (DA). They called it a message bus because it did content based routing as well as transformation. It also applied some business rules to the messages that came through before they were sent on their way.



The DA was integrated with the Elster EICT MDM using an embedded API integration technique. A wrapper system called Energy Utilization (EU) was implemented to provide a vendor independent interface to the MDM using embedded Java API's. The EU wrapper communicated with the DA using RMI's. RMI's were also used to interface with another system called Meter Services (MS) that became the primary well defined point of interoperability. The MS wrapper communicated with the DA using web services (WS). The MS system was then able to provide meter data services to their two home grown billing systems (Customer Service Billing [CSB] for residential, and Key Customer System [KCS] for C&I) and other systems through WS based interfaces and with IBM's WebSphere MQ product – a commercial enterprise message bus technology designed for efficient and scalable transport of messages and data.

If you have managed to follow this story along so far – especially with all of the acronyms - you can see that there are many interfaces and technologies utilized that are limited in their ability to scale. The system performed reasonably well for almost three years but as they grew from 30,000 to 50,000 meters they "hit the wall". DTE noted that the spectacular failure that lead to accelerating their search for a better solution was with the DA system. DA had severe scaling issues once they hit 30,000 meters installed and had to be monitored daily/nightly. This meant that someone would wake up every 3 hours at night and log in to make sure that it was ok. A lot of times (almost daily, definitely weekly) it had to be rebooted to release the memory. The DA was developed internally until they could get something more permanent in place. The DA was implemented using Java message Service (JMS) queues all in an Oracle WebLogic application server and all running in the same Java Virtual Machine (JVM). There were simply not enough resources – they could not throw more memory at it or spawn more threads – they were at an architectural dead end.

Solution Description

What is the CIM?

"The Common Information Model (CIM) is an open standard for representing power system components originally developed by the Electric Power Research Institute (EPRI) in North America and now is a series of standards under the auspices of the International Electrotechnical Commission (IEC). The IEC standard 61970-301 is a semantic model that describes the components of a power system at an electrical level and the relationships between each component. The IEC standard 61968-11 extends this model to cover the other aspects of power systems software data exchange such as asset tracking, work scheduling and customer billing. The CIM for Electricity markets then extends both these models with the IEC standards 62325-301 to cover the data exchanged between participants in electricity markets. These three standards, 61970-301, 61968-11 and 62325-301 are collectively known as the CIM for power systems and currently have three primary uses: to facilitate the exchange of power system network data between organizations; to allow the exchange of data between applications within an organization; and to exchange market data between organizations." – Common Information Model Primer, EPRI Technical Report 1024449 - November, 2011

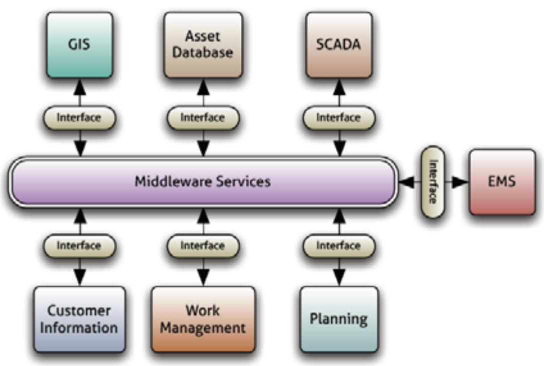
In 2009 while the AMI enterprise architecture team was struggling to build, scale, and operate their pilot system, the opportunity arose to submit a proposal to DOE to access ARRA program money to accelerate their AMI and Smart Grid program. The DOE program description required the use of concepts emerging from the industry around standards based interoperability. The DOE noted the work underway by the National Institute of Standards and Technology (NIST) to develop a smart grid interoperability framework as mandated by the Energy Independence and Security Act (EISA) of 2007. The initial NIST framework report noted that the most significant standard for Smart Grid Interoperability relevant to IT applications is the Common Information Model (CIM) – also known as IEC 61968/61970.

In DTE Energy's grant application, they proposed a program called SmartCurrents. The SmartCurrents program consists of three parts – AMI, Smarthome, and SmartCircuit. Their grant application proposed that the SmartCurrents program shall utilize the CIM for integration, they shall develop an Enterprise Semantic Model (ESM) as the basis for all application interfaces, and SmartCurrents shall have a centralized project team with responsibility to ensure development of ESM-compliant application interfaces.

During 2010 a "perfect storm" arose as DTE Energy describes it. They were aware of and struggling with their point-to-point integration approach, they had begun implementing SOA to start mitigating that problem, they had secured DOE funding for the SmartCurrents program, and the program had a requirement to implement a CIM based ESM. During the same time frame, key DTE Energy enterprise architecture staff attended a CIM users group meeting and began participating in other industry collaboration activities of the Utility Communications Architecture international Users Group (UCAIug) including the Open Smart Grid (OpenSG) Enterprise Information Model (EIM) working group. This perfect storm resulted in the accelerated implementation of the CIM at DTE.

To further get up to speed on the CIM, DTE Energy brought in a CIM expert to help them figure out how to map their integration needs to the CIM and use it as the basis for their ESM. The consultant led the

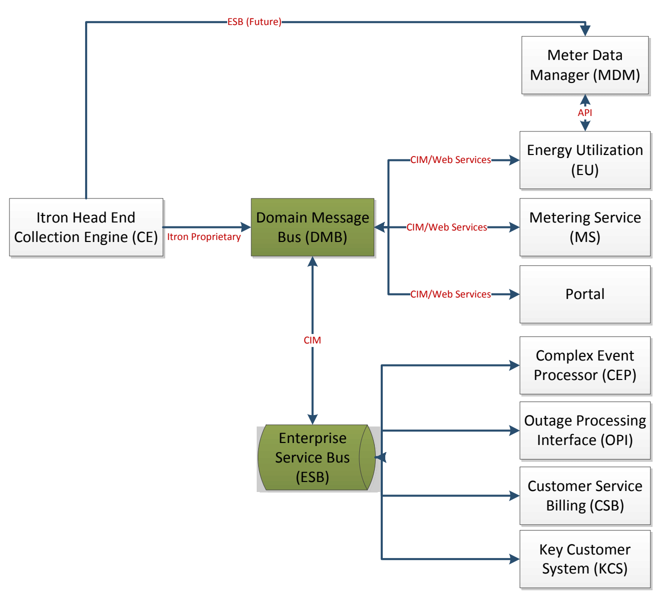
Integration with an Enterprise Service Bus (ESB) – Extensible and maintainable



architects through the process of mapping their specific messaging requirements to the CIM model. DTE Energy personnel highlighted the experience in mapping their models to the CIM elements that are identified using Universally Unique Identifiers (UUID). UUID's are very long, randomly generated numbers that uniquely identify a CIM object or message type. Sometimes the process of mapping an internal requirement to a CIM model can become tedious. Within DTE Energy the architects began referring to UUID's and the mapping process as the Giant Stupid Number (GSN) mapping. Within three months of that initial session with the CIM expert, DTE's enterprise architects were managing their own work sessions developing their ESM and mapping objects to GSNs themselves. Generating the utility specific ESM is probably the most labor intensive part of the process but this up front effort pays major dividends down the road. The concept of the ESM was key to get everyone on the same page with respect to having "standard names for standard things" and a machine readable implementation based on a scalable SOA based architecture via an Enterprise Service Bus (ESB).

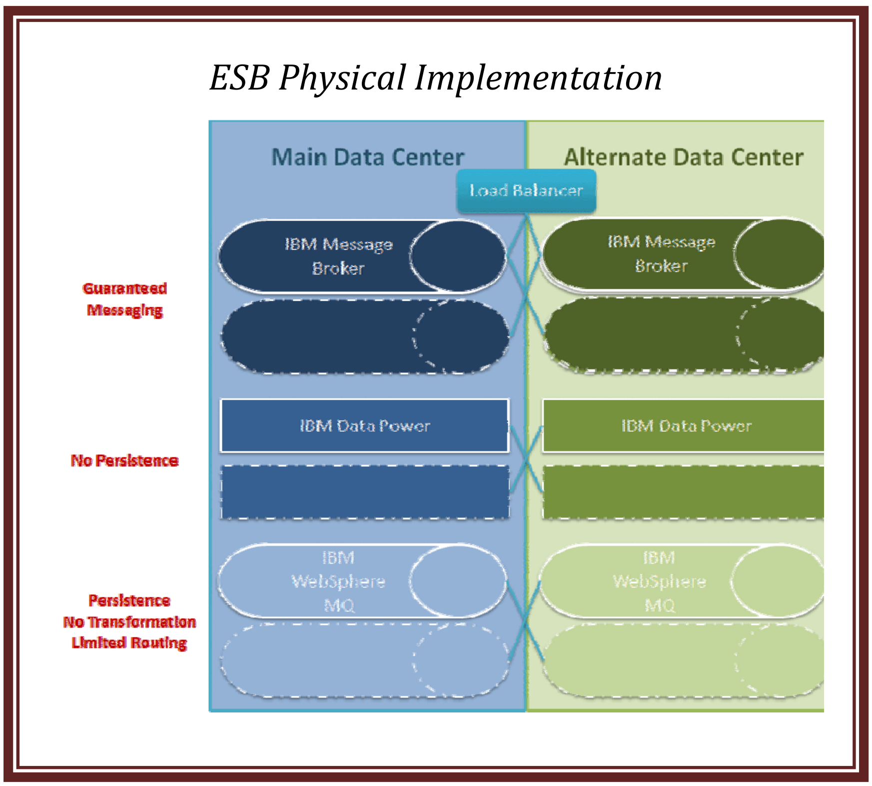
As DTE Energy enterprise architects designed and implemented their ESB, they began replacing services in the DA one by one. The replacement for the DA system was called the Domain Message Bus (DMB). The fundamental difference between the DA and the DMB was that it was an ESB implementing technology designed and built to handle messages at the required volume by experts.

DTE ESB Based Architecture



In the new ESB based architecture depicted below, the DMB replaces the DA system but is AMI application specific. It interfaces to the proprietary Itron CE interface on one side and presents a web services based interface using CIM as the ESM on the other side. The EU system is still needed to interface to Elster's proprietary integration API. The Metering Service (MS) system was updated to use WS and the CIM to connect to the main ESB. The Key Customer System (KCS – C&I billing system) was the first to be converted to use the CIM based ESM over the ESB. Other systems soon followed including the Customer Service Billing (CSB) and the Complex Event Processor (CEP) and Outage Processing Interface (OPI).

Initially, the ESB was implemented using IBM Message Broker (now known as IBM Integration Bus Advanced). It was configured to have two pipes at the main data center and two at the alternate data center for resiliency. Load balancers were used to distribute the processing load. This solution is a "heavy weight" approach. It provides guaranteed messaging, transformation routing, persistence, and is scalable – well architected but expensive.



After the initial implementation achieved 70% of capacity they realized the licensing cost to scale it up was oppressive. This discovery led to a decision to procure IBM Data Power – a messaging appliance. It was relatively inexpensive and can be scaled by simply adding additional Data Power appliances. It didn't have persistence or guaranteed messaging but that was fine for much of the applications on the ESB. For those applications that required persistence they implemented IBM MQ which has persistence but no transformation and limited routing. These three technologies together created a Hybrid ESB which is what DTE Energy initially called the solution but now simply refer to it as the ESB.

Solution Benefits

When asked if they had a formal process or metrics for evaluating internal project cost-benefit, DTE Energy reported that they did not. They are working to develop such processes and are improving their measurement of the costs associated with a particular project integration. Time and expense budgets for projects are specified within the business units, but current governance limits involvement of the enterprise architecture teams in costing a project out and limits full traceability between costs and benefits against different implementation approaches.

Even without a formal process for cost-benefit evaluation, there has been demonstrable value added in the use of CIM and the ESB. Part of the value seen is the lowered distance to integrate. The pieces of the lowered distance to integrate that DTE Energy has seen are time to delivery, total cost of ownership, common knowledge of the model, and common integration patterns. The enterprise has seen the time to delivery of services using the CIM and the ESM decrease in many cases by a ratio of 4 or 5 to 1. With an established message structure, time does not need to be spent on developing and obtaining agreement on a message structure. There is an upfront cost to implementing the CIM message for the first time and determining what part fits for that use case **but the total cost of ownership is less because that initial effort is not repeated for every new interface or change.**

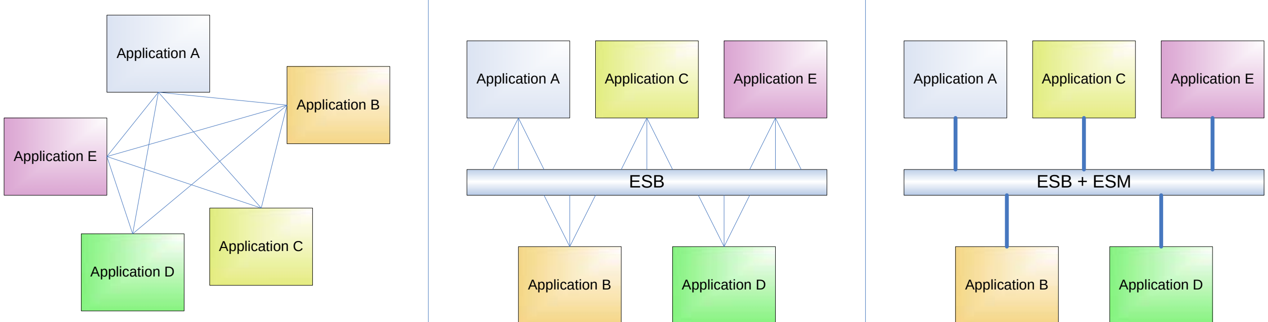
> *"Any single integration that used to take 3-4 weeks now can often be done in 3-4 days"*
>
> *– Jeff Kenward, DTE Enterprise Architect*

Developers also learn the structure and there is a common knowledge of how to use the CIM and existing messages that exist in the ESM. With the established use of the CIM, development of an ESM and the introduction of an ESB, a common integration pattern has emerged that also builds on the lowered distance to integration. DTE Energy has seen value in having a repeatable pattern for integrating systems while reducing the coupling between those systems.

DTE Energy has also seen value in this approach outside of lowering the distance to integrate. Adopting CIM for their electric distribution model provided the basis for the ESM. There is still significant work to do to move the ESM forward but DTE Energy has already seen value in the portion that has been developed.

The CIM has become an industry standard for electric utilities and is growing to accommodate more parts of the business. This adds value to DTE Energy by facilitating interoperability, if needed, with outside partners who have also adopted the CIM and that will continue to interoperate in the future as each partner evolves and improves their systems using the same common messaging format that the CIM offers. The CIM has facilitated the standardization of business terms and make these terms common across business areas. It has allowed the company to speak the same language within its own walls.

DTE Energy architects commented that the use of the CIM/ESM and ESB have improved their work environment and as they reported, their sanity. Having standardized patterns and well defined processes for integration leaves them with one less thing to think about and provides a reduction of complexity. This takes the fear out of making some choices – far less stressful and less completion anxiety. There are embedded lessons learned in reusable information models and design patterns as long as the context and requirements were compatible and communicated.



- Point-to-point systems
- Typically difficult to integrate
- “Brittle” interfaces that are difficult to change
- Duplication of data and business logic

- Web services all for easier interoperability
- Web services begin to promote reuse
- Business processes are easier to integrate
- Interfaces are easier to develop and maintain
- While an improvement over point-to-point systems, governance may still be a problem

- Interfaces have been rationalized and harmonized to eliminate redundancy
- Cost of ownership is reduced
- Governance is improved
- Data quality increases

Electric Power Research Institute, 2012

Lessons Learned

The DTE Energy story on their use of the CIM at the ESB is a very important one. This is because (to paraphrase) prognosticators have often said, “SOA and the use of a common model reduce costs” but there were few business cases that one could point to that validated this claim. The DTE Energy experience is one such case. While there were some challenges in the implementation, overall the experience was valuable; provided cost savings reduced delivery times, and reduced the total cost of ownership. The use of the CIM within the SOA facilitated the creation of a framework and a foundation for greater integration agility and the ability to leverage reusable integration patterns. Specific lessons learned include:

Build out domain areas based on areas of the business.

This ensures the company can identify smaller areas to focus on ESM development and determine where the CIM fits. It also identifies a defined business model of how their business is made up and where the overlaps occur.

Look at other information models to build out the ESM.

The CIM fits many aspects of the DTE Energy business on the electric side but there were gaps identified relating to the business needs of the gas utility. However, these gaps were easily remediated by extending the model. It did not and still does not fit all aspects of the business. There are efforts underway to harmonize other models with the CIM to remediate some of these gaps. Developing an ESM would have been much easier if other information models had been identified to fill gaps in the CIM. This is also where the defined domain areas would be useful. With the business model defined, identification of models for the individual areas would have been easier and DTE Energy would have been better at identifying where the CIM fit and where it didn’t fit.

Dedicate an effort to develop the ESM.

DTE Energy has a team dedicated to the development of Enterprise Services but not the overall ESM. The Enterprise Services Development team will add to the ESM as requirements arise, but they are not working towards defining the overall ESM. Having this prepared beforehand with defined messages in a library, development of new services for new integration points would benefit earlier in the lifecycle. This should be a dedicated effort to define the corporation’s model instead of piecing it together as they go.

Improve communication on the value of the ESB and the CIM.

There has been a lot of push back around the use of the ESB and even around the use of the CIM. The belief is that this stems from a lack of understanding of how both work and the benefits that can be achieved.

Participate more in the CIM User Group.

DTE Energy has been involved in the CIM User Group but on a fairly limited basis. There is value that could have been added and received in that participation. Because the participation has been limited, the company only has a couple of people who know and understand how to use the CIM and can give feedback on future releases.

Take advantage of help from other entities.

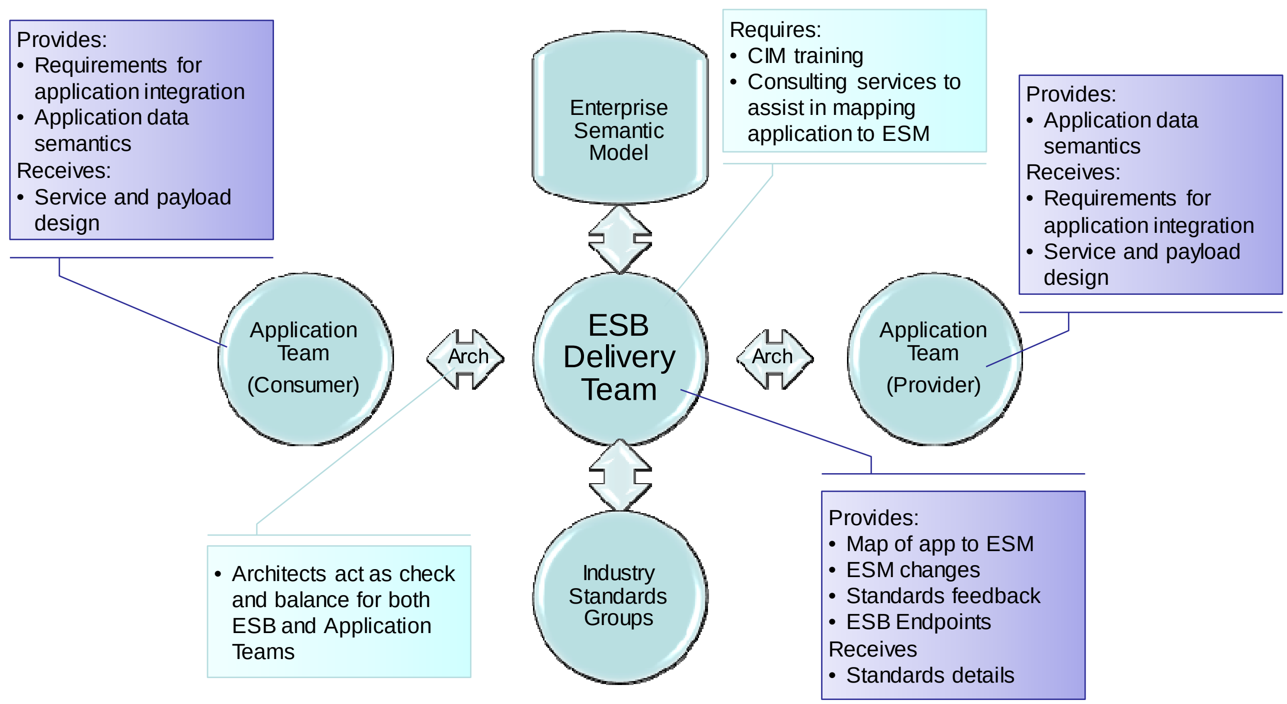
Many utilities have adopted the CIM for modeling their electric distribution business and have a tremendous amount of learning based on that experience. Many companies including utilities have built out their ESM and have also learned from that experience. DTE Energy did not take full advantage of the help that these companies were able and willing to offer. They could have benefitted from the lessons learned around the process of developing an ESM using industry standards such as the CIM. Participation in SGIP's Smart Grid Implementation Methods Committee (SGIMC) is also a forum for identifying and sharing implementation lessons learned and standards gaps that need to be addressed.

Develop a maintenance plan

As changes occur in the model and implemented services, there needs to be a strategy and migration plan for applying these changes systematically. DTE Energy does not currently have a strategy for moving to new releases with major changes. However, minor changes can be managed through versioning of messages, a feature of the ESB. This maintenance would be needed with any semantic model or application that goes through a maintenance cycle - it is not specific to the CIM

The CIM is designed to evolve and be extended through customizations

DTE Energy discovered that the required skills and maturity for ESM/CIM-based implementation requires a centralized development approach with their best technical people. Application consumer and provider team members and enterprise architects must work together to get the most out of the platform. Internal expertise must be developed and maintained through adequate training programs and augmented by external consulting services as required to maintain proficiency. Interaction with industry user communities and standards groups is also important to make sure that the delivery team has access to best practices for the CIM and ESB implementation.



Relationships between the ESB Delivery Team and other DTE teams and systems

Other observations:

- The lack of an ESM results in a proliferation of application specific data implementation - this is the root cause of point-to-point interfaces, “accidental architecture”, and profound scaling issues
- The CIM is sufficient to provide a basis for a comprehensive ESM that meets the needs of SmartCurrents and DTE Energy
- Incremental integration using the ESM to define data messages is a successful approach for ESM refinement and application interface development

Recommendations to Industry

DTE Energy has identified several key recommendations to industry for improving the continued deployment of the CIM (an ESM in general) on an ESB.

1. SGIP should facilitate resurrecting or implementing a new collaborative effort between the SGIP SGIMC, the UCAIug (CIM Users Group and OpenSG EIM group), and EPRI to facilitate information exchange and the development of industry best practices for the CIM and ESB implementation.
2. The UCAIug/CIM Users Group should implement a better set of collaboration tools (adhoc list servers, SharePoint, Web meeting accounts).
3. Facilitate better access to the IEC standards community to ensure extensions by DTE Energy and other utilities are vetted, implemented in revisions to the standards, and then fed back to the implementing utilities.
4. Organize physical meetings and events to get multiple utilities in a room to share and develop common requirements and semantic models more efficiently.
5. Facilitate utility participation as observers at vendor interop events
6. The SGIP SGIMC may be able to serve as a focal point for capturing and prioritizing utility enterprise architecture application requirements – identifying the gaps in the CIM and other models – and working with the UCAIug groups and the SGTCC to develop the actual models and the associated test and validation methods.
7. DTE Energy discovered that although the CIM served well as the base model for their ESM, other standards based information models are out there that can be used to augment the ESM for other applications.

Getting Started

If you have an enterprise systems integration project and want to know how to get started using the CIM, here are a few key starting points:

- Develop a vision of how you want to approach enterprise systems integration in the future and identify an executive sponsor.
- Organize a working group of your best enterprise architects to communicate the vision and develop a clear description of the integration problems you have been having. Develop a disciplined set of requirements that a new approach must address.
- Engage an outside expert at least temporarily to help bring you up to speed quickly on the industry state of the art and best practices, facilitate your initial working group meetings, and act as an honest broker to get you on the right track.
- Become familiar with the NIST Smart Grid Framework – especially the Conceptual Architecture Framework section (chapter 3 in version 2 of the framework - http://www.nist.gov/smartgrid/).
- Become familiar with the GWAC Interoperability Framework (http://www.gridwiseac.org/).
- Download and study the documents listed in the Resources section of this report
- Join the UCAIug CIM Users Group to avail yourself of all of the tutorial information available to members.
- Attend a UCAIug CIMug meeting or interoperability event to understand how others are approaching CIM implementation.
- Using the UCAIug, EPRI, SGIP, and other collaboration organizations and venues, build and maintain relationships with your peers in other organizations who have either implemented or are considering implementing the CIM.
- Communicate and publish your successes, failures, and lessons learned through users groups, industry publications and other venues.

References

[EPRI Common Information Model Primer]

http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001024449

[Reducing the Distance to Integrate: DTE Energy use of CIM at the ESB]

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[Reducing the Distance to Integrate: DTE Energy's Use of the CIM at the Integration Layer]

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[CIM Standards Overview and CIM's Role in the Utility Enterprise – Part 1]

http://cimug.ucaiug.org/Meetings/Ljubljana2013/Presentations/Day%201%20-%20Tuesday,%2011%20Jun%20-%20CIM%20University/CIM%20Standards%20Overview%20CIM%20U%20Ljubljana%20Part1.pdf

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Appendix A - Glossary

Energy ICT – Elster Meter Data Management (MDM) system/platform

Enterprise Semantic Model (ESM) - A method of organizing data that reflects the basic meaning of data items and the relationships among them. This organization makes it easier to develop application programs and to maintain the consistency of data when it is updated. [Gartner]

Enterprise Service Bus (ESB) - software architecture model used for designing and implementing the interaction and communication between mutually interacting software applications in service-oriented architecture (SOA). As a software architecture model for distributed computing it is a specialty variant of the more general client server software architecture model and promotes agility and flexibility with regards to communication and interaction between applications. Its primary use is in enterprise application integration (EAI) of heterogeneous and complex landscapes. [Wikipedia]

MQ (IBM WebSphere MQ) - A flexible system for efficient transport of messages and data.

Remote Method Invocation (RMI) – object oriented equivalent of remote procedure calls (RPC)

Service Oriented Architecture (SOA) - a software design and software architecture design pattern based on discrete pieces of software providing application functionality as services to other applications. This is known as Service-orientation. It is independent of any vendor, product or technology. [Wikipedia]

WebLogic (Oracle) - consists of a Java EE platform product-family that includes:

- a Java EE application server, WebLogic Application Server
- an enterprise portal, WebLogic Portal
- an Enterprise Application Integration platform
- a transaction server and infrastructure, WebLogic Tuxedo
- a telecommunication platform, WebLogic Communication Platform
- an HTTP web server

Web Service (W3C) - a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards.[1] There are two major classes of Web services:

- *REST-compliant Web services*, in which the primary purpose of the service is to manipulate XML representations of Web resources using a uniform set of stateless operations; and
- *Arbitrary Web services*, in which the service may expose an arbitrary set of operations.[2] [Wikipedia]

Implementing the CIM at DTE

An Implementation Methods Committee Case Study

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