PACIFICORP'S INTEGRATION BUS IS HELPING TO IMPLEMENT RETAIL ACCESS

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Abstract

PacifiCorp must implement systems infrastructure changes to support deregulation in the electric industry in Oregon starting on March 1, 2002. Existing utility companies are responsible for continuing meter management and reading as well as transmission and distribution of power through electric lines. Commercial and industrial customers have the opportunity to purchase power from an Electricity Service Supplier (ESS) or to opt for 'standard offer' rate. Residential customers have several 'portfolio' options to choose from including renewable resources.

PacifiCorp has been designing and implementing business changes for the market opening. Legacy systems are being enhanced, and several new computer applications are being put into operation to support customer enrollment, billing, franchise tax, settlements, profiling, and meter data management. Integration of these applications is being performed through an integration framework referred to as an Integration Bus. The bus allows the sharing of information among many systems without requiring costly point-to-point links.

Enterprise Application Integration (EAI) technology provides the communication infrastructure among the applications. The common language among the applications is based on a utility industry Common Information Model (CIM), which is being extended through object oriented analysis and design techniques. PacifiCorp is both benefiting from and helping to drive these developing utility industry standards. This paper describes how projects are taking advantage of the Integration Bus for automating business processes needed for Oregon's Retail Access.

Introduction

PacifiCorp is one of the United States' lowest-cost electricity producers, with almost 1.5 million residential, commercial and industrial electric customers. Headquartered in Portland, Ore., PacifiCorp has more than 8200 megawatts of generation capacity, 15,000 miles of transmission line, and 150 points of interconnection. With 8,000 employees in the United States, PacifiCorp operates as Pacific Power in California, Washington, Oregon and Wyoming and as Utah Power in Idaho and Utah.

Since 1999 PacifiCorp has been part of the ScottishPower group, which additionally provides energy and other utility services to 5.5 million customers in the United Kingdom.

Scottish Power has implemented systems in a de-regulated market in the United Kingdom and has been planning some structural changes in its US operations.

Business problem - Retail Access in Oregon

Oregon's electric restructuring bill (SB 1149) was signed into law in July 1999, and, based on action during the 2001 Legislative session, will take effect March 1, 2002. The bill establishes a restructuring plan for Oregon's investor-owned electric utilities. It introduces more energy supply pricing options for all customers and competition in electricity supply for business customers.

Pacific Power has been working with state regulators, elected officials and other interested parties to prepare for these changes and to answer questions for its half a million Oregon retail customers.

What does the restructuring law do?

- Provides residential and small business customers the opportunity to choose between basic service rate and five other electricity supply options from their current utility
- Allows all business customers to choose between their current utility and an alternative Electricity Service Supplier (ESS)
- Establishes state-managed programs for energy conservation, renewable resource and low-income energy, to be funded through a 3 percent charge on customers' bills
- Requires investor-owned utilities to continue to collect funds for low-income bill assistance
- Changes the look of customer bills to show itemized charges for electricity, supply, transmission, delivery, taxes and other charges

Will electricity be "deregulated"?

Pacific Power's rates will continue to be approved and regulated by the Oregon Public Utility Commission (OPUC). Pacific Power will continue to deliver power and will maintain the safety and reliability of its system of poles and wires that deliver power regardless of who supplies it.

What are the options?

Under Oregon's restructuring law, residential customers can purchase power from a portfolio of regulated options. An advisory committee working with the OPUC set up the following choices, which will be available beginning March 2002:

- **Basic service**: This option is similar to current residential rates. Customers will continue on this rate unless they select another option.
- **Time of use**: This energy charge per kilowatt-hour (kWh) is based on the time of day and season energy is used. Enrollment is for a 10-month term, a special meter is required and a monthly meter fee applies. Enrollment is limited and there is a price guarantee.
- **Fixed renewable**, Pacific Power's Blue Sky program: Electricity used is billed at the basic service rate, plus an additional fixed monthly charge to purchase 100 kWh "blocks" of 100 percent new wind power through Pacific Power's Blue Sky program.
- **Renewable usage**: Electricity is billed at a rate higher than basic service to support clean, renewable energy sources.
- **Habitat**: Electricity used is billed at the basic service rate, plus a fixed monthly charge to restore fish habitats and support renewable power sources that don't harm native fish species.
- **Seasonal flux**: The customer's electricity charge per kWh varies each month to follow projected market costs, based on variables such as temperature, availability and demand. There is a 10-month term and the enrollment period is limited.

Solutions considered for automating business processes

PacifiCorp Power Delivery recently developed a 5-year strategy for building a system framework that will support the foreseeable business requirements. This framework needs to support the changing business requirements caused by Power Delivery's merger commitments, transition initiatives, RTOs, and Retail Access. This study maps out Power Delivery's 5-year investment priorities for information systems and a plan for moving the existing system framework from where it is today to where it needs to be five years from now.

A key component of this framework calls for the implementation of an Integration Bus. Using an analogy of a party-line telephone network, the middleware provides the network. However, each interface between various applications is expressed in different languages. Even though all of the applications are listening on the same party line, a separate translation must occur between the 'speaking' application and each of the separate listening applications. For example, if three applications want to hear about a particular topic, the same information must be stated three different times in the native language of each application. While the party line is helpful, it is obvious that, if each application would be willing to learn one international common language, there is much potential to save effort in communicating. An Integration Bus promotes use of a common language among the party line participants so that each statement must only be expressed one time. As implementing an Integration Bus is an evolutionary process, participating applications use 'universal translators' (adapters that wrap application specifics) until the application is able to speak the common language. Opportunities for this occur whenever PacifiCorp is implementing a new product release or procuring new products.

An "Integration Bus" is a solution that is built on middleware technologies; it establishes an infrastructure for systematic, cost-effective integration of autonomous applications while enabling the flow of information to support business processes. The Integration Bus includes the implementation of the following:

- a message broker or Enterprise Application Integration (EAI) product
- a common language for application information exchange and persistent storage that is based on an industry-standard overarching enterprise information model (requiring a standards coordination strategy)
- guidelines and tools so that autonomous projects achieve cost effective and consistent use of this corporate resource (i.e., the Integration Bus)

The concept of an Integration Bus is depicted in figure 1.

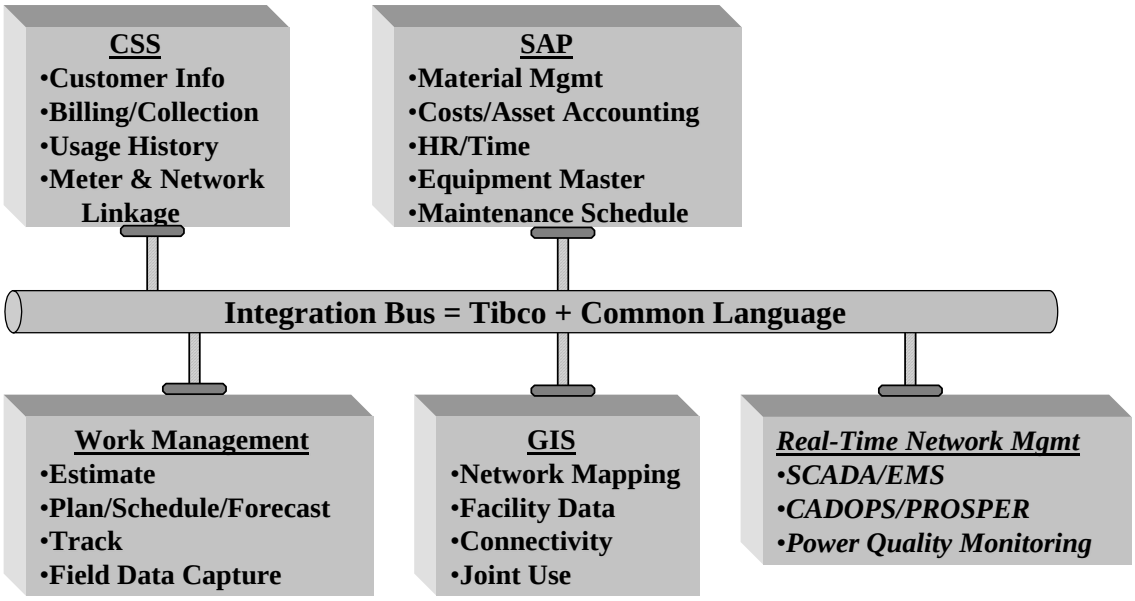


Figure 1: The integration bus concept

The Integration Bus provides an adaptable inter-application integration infrastructure that transcends the lifecycle of individual application systems and middleware technologies. Applications exchange information using a common language based on a developing power utility industry standard Common Information Model (CIM). [1] Objectives of the integration bus include the following:

- Re-usable software infrastructure for integration, which reduces the cost of future integration efforts.
- Organization and accessibility of information which is being exchanged.
- Faster integration of desired and/or necessary application systems and information, thereby improving PacifiCorp's ability to react quickly to business changes.
- Implement fewer, simpler, more consistent interfaces between applications, thereby minimizing application maintenance costs.

Being "Model Driven"

A critical element for successfully implementing robust integration solutions is the common language. If this common language is not based on an overarching enterprise information model, then reuse of project integration efforts will be minimal.

In addition to providing a "jump start" for message exchange definitions, integration efforts that are based on an industry standard common information model have these major benefits:

- Individual projects are able to focus on only the objects and their relationships that are within scope and schedule of their project. When integration efforts of multiple disparate projects result in overlapping information (a common occurrence), these objects and relationships all fit together in a common framework. Therefore it is possible to navigate information relationships that are not within scope of a single project. For example, logical, electrical,

physical, location, organizational, financial, and activity relationships will be consistently used and understood among the different types of applications.

- The common model provides a neutral vehicle for achieving agreements among different organizations. Rather than win/lose efforts for competing models from different projects and applications, everyone agrees that for information exchange purposes, the common model will be used. Each project's integration energy becomes focused on filling the gap between the corporate model and their project needs.
- The content of and relationships among various types of data can be discovered and obtained that span multiple application and database domains. This is accomplished, from an application and user interface perspective, by basing the schema for persistent stores (e.g., data marts) on applicable portions of the common model. In some cases, this can be implemented by "wrapping" stores so that they support an interface based on the common model. In other cases, it will be appropriate to base the internal design on the common model. This could result in simplified integration efforts for new stores as minimal data transformation is required for databases storing information obtained via the Integration Bus, or by an application that stores and retrieves data using the same semantics. As this capability is implemented in small steps over time, the integration infrastructure provides the ability:
  - For people and applications to browse and discover information that originated from multiple disparate sources (data models of multiple applications, each designed with little or no awareness of the other data models, can)
  - To navigate object relationships among events stored in Event History repositories. This is very useful for regulatory reporting and analyzing events resulting leading to key performance indicators
  - For applications to obtain needed information from persistent queries (vs. messages).
  - For applications to initialize from persistent stores rather than having to publish requests for each type of event data.
  - To perform ad-hoc decision support without major development costs.

CIM solution chosen

IEC Technical Committee 57 (IEC TC57), in collaboration with the Electric Power Research Institute (EPRI) Control Center Application Program Interface (CCAPI) Project and the Open Applications Group (OAG), is developing a Common Information Model (CIM) that represents all the major objects in an electric utility enterprise. The model includes public classes and attributes for these classes, as well as the relationships between them. A key purpose of the CIM is to provide a common language for describing exactly what data is being exchanged among Abstract Components of Business Functions. As opposed to using custom defined tags for information fields in message payloads, fields identification is based on class/attribute and association relationships defined in the CIM. Using an industry supported model thereby provides rich capabilities for various types of analysis as well as a degree of off-the-shelf support from product vendors.

PacifiCorp selected the CIM as a basis for its overarching enterprise wide information model, referred to as the PCIM (PacifiCorp Common Information Model) to distinguish it from the generic utility model. The IEC has defined recommended processes for extending the CIM and

associated pre-defined message types. This frees PacifiCorp to focus its resources on the unique aspects of its business process automation. While PacifiCorp is aware of other XML message format initiatives, the IEC approach was selected as it is the only one able to offer the benefits described in the preceding section because:

> It is a model-driven process. Without an overarching model, achieving consistent use of information elements and their relationships in messages exchanges among the myriad of disparate application becomes complex and problematic.
>
> It offers an overarching, enterprise wide, framework. Otherwise, significant effort will be required for each interface where an application is covered by one initiative with another application that is not.

Technology platforms chosen

Although the methodology described in this paper can be used with a variety of technologies, PacifiCorp chose the following set of tools to realize the analysis, design, and implementation of CIM-based interfaces.

- Business process modeling with CASEwise
- Detailed process and data modeling with Rational's Rose Tool
- Enterprise Architecture Integration with TIBCO tools:
  - Tib InConcert automates the workflow of customer-oriented processes that rely on human intervention.
  - Tib Integration Manager defines and manages automated business processes that span multiple applications and transactions.
  - Tib Message Broker performs automated message transformation and business object mapping.
  - Tib Adapter integrates off-the-shelf applications and databases into your e-business infrastructure.
  - Tib Adapter SDK integrates custom applications and databases into your e-business infrastructure with the development of custom adapters.
  - Tib Rendezvous messaging system, is the foundation of ActiveEnterprise
  - Tib Hawk system monitoring and management capabilities.
- XML Authority for message content management, based on the CIM

This project used the software above to initially integrate these two systems:

- Mainframe in-house developed Customer Information System called CSS – IBM 390, MVS, DB2, CICS, Cobol code generated by Cool-Gen. First installed 1996.
- Purchased interval meter reading and storage applications from Itron: MV-90, MV-COMM, MV-STAR. These are Oracle-based systems housed on Sun Solaris Servers.

Establishing the common language for this project

After helping establish the general integration framework, the authors of this paper supported the Retail Access Project Team with information exchange modeling. The basic process performed is depicted in the following diagram (figure 2).

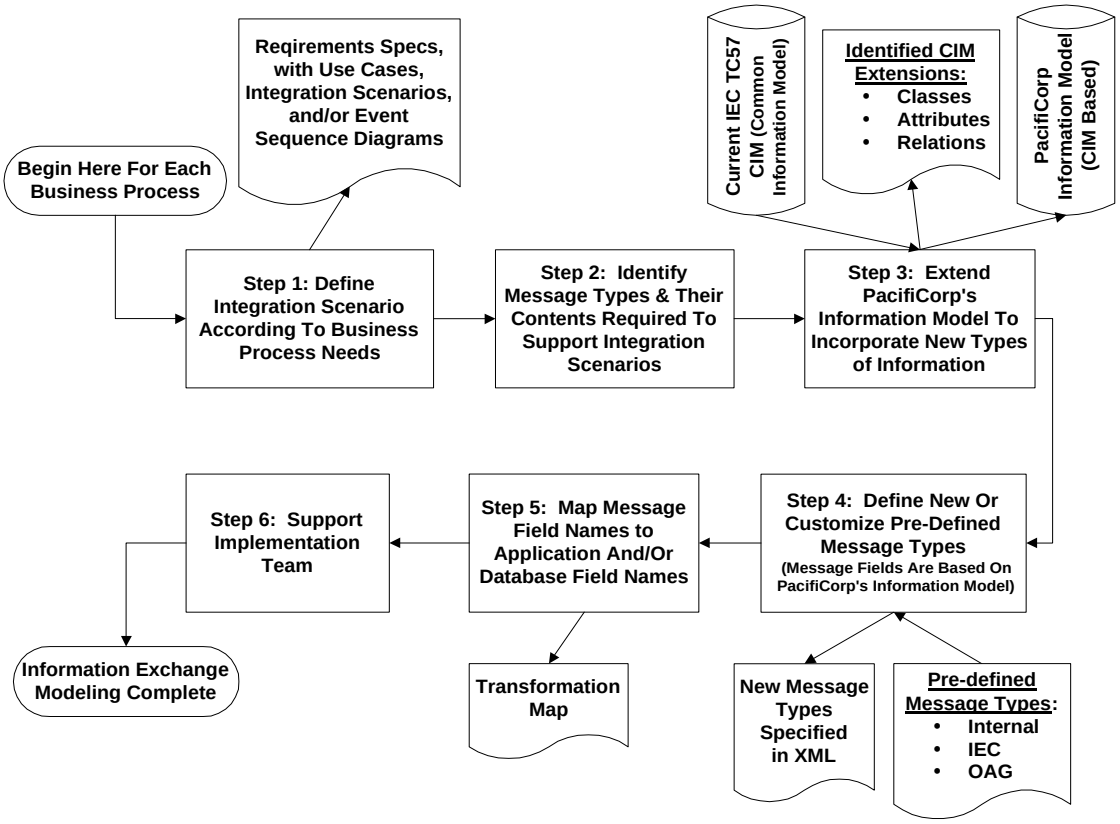


Figure 2: The information exchange modeling process

An overview of the message exchange requirements for this project are numbered one (1) through eleven (11) in the following diagram (figure 3), which is a type of integration scenario regarding meter data management. This served as a basis the first two steps of the information exchange modeling process described above.

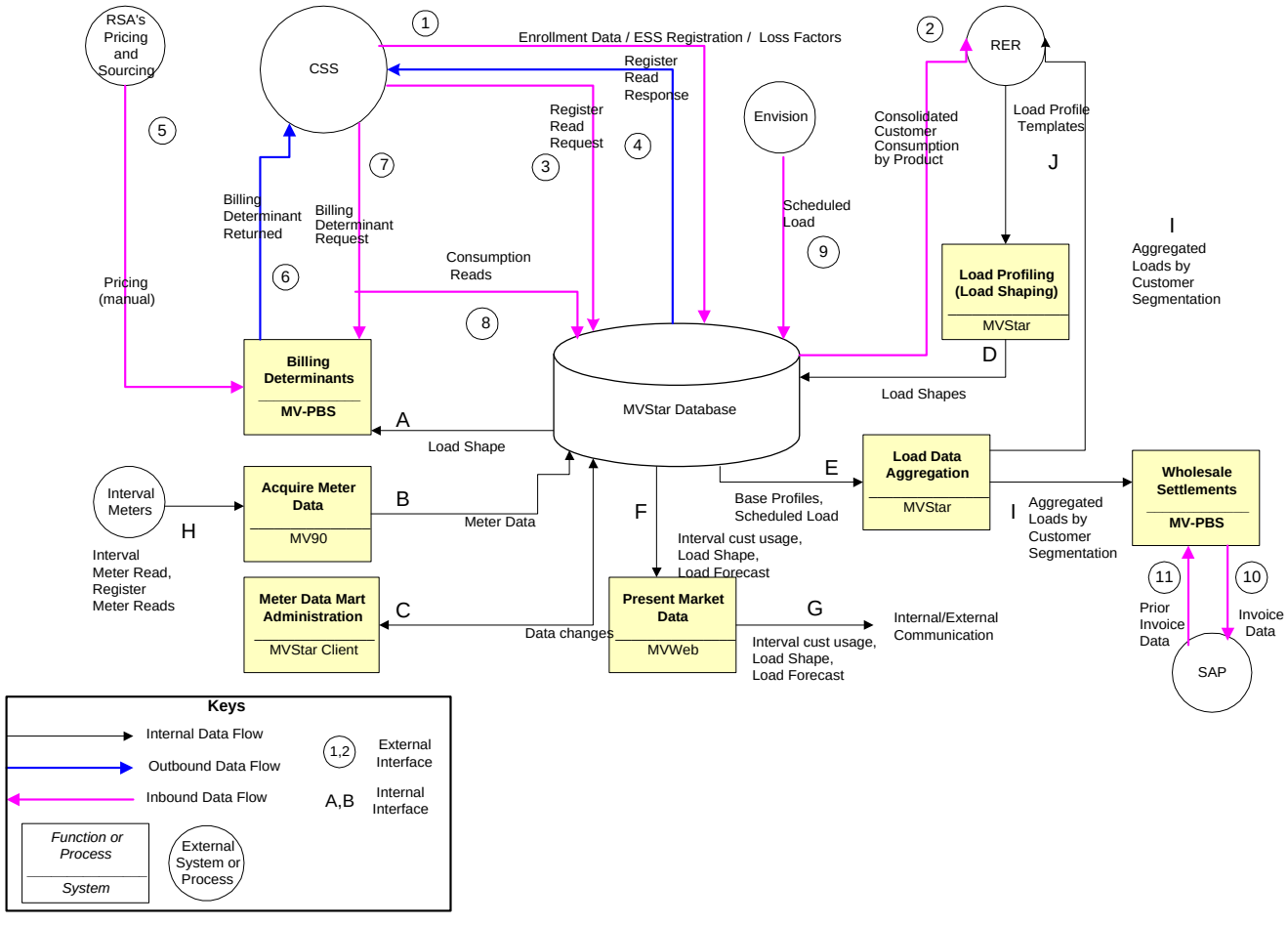
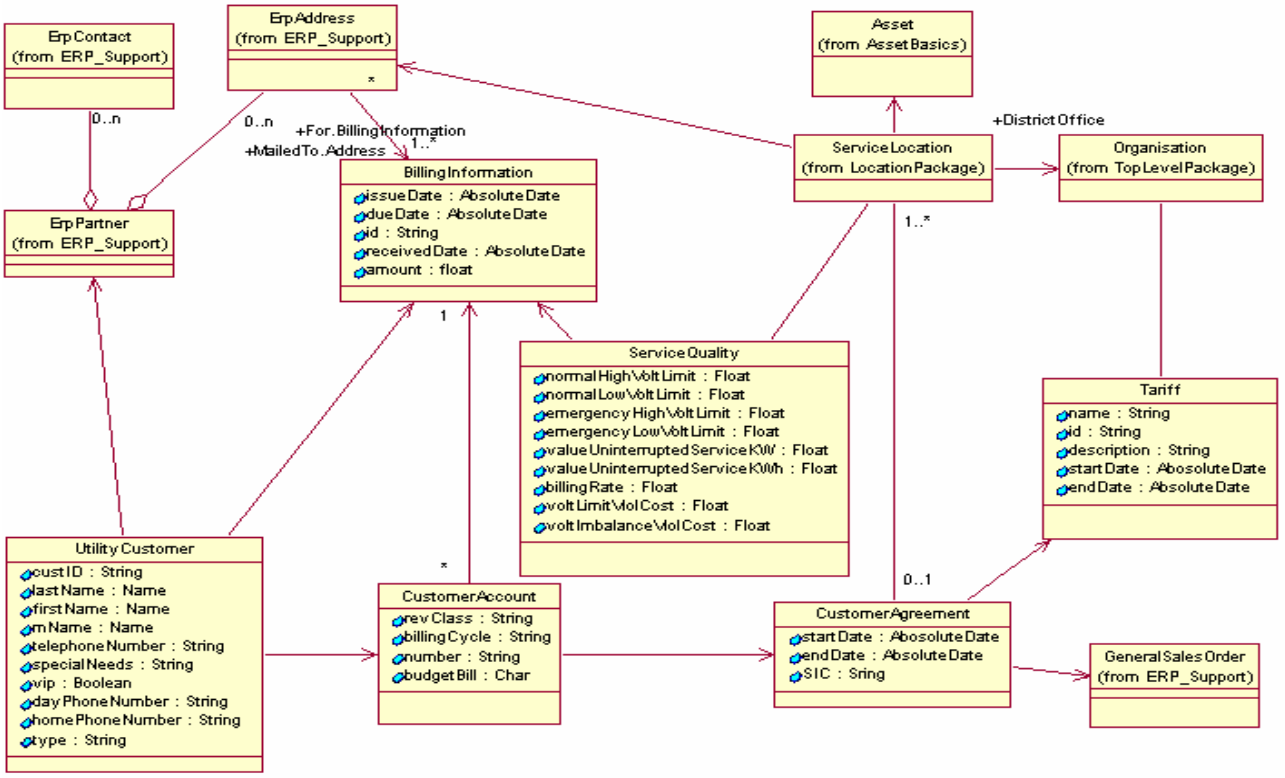


Figure 3: An example integration scenario for the retail access project

Once the messages and their contents have been identified, PacifiCorp's Common Information Model (PCIM) is extended (step 3 of the process). Recall that one of the main purposes of the PCIM is to provide a common language for describing exactly what is being exchanged among publishers and subscribers of various categories of information. Real world objects along with their attributes and relationships must first be defined in the PCIM before they are used in message type definitions. By doing so, it is possible to ensure that regardless of how many times a given attribute is used in various types of messages, the attribute is always used consistently. As semantics are clearly defined and understood, the published information is directly consumable by other subscribers.

As is true for the CIM, the PCIM is specified with Unified Modeling Language (UML) notation. The TC57 CIM along with the OAG Model provides a fairly complete basis for enterprise wide inter-application integration. A portion of this is depicted in figure 4.

Figure 4: UML Model for Customer Related data in CIM



Step four (4) of the information exchange modeling process is to define the message types in XML using graphical tools. A portion of an example message type for enrollments is shown in figure 5.

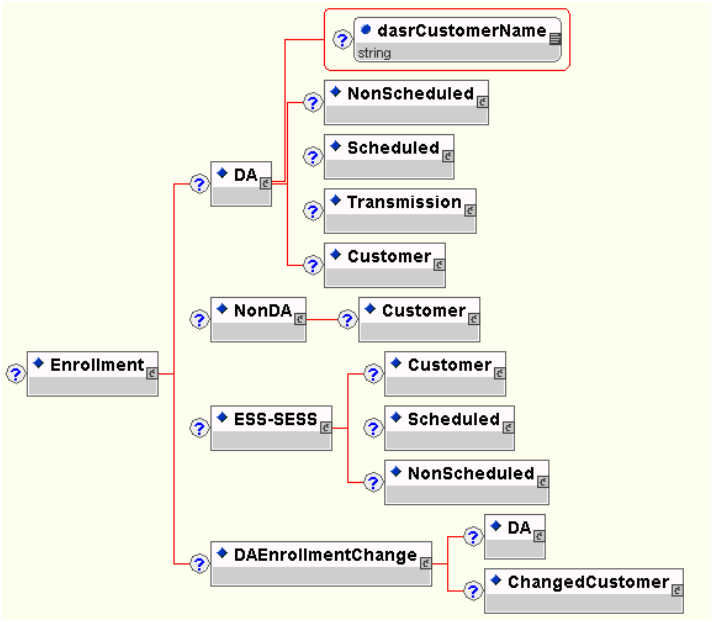


Figure 5: CIM represented in XML Schema using XML Authority

The fifth step of the information exchange modeling process is to map the fields of the message to the appropriate fields for each of the applications exchanging the information. This is used the by the EAI implementers for developing the necessary transformations. Other than providing support for implementation, the information exchange modeling process is complete for this project once all of the message types and their mapping are defined.

As individual projects are typically short in duration, it is difficult for project teams to master the PCIM and all of the supporting tools necessary to achieve optimum integration for both the project and the corporation. Therefore, to maximize reuse and to leverage expertise, information exchange modeling is treated as an information technology service that is offered to projects whenever integration is required with applications outside of the project's application suite.

Future direction

PacifiCorp is continuing to use the CIM to model new system interfaces. The goal is to avoid point-to-point connections where data may need to be shared. Other applications where the CIM has been used include some power supply mid-office applications, customer data warehouse updates, IVR query interface to the outage management system, customer call center interface to the outage management system (re-use of the previous outage interface), and electronic tagging of energy sales.

PacifiCorp is attempting to manage its own version of the CIM, extending the model only where absolutely necessary. As much as it can, PacifiCorp is using elements that already exist in the model, but some areas, such as energy trading must be added. The CIM extensions are sent to WG 14 for review and possible inclusion in future versions of the CIM.

There is no funding at PacifiCorp to re-write existing point-to-point interfaces. As applications systems are changed out, CIM interfaces can be added to the overall architecture as part of the new applications. Some highly proprietary interfaces may never be mapped to the CIM.

PacifiCorp will continue to manage system interfaces in a central information technology group, in an effort to control duplication and encourage re-use.

Lessons learned

The first lesson learned from this implementation of the common information model is that, despite concerns about the company's ability to handle dramatic change, it does work. Messages flow very quickly between the applications implemented with the enterprise architecture integration. With the message broker handling the translations, both sides of the interface use the CIM and do understand and act upon the message content.

Another lesson learned from this integration effort is that system integrators need to be evangelists for this new interface architecture. The CIM, in particular, is a very hard sell, as each application has its own vocabulary to meet its business needs. Implementation project team members have a hard time seeing the value of a common model, since their focus is usually to implement their application(s) as quickly as possible. This has been a particular problem with the PacifiCorp model of using outside consultants on new project teams. At some points we have had to say, 'these are our standards and you must follow them.' Having a central data team responsible for interface content does help implement this standard

Once the interface infrastructure is in place, CIM interfaces do not cost more than point-to-point interfaces. Cost reductions will be achieved when interfaces are implemented a second and third time, sharing data with separate parts of the organization.

PacifiCorp's goal is to create a reusable, object oriented integration framework which will link a variety of purchased and in-house developed application systems. PacifiCorp has recognized the need to control interface proliferation and encourage reuse of existing interfaces. The Common Information model provides a mechanism for managing this critical piece of Information Technology.

Acknowledgments

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References

[1] Common Information Model (CIM) and various draft standards of IEC 61968, IEC TC57 Working Group 14, 2001.

[2] Open Applications Group (OAG) specifications.