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Meter Data Management

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Abstract

Meter Data Management

The most basic function of an MDMS will be to support the utility's billing system; but monitoring power usage on an hourly or shorter time interval basis and communicating time-varying tariffs to customers will require much more data acquisition, storage, and processing, especially for applications that need real-time access to MDMS information. Better MDM systems can consolidate and streamline billing while realizing cost savings in a variety of utility activities such as disconnections and reconnections, electrical theft detection, and payment collection. MDM systems can also provide operational benefits across the utility enterprise including improved outage and transformer load management, distribution planning, asset management, enterprise resource planning, forecasting, and distribution state estimation.

Harmonizing, normalizing, and validating field-collected meter data presents a set of significant technical challenges because data must be collected from a wide variety of modern and legacy equipment and yet emerge from the process in a uniform, usable form. More generally, the complexity, cost, and sheer scale of developing new MDM systems, especially in conjunction with the deployment of advanced metering infrastructure (AMI), requires a through understanding of the relevant technologies and their business implications.

This white paper discusses the existing and potential functionality of MDM systems and provides utilities with a skeleton MDM deployment strategy that can be adapted to fit specific circumstances. It assembles information on five MDM system vendors and their already installed systems.

Contents

Meter Data Management

Background

The fundamental goal of a Meter Data Management (MDM) system is to centrally acquire meter data from large numbers of metering devices and prepare it for the billing process. But that is a deceptively simplified representation of what is actually in play. Several of the major suppliers see this as an opportunity for strategic integration of disparate enterprise systems. It is fair to say that Meter Data Management Systems (MDMS) have the potential to strategically reshape electric power delivery, management, and economics.

Although meter data is principally revenue oriented, it potentially has enormous operational value. This is the aspect of MDM that is so intriguing. The sheer breadth of scope, the communication requirements, the need for upscale computational power and storage management, and associated costs would no doubt have made these objectives too challenging to consider in earlier years.

Perhaps now - armed with architectural planning methodologies for durable, technology-neutral, interoperable, and reusable system components, international standards, and dramatic technological advances – it is time for reconsideration.

Meter Data Management Backdrop

The Backdrop: MDM's Inherited World

To capture a perspective of where we have been, and where we need to go and why, a recounting of our present situation is useful.

For many years, the industry has recognized that simply building more power plants cannot solve our electricity supply problems. New plants are very expensive. Transmission right-of-ways are congested. Pollution control, energy independence, and public safety are often competing priorities. Wind, solar, geothermal, and other "green" sources have made a lot of progress, but they all have their technical and economic growing pains. It is clear they cannot make up the difference between supply and demand in the near future.

Power conservation has long been considered a superior alternative to new generation. Every bit of conservation results in deferred generation. This in turn allows us to place a price on conserved power, supporting economic rewards for the installation of more efficient electrical appliances, industrial equipment, and lighting. This is a static type of conservation, as the benefits are simply differential whenever these electrical loads are active.

Enter dynamic energy management, an approach that strives to constrain demand to available generation. Utilities often purchase power on the spot market when demand exceeds available supply. Others maintain standby generation for such contingencies. Both approaches result in higher, marginal power costs, which are typically passed on to consumers via tiered rates or contract provisions. Using economic incentives, utilities can reduce their residential and small business electrical loads without unilaterally using load shedding or rotating outages. The key is to inform consumers when supply is tight (e.g. via higher time-of-use tariffs). Many will voluntarily

defer certain uses of power to periods when supply is more available and less expensive. In practice, this can be accomplished via automated mechanisms. If emergency supply conditions occur, selected consumer loads can be disconnected or cycled to accommodate system requirements. These approaches flatten the demand curve, reduce contingency costs, and enable the power delivery infrastructure to be used more efficiently. Properly implemented, dynamic energy management achieves its goals without ever shutting off power to critical loads. It is an approach that suppliers and consumers can live with.

Note, however, that dynamic energy management is only viable if the utility can monitor consumer usage on an hourly or shorter time-interval basis and apply time-varying tariffs that are communicated to consumers. But once this objective is achieved, a wide variety of other operational benefits becomes possible.

Enterprise Integration

The following in a list of utility enterprise systems and objectives that often lack sufficient integration to achieve effectiveness:

- Customer Information System (CIS)
- Outage Management System (OMS)
- Transformer load management system
- Distribution planning system
- Asset Management System (AMS)
- Constraint of demand to available supply
- Load-leveling to reduce load diversity
- Enterprise Resource Planning (ERP)
- Forecasting
- Managed use of protection group settings
- Distribution state estimation

Many of these objectives can be moved forward by MDMSs in two significant ways:

- By providing access to meter data that is usefully combined to provide critical information needed by individual enterprise systems.
- By providing the means for these collateral systems to exchange data among themselves.

It is left up to the individual utility to select a vendor MDMS offering that provides the set of functionality and integration that is needed for their particular need.

The Meter Data Management System

MDM Functional Evolution

MDM applications are focused on harmonizing and normalizing the field-collected meter data in a manner that allows it to be married with just enough other information to provide it to another application in a meaningful manner. This may minimally be a set of validated, edited or estimated interval energy values with a serial number, for example, where the MDM has performed the validating/editing/estimating (VEE) function on the collected data. The CIS may then marry that information with the customer record on a monthly basis to produce a bill. The MDM does not need to have knowledge of the entire customer record, only an agreed-upon key value to provide the data for that particular query.

One type of MDMS provides consolidation and streamlining of operational and support functions.

- MDMS-based data integration with multiple utility information systems
- Integration of meter-related data from multiple sources into a single repository
- Advanced analytics for processing meter-related data in the MDMS repository

An expected MDMS benefit is cost reductions for the following utility activities:

- Billing research in response to customer inquiries
- Reduction in number of service orders for special reads
- Remote disconnections and reconnections
- Electrical theft detection and revenue recovery

- Reduction in number of trouble calls due to prior utility knowledge of service problems
- Payment collections for service restoration
- Reduction in number of distribution and transformer outages
- Reduction in customer interruptions, minutes of lost service
- Outage information feedback to customers
- Automated outage verification (through AMI infrastructure)

MDMS data is also expected to improve other utility operations since this customer load-level data will complement the existing system component-level data for many planning and operations analyses. These analyses include

- Forecasting: Predict system load and usage to avoid imbalances and to reduce off-network purchases.
- System planning: Pinpoint over- or under-utilized infrastructure.
- Data communications: Improve system throughput.
- Energy delivery: Protection; asset management.
- Maintenance: Speed service restoration after outages; reduce costs associated with service disconnects / reconnects; reduce costs due to over/under-sized assets.
- Regulatory compliance: Audit records and security (EPACT 2005; Sarbanes-Oxley Act); PUC-mandated outage records.

Another benefit is the reduction of operational costs incurred from independent, non-centralized meter-data collection systems.

Core MDM Functionality

Revenue and Billing Data

The utility's revenue-lifeblood flows through the MDMS. Time-of-use (TOU) metering requires a lot more data to be collected and validated from each meter. This means more communicated data, more storage, and much more processing. In most cases, the CIS or billing system will remain unchanged and expect to transparently receive usage data for billing calculations as though nothing different had occurred. This means the MDMS will require more performance-related development to preserve this illusion. On the other side, the MDMS will have to intercept all the incoming meter data through multiple delivery systems of different types and vintages. Meter usage data is likely to arrive through a variety of methods: data networks, modems, handheld devices, and perhaps even paper-recorded readings. IP-based methods may be the wave of the future, but the legacy methods will still have to be accommodated as long as they exist. These systems were designed by different companies and personalities, so they use different protocols and have different eccentricities.

Another level of difficulty comes from the fact that some utilities outsource meter data collection, storage, and calculation responsibilities to Meter Data Management Agents (MDMA), organizations that are commissioned to set up their own servers with secure access provided to the utility. Depending on their scope, these arrangements may allow the utility to bypass the need for their own MDMS facility.

The MDMS must also serve as System of Record, or data source, for all metering data, including measurements and billing determinants. This eliminates uncertainty about the origin of this critical revenue-generating data. The MDMS should be structured to only allow access to those individuals or applications with the proper credentials, especially in the case where the load information is married to the customer record (name, account number, address, etc.).

Customer Information/Billing System

The CIS will need access to the MDMS data in real time. The cyclical billing cannot be hampered by other applications of the MDMS as this leads to obvious revenue issues. For the billing to be correct, the MDMS must allow for validation, editing and estimation (VEE) activities to be performed on the data at any time. Auditing and versioning are also important functions that the MDMS must be able to support. The typical use by the CIS of the MDMS is a customer calling the utility to dispute a bill. The MDMS must be able to support the utility representative during that call with the same information (meter readings, billing determinants, and algorithms) that the customer received on their bill. To enhance the confidence of the customer in the utility's data, it would be beneficial for the MDMS to support an on-demand read while the utility is speaking with that customer.

Finally, it is possible that the CIS is separate from the Billing System, and the MDMS must allow for this architecture as well.

Other Beneficial Features

It should be noted that many vendors are providing much more functionality beyond these basic functions. In a perfect world, the validated, harmonized data would be distinct from the disparate applications that one may want to perform on that data, with each utility selecting those applications that are not already incorporated within another enterprise system. In this manner, the purchased MDMS solution would then always be “right” sized for each utility. In reality, the vendors argue that the added features/functionality are what keeps them from producing commodity MDMSs, and have no interest in an à la carte approach to the additional applications.

Aside from the core features, other supported applications/functionality would include revenue protection monitoring (sometimes known as revenue assurance), diagnostics and exception handling, service-oriented architecture-based integration, AMR business intelligence (load research, system planning, market research, energy management), gateway to multiple metering systems, data synchronization engine for the entire utility, network performance calculations, workflow tools, AMI operations (provisioning, installation), customer (internal, external web) presentation, meter asset management, distribution operations.

MDM Benefit-deriving Applications

The MDM environment is an especially demanding and critical sector of the utility enterprise. The following discussion outlines applications that MDM systems may feed or incorporate and point out benefits that these enterprise applications can derive through the exchange of critical data and control operations with an MDM System, a proxy for all customer premises.

Aside from the focus on MDMSs and the closely related billing and CIS systems, the nature of data exchanges and control operations among the other enterprise applications is not addressed. It is sufficient to observe that those needs no doubt exist, and that an MDMS is probably a natural conduit for that activity.

Outage Management

The OMS is usually reliant on the end customer to notify the utility that service has been lost. A record for that customer is then made by marrying the outage notification call with information from the CIS. Improvement upon this system comes from the MDMS recognizing when intervals are absent and creating a ‘possible outage’ notification for whatever system may want to act upon this information. This allows the utility to react to outages at times when the end customer is not present to call and provide the notification.

Transformer Load Management

Distribution transformers are often sized and placed based on distribution planning engineer load estimates. The data used for the estimates is usually some combination of that engineer’s experience and data such as square feet/customer, ‘similar’ feeder parameters, average area load, and others. One risk is that the transformers are either grossly oversized, resulting in high non-billable transformer core no-load energy losses. The other risk is that the transformer is just right sized or partially undersized, leading to a shorter life and power quality problems for the end customer. The MDMS improves on this problem by providing the planning engineer with actual energy consumption (in addition, perhaps demand, voltage, and power factor values) for every customer in the service territory making the sizing and placement calculation trivial. This data can then be monitored against the transformer parameters to signal the utility that a problem is not far from manifesting itself.

Distribution Planning

The distribution planning engineer often relies on estimated parameters and experience when developing the distribution system. With ubiquitous communications and information about every load the estimated data can be replaced by measured data, providing more precise solutions. The quantity of validated data that the MDMS stores will enable the planning engineer to precisely calculate values such as line losses, feeder loading, and transformer utilization.

Asset Management

More common than imagined is the information on the placement, parameters, operational characteristics and age of every piece of equipment installed in the power system. This is especially true in metering, where millions of meters are installed, read and managed by varying departments and systems. The advantage of the AMI roll-out is that most utilities will need to touch every meter in the system at least once, allowing them to both identify lost meters, but also gather and record detailed information about the new meter asset. Once the MDMS is loaded with this information, it can be combined with the revenue data (energy, demand, voltage, etc.) to allow the utility to manage the complete lifecycle of the metering system, and also improve on the asset management of other distribution equipment such as transformers, cut-outs, reclosers, etc.

Load-leveling to Reduce Load Diversity

Since utilities cannot always dictate where their customers are located, or where they are able to site their generation and transmission assets to meet the load, the power grid is not always optimized with respect to the diversity of the load. The ability to run load studies with the detailed MDMS data on every load in the system will allow the utility to match the capacity of their system with the loads it needs to serve.

Enterprise Resource Planning

The core of any ERP system is its data warehouse. Since that is also the core of the MDMS, this can either be a complementary asset or the MDMS may serve as the complete asset. In either case, the management of the utility business functions will be improved by the quantity validated load data that can then be sliced, evaluated, combined, forecasted, etc. in any manner that is needed.

Forecasting

A forecast is only as good as its historical data. The MDMS will have interval data (down to the 5-minute interval, in some cases) from every load in the system. This granularity, combined with other traditional data such as temperature, humidity, and wind, will provide forecasts with a higher degree of confidence. If the utility needs to purchase power and provide their customers with hour-ahead and day-ahead pricing, the new-found accuracy will be nearly invaluable.

Distribution State Estimation

The science of state estimation was grown from the need to know detailed information about the power system without the communications and computing power to do the calculation in near real time (within five minutes or so). Once the AMI is in place and the utility begins to get data from every load in the system, the measured values from the MDMS can be fed to the state estimator, improving both the calculation time and the data upon which the calculation is based. Ideally, the state estimator will become more of a state reporting engine, as the communications speed will increase and the calculation time will decrease over time.

MDMS within the AMI

Possible Deployment Strategy

A utility is required to decide on one of four strategies: AMI first, MDMS first, the two together, or neither at all. Leaving the last alone, each utility will have to evaluate the benefits and disadvantages of their strategy on their own, as this is rarely transferrable from one utility to another. This section provides a skeleton deployment strategy that can be used to develop one that is robust and detailed.

Develop an AMI business case

- Determine how AMI data would touch the utility's existing systems
- Assess the capabilities required of an MDMS
- Evaluate AMI technologies in light of requirements

Investment payback

- AMI investments including meter retrofit/replacement and the AMI communications network typically have a payback approaching 10 years.
- MDMS and its integration with an existing AMI system typically have < 3-year payback.

Consider adopting one end-to-end, integrated, seamless solution

- Meter module hardware
- Communications infrastructure
- AMI head-end system
- MDMS
- Integration with existing back-office systems

Use MDMS to support installation activities

- Route planning
- Materials forecasting
- Exception management
- Asset management

MDMS can leverage advancements in AMI system capabilities

- Continual meter-read data (in lieu of batch processing)
- On-demand, real-time meter pinging for special requests

This strategy should be developed with the following required MDMS provisions in mind.

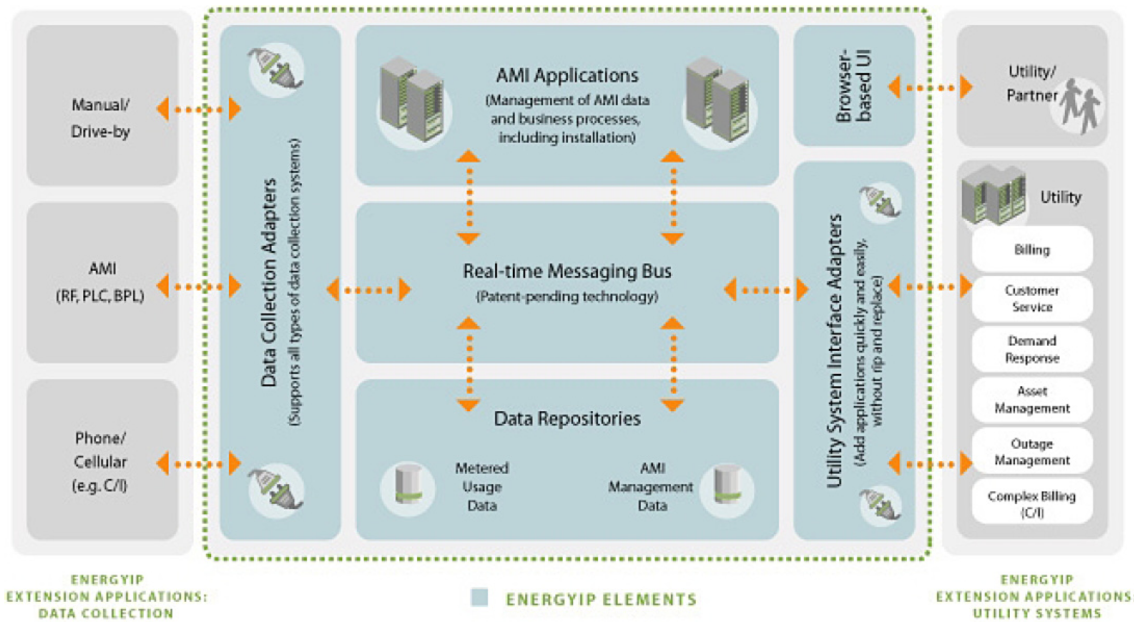
- Gateway access: The MDMS should provide a gateway for access to repository data and for interfacing with other utility information systems.
- Access to customer's meter-read history: The MDMS should be able to provide a customer interface representative with a convenient view of a customer's meter-read history.
- Access to customer's current consumption and demand: The MDMS should be able to perform on-demand reads of current consumption or demand data for a customer.
- Outage management coordination: AMI must be capable of providing outage status. The MDMS should be able to throttle outage data to the OMS at suitable level, ping bellwether meters to obtain up-to-date outage status, and process on-demand requests from OMS to the correct AMI data collection system.
- Meter tampering and illegitimate consumption coordination: AMI must be capable of providing data to detect theft. The MDMS should be able to ingest and analyze that data to initiate, track, and close-out follow-up work orders via the utility's work-management and MWM system.

MDM Product Overview

This following section describes several MDMS vendors along with how they match up on a sample evaluation matrix. Non exhaustive, this section is not intended to provide decision-making data or serve as a promotional or marketing document, only an example of real, installed systems.

Company: eMeter

Product: EnergyIP



MDMS Core Elements

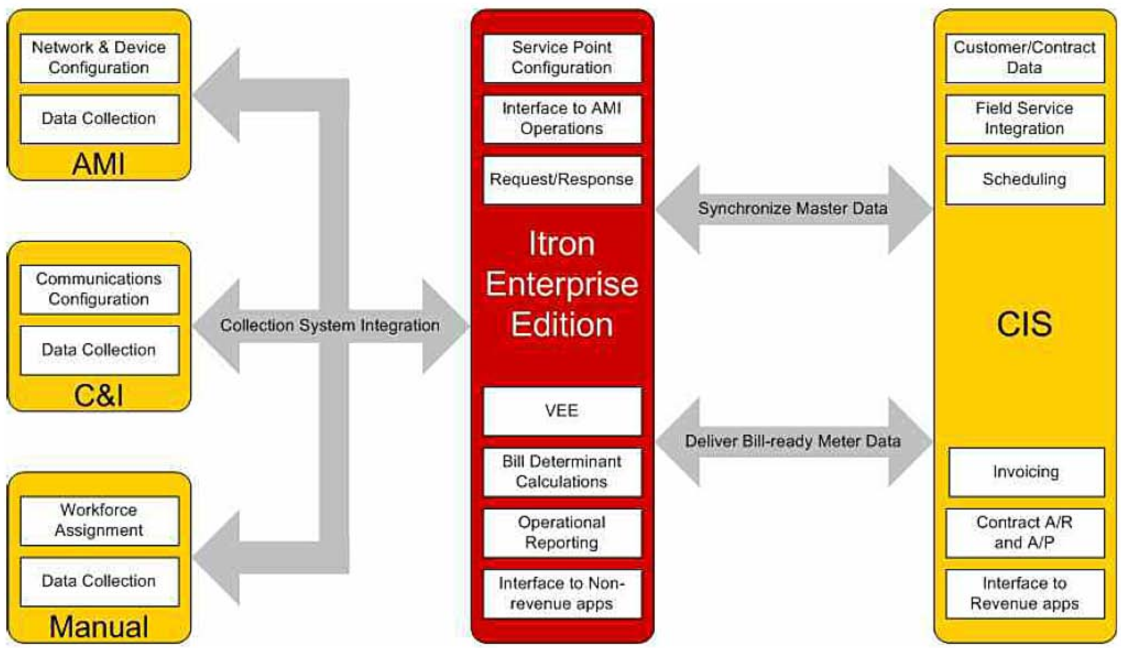
- Data Collection Adapters
- AMI Applications
- Data Repositories
- Browser-based UI
- Utility System Interface Adapters
- Real-time Messaging Bus

Reference Installations

Alliant Energy, Anaheim Public Utilities (pilot) , California Energy Commission, CenterPoint Energy, JEA (Jacksonville Electric Authority), Oncor ED, Ontario Energy Ministry (pilot), Ontario IESO, Pacific Gas & Electric (pilot), Southern California Edison, Toronto Hydro

Company: Itron

Product: Itron Enterprise Edition



MDMS Core Elements

- VEE
- Bill Determinant Calculations
- Operational Reporting
- Non-revenue Applications Interface
- AMI Operations Interface
- Service Point Configuration
- Request/Response Engine

Reference Installations

Dominion, Pacific Gas & Electric, Omaha Public Power, San Diego Gas & Electric, Southern Company, Tenaga Nasional Berhad (Malaysia)

Company: Aclara Software (formerly Nexus Energy Software)

Product: Energy Vision®

Energy Vision delivers a broad set of functionality that leverages meter and customer data to address key issues in energy service planning and delivery. Building upon a flexible meter and customer data repository and a set of powerful algorithms that create, analyze and aggregate load profile information, Energy Vision supports load and revenue forecasting, complex billing, wholesale and retail settlement, distribution and transmission planning, and revenue protection. Energy Vision is a browser-based application, providing users with anytime, anywhere access. It utilizes a 3-tier architecture that supports maintainability and scalability, and offers a flexible environment aimed at the business user.

MDMS Core Elements

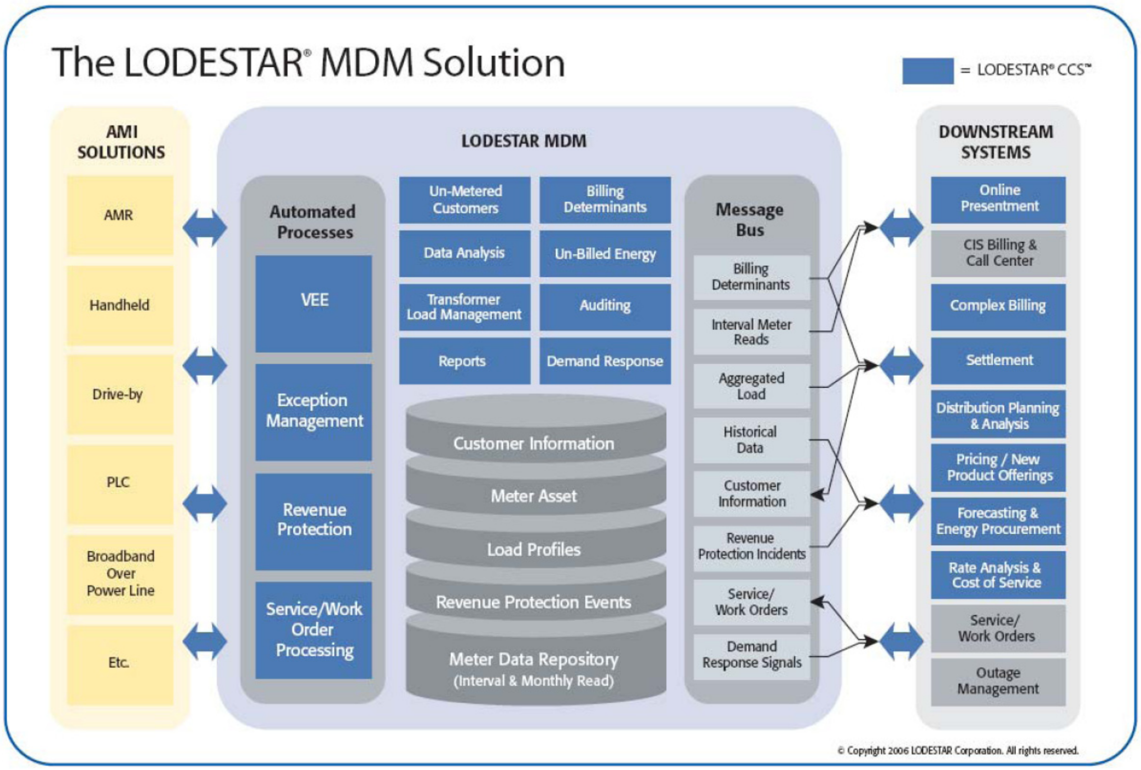
- Browser-based Application
- Meter Vision (Oracle-based data repository underlying all application modules)
- Load Vision (Delivering highly accurate load forecasting and settlement, leveraging a powerful load profiling and aggregation engine that integrates both interval and consumption data)
- Bill Vision (A complete solution for wholesale and retail complex billing, with a flexible billing engine capable of handling highly complex pricing structures, based on an easy-to-use, graphically driven rates designer.)
- Wire Vision (Effectively combining customer and GIS data to forecast and monitor load at any point on the network, helping improve circuit utilization, increase reliability, and reduce costs.)
- Revenue Vision (A Revenue Protection solution that provides a powerful analytic tool to mine large quantities of meter information generated by AMI as well as complete support for accurate Unbilled Revenue Recognition.)
- Energy Vision AMS (Complete Meter Asset Management System -- can provide an Enterprise solution for full meter equipment management and serve as the system of record, or interface with and add capabilities to existing asset management and meter history systems.)

Reference Installations

ATCO Electric (Canadian Utilities Ltd), PPL Electric Utilities

Company: Oracle Utilities (formerly Lodestar)

Product: Meter Data Management Standard Edition

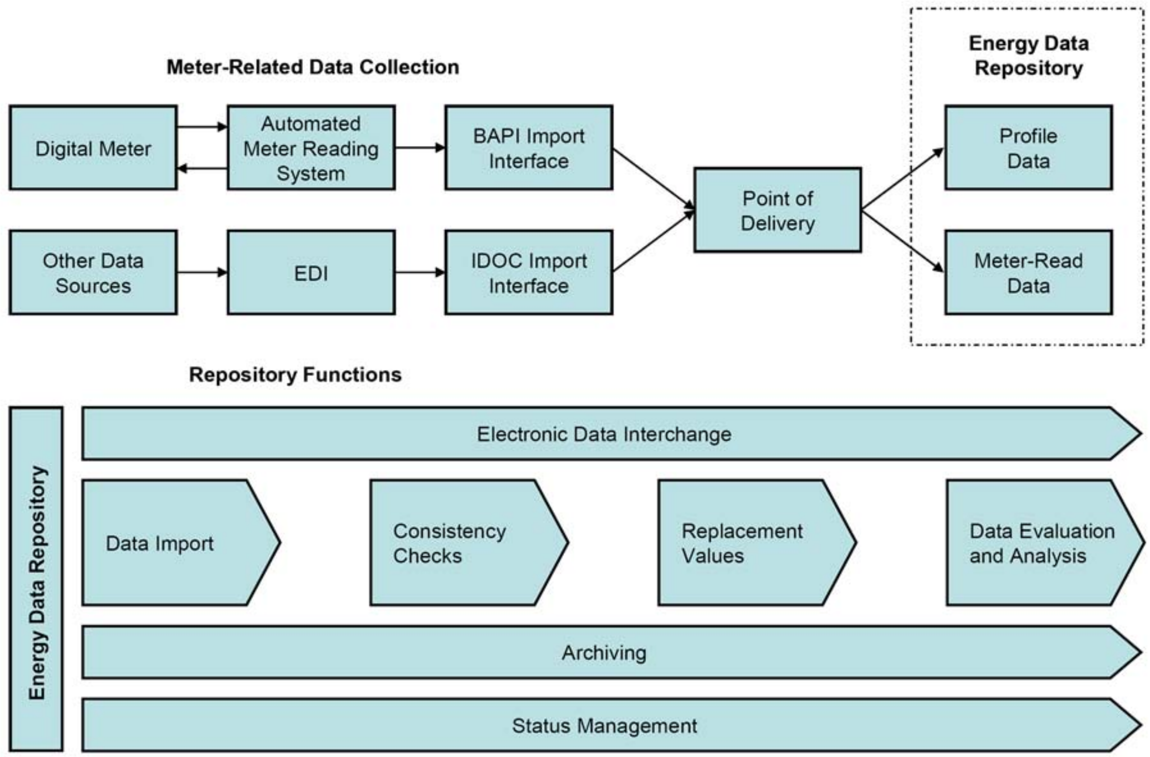


MDMS Core Elements

- Automated Processes (VEE, Exception Management, Revenue Protection, Service/Work Order Processing)
- Message Bus
- Database (Customer Information, Meter Asset, Load Profiles, Revenue Protection Events, Meter Data Repository)
- Applications: Data Analysis, Transformer Load Management, Reporting, Auditing, Demand Response, Billing Determinants, Un-metered Customers, Un-billed Energy

Company: SAP

Product: Energy Data Management

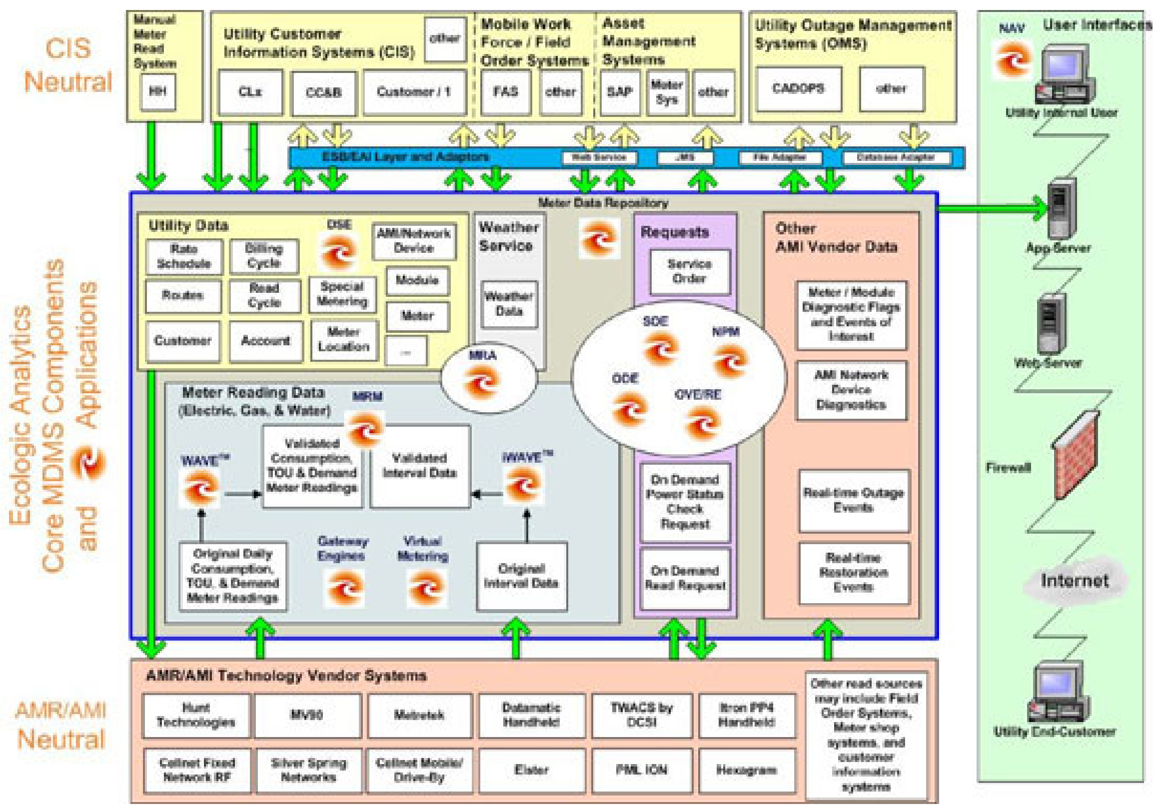


MDMS Core Elements

- EDI
- Data Import
- Consistency Checks
- Replacement Values
- Data Evaluation and Analysis
- Archiving
- Status Management

Company: EcoLogic Analytics (formerly WACS, LLC)

Product: WACS Meter Data Management System



MDMS Core Elements

- Meter Reading Data (Capture, Validate)
- Weather Service
- Utility Data (Rate Schedule, Routes, Billing Cycle, etc.)
- Requests (Service Order, On Demand)
- AMI Vendor Data (Diagnostic and Event Flags, Outage and Restoration Events)

Reference Installations

Pacific Gas & Electric, Puget Sound Energy

MDMS Evaluation Matrix

This matrix is provided for utilities to fill in. It is intended as an aid in analysis of the relative maturity of the offerings against a particular set of desired features.

Description	eMeter	Itron	Nexus	Oracle	SAP	WACS
General						
Provides an enterprise-wide solution: ■ Has provisions for collecting meter-related data from varied system sources ■ Can exchange meter-related data with billing and other utility systems that need it						
Supports continual system integration and change activity as the system matures.						
Supports open, multi-vendor integration based on mainstream standards and best practices.						
Documents how standards and best practices are applied to system and product offerings.						
Scalable to large number of meters and meter-collection systems. State limits and assumptions.						
Provides security and auditing capabilities in conformance with regulatory requirements and guidelines.						
Architecture and Infrastructure Deployment						
Provides an open, technology-independent, architectural framework for system integration and system information exchange: ■ Standard, generic interfaces ■ Standard information models ■ Standard, common services						
Accepts a variety of technologies that conform to the architectural framework.						
Provides an industry-standard, central repository for storing / warehousing all meter-related data. Examples: ■ Microsoft SQL Server ■ Oracle relational database						
Provides versioning for stored data.						
Integrity of internal data management processes is insulated from external system activities.						
Processing rate for acquired data items: State limits and assumptions.						
Applies consistent interfaces and processes to all acquired meter-data.						
Provides capabilities for identifying problem data.						
Provides validation, editing, and estimation capabilities for dealing with problem data.						

Description	eMeter	Itron	Nexus	Oracle	SAP	WACS
Meter Communication						
Fully manages the data collection process.						
Provides two-way capability for communication with metering devices (if the data collection system permits it).						
Integrates legacy data-collection systems that use either mainstream or proprietary technologies.						
Supports integration of manually-collected data.						
Accommodates variable characteristics of different, data collection systems (e.g. rates, protocols).						
Supports collection of meter registers and interval data.						
Supports off-cycle read and control operations in support of non-billing applications / operations: ■ Verify power ■ Remote meter connect / disconnect ■ Outage events ■ Tampering / theft indications ■ Change of tariff rates ■ Emergency curtailments ■ Meter reprogramming ■ Meter configuration ■ Network configuration ■ Customer payments ■ Meter-site maintenance indications ■ System and network management indications						
Supports network and device configuration.						
Supports control of alternate pathing, where appropriate.						
Billing System Integration						
Integrates with current utility billing systems without requiring major structural changes or the rebuilding of interfaces.						
Provides "request and response brokering", so that the current billing system can receive meter-data in the bill-ready formats presently used.						
Integration with Utility's other Operational Systems and Applications						
Integrates and supports other operational systems at the utility for exchange of requests / responses: ■ CIS ■ OMS ■ GIS ■ ERP ■ MWM ■ TLM						

Description	eMeter	Itron	Nexus	Oracle	SAP	WACS
Isolates business processes and systems from the details of metering and meter-data collection.						
Provides concurrent, real-time support for the billing system and any other integrated systems.						
System Tools for Utility Users						
Provides advanced, prepackaged analytical applications.						
Provides analytical tools / calculators that enable users to define information exchanges between the MDMS and other utility systems. For example: ■ Complex billing integration and calculation capabilities ■ Complex operational calculations and decision support for other utility systems						
Infrastructure Management						
Maintains records for each meter: Lifecycle events (e.g. purchase, test, field installation, maintenance history, and retirement), settings, current location.						
Maintains records for each meter-data collection system: Attached meters, path(s) to each meter, path technology, system & network management indications (e.g. outages, maintenance alarms), audit trail for path usage.						

References

This report makes use of the following references:

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[3] Aclara Software (formerly Nexus Energy Software): http://www.aclaratech.com/AclaraSoft/Pages/default.aspx

[4] Oracle Utilities: http://www.oracle.com/industries/utilities/oracle-utilities-meter-data-management.html

[5] SAP: http://www.sap.com/industries/utilities/edm.epx

[6] EcoLogic Analytics (formerly WACS): http://www.ecologicanalytics.com/solutions_ecologic.html

Appendix A Glossary

Acronyms and Abbreviations

Acronym	Expansion
A2A	Application-to-Application
API	Application Program Interface
AMI	Advanced Metering Infrastructure
AMIS	Advanced Metering Information System
AMR	Automatic Meter Reading
B2B	Business-to-Business
BPI	Business Process Integration
CIS	Customer Information System
EAI	Enterprise Application Integration
EDI	Electronic Data Interface
EII	Enterprise Information Integration
EPACT 2005	Energy Policy Act of 2005
ERP	Enterprise Resource Planning
ESB	Enterprise Service Bus
ESP	Electricity Service Provider
FERC	Federal Energy Regulatory Commission
GIS	Geographic Information System / Geospatial Information System
GUI	Graphical User Interface
ISO	Independent System Operator
IT	Information Technology
MDMA	Meter Data Management Agent
MDMS	Meter Data Management System
MWM	Mobile Workforce Management
MOM	Message Oriented Middleware
OMS	Outage Management System
POD	Point of Delivery
RTO	Regional Transmission Organization
SAN	Storage Area Network
SOA	Service Oriented Architecture
TCO	Total Cost of Ownership
TLM	Transformer Load Management
UDC	Utility Distribution Company
VEE	Validate, Estimate, and Edit
XML	eXtensible Mark-up Language

Industry-specific Terminology

Term	Definition
Billing Determinants	Billing determinants are specific technical parameters that apply to the calculation of a customer's energy bill. There is no guess-work involved. Each energy bill is precisely derived by applying the appropriate billing determinants against metered usage and the applicable tariff or contract by which the customer receives power. Billing determinants become more complex when factors like time-of-use and critical-peak pricing are applicable. These require complex load calculations, aggregations, and unit conversions.
Enterprise Service	An enterprise service is typically a series of abstract Web services combined with business logic that can be accessed and used repeatedly to support a particular business process. Aggregating Web services into business-level enterprise services provides a more meaningful foundation for the task of automating enterprise-scale business scenarios. Enterprise services may also be emulated through use of service sets supported by pre-existing or legacy enterprise systems.
Security	Security management protects a utility against risks that can threaten its mission. These include risks to the physical well being, data assets, and operations of systems. To this end, organizations create security policies that specify objectives, processes, and internal controls for specific systems and the enterprise as a whole. System-related issues include … ■ User authentication (e.g. User ID and password for system access) ■ Access controls (i.e. restriction of users to their actual business responsibilities) ■ Record-level security ■ Archiving, backup, and recovery ■ Interface security ■ Communications security
Service Point	A service point is created in the MDMS for each unique metering point in the utility's system. Raw metering data acquired for the point is processed into the format required by the billing system and held at the service point until the billing system requests it.
Storage Area Network (SAN)	A network of storage disks. In large enterprises, a SAN connects multiple servers to a centralized pool of disk storage. Compared to managing hundreds of servers, each with their own disks, SANs improve system administration. By treating all the company's storage as a single resource, disk maintenance and routine backups are easier to schedule and control. In some SANs, the disks themselves can copy data to other disks for backup without any processing overhead at the host computers.[www.pcmag.com]
Synchronization	The process by which master data, owned by its system of record, is provided to interconnected enterprise systems for their use. Synchronization may be initiated by specific events or on a periodic schedule. Synchronization is important for ensuring that enterprise processes use appropriate and consistent values of master data for producing their results.
System of Record (Itron)	To effectively manage the diverse metering information in an AMI system, the utility must assume a system of record for each type of data and a requestor for each data transaction or command request. Controlling who owns and is accountable for what kind of data is critical for managing the large amounts of incoming data, new commands and requests. Each system of record (e.g. AMI, MDMS, CIS, OMS, MWM, TLM) owns master configuration data relevant to its functional role in the system. Copies of this data may be shared and synchronized with other systems. To eliminate unnecessary data redundancy, processing, and potential inconsistencies, the IEE-MDM product uses a simple integration point to simplify data sharing. Representing a unique point of service delivery at a specific location, the service point is the main link, for example, between the MDMS and the CIS.

Term	Definition
Versioning	Versioning supports system auditability. Versioning capabilities allow administrators to trace the history of system values and other content based on time and specific types of changes. Examples of such content include meter data, business rules, tariffs, validation processes, and approval procedures. As applied to meter data, versioning maintains a snapshot of each meter read, including an appended time reference. Each subsequent stage of data processing (e.g. estimation, editing, subsequent value production) is also subject to versioning, so that there is traceability for each significant piece of data. The following are examples of activities that are supported by versioning: ■ Resolution of billing issues ■ Processing of off-cycle events such as reconnects / disconnects. ■ Maintenance of data accuracy across infrastructure changes such as meter exchanges ■ Internal controls required to support financial reporting. Versioned data is critical for ensuring operational integrity where data is shared across system boundaries within a utility enterprise. Regulatory law increasingly requires records of data-change occurrences, especially when billing and settlement charges depend on them. Changes are usually captured in automated system logs and database records.

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