Meter Data Management 2.0

New levels of enterprise integration and analytics to improve utility business operations

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According to the "2012 Smart Grid Executive Survey" from Zpryme Research and Consulting, more than 52 million smart meters will be installed in the United States by the end of 2012, signaling an industry-wide expansion of the advanced metering infrastructure (AMI). Already, smart meters are feeding hundreds of thousands of readings per day to utilities, providing critical data in near real-time.

To enable the utility to cope with the sheer numbers of data points flowing in, and then effectively use this data, every AMI has a Meter Data Management (MDM) system that serves as a central information depot. These powerful solutions perform critical Validation, Estimation, and Editing (VEE) functions before sending data on to the utility's CIS. These VEE functions ensure the accuracy and timeliness of billing and have been the primary purpose of MDM systems for some time.

However, the data generated by the AMI and processed by the MDM provides a wealth of information that utilities can put to work in real time, beyond accurate billing. This information provides the entire enterprise, even customers themselves, insight into energy consumption patterns. Powerful analytic calculation engines integrated with the MDM system can develop trends and insights that can be hugely beneficial in future infrastructure or distribution planning. Yet, often this valuable information is left on the table and not exploited to improve distribution management and consumer options — and to help the utility move forward toward its Smart Grid goals.

In this paper, we discuss how innovative MDM solutions can integrate with utility enterprise systems to offer a new doorway to better business and operational improvements.

Start with data storage and analytics

Consider the amount of data your AMI generates, even with 250,000 meters, each reading two data values (e.g. kw, and kwh) four times an hour: this AMI produces at least 2 million data values an hour, 48 million a day and 17520 million a year.

A core feature to extracting the most value from the AMI is a single, secure database where the millions of data points being collected from multiple sources can be stored and integrated. The MDM data collection application automatically identifies meters, configures data points and can measure consumption at different time intervals to support time-based variable rates. It also can collect different reading types, such as kwh, kw and power quality.

With the single database, the MDM system with highly precise VEE functions can draw from historical data to check data integrity; identify missing readings, invalid meter multipliers and meter tampering; and replace any missing data with accurate estimates. Configurable rules can specify which validations/estimations to apply and how to apply them. This flexible framework creates custom validations that support specific workflows.

For example, if the system gets a full day's worth of data, and some data points are missing in the middle, it can either interpolate the data, look at consumption data for a similar day for that customer, or look at average consumption data for this customer type — such as single family apartment — for that day, to replace the missing data with an accurate estimate.

Alternatively, the MDM system can issue automatic re-read requests when missing data cannot be estimated. This functionality allows the utility to identify meters exhibiting abnormal use and take appropriate action, such as removing the meter from validation and estimation, re-reading the meter, or creating a work order for the meter.

MDM enables time-of-use rates and customer engagement via consumer Web portals.

Integration across the enterprise

MDM provides not only a single-source system of record for meter-read data, but also a point of integration of that data with other enterprise systems. The MDM system with meter modeling components and standardized connectivity can integrate with the utility geodatabase (GIS), distribution management system (DMS), supervisory control and data acquisition (SCADA) system and outage management system (OMS) to support identification of network outages, losses, overloading, theft and load forecasts.

Outage Management

With near-real-time readings coming in from meters, MDM systems quickly identify meters that are returning 'last gasp' messages, signaling a potential power outage. An OMS with enhanced processing power and advanced prediction algorithms, integrated with the MDM, will accurately identify the outage event and rapidly determine the scope.

The MDM system also can contribute event notifications from non-meter devices higher on the network. The OMS can prioritize those events and rapidly identify related downstream locations — all to implement faster response and restoration.

The MDM system also helps in verifying outage status and optimizing restoration efficiency by actively pinging meters to determine their power status. This capability helps the utility prevent over-prediction of outages and identify nested outages during restoration, providing specific information to field restoration crews and reducing additional trips into the field.

MDM integrated with OMS supports outage detection and restoration verification, including outage statistics and accurate reliability indices calculation.

Operational and business network losses

With readings automatically collected on a regular basis, in real time, AMI and MDM implementation also eliminates truck rolls into the field for everyday meter readings.

However, those meter technicians also provided a monthly field inspection of each meter while collecting the reading, imparting the first line of defense against meter alteration for theft purposes. Without in-person monthly inspections, that defense might be greatly reduced. New MDM systems fill this void with built-in analysis tools that can compare real-time data to historical trends from the same meter or similar customers. This analysis can identify patterns that suggest theft or tampering, and automatically generate a work report for the revenue department and field teams to investigate.

In addition, the integration of the MDM system with SCADA or DMS allows aggregate comparisons of energy supply and demand load, helping to identify potential theft or network loss. For example, the MDM system can aggregate usage data from all the meters tied to a specific feeder and compare those figures to the power delivered to that feeder. Aggregated usage figures that are significantly less can signal the utility of potential theft or network loss during transmission.

MDM integrated with SCADA or DMS allows comparison of information at substation/net-stations with aggregated data from meters, to help control operational and business network losses.

Load profiling and planning

Similar aggregate comparison can assist utilities in analyzing the network and planning for the near and long term. This capability can be highly valuable for utilities facing the challenges of increasing energy demands and a more complex energy generation distribution. MDM systems create advanced network load projections by leveraging the meter-read database to identify demand trending and forecast demand during key periods, such as peak load or storm situations.

With this information, utilities can manage peak loads and plan for increasing energy demands more effectively, reduce the need to add generation capacity and take advantage of distributed sources of renewable energy generation. By integrating MDM systems with DMS solutions and accurate weather feeds, utilities can optimize the performance of existing networks and achieve key environmental and business goals.

Similar benefits can be seen on a smaller scale, by aggregating the data from individual meters to determine the load on transformers and higher level devices and identifying equipment that should be replaced in order to optimize asset performance. For example, existing residential infrastructure might become ineffective with the introduction of electric vehicles. MDM can identify for utilities where load demand has exceeded rated capacity, allowing the utility to replace the device before a more expensive and disruptive event, such as a blown transformer, occurs.

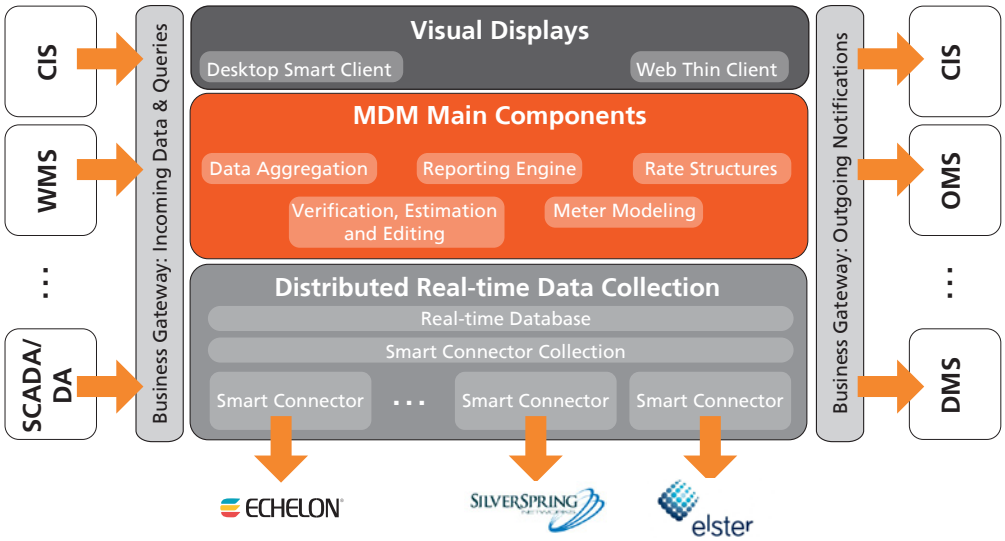
MDM integrated with an Advanced DMS (ADMS) supports operational excellence through:

- Power quality and network analysis — voltage and current information from strategic nodes helps improve state estimation.
- Demand-side management — more intelligent data helps the utility grow without adding more capacity.

Visualization

All of these enterprise businesses gain tremendous value through the visualization enabled by the integration of the MDM and the GIS database, which provides a clear display of network information, data and AMI deployment. These visualizations can assist controllers by spatially displaying areas of projected concern or opportunity. During power outage situations, this display allows controllers to view the size and scope of the outage. A visual identification of geographic areas at high risk for theft can help the utility manage business loss.

The tools described above, available with an advanced MDM solution, help the utility extract the true return on investment from AMI implementation, providing highly valuable intelligence that enables a better understanding of the network and its real-time behavior. As more and more utilities realize MDM capabilities beyond simple meter-to-cash functionality, the industry can expect they will integrate MDM across all operational enterprises to help achieve a smarter network grid.



Above: The Telvent Conductor MDM shares AMI data with key business and operational applications in real time, to improve efficiency and support decision making across the enterprise.

Conclusion

With the rich repository of network intelligence possible with MDM, utilities can squeeze every network performance benefit possible from their AMI initiative:

- Efficiency and cost savings are realized with system interoperability, reduced IT costs, reduction of peak demand, and optimized forecasting of demand.
- Service reliability increases through a more efficient distribution network, management of peak loads without additional generation capacity, and improved outage management.
- The utility is better able to extend the network with renewable sources and achieve GHG emissions goals.