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Operational Responsiveness: Managing Events on the Energy Grid in Real Time

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Overview

The intelligent grid proliferates the use of devices and communications network infrastructure, which support decisions through vastly greater amounts of data. The devices can be power- or IT-centric, and will share data across applications and business processes. As utilities make decisions to maintain a safe and reliable grid, a critical component to the efficient and economical use of those technology assets is business-event processing software.

"Business-event processing software" is a term that defines advanced analytics that quickly process large amounts of low-level data — e.g., device messages — and make informed decisions for a business process. As utilities' demand for and adoption of intelligent grid technologies increases, advanced analytical software that can visualize and analyze the grid in real time will become essential to better grid and business performance.

This IDC Executive Brief discusses the emergence of analytics software that supports real-time event management for better decision-making. The paper furthers the notion of advanced analytics to support very quick decisions, or VeQuiDs

Introduction

IDC Energy Insights defines the vision of the intelligent grid as an electric transmission and distribution (T&D) network that, through the use of information technology, is smart enough to predict and adjust to network changes. The holy grail of an intelligent grid, a predictive and self-healing electric network, is a worthy goal, although it remains years away. However, on the intelligent grid's evolutionary path is the ability of a utility company to collapse decision-making time from hours, minutes, and seconds to milliseconds. That capability is beginning to take shape today in corners of the utility

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industry. In this evolutionary journey, utilities strive for the ability to make VeQuiDs.

The notion of VeQuids embodies better business decisions through a rapidly responding utility information and communications (ICT) infrastructure. Utilities gain new capabilities for improving business performance as devices and the communications networks increase in volume, speed, and capacity. A fundamental component to complement these technology assets is analytic software that can process the deluge of valuable data produced by the devices and networks. With these capabilities in place, a utility can ably shift business decisions based on historical trend data to VeQuiDs based on real-time data feeds. In the absence of this analytic software, an opportunity is lost — but more importantly, the utility is neglecting to address the trends that impact and will continue to shape the energy industry at large.

Business Need

The effects of the 2003 Northeast blackout resonate loudly within the utility industry, and grid reliability remains a critical investment driver in the eyes of regulators and utilities alike. The widespread impact of the blackout that cut off power to 50 million customers is instructive for this discussion, in that the massive grid failure preceded the determination or reaction to it — the initial impetus of the blackout was in process two hours before, and it took only nine seconds to spread from Ohio to New York once the critical problem took root. Having systematic visibility into the problems with analytics could have mitigated or eliminated the severity of the failure.

With reliability a key driver, challenges that inhibit utilities from maintaining a reliable power infrastructure help to rationalize the value for analytics to support VeQuiDs including the following:

- **Aging assets and limited capital.** Many grid assets are reaching the end of their useful life and face an increased risk of failure. However, utilities cannot afford to replace all of their aging infrastructure, so they must better understand and maintain their existing assets.

- **Aging and shrinking workforces.** Further complicating this problem is the reality that a utility will have to maintain its infrastructure with a rapidly aging workforce. Many utilities ultimately want to replace their retiring workforce with fewer, more productive employees. However, new employees do not have the same extensive knowledge about the grid as longtime employees do.

- **Complexity of the grid.** With the need to understand many complicated factors, such as power flows and voltage profiles, analyzing the grid is already difficult. New additions to the grid, such as distributed and renewable energy sources, smart metering, and demand-response programs, are only going to increase the grid's complexity. Energy trading also introduces

more complexity because utilities have to deal with multiple power sources and providers.

- **North American Electric Reliability Corporation (NERC) reliability standards.** These extensive standards cover a broad range of issues, from resource and demand balancing to personnel performance, training, and qualifications. With the enforcement of NERC reliability standards, utilities can now face fines of up to $1 million per event, per day.

Infrastructure investments in Intelligent grid analytics build knowledge by bringing together complex data and turning it into information that utilities can then use to make well-informed, effective decisions about the grid.

Current Environment

As utilities collect new data and better leverage existing information for the grid, a way to analyze this information and enable better decision-making than currently accomplished becomes critical. For example, utilities may collect interval data from their smart meters for more efficient billing processes, but are incapable of fully leveraging the data for decisions in initiatives like demand response, dispatch, time-of-use pricing, and net metering. Complex data underpin these business processes, since multiple applications and operational systems feed data inputs into actionable decisions.

Utilities need to deal with not only larger volumes of data, but also data coming from a wider variety of sources. For example, locating a new distributed-generation resource might require a utility to look at end-user consumption patterns in a part of its service territory and energy flows in the T&D network. As the intelligent grid demands more accurate decisions based on increasingly complex information made available through technology, utilities will have to consider data from the following different sources when making decisions:

- Consumption data from smart meters
- Grid status data from intelligent devices, including line sensors and intelligent electronic devices (IEDs)
- Vegetation status data from vegetation management applications, satellite imaging, and geographic information systems (GIS)
- Information about customer behaviors, as derived from meter data and survey or customer relationship management (CRM) data
- Energy prices from external sources
- Weather data for the area

Utilities also need to consider this data in the context of budget constraints, whether capital budgets when considering major additions to the grid, or operating budgets when making decisions about supporting reliability or work and asset management.

To enable business processes that improve grid reliability, or any process along with other measurable benefits (e.g., more efficient mobile and field asset utilization), utilities are putting intelligent sensors on the grid. Synchrophaser's and the installation of power monitoring units (PMUs) are already being installed, and many of the proposals for smart grid demonstration projects include this approach to a more reliable grid.

Smart meters installed at the customers' premises will add significantly to data volume increases. Utilities need an effective way to collect and use the data from their transmission and distribution sensors, Energy Management System (EMS)/ Supervisory Control and Data Acquisition (SCADA), and smart meters, and drive them into their business processes. Analytics are required.

Event Management Technology

Event management analytics is a robust software technology built to measure and analyze multiple real-time data streams. Regardless of whether the data is externally or internally sourced, the key function of the software is to correlate complex time-based events. The correlations are made to discover and determine patterns and relationships, which are then applied to managing and optimizing a business process. The broadly applied term is referred to as business-event processing (BEP) software.

The software recognizes patterns and relationships in sub-second time frames that would otherwise go unnoticed when manually measured or monitored. While the data streams can always be archived, mined, and analyzed, the valued purpose is to enable enterprises to make VeQuids in near real-time as applied to business processes. For example, dynamically priced demand-response programs give utilities a mechanism to shed or redistribute load. In a simplified case applied to smart meters, the connected devices communicate price signals to the end-user customer and monitor end-user responses. End-user responses are aggregated by sections of the connected grid.

Utilities can then use this information to determine optimal supply and demand balance based on the needs of the utility. This is complex decision-making under ordinary operating constraints. With the addition of renewable energy to the grid, optimization becomes even more complex. Put in context, wind is a variable supply, so the analysis must include future expected wind speed based on weather forecast data feeds, for example, that will impact power production. It is one thing if the utility owns and monitors its own wind farm, but with the addition of distributed wind generation at the end-consumer location, this dynamic provides yet another variable to the challenge utilities will face in achieving constant, optimal decisions.

Within the utilities, business processes and the event management analytics that can optimize them can span many operational areas such as vehicle and mobile workforce dispatch, outage management, and distribution automation. With any new application of a technology to a business process, the industry needs to expect that systems integration is a required activity.

Considerations

The early success stories of the transformative power that smart grid technologies have on utilities' business processes are emerging. Gains in operational efficiency merely scratches the surface of possibilities. Behind the proliferating number of intelligent devices and communications networks sit the advanced analytics that will augment and automate the decisions within the business processes.

As the data coming off the smart grid infrastructure begins flowing, utilities have the opportunity to take concrete steps today with BEP software. Outside of the utilities that have begun experimentation with BEP, the use of widespread event-management solutions remains nascent for a few key reasons:

- **Smart meters' data value remains untapped.** Even though utilities are deploying smart meters en masse, most remain limited in the use of the technology and the data to their fullest extent. For example, a basic meter-data management system can handle smart meters that simply automate meter reading and create billing determinants, but fall short of leveraging that data in combination with other data to make business decisions.

- **Lack of technologies demanding more advanced analytics.** Other technologies that would demand advanced analytics to manage them, such as distributed and renewable generation sources, plug-in electric hybrid vehicles, and distribution network sensors, have not yet reached the critical mass necessary to require utilities to invest in more advanced analytics. For example, as plug-in electric hybrid vehicles come into greater use, there will be a whole new set of commercial relationships to be supported.

- **Limited use of intelligent grid data.** BEP software acts as a point of intelligence between the devices and the communication networks. BEP can aid in selecting, sequencing, and acting on the valuable data streams coming off the grid. When monitoring hundreds of thousands or millions of intelligent devices and making real-time decisions based on a complex set business objectives, analytic software provides extreme value. However, utilities have not yet fully embraced the use of the data system-wide. Instead, utilities are implementing analytics in point solutions. Whether deploying intelligent technologies for 1,000 customers or just smart meters for larger groups of customers, utilities can usually handle these deployments with basic analytics applications or ones supplied by device vendors. As

pilot programs for smart grid migrate to system-wide installations, BEP will become a "must have" technology.

- **A foundation that supports BEP.** While some utilities possess an architecture that supports BEP, many more are in a very early stage of evolution. Understand what your state of evolution is and the limitations of your current infrastructure — i.e., Will it be a firm foundation on which to process VeQuiDs and QuiD? For example, does your current infrastructure support industry standards such as the IEC CIM? These standards provide interoperability between wholesale markets and retail markets. How reliable is the underlying integration platform? Is it resilient enough to manage failure without any downtime? Given the volume of data and events that stream from the new advanced meters, this level of resiliency will be vital.

Conclusion

As utilities' demand for and adoption of intelligent grid technologies increases, it will begin to make more sense for them to deploy commercially available advanced analytics that can analyze the grid on a real-time basis to support reliability and new commercial relationships. Advanced analytics will not be a substitute for the engineering and control systems used to balance the grid, but analytics will be an essential part of enabling VeQuiDs.

The first push for enterprise-wide advanced analytics will come with the impetus to fully utilize smart meters and sensors. As the utility industry leverages the powerful data these smart devices can deliver to benefit the business, the need for more advanced analytics will increase.