SMART CLOUD FOR THE SMART GRID: LEVERAGING VBLOCK™ INFRASTRUCTURE PLATFORMS TO ACHIEVE SMART GRID SUCCESS

March 2011
Table of Contents

Executive Summary ........................................................................................................ 3
Utility Industry Challenges ......................................................................................... 4
The Smart Grid Is the Answer ...................................................................................... 4
  Dynamically Managing the Grid ............................................................................. 4
  Monitoring Demand and Outages .......................................................................... 4
  Converging Business and IT Interests Through the Smart Grid ...................... 4
  Smart Grid Offers New Opportunities .................................................................. 5
  Smart Grid Requires that Utilities Support a Wide Range of New and Existing Applications ........................................................................................................ 5
Supporting the Smart Grid Also Means New IT Challenges .................................. 6
  Predictable & Scalable ......................................................................................... 6
  Flexible & Responsive ......................................................................................... 6
  Secure & Compliant ............................................................................................ 6
  Cost Effective ....................................................................................................... 7
  Simple to Manage ................................................................................................ 7
Vblock Infrastructure Platforms – the Smart Choice for Smart Grid Success ........ 7
  Predictable & Scalable ......................................................................................... 7
  Flexible & Responsive ......................................................................................... 8
  Secure & Compliant ............................................................................................ 8
  Cost-Effective ...................................................................................................... 8
  Simple to Manage ................................................................................................ 9
Conclusion .................................................................................................................. 9
For More Information ............................................................................................... 9
References .................................................................................................................. 9
  Further reading .................................................................................................... 9
  Sources ............................................................................................................... 10
Executive Summary

The utility industry is overwhelmed by rising costs, escalating energy demand, changing consumer habits, aging infrastructure, and the inability to see or remotely manage the complete power network. The Smart Grid initiative is a global effort to modernize the electrical grid, extend management visibility to the most remote parts of the network, and introduce new controls that allow operators to efficiently respond to changing conditions. Although the Smart Grid is smarter, it poses its own set of challenges. Uncertainty about new technologies, combined with an overriding commitment to security, makes these decisions difficult for some utility operators.

The structural and operational requirements to support millions of smart meters and securely transport, store, and analyze the data they produce adds to the challenge. Myriad new software applications and tools, many with competing requirements, require creating, deploying, and managing complex IT systems that most utilities do not have the resources or time to undertake.

VCE, the Virtual Computing Environment Company formed by Cisco and EMC with investments from VMware and Intel, aims to accelerate the adoption of converged infrastructure and cloud-based computing models, which dramatically reduce IT costs and drive up productivity. Vblock™ Infrastructure Platforms, along with solutions, services and development environments are offered through an extensive partner network, allowing customers to focus on business innovation instead of integrating, validating, and managing IT infrastructure from different vendors.

VCE understands the need for reliability, flexibility, security, and scalability in a Smart Grid solution. Combining next generation converged infrastructure and the best benefits of cloud computing, VCE’s Vblock™ Infrastructure Platforms allow utility operators to focus on their core competencies and business needs. Through its extensive partner network, VCE enables utilities of all sizes and scopes to leverage the benefits of the Smart Grid with the predictability, dependability, and security of best-in-class, pre-integrated, rapidly deployed platforms.
Utility Industry Challenges

Electricity demand is rising more quickly than utility companies can keep up with. Meanwhile, conventional electrical production based on fossil fuels is becoming more expensive and consumers are becoming increasingly concerned about greenhouse gases resulting from coal and natural gas based energy production.

Consumer demands are also responding to economic and environmental pressures by demanding a granular view of their real-time usage and time-of-day pricing. Consumers increasingly want information about and control over their energy usage patterns so they can make intelligent environmental and economic decisions about their electrical use. The centralized approach to utility management is no longer adequate to meet today’s market and environmental needs.

The traditional industry focus on security, compliance, and safety is still a paramount concern. The Critical Infrastructure Protection (CIP) Cyber Security Standards maintained by the North American Electric Reliability Corporation (NERC) may be difficult to apply to new data models and operational practices. New data may reside in new locations, which impacts current as well as future physical security strategy. Finally, as new technologies provide access to new levels of automation, utility operators will need to reevaluate their cyber-security readiness.

Utilities must meet the above challenges and comply with the ever-increasing demands and requirements of today’s energy, social, regulatory, and economic landscape with new operational models and processes.

The Smart Grid Is the Answer

While much of the original transmission and distribution infrastructure that was installed thirty years ago is still in operation today, aging power plants are gradually being retired as their operations become cost prohibitive. Recent Smart Grid funding has allowed many major utility operators to implement new power infrastructure, software and hardware platforms, and operational methods and models. Although the rise of cloud computing is recent, a survey conducted by a leading market research firm of 177 utility representatives found 40 percent are either already using or are currently evaluating some form of cloud services. Utility operators that have made the transition to The Smart Grid are realizing significant improvements in operational efficiency, cost, and customer service. According to the U.S. Department of Energy, The Smart Grid will drive the electric industry’s transformation from a centralized, producer-controlled network to one that is less centralized and more consumer-interactive.

Dynamically Managing the Grid

In the past, utility operators planned for unanticipated power demands by producing a reserve margin ranging from 15-20% in excess power because operators did not have access to real-time data and could not make rapid changes to their current operating plan. Increasing economic pressures have forced utility operators to reduce these margins below 15%, yet there have been no improvements to the electrical or IT network to mitigate the risks involved. The Smart Grid allows operators to safely reduce this margin by providing real-time data, enhanced automation, and operational responsiveness.

Monitoring Demand and Outages

Traditional utility network operations practices have relied on customer calls to troubleshoot potential outages because utility network monitoring did not extend beyond the substation. Operators using a smarter grid rely on analytics engines to evaluate smart meter data and proactively forecast potential failures and optimization opportunities. Smart Grid maximizes uptime, reduces total cost of ownership through preventive repair and replacement, and avoids catastrophic break/fix and expensive disaster recovery procedures.

Converging Business and IT Interests Through the Smart Grid

Smart Grid is blurring the lines between IT, network operations, and utility business communities. Operations and enterprise teams equally benefit from the simplicity and flexibility afforded by converged infrastructure.
Meter data from Meter Data Management systems is needed for both back office and grid operations teams. The same data that is used for billing and managing customers may signal potential network trouble. It also provides network operations information to gain greater operating efficiencies. Metering systems provide a bridge into Home Area Networks, where utility operators can monitor and manage high-usage appliances and electric plug-in vehicles. Each of these applications has unique needs for storage, compute and networking.

**Smart Grid Offers New Opportunities**

The National Institute of Standards and Technology (NIST) anticipates the Smart Grid will provide many new opportunities for the utility industry:

- Improved power reliability and quality
- Optimized facility utilization and reduced construction of back-up power plants to manage peak loads
- Enhanced capacity and efficiency of existing electric power networks
- Improved resilience to disruption
- Predictive maintenance and self-healing responses to system disturbances
- Expanded deployment of renewable energy sources
- Automated maintenance and operation
- Reduced greenhouse gas emissions by enabling electric vehicles and new power sources
- Reduced oil consumption by reducing the need for inefficient generation during peak usage periods
- Improved grid security
- Increased consumer choice

**Smart Grid Requires that Utilities Support a Wide Range of New and Existing Applications**

- **Advanced Metering Infrastructure / Meter Data Management Systems** provide usage information taken from smart meters or meter reads. This sampling rate will grow from once per month to once per 15 minutes – a 2900-fold increase. The two-way communications that come with AMI will also provide significant opportunities for energy control to the smallest point of service.

- **Transmission and Distribution Management Systems** are used to gauge the integrity and efficiency of the transmission and distribution electrical networks (central office to substation). Increased automation and two-way communications are important changes that occur in this part of the Smart Grid. With support from NERC and Federal funding, highly advanced synchrophasors generate a continuous data stream that advanced analytics engines use to plan, design, and operate the transmission network. These technologies require effective storage strategies for managing their small but continuous data stream.

- **Demand / Response Management Systems** translate meter reads into load requirements, resulting in optimized energy distribution between substation and end-user. Supervisory Control and Data Acquisition (SCADA) is evolving to support more proactive, robust, remote network management. These applications enable self-healing from power disturbances, but they also introduce new concerns for cyber-security, as they evolve to IP- and internet-based architectures.

- **Outage Management Systems (OMS)** provide emergency controls and activate exceptional resources and processes in the event of an outage.

- **Alternative Energy Management Systems** are new systems that will allow utility network operators to leverage distributed generation from renewable sources (wind, solar, geothermal, hydro).

- **Geographic Information Systems (GIS)** match events to geographical locations, which is useful in landscape maintenance tasks like tree growth management, as well as outage identification and call-out optimization.

- **Utility Enterprise Applications** allow all personnel to manage the growing domain of collaborative customer relationships. These systems include billing, customer care, customer usage portals, and traditional IT platforms.

- **Data Analytics Applications** take advantage of new types of data from the Smart Grid, as well as historical data. Operations, enterprise network (IT), and business analytics engines are fed by convergent systems.
Supporting the Smart Grid Also Means New IT Challenges

The variety of new software and automation systems that are required to implement efficient and reliable delivery of electricity is complex – Meter Data Management (MDM) platforms to provide automated billing and usage information to the enterprise IT and grid operations staff; transmission and distribution management systems to automatically respond to variable weather and external conditions; home area network management solutions to monitor and optimize consumer, commercial, and industrial usage profiles; and demand planning tools to factor in new usage patterns resulting from increasing plug-in vehicles and distributed alternative energy generation. The list of applications and opportunities is long.

Gathering accurate real-time information is a critical requirement for Smart Grid initiatives to deliver expected benefits like costs-savings, reliable pricing, reduced emissions, and increased energy efficiency. The staggering data volumes created by Smart Grid meters and monitoring sensors already present a significant challenge for utilities (as well as for service providers serving the industry). Collecting, transporting, monitoring, analyzing and protecting this data require a new kind of information technology infrastructure. Cloud computing is an exciting and significant revolution in information technology that promises to allow utilities to manage and take advantage of the wealth of data offered by Smart Grid.

Historically, the utility industry has been particularly resistant to change because of the absolute imperative for reliability, safety, and security in our utility infrastructure. While cloud computing is widely recognized as the ideal solution for widespread Smart Grid deployment, there is more to implementation than simply renting space with an online public cloud vendor. Utilities and energy companies require a robust IT platform that provides them the security of a next generation data center, with the financial and operational benefits of cloud computing. The Smart Grid requires that utilities quickly deploy highly converged, virtualized infrastructures to provision and deliver new services and initiatives. It requires utilities have a private cloud or provider-hosted private cloud that is capable of quickly, securely, and cost-effectively running mixed workloads of Smart Grid and existing business and industry-specific applications.

Utility industry leaders recognize their core competency is in the design, deployment, and operation of a secure and efficient energy network. They are not experts in planning, designing, deploying, and integrating disparate software products and hardware platforms. They recognize the immense value of a pre-integrated, pre-tested, pre-validated next generation converged infrastructure that meets their exacting IT requirements.

Predictable & Scalable
Utility operators need a robust platform that can quickly expand to meet growing demand across a wide range of applications and provide performance equal to current dedicated hardware installations. As the utility market grows and changes, and as long-term demand rises, utility operators must be able to rely on easy scalability for changing storage, compute, and network requirements.

Flexible & Responsive
Utility operators need a single platform to reduce the complexity of managing IT and network operations through application development, deployment, and maintenance; and that can quickly respond to network traffic spikes and unpredictable application behavior.

Secure & Compliant
Utility operators have traditionally been charged with safeguarding the nation’s power supply, and they need a platform that offers ample assurance of security and compliance with government regulations such as NERC/CIP. A converged IT infrastructure for utility operators must offer centralized data analysis and protected storage, authorized user access to resources, and audited systems that comply with all regulations concerning the security of our nation’s power supply.
Cost Effective
Utility operators are under constant public and private financial scrutiny – investor-owned utilities (IOUs) must demonstrate acceptable rates of return to raise capital for new IT, and municipal and cooperative utilities must obtain public approval for infrastructure improvements without raising prices. A consolidated, optimized platform that supports a broad range of requirements must bring a significant return on capital compared to previous fragmented and dedicated IT investments, allowing utilities to use new virtualized IT solutions while meeting stringent financial objectives.

Simple to Manage
Utility operators need the simplicity of a streamlined management application that offers single pane of glass management and integrates with higher-level applications and business intelligence management systems. Operational efficiencies are improved by using workflow-level commands, thereby eliminating the need for discrete hardware specialization.

Vblock Infrastructure Platforms – the Smart Choice for Smart Grid Success
With Vblock Infrastructure Platforms, VCE delivers the industry's first completely integrated IT offering that combines best-in-class networking and compute components from Cisco; storage, security, and management technologies from EMC; and virtualization capabilities from VMware. Seamless support assures end-to-end vendor accountability. This pre-integrated, converged infrastructure enables rapid virtualization deployment so customers quickly see a return on investment. Vblock Infrastructure Platforms offer varying storage capacities and processing and network performance, and they support such capabilities as enhanced security and business continuity.

Vblock platforms address the needs of large and small utility operators in meeting the challenges caused by increasing demand and aging infrastructure. Vblock platforms:

- Address the security, reliability, performance, management, and financial requirements of data center managers, network operators, and financial investors
- Present the Smart Grid as a holistic entity by aggregating the diverse requirements of utility infrastructure management with a streamlined and predictable approach to deployment, expansion, and long-term support

Vblock platforms are a best-of-breed converged infrastructure platform that provides utility operators, network operators, and financial investors the security, reliability, and efficiency they require in a converged infrastructure solution.

Predictable & Scalable
Vblock platforms are predictable and scalable, accommodating an ecosystem of applications coexisting on one platform. As data center needs grow to accommodate new Smart Grid solutions, Vblock platforms are easily scalable while maintaining stable and predictable performance, security, and compliance.

Vblock platforms are engineered for performance following best practices for availability and data throughput, which provides the proper foundation for clustering virtual machines on VMware. VMware Distributed Resource Scheduler (DRS) ensures that workloads running on physical hosts are distributed to cluster members with available CPU and memory resources. Vblock platforms are comprised of architectures that are pre-tested, fully integrated, and scalable, with:

- Repeatable units of construction based on matched performance, operational characteristics, and discrete requirements of power, space, and cooling
- Repeatable design patterns that facilitate rapid deployment, integration, and scalability
- An architecture that can be scaled for the highest efficiencies in virtualization and workload re-platforming
- An extensible management and orchestration model based on industry-standard tools, APIs, and methods
- A design that contains, manages, and mitigates failure scenarios in hardware and software environments
- Faster deployment times facilitated by a 3-day delivery process and quicker integrations than traditional IT deployments

Flexible & Responsive
Vblock platforms reduce the cost of test and development by leveraging virtualization with virtual machine cloning technology. A utility can easily scale a smart meter solution and switch from test to production using virtualization technology.

Vblock platforms are able to meet spikes in network traffic and other unpredictable demands using technologies like storage tiering, data caching, and network QoS. Implemented with self-curing architecture, Vblock platforms accommodate unplanned events such as data spikes, server crashes, and physical component failure. VMware High Availability (HA) restarts the server and Fault Tolerance (FT) provides zero downtime, zero data loss, and continuous availability for your utility and IT applications – without the cost and complexity of traditional hardware or software clustering solutions. VMware VMotion enables IT to move mission-critical workloads between members of a cluster without downtime.

Secure & Compliant
Data security and access control capabilities can be enforced system-wide with RSA solutions that meet NERC/CIP Critical Cyber Asset Identification & Protection Standards: Electronic Security Perimeter, Incident Reporting and Planning, Critical Cyber Assets, malware systems, vulnerability detection, disposal logs, and patch compliance. This ensures the confidentiality, integrity, and availability of the environment at every layer using technologies like identity management and access control, encryption and key management, firewalls, malware protection, and intrusion prevention.

- Security Information and Event Management (SIEM) to provide centralized storage and analysis of logs of network logs and events.
- Data Loss Prevention (DLP) to identify, monitor, and protect data in use (e.g. endpoint actions), data in motion (e.g. network actions), and data at rest (e.g. data storage) through deep content inspection, contextual security analysis of transaction (attributes of originator, data object, medium, timing, recipient/destination, and so on) within a centralized management framework.
- Strong, two-factor, adaptive authentication to provide robust authentication.

Cost-Effective
Vblock platforms allow utilities to use converged architecture and virtualization to cost-effectively design, plan, and deploy applications. Instead of ordering dedicated hardware, software, and storage – as well as incremental networking – the utility data center manager can simply create virtual machines, based on an elastic pool of resources. Depending on the application requirements, utilities can realize significant IT efficiencies by oversubscribing network, compute, and storage resources up to 10:1.

Vblock platforms provide numerous implementation and ongoing savings for utility operators:

- Pre-integration provides significantly faster deployment and shorter time to value.
- Design, order, and installation occur in a matter of weeks, compared with several months for a traditional IT approach.
- Optimized energy efficiency provides ongoing cost savings.
- A single user interface reduces IT resource requirements.
- An integrated IT reduces training expenses compared to traditional systems using discrete pieces of equipment.
- VCE’s single point of contact for integrated customer support reduces IT costs for hardware specialists.
Vblock platforms provide a streamlined, financially and operationally efficient system.

Simple to Manage
Vblock platforms include Unified Infrastructure Management (UIM) and complementary IT Network Monitoring Solutions (NMS) to provide the orchestration and visibility required for easy configuration and operation of the Vblock platform. Additionally, in partnership with EMC, Ionix offers a complete suite of tools designed to monitor proprietary devices and other IP-enabled technology such as smart meters, transformers, and other Smart Grid elements.

UIM provides simplified Vblock management for a utility environment by combining provisioning with configuration, change, and compliance management. A single UIM instance can manage multiple Vblock platforms, and it provides an API that easily integrates with existing enterprise management platforms, allowing operators to manage the Vblock platform installation as a single entity. It integrates with enterprise management platforms and consolidates views from all Vblock platform components, including network, compute, and storage. UIM also supports policy-based management for IT security.

Cisco, EMC, and VMware have invested in building a unique, cohesive support experience using collaborative tools, people, and processes. A single contact point directly connects you to a team of VCE technical support experts.

Conclusion
More than ever, utility operators face challenges posed by a changing marketplace and aging IT infrastructure. New applications offer utilities the promise of answering these industry problems, but these applications require utilities upgrade to a cloud-based IT infrastructure, which comes with it’s own set of challenges. Faced with concerns about security, performance, and reliability, utilities have been hesitant to adopt new cloud-based technologies. VCE answers those challenges, and Vblock platforms’ converged architecture supports Smart Grid applications and operations requirements. Working with VCE, utility operators can adopt a best-of-breed, pre-integrated, predictable, reliable platform that offers streamlined management tools and seamless support.

For More Information
To put the power of a next generation converged infrastructure to work for you, and to learn how you can achieve your Smart Grid goals faster, contact VCE today:

- For more information, please visit www.VCE.com.
- To contact a sales executive:
  - Visit http://www.VCE.com/contact.htm
  - Call VCE at +1-855-823-1317

References
Further reading

Sources


ABOUT VCE

VCE, the Virtual Computing Environment Company formed by Cisco and EMC with investments from VMware and Intel, accelerates the adoption of converged infrastructure and cloud-based computing models that dramatically reduce the cost of IT while improving time to market for our customers. VCE, through the Vblock solution, delivers the industry's first completely integrated IT offering with end-to-end vendor accountability. VCE's prepackaged solutions are available through an extensive partner network, and cover horizontal applications, vertical industry offerings, and application development environments, allowing customers to focus on business innovation instead of integrating, validating and managing IT infrastructure. For more information, go to www.vce.com.

Copyright © 2011 VCE Company, LLC. All rights reserved. Vblock and the VCE logo are registered trademarks or trademarks of VCE Company, LLC, and/or its affiliates in the United States or other countries. All other trademarks used herein are the property of their respective owners.

© 2011 VCE Company LLC, All rights reserved.