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Building an Energy-Sharing Economy

A Digital Transformation Vision

In this issue

Gartner

Creating New Markets in the Utilities Sector

As with many companies planning for the future in this era of disruptive change, companies in the utilities sector have a clear opportunity to embrace new visions and to explore different business models available through digital transformation. By taking advantage of cloud-based technologies, utilities have a means to create digital platforms that can lead to expansion into new markets and the development of innovative market offerings. To date, IT modernization hasn't been a pressing issue for utilities. Legacy systems and existing business models have not necessitated the use of advanced IT infrastructures, so CIOs of these firms have had no real incentive to adopt more modern architectures. With the deep and ongoing changes now underway in the industry, this is an ideal time for CIOs and IT professionals to evaluate the benefits of these technologies and consider what they can contribute to the company's mission.

One of the primary disruptors in the utility sector is the increase in prosumers—home residents community cooperatives, and small business owners—who harness wind, solar, and geothermal technology to generate power that can then be delivered back into the energy grid. The presence of this new sector in the energy market gives innovative CIOs an opportunity to launch services that can monitor, price, and exchange this surplus energy within the framework of an economy-sharing platform, built using several technologies that have been refined and improved in recent years. For example, the combination of Internet of Things (IoT) technologies and smart machine advances provides a means for utilities to make

the best use of their assets, achieve high levels of automation, optimize production and delivery, and launch new lines of business that capitalize on information and analytics.

Without the background or expertise in developing modern IT infrastructures and IoT solutions, these utilities will need support and guidance from industry leaders in this space. Intel and Red Hat have pioneered many of the technologies that underlie advanced, enterprise-scale networking and cloud-based services and have co-developed many of the building blocks for implementing solutions based on open standards that can serve as a springboard to the creation of unique service offerings.

In the research note that follows, Gartner provides recommendations to utility CIOs, suggesting that they collaborate with business and IT leaders to devise a workable industry vision for their firm. CIOs should investigate examples of other platform providers that have launched energy-sharing economy efforts in specific industries to see how an effective digital business strategy can be enacted and to determine the best practices that are most likely to lead to success.

Source: Intel / Red Hat

Research From Gartner

Industry Vision: Utilities as Platform Providers for the Energy-Sharing Economy

One way to pursue digital business transformation is to create an industry-specific vision. A vision of the future energy provisioning business can help utility CIOs move beyond just capturing operational efficiencies to more directly enabling strategic digital business transformation.

Key Challenges

- The emergence of "prosumers" as the most significant disruption in the utility sector is challenging the financial viability of the existing utility business model.
- Traditional business models have not required utilities to develop IT as a core competency. Transforming into digital utilities will require building internal IT capabilities and digital platforms, or relying on external entities – vendors or digital leaders from other sectors.
- Many utilities still struggle with understanding and capturing the potential of digital business transformation. They can transform by stretching their thinking about what is possible by using digital capabilities to create or enter new markets.

Recommendations

Utility CIOs should:

- Work with a team of business and IT leaders to create an industry vision, such as a utility as an energy-sharing platform provider. It must be done quickly and simply, with little detail or consideration of feasibility.
- Research how sharing-economy platform providers have transformed other industries, and learn from their experience. Identify best practices, differentiation and overlap.
- Provide the CEO, as well as the chief strategy officer or chief digital officer, with the IT architectural vision and model upon which a new utility industry scenario can be enacted.
- Convince the CEO to pull digital business efforts into one unit or coordinate them centrally.

Introduction

According to Gartner's 2015 CIO survey, utility CIOs share the same level of expectation as global CIOs regarding the impact of digital on creating new market opportunities. Although many utilities operate in traditional regulated markets, the disruption they feel as a consequence of the penetration of prosumers (energy consumers who are also able to generate and deliver power back to the grid) and falling revenue from traditional services is forcing them to consider new business models, many of them enabled through digitalization. To implement new business models, utility CIOs will need to help their organizations change the basis of competition, create new markets and cross industry boundaries by leading the creation of an industry vision for digital business in utility sector.

Broadly speaking, an industry vision shows what business could look like if enterprises use the Internet of Things (IoT) and smart machines to their full potential. For asset-intensive industries, such as utilities, digital technologies can automate operations on a large scale – optimizing production and delivery capacity, and improving resource use to address energy sustainability concerns. In addition, an industry vision can include new lines of business around information services, such as creating new offerings based on leveraging access to information, analytics and algorithms.

An Industry Vision Changes Everything

An industry vision proposes nothing less than the complete redefinition not only of the enterprise, but the industry. It is one vision of many that could be possible for any given industry. The purpose of an industry vision is to stretch your thinking about what is possible. An industry vision should make all but the luminaries feel uncomfortable because it is a total rethink of how value is created and delivered.

Industry Vision Description: Utilities as Platform Providers for the Energy-Sharing Economy

The emergence of prosumers, the most significant disruption in the utility sector – driven by energy technology consumerization and innovation at the edge of the grid – is creating challenges to the existing utility business model. One possible industry vision for digital business is for utilities to become a provider of the sharing-energy economy platform. Such a platform would enable the integration of prosumer-owned distributed energy resources into energy markets by exposing them directly to consumers. By managing an information exchange platform utilities will enable value exchange (by leveraging data,

analytics and algorithms) among parties, and be able to capture a share of created value. In this vision, we are not proposing that a utility stop providing its core functions – managing and operating commodity and assets value chain to generate and deliver energy to consumers. Instead, we are proposing that utilities supplement their existing revenue, and compensate for loss of revenue caused by customer exodus, by becoming companies that provide energy-sharing platforms.

As digitalization starts to transform the utility sector, "ownership" of assets is no longer the only, or even the primary, means of generating economic value. We are now facing a new economics of connections that extends the basic principles of Metcalfe's Law (network effect) from the virtual world to the physical world. The sharing economy (sometimes referred to as "networked economy"), as exemplified by companies such as Airbnb and Uber, is the epitome of digital business. It relies on information processing acumen, rather than ownership of production or delivery assets, to enable distribution, access and the sharing of excess capacity in goods and services. Information is shared in a virtual online marketplace using digital platforms that sharing-economy providers own and operate. Providers leverage cloud and mobile technologies to make their offerings easy to deploy and access.

The sharing-economy model for enabling energy exchanges (between individual prosumers with extra production capacity and consumers interested in using this capacity) is an effective way to integrate prosumers into energy markets in a controlled manner that also provides additional revenue opportunities for utilities. Specifically, the sharing-energy economy will require two distinct platforms:

- **An energy-sharing economy platform** – This will bring interested parties together and deal with the payments and financial aspects of microenergy transactions. This platform will leverage consumption analytics and advanced algorithms to create additional value to platform operators and participants.

- **A digital distribution platform** – This will maintain and operate an open-access distribution grid for all participants. Distribution platform providers will calculate and charge for delivery services for microenergy transactions between prosumers and consumers, while ensuring the safe and reliable operation of the distribution network and optimal utilization of the existing energy delivery infrastructure.

To succeed with this industry vision, utility CIOs must:

- Create and describe an industry vision for the utility as a sharing-energy economy platform provider with a team of business and IT leaders

- Identify examples for inspiration

- Choose the right approach

Analysis

Create an Industry Vision for the Utility as a Platform for the Energy-Sharing Economy With a Team of Business and IT Leaders

An industry vision for a utility to become more like a platform provider for the energy-sharing economy that facilitates prosumers' distributed energy resources integration in energy markets should consist of four parts – concept, capabilities, assets and research.

Concept

An industry vision seeks fundamental change; therefore, it will affect many dimensions of the business and operations. The core of the digital transformation of the utility sector is enabled and based on digitalization where ubiquitous connectivity, access to information and unprecedented computing capabilities allow utilities to operate under new economic principles – such as transactive energy markets. The operating principles of transactive energy markets (1) congestion management (for network operation), (2) real-time bidding (for energy source, including distributed energy resources [DER] management), and (3) multisided aspects of the sharing economy are, to some extent similar to those already deployed for transmission network and wholesale market operations.

A vison for utilities to become energy-sharing economy platforms involves four components:

1 **Digital Business Model** – Today's business model for utilities, either Utility 1.0 (regulated market) or Utility 2.0 (deregulated market) is based on a closed business model in which value is created, only inside-out (see "'Transforming While Performing' Demands Organizational Ambidexterity and Bimodal IT" for further details on utility business model evolution). By having the exclusive control over the entire value chain, utility revenues are based on ensuring available capacity to meet customer demand. This noninclusive model does not rely on economic principles to optimize utilization of the delivery asset and generation capacity. Digital business models, such as Utility 3.0, on the other hand, are open and enable ecosystems of people, businesses and things to co-create value (for example, by leveraging prosumer sources to address energy delivery bottlenecks). By including external parties (people, businesses and things) value can be created, inside-out outside-in, and through co-creation (for example, by letting DER owners, demand response [DR] providers and aggregators optimize their bidding strategies and negotiate better prices for their energy through access to platform-provided algorithms).

2 **Energy-Sharing Economy Platform** – A business model platform in a multisided market is an innovation that allows platform owners to expose excess capacity in resources or assets to interested parties. A platform creates value by leveraging network economy. The network effect and multisided nature of the sharing economy have, in a short time frame – in some cases, less than five years – created market leaders such as Facebook, Airbnb or Uber, with valuations larger than incumbent providers in

their respective markets. In addition, these market leaders have made their achievements without ownership of any physical assets or traditional delivery channels. Instead, the value is created by leveraging IT competencies such as cloud, analytics, mobile, APIs and algorithms. The sharing economy model for enabling energy exchanges (between individual prosumers with extra production capacity, and consumers interested in using this capacity) is an effective way to integrate prosumers into energy markets. Energy-sharing economy platforms enable DER marketplaces by exposing excess DER capacity to interested party (consumers). The microenergy transaction is completed via an open-access distribution network managed by a distribution network operator. Value is created by optimizing the use of all available resources (utility- and prosumer-owned) and providing information processing services such as power matching and negotiation, assessment of the technical feasibility of the transaction (outsourced to distribution platform providers), billing and financial settlements.

3 **Digital Distribution Platform** – Unlike Uber or Lyft – ride-sharing companies that leverage public transportation infrastructure – the sharing of prosumer DER is done over distribution networks that are owned and managed by distribution companies that have sole responsibility for network operational integrity and economic viability. Cars slow down during peak hours due to traffic congestion. Energy delivery during peak hours cannot slow down. Instead, if unchecked, demand creates asset overload that can cause faults and network outages. Based on the available delivery capacity at any point in time, the cost of energy delivery at any location varies (aka distribution marginal prices) and can be calculated as a part of an individual energy microtransaction. Consequently, the role of the digital distribution platform operator is to assess technical feasibility and the cost of any proposed energy microtransaction. By using analytics-based applications for congestion management, distribution platform operators can optimize utilization of the network and send market signals for investment in generation (utility- and customer-owned) and delivery assets. Digital distribution platforms enable monetization of new business models for inclusion of DER by assessing technical feasibility and calculating the delivery cost of proposed microenergy transactions. This also enables more rapid development of the energy-sharing economy platform.

4 **Business Ecosystem** – A business ecosystem leverages business models and platforms to create new solutions. The business ecosystem broadly includes customers (consumers and prosumers alike), energy brokers, demand response providers, business partners and employees. In addition to businesses and people, the ecosystem includes things – smart machines that operate independently based on a set of parameters (such as turn dryer off when the price exceeds a certain threshold) or act on behalf of customers and their households (such as home energy management that optimizes on-site production, storage and demand, and

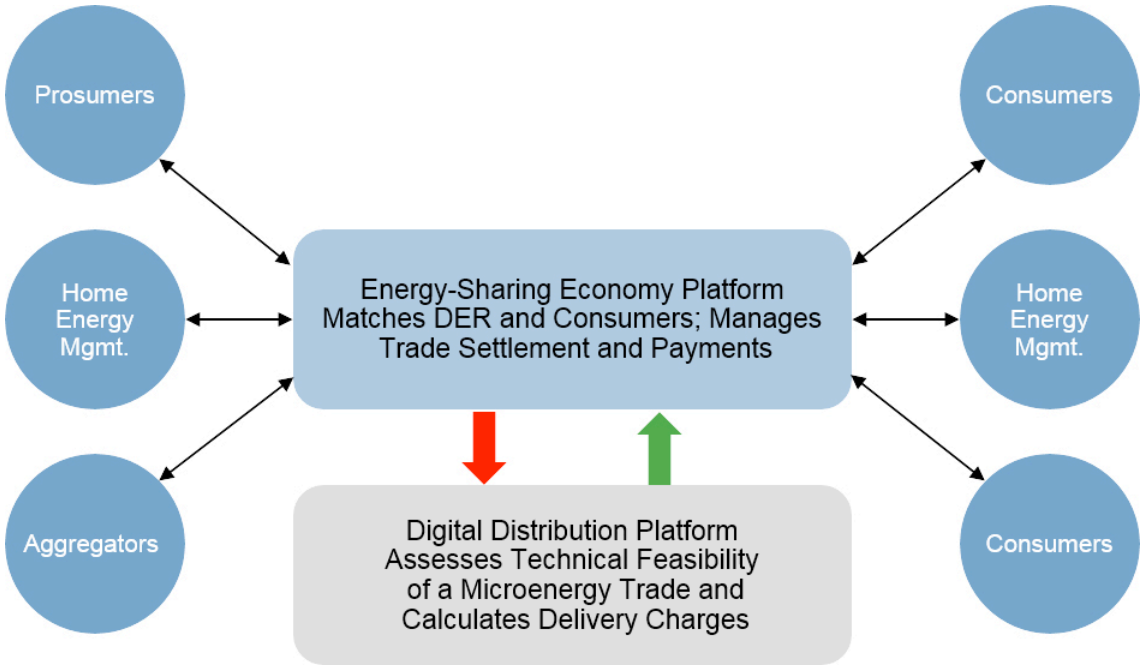
negotiates energy purchases or sales with external parties over an energy-sharing economy platform). Partners is a broad category, and for utilities includes technology startups, third-party developers of DER, universities, vendors, trade associations and consortia (such as EEI, IEEE, EPRI, Eurelectric) and peers (because not all utilities will have the resources to create their own business model platforms). Figure 1 depicts an energy-sharing economy platform, digital distribution platform and business ecosystems.

Assets

A utility CIO will need new assets to execute the utility as an energy-sharing economy platform provider vision. For example:

- An apps development environment to create compelling mobile customer/partner experiences.
- Microtransaction billing and settlement systems.

Figure 1. Ecosystem for the Utility as an Energy-Sharing Platform Industry Vision



Source: Gartner (May 2016)

- APIs for integration with a digital distribution platform capable of calculating distribution marginal prices and delivery charges for microtransactions, as well as a demand response provider platform.

- Analytical capabilities and algorithms for discovery, biding, negotiation and matching excess DER supply and demand.

- Intelligent business processes to scale the curation of what ecosystem partners have created, and to ensure solutions are ethical, reliable, secure and compliant.

Capabilities

A utility CIO will need a new set of capabilities to make the utility as an energy-sharing economy platform vision work. In some cases, these capabilities will be shared with other C-level executives such as the COO, chief marketing officer (CMO) or chief strategy officer (CSO). For example:

- An IT culture that embraces openness, such as being open for technologies and best practices from other technology domains and industry sectors. Because utilities tend to be relatively detached from other sectors, this will be a big challenge for most utility CIOs.

- Acquiring new talent that is versed in digital business and open-platform implementation and delivery.

- A bimodal IT approach to launch business model platforms.

- Developer resources to manage and maintain energy-sharing economy, and digital distribution platforms and ecosystems.

- Marketing resources to recruit the ecosystems of new/existing partners that will leverage the platform – for example, students, vendors, energy service providers, DER providers, and so on (CMO responsibility).

- Vendor and partner management capabilities to coordinate a dynamic ecosystem of partners.

- An organizational and compensation structure aligned around business model platforms, rather than products/services (CEO and COO responsibilities – an enormous change, especially given the market tendency to focus on short-term profits).

- New approaches to risk management and intellectual property (IP) that adapt to a digital business model that shares critical IP assets with ecosystem partners (chief risk officer [CRO] responsibility).

Research

There is a very high interest in utility business model transformation among energy policymakers, regulators and energy utility executives, driven by innovation in digital technology on the edge of the grid. Consequently, there is a lot of activity devoted to finding new digital business models for the utility sector. Developments around digital business models are not static; they are changing rapidly, and will expand into new areas. The CIO (jointly with the

head of strategy–CSO or chief digital officer [CDO]) will, therefore, have to maintain a research program designed to monitor and adapt its vision of a utility as an energy-sharing economy platform provider. The utility CSO will need to experiment continually with new digital business possibilities. Those possibilities will require new technologies, so the enterprise will need research partnerships, especially with universities and trade associations (SGIP, EEI, EPRI and Eurelectric).

Identify Examples for Inspiration

CIOs can better understand what an industry vision for a utility as an energy-sharing economy platform provider is by looking at companies that have already embarked on similar visions. These companies use the vision as a kind of blueprint, and build it out gradually as they acquire the knowledge and ability to do so (see Table 1).

Table 1. Examples of Utility Energy-Sharing

Company	Country	Description
LichtBlick	Germany	Provides SchwarmDirigent platform that connects, analyzes and optimizes consumer-and provider-owned generation and storage, as well as manages demand.
Flexiblepower	Netherlands	Flexiblepower has created the PowerMatcher platform that integrates prosumer-owned generation and storage resources with demand via a transactive energy market framework.
vanderbron	Netherlands	Provides a platform for the peer-to-peer energy marketplace that connects renewable independent power producers and residential consumers.
Open Utility	U.K.	Provides Piclo an online marketplace for renewable generators and commercial consumers.
Yeloha	U.S.	Yeloha provides a platform for sharing solar energy resources between consumers and residential solar owners.
ComEd	U.S.	Planning to provide a distribution system platform to interconnect DER and manage reliability while earning market-based revenue through transaction fees and access to usage data.
Source: Gartner (May 2016)		

Choose the Right Approach

The cross-functional team (including the CIO) can take one of three approaches to creating an industry vision for utility sector:

- **Create an industry vision for a utility as an energy-sharing economy platform provider that supersedes a competitor's vision.** A CIO might judge that his or her enterprise can create its own industry vision, which will prevail because the enterprise has a more complete or compelling vision, or has the capabilities and assets that will allow it to move fast. However, competing against another company's industry vision introduces the extra challenge of convincing research and business partners to support the enterprise's effort, rather than, or more than, the rival's vision.

- **Join another enterprise's vision for a utility as an energy-sharing economy platform provider and try to dominate one layer of it.** If another company leads an industry vision that can't be superseded, a CEO can still lead his or her enterprise to prosperity in digital business by providing a critical part of the vision. For example, having a successful deployment of an advanced distribution management system (ADMS) that can calculate distribution marginal prices, and having and API that can share that with multiple energy-sharing economy platforms, can make a company an indispensable provider of digital distribution platform services. However, this approach allows a competitor to set the terms for the industry, and leaves the enterprise vulnerable to being replaced if the competitor can develop or acquire a better solution.

- **Create an entirely new industry vision. A CEO/CSO might assess an industry vision for utilities as energy-sharing economy platform providers and reject it for any number of reasons – such as lack of significant DER penetration or an unfavorable regulatory environment.** These CEOs/CSOs should then lead their enterprise to create a new industry vision and evaluate the opportunity to become the first in its industry to pursue it. The enterprise can thereby gain a first-mover advantage and set the terms for competition in its industry. Its vision would emphasize the enterprise's competitive advantages. For example, if it excels at customer service, it could design the vision around that aspect. Or, if it excels around asset operation or commodity management, it could design around those respectively. However, going first also means the enterprise must wrestle with digital business challenges, without the benefit of learning from other the experiences of other companies.

Evidence

We based this research on discussions with CIOs of utility organizations and utility business strategy leaders, secondary research into industry-specific visions for digital business, and on our overall research into digital business.

Source: Gartner Research Note G00303110, Zarko Sumic, 04 May 2016

Intel Contributions: From Gateways to Advanced Data Centers

The visionary goals that Gartner presents are possible only with a technological framework in place. Data is and will continue to be a substantial factor in utility company operations and next-generation technologies that collect and connect data will be instrumental in achieving desired goals. Collection, filtering, and aggregation of data can be enhanced through IoT solutions being developed by Intel and partners collaborating with Intel. Red Hat contributes to the development of end-to-end solutions by providing technology that can connect datastores and integrate the sensors and IoT devices across the infrastructure into a cohesive, functional whole. Utilities can gain a competitive advantage by means of value extracted from the data harvested, combined, and analyzed in this manner. IoT technology, an area where Intel is building a thriving ecosystem through the Intel® IoT Solutions Alliance, is a mainstay in the creation of an energy-sharing economy.

Variable and difficult-to-predict energy sources are increasingly being added to the grid. These sources disrupt previous models for planning energy supply and demand relationships. To contend with this challenge, Intel offers a number of technologies that support smart grid control and energy load balancing, taking maximum advantage of IoT capabilities to harvest relevant data and derive intelligence from it.

Building Solutions with Intel® IoT Gateways

Building block components designed for maximum interoperability–from a hardware foundation built with Intel architecture hardware

to the big data applications that filter and analyze tremendous volumes of input collected from IoT devices—represent the basis for large-scale IoT solutions. These solutions help enable the visionary proposals Gartner is highlighting in its research note. Intel® IoT Gateways are an important part of building the infrastructures upon which IoT solutions can be launched. Combined with the expertise that Red Hat provides (with middleware solutions that connect and integrate IoT components), as well as contributions from experienced ecosystem partners who provide specialized services and equipment, comprehensive end-to-end solutions can be efficiently developed. These solutions deliver value to utility companies that want to track and manage assets more precisely, achieve centralized control over operations, improve security across a complex infrastructure, and, as Gartner suggests, enable the creation of innovative business models to establish new revenue channels.

Enabling the Smart Grid

As energy sources shift from centralized, monolithic plants to multiple, lightweight renewable sources constructed using microgeneration principles, the smart grid will be a key factor in sourcing and distributing power. The energy-sharing economy that Gartner envisions will depend on an agile, accessible smart grid that can handle millions of incoming sources of energy and control the distribution and use in an intelligent way. Renewables represent much less financial risk to utilities because they can be quickly built and started.

Distributed energy resource management depends on interconnecting the devices that use energy with the systems that produce it and intelligently allocating resources. As described in a Rocky Mountain Institute article, "Capturing the Full Benefits of Demand Flexibility:"

> As more and more loads, batteries, and distributed generation sources like smart appliances and electric vehicles become connected, and our ability to orchestrate them to create less obtrusive but highly valuable energy services increases, demand-side flexibility will continue to grow both as a tool for customers to save money, and as a tool for grid operators to save on infrastructure expenses. As these trends become more powerful and embedded within the power grid, we foresee a future where the electric system does not need to be built to meet occasional peaks, but one in which supply and demand can respond to each other dynamically, benefitting customers, utilities, grid operators, and the environment.[1]

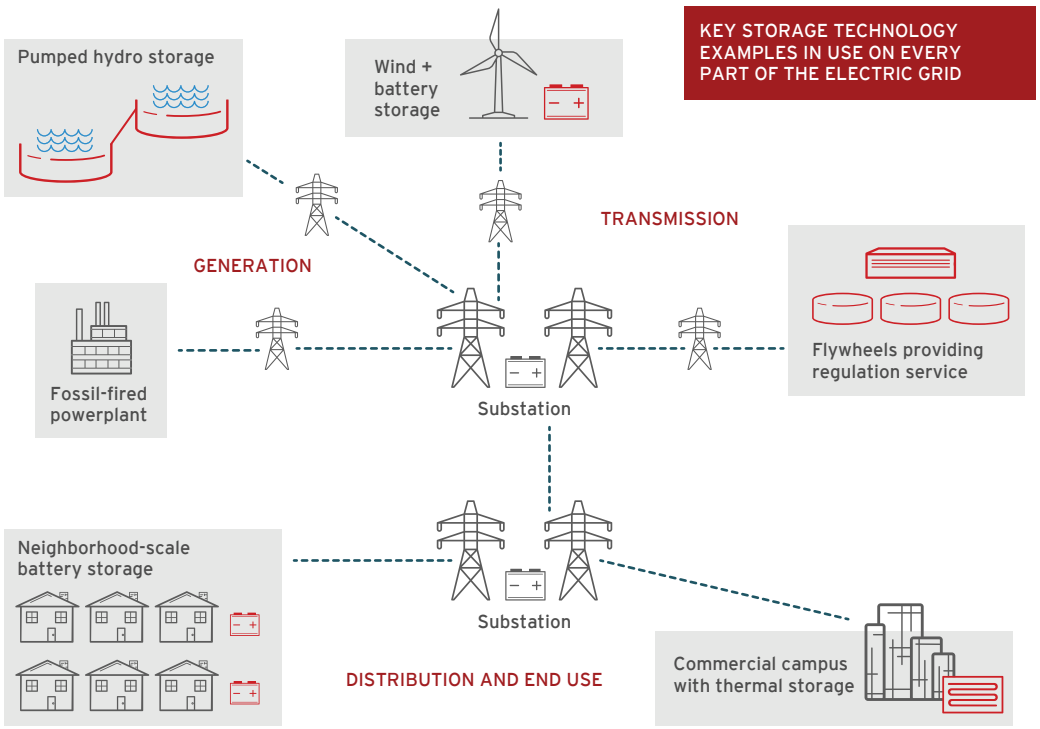
Intel® IoT Platform solutions can help accelerate the creation of smart grid applications. Intelligent systems that capitalize on IoT technologies can be used to manage the electrical grid and make it possible to reduce infrastructure costs for utilities. Intelligent grid devices, now available from a number of manufacturers, can be integrated with switch and sensor hardware as a way to control operations from the edge of a microgrid. Ultra low power processors from Intel and embedded operating systems reside in many of these devices, providing a high degree of intelligence at the edge of the IoT infrastructure. The Intel® Xeon® family of processors plays a key role in the data center, where

[1] http://blog.rmi.org/blog_2016_08_12_Capturing_the_Full_Benefits_of_Demand_Flexibility

big data analytics help utilities gain visibility into what is happening across the grid network. Intel collaboration on end-to-end synchrophasor solutions, which measure waves on an electrical grid against a common time source, support multiple measurements of different points on the grid remotely.

Storage systems that can store energy in a variety of forms (kinetic, thermal, chemical, potential, and so on) can also be factored into smart grid scenarios, as shown in the following figure. This is another area where centralized visibility into the grid components can be used to drive predictive analytics and enhanced distribution models across the grid. Storage is an important contributor to a distributed energy-sharing economy in which large numbers of small generators are all releasing power into the grid at different rates and times.[2]

Figure 1. Electric Grid Storage Technologies



Source: Intel, Figure courtesy of the U.S. Energy Information Administration (EIA)

[2] http://itpeernetwork.intel.com/utility-transformation-energy-storage-the-disruptor-from-the-edge/

Securing the Smart Grid

The critical nature of smart grid installations presents a significant security challenge, primarily because of the large attack surface associated with an expansive infrastructure composed of numerous distributed and interconnected systems. Ensuring that strong security is in place across the entire system is essential to avoiding attacks that could cause blackouts and threaten the integrity of data that drives IoT operations.

Best practices to secure smart grid deployments involve a range of cybersecurity technologies, including system hardening, network security design principles, intrusion prevention systems, anti-virus applications, malware detection, and so on.

Intel® technologies, combined with supporting applications from Red Hat, Wind River, McAfee, and others, provide a deep security layer grounded in hardware, extended within the embedded operating system, and integrated into the security software. Intel® Trusted Execution Technology (Intel® TXT) employs silicon-based protections that function pre-launch to detect any changes or intrusions in the BIOS, operating system, and fundamental platform components before completing the boot process. A McAfee data exchange layer can complement Intel TXT protections, offering real-time context sharing and orchestration, adaptive threat protection capabilities, as well as techniques for collective threat intelligence.

Another invaluable solution for providing Critical Infrastructure Protection (CIP), an important consideration for utilities required to secure assets that constitute North America's bulk electric system, is Security Enhanced Linux (SELinux). SELinux, enabled by default in Red Hat Enterprise Linux, adds Mandatory Access Control to the Linux kernel, establishing consistent access control to guard files and processes against threats and vulnerabilities, as described in the next section. Protecting the large-scale networks required to operate a smart electricity grid requires a coordinated, multi-layer approach to security, leaving no area of vulnerability for hackers to exploit.

Source: Intel

Mapping Visionary Goals to Red Hat Solutions

In general, the overarching needs of utility companies tend to fall within three major areas: reducing operational risks, maximizing productivity, and ensuring compliance with the multiple regulations and laws that they are subject to. The business initiatives to accomplish this dovetail with a number of Red Hat technology initiatives and, depending on customer needs, can typically be mapped to one or more Red Hat solutions. Numerous deployments in the energy sector demonstrate the validity and success of these solutions at resolving key challenges for utilities. However, as discussed in the Gartner research note, a visionary approach to using digital transformation adopts a more imaginative perspective, going beyond the traditional business model of utilities and establishing new lines of business built around new and emerging technologies.

The energy-sharing economy that Gartner envisions will require an expansive, elastic IT infrastructure, a large-scale distribution architecture, and a supporting ecosystem–both in functional and technological terms. Managing this system and communicating with customers and business partners will also require an application platform that provides a public view of what is happening across the infrastructure and what service capabilities are available. The following sections touch on some of the Red Hat solutions that can help create a platform for energy-sharing services.

Replacing Monolithic Applications with Microservices

The provisioning of customers in a large-scale infrastructure that supports an energy-sharing ecosystem can be efficiently handled using container technology. OpenShift Enterprise by Red Hat provides a complete Platform-as-a-Service (PaaS) that makes it easier for developers to improve IT service delivery, create and launch microservices, and securely manage open containers. The virtues of open-source community development have made it possible for Red Hat to become an industry leader in container technology and microservices, capabilities that fit well within the scope of Gartner's projections for the energy sector.

Monitoring and Controlling Operations Remotely

Mobile device and apps enable the management and monitoring of a complex infrastructure without being tethered to a desktop machine, creating opportunities for new services and improved efficiencies in existing services. Technicians, administrators, field service personnel, and other staff members for electric utility companies can use apps running on smartphones or tablets to survey electrical transmission towers and equipment that is difficult to physically reach. Mobile control of unmanned aerial vehicles for data collection, inspections, and maintenance can simplify many field operations. Administrators can monitor operations zone by zone, access data in the back office as needed from wherever they happen to be, make control adjustments remotely, perform data-driven decision-making, and perform other tasks while traveling or away from the main site.

The enterprise-caliber Red Hat Mobile Application Platform, built based on the acquisition of FeedHenry, bolsters the quick development of mobile apps, as well as integration and deployment to diverse systems. Electric utilities can readily connect existing data stores into a mobile framework that extends information sharing and operational details to field personnel, administrators, and other staff members, providing ways to introduce new services.

Perfecting Data Storage and Transfer

The energy-sharing ecosystem suggested by Gartner will depend on being able to move large volumes of data from one datastore to another. The IoT solution architectures being pioneered by Intel rely on the collection and storage of massive amounts of information, requiring responsive, secure, flexible storage systems. Red Hat Storage solutions, designed to scale reliably across physical, virtual, and cloud resources, are an important aspect of a modern IT infrastructure. Based on open standards and applying next-generation software-defined storage techniques, Red Hat Gluster Storage and Red Hat Ceph Storage support independent scaling that can range beyond the individual hardware components in the storage system.

Red Hat Ceph Storage, which lets architects create optimized cluster configurations for a variety of workload types, works well on Intel processor-based servers equipped with Intel® Solid State Drives. Data center capable storage devices, such as the Intel® SSD DC Series, fit effectively within the software-defined storage framework developed by Red Hat that can control the storage parameters both in the cloud and on-premises.

Red Hat Gluster Storage provides another means for managing large stores of data that may be distributed in public, private, or hybrid cloud environments. Utilities creating an ecosystem for energy sharing can streamline file and object access and securely manage unstructured and semistructured data in a flexible, cost-effective manner.

Beyond simply storing data, data transfer mechanisms need to be secure and reliable, as well as capable of integrating with the components of a heterogenous network. This can be seamlessly accomplished with Red Hat JBoss® Fuse, a lightweight integration platform. Red Hat JBoss A-MQ provides a lightweight distributed messaging platform that enables real-time integration. In a electric utility infrastructure, vital information–such as alerts, updates, service status, and so on–can be rapidly communicated to headquarters, control centers, distribution sites, and other endpoints.

Automating Routine Tasks

The ambitious scope of building an energy-sharing ecosystem across an expansive IT infrastructure, as presented by Gartner, will require modern automation tools geared to the challenge of creating and maintaining a data-centric IT infrastructure.

Red Hat has developed automation tools that can relieve administrators and IT professionals from many of the time-consuming tasks related to maintaining a large infrastructure–including provisioning resources, metering transactions, monitoring network health, orchestrating intra-service operations, and anticipating potential failures. Ansible by Red Hat, an enterprise-caliber IT automation engine, can reduce the complexity of IT maintenance of multi-tier deployments. Based on a straightforward language that makes it easy to define automation sequences, Ansible uses DevOps principles to streamline the development, deployment, and lifecycle management of applications. A complementary web app, Ansible Tower by Red Hat, gives customers control over enterprise-wide automation and visibility into processes.

Providing Critical Access Protection for Utilities

Cybersecurity threats and other malicious intrusions that could potentially endanger the continuity of the nation's electrical grid (as well as other national infrastructures) are addressed in a set of standards and requirements established by executive order EO 13010 in 1996, known as the Critical Infrastructure Protection plan. The US Department of Homeland Security extended risk management practices with the release of the National Infrastructure Protection Plan in 2013 (NIPP 2013). Standards and regulations introduced cooperatively by the government and private sector are designed to strengthen safeguards, ensure resilience, and minimize risks to national infrastructure assets.

Red Hat Enterprise Linux, through the default enabling of the mandatory access controls granted by SELinux policies, goes beyond traditional UNIX permissions to provide fine-grained access control over files and processes. Included in the Linux kernel, these controls make it possible to enforce data confidentiality and the integrity of files. They also can confine malicious applications and services. SELinux complements,

but does not replace, other security tools, such as firewalls, antivirus software, and passwords. Instead, it provides another layer of security that is important to meet the requirements of CIP and NIPP 2013 and maintain the ongoing operation of the electrical grid by hardening the IT infrastructure of utilities.

Managing Risk

Public utilities, by nature and by regulation, are risk averse. Risk management should be an integral consideration of all aspects of operation, particularly those that involve new services and emerging technologies. To optimize IT infrastructures and mitigate risk, Red Hat Insights provides a means to proactively identify pending threats to security, performance, and stability. Using prescriptive analytics to determine IT risks, vulnerabilities can be caught and corrected across complex hybrid cloud environments that may include a mix of physical and virtual components, containers, public and private clouds, and so on. The success or failure of an energy-sharing economy may hinge on avoiding downtime and addressing issues in the IT infrastructure before they have a serious impact on operations and service delivery.

Managing APIs and Business Processes

Successful development of a modern IT infrastructure to support an energy-sharing ecosystem will also require robust API management tools, both for development of cloud and mobile apps and integration of components. Red Hat recently strengthened its middleware portfolio by acquiring 3scale, which provides tools for increasing interoperability between on-premises and cloud-based components. Infrastructure architectures are evolving into an expanding network of APIs and collections of microservices that communicate among each other. Red Hat is a leader in this evolution, pioneering many of the tools and techniques to further this type of rapid, flexible development model.

Another area where utilities can gain competitive advantage through IT modernization is by integrating IT operations and business processes. Red Hat JBoss BPM Suite combines business process management (BPM) and business rules management (BRM) to provide a common language between IT users and business users. This enables fine-grained control over business logic and a fluid structure for mapping procedures and policies.

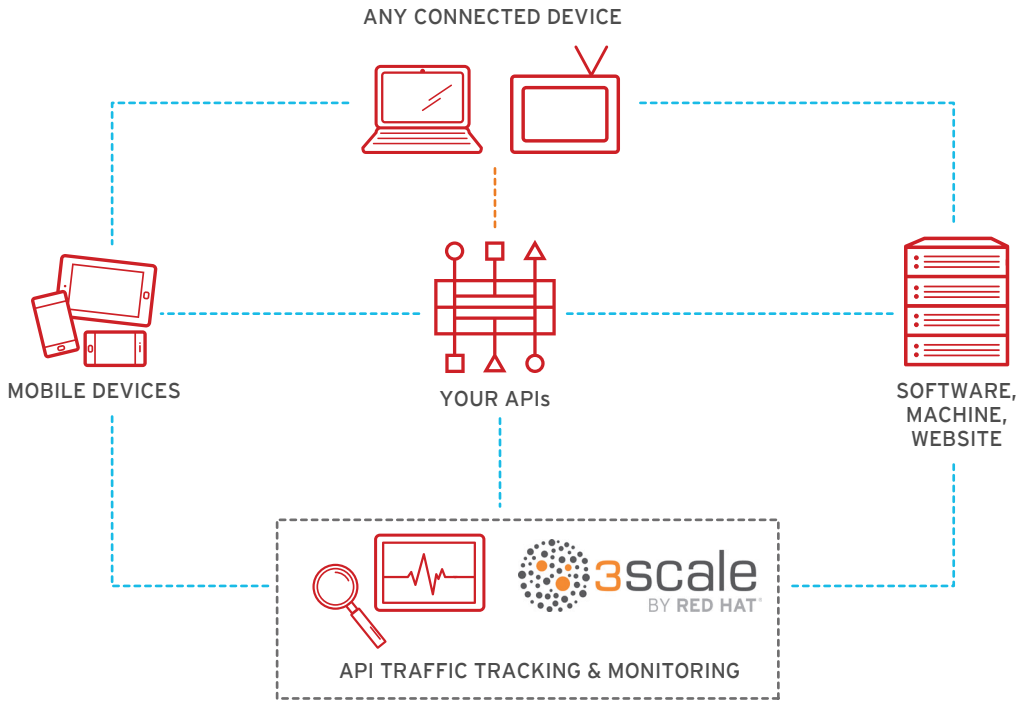
Building an Energy-Sharing Ecosystem of Innovation

The power and strength of the open-source community for generating innovative solutions to IT challenges is unprecedented. Red Hat and Intel are major contributors to many of the open-source projects that are reshaping modern IT infrastructures. In effect, the open-source community is creating the world's largest software development research endeavor, paving the way for the kinds of visionary ideas that will have deep impact on the future of IT.

Summary

The challenge faced by utilities–as described in this paper–is to progress beyond seeking basic cost-effective operational efficiencies and embrace more visionary goals that have the potential for creating new streams of revenue and attracting customers in emerging markets. Instead of merely reacting to changing market conditions by reworking existing business models, digital business transformation

Figure 2. Advanced API Management



Source: Red Hat

offers opportunities to apply new tools and technologies that extend the energy market in a more innovative ways. Developing solutions and services based on modern, open architectures can attract a new generation of customers and provide entry into markets where these kinds of services were technologically impossible a decade or so ago.

Red Hat and Intel–both leaders in championing and developing advanced technologies using open standards–are well equipped to support utilities in their quest to create and enter new markets, with hardware and software components that can be used as the building blocks for developing the solutions to establish an energy-sharing economy.

For more about Intel's contributions to an intelligent, energy-efficient future, visit http://www.intel.com/content/www/us/en/energy/energy-overview.html.

For insights into the ways Red Hat can help enhance energy use, go to the Energy category of the Red Hat vertical industries blog: http://verticalindustriesblog.redhat.com/category/energy/.

Source: Red Hat

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2200 Mission College Blvd.
Santa Clara, CA 95054-1549
USA
Phone: (408) 765-8080

About Red Hat

Red Hat is the world's leading provider of open source software solutions, using a community-powered approach to provide reliable and high-performing cloud, Linux, middleware, storage, and virtualization technologies. Red Hat also offers award-winning support, training, and consulting services. As a connective hub in a global network of enterprises, partners, and open source communities, Red Hat helps create relevant, innovative technologies that liberate resources for growth and prepare customers for the future of IT.

Learn more about Red Hat's open cloud solutions at www.redhat.com/solutions/cloudcomputing or by contacting a representative in your region.

Contact

NORTH AMERICA
1 888 REDHAT1

EUROPE, MIDDLE EAST, AND AFRICA
00800 7334 2835
europe@redhat.com

ASIA PACIFIC
+65 6490 4200
apac@redhat.com

LATIN AMERICA
+54 11 4329 7300
info-latam@redhat.com

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