DELL Technologies intel

WHITE PAPER

UTILITIES AT THE EDGE:

Intelligent Management through Strategic Modernization

As electric utility leaders look for new ways to optimize operations and management in the evolving energy market, many are using Edge and Internet of Things (IoT) technologies to turn enormous volumes of data into actionable intelligence.

Utility companies have implemented millions of smart meters, generating significant amounts of data that must be harvested to offer insight into energy consumption and demand. Deregulation continues to open the door for new, non-traditional competitors, especially in the European market. At the same time, consumers are becoming prosumers with expanding energy options and the ability to produce electricity from distributed energy resources and microgrid technology. As a result, managing energy on the grid has become increasingly complex, necessitating more efficient solutions to manage peak demand and maintain reliability.

To move forward their digital transformation, utility companies are deploying Edge and IoT devices to manage and monitor electricity at a higher level of granularity than than in the past. Importantly, they also need a modern distributed architecture and analytics capabilities to take full advantage of the data collected to deliver real-time insights that meet changing business demands.

Utilities are using data collected from Edge and IoT infrastructure to enhance operational efficiency and, as a result, service reliability. As an example, utility leaders are monitoring data from remote equipment to enable proactive maintenance, avoiding shutdowns. A data-driven approach can potentially reduce annual utility downtime by 70% and can also potentially bring unplanned costs down to 22% of total expenditures, compared to 50% currently.[1]

The Edge and IoT ecosystem, combined with a distributed analytics architecture, creates valuable insights that improve efficiency, reliability, safety, affordability, and customer satisfaction – and provides an opportunity to create new, unregulated services that deliver additional revenue streams and diversify utility business models.

THE GRID OF THE FUTURE

Historically, grid operators used past demand data to forecast needs and balance supply and demand.

Today, grid technology has evolved to allow for two-way communication between the utility and its customers. Electricity flows outward from central power plants and, increasingly, into the grid from distributed sources including consumers generating power via solar and wind farms.

To manage the grid in this increasingly complex environment, utility leaders are using digital transformation technologies and providing Edge compute functionality to manage data velocity and/or perform advanced analytics at the source or point of collection. These leaders are working to:

- **Enable (real-time) demand forecasting to reduce costs and drive affordable service:** A complex set of equations determines how to manage demand and supply of energy on the grid.

COMPUTER VISION FOR UTILITIES

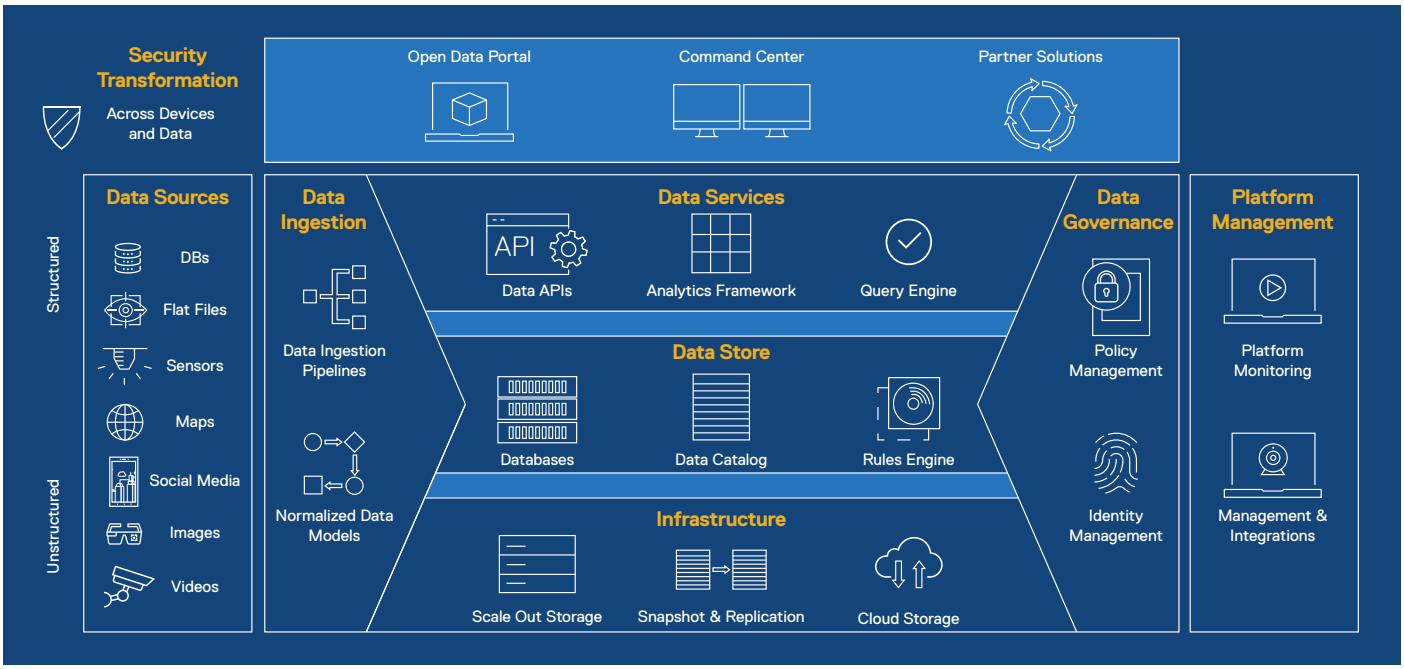
Computer vision uses cameras (fixed or on drones or other devices) as sensors to capture video data along with built-in analytics/machine learning capabilities – right in the cameras – to then inspect assets, automate data analysis, and identify patterns, anomalies, and perceived threats. With these capabilities, the Edge devices provide reliable information for condition-based maintenance, power grid management, energy deployment, and security in the field. Utilities use the technology to improve operations and asset restoration and take a proactive stance – reducing outages, and in turn, lowering maintenance costs and increasing customer satisfaction.

As an example, computer vision cameras with machine learning capabilities can remotely inspect assets through virtual site tours and run algorithms to analyze and score the condition of those assets, prioritizing areas that need immediate attention. From a safety perspective, these cameras monitor facilities or substations to identify personnel that pose a threat or safety hazard. In areas where vegetation management is an issue, drone analytics platforms can monitor vegetation overgrowth and encroachment around power lines, minimizing the possibility of outages or wildfires.

Utility companies can leverage the Dell Technologies IoT Solution for Safety and Security, powered by Intel, a software-defined infrastructure system with tightly integrated compute, storage, networking, and virtualization resources to help improve system performance and lower total cost of ownership. It is purpose-built to a complex camera-on-cloud infrastructure with support for demanding mixed data sources including video, audio, weather conditions, and more.

[1] Deloitte report from: Dell Technologies Energy Vertical Experience and Vision Presentation

Figure 1: Enterprise-grade, end-to-end AI-ready computer vision platform



Utility companies need smart electronics to manage and monitor electricity in much more detail than ever before. In addition to smart devices, distributed analytics at the Edge provides utilities with the ability to monitor electricity generation and consumption, and manage peak demand. Bandwidth limitations cause network latency and limit analysis of harvested data, but Edge intelligence enables companies to extract valuable insights where data is collected, and transfer only the most relevant data for quick insight to action. As a result, utilities can build a smart grid capability that monitors all energy transactions and deploys available energy resources intelligently

- **Predict problems, deploy resources efficiently, and avoid outages to improve reliability:** With a distributed analytics architecture, utility leaders can monitor systems, assets, facilities, and the grid remotely. Suppliers can reduce routine and repetitive tasks such as meter readings and inspections, saving time and resources. Cameras, drones and sensors monitor utility facilities, providing the ability to proactively prevent and quickly respond to maintenance issues. The devices run algorithms and analyze data at the Edge, monitoring the condition of assets to prioritize issues and reduce outage risk, in real-time

- **Modernize physical security to keep facilities and employees safe:** Use computer vision (cameras with built-in analytics and machine learning capabilities) to inspect and monitor facilities, identify patterns, and detect anomalies. This allows for the communication of instantaneous safety hazard alerts. See Figure 1 for a detailed overview of a computer vision platform

- **Automate operations, enabling new service development and driving customer satisfaction:** Utility companies can draw insights from the Edge and IoT infrastructure to create new products and services that give customers flexibility, control, and affordable services. For example, utility companies are moving to time-of-use (TOU) pricing, a model where the cost of electricity varies depending on when customers use it

CONNECTING CLOUD, SECURITY, AND ANALYTICS TO THE UTILITIES EDGE

While utilities need a flexible infrastructure at the Edge, the solutions must run on a common framework to achieve a homogenous IoT architecture that can integrate with multi-cloud platforms as workloads dictate. Edge Compute and Gateways can capture high-velocity data and are critical components enabling distributed analytics in both online and offline environments. This integration is important as computational workloads can now run in a variety of different configurations – whether in a public cloud, private cloud, on-premises, or at the Edge.

Traditionally, organizations have built a data lake, labeled and combined their data, and applied machine learning on consolidated data sets. They generate models that can then help the technology perform specific tasks. The challenge is that the models require moving all data to one location to analyze. Today, given the increased volume and velocity of data collected by smart meters, bandwidth restraints, and regulatory issues, this is no longer a feasible approach on its own. Electric companies need a distributed analytical AI capability where data is not relocated back to a central location each time it needs to be processed. Instead, utilities must incorporate machine learning at the Edge (so all data is not required to be transmitted) with deep learning and AI at the core. This distributed analytics model delivers a powerful continuous learning capability.

From a security perspective, Edge and IoT ecosystems require additional considerations, due to the increased number of hardware and software-based network access points. This increases the criticality of cyber and physical security considerations when designing and managing these networks. Utilities need to address security concerns early in the development process, alongside data collection and application development.

This said, the distributed analytics architecture and resulting insights can provide new (and previously impossible) opportunities to identify anomalies and potential threats. Utilities can now use unstructured data, including video and audio, to build a security architecture that is predictive and proactive, improving threat visibility and mitigation.

POWERING SMARTER ENERGY

Utilities Edge and IoT solutions power data-driven prediction and management, increased reliability and affordability, and greater customer satisfaction. Dell Technologies provides the analytical capabilities and complete edge-to-core-to-cloud infrastructure to develop holistic solutions to manage smart grid functionality and automate operations, understand energy demand, and deploy resources as efficiently as possible.

Together with the most robust partner ecosystem in the industry, Dell Technologies supports an end-to-end infrastructure allowing for multi-tenant workloads, building a distributed AI capability for effective analytics, labeling/tagging data, and generating an AI model. Utility organizations can deploy the AI model to any device on the Edge, providing a distributed analytical capability to summarize data before bringing it back to a centralized data repository.

Dell Technologies leverages Intel-based distributed analytics devices to deploy, orchestrate, train, and test machine learning against data sets, reducing data transmission requirements and enabling analysis in place. Solutions include:

EDGE AND IOT NETWORKING

- Dell Edge Gateways for IoT with Intel processors are designed to aggregate diverse data across many protocols and start the analytics process for distributed energy resource management, microgrid monitoring and control, and automated demand response
- EdgeXFoundry™ (for interoperability): Dell Technologies is a founding member of the world's leading open interoperability platform for the global IoT Edge ecosystem, providing a vendor-neutral, open source framework for IoT Edge computing to enable the use of plug-and-play components unifying the marketplace and accelerating deployment of services

MULTI-CLOUD

- Dell Technologies Cloud powered by VMware brings private, public and edge cloud services together in a consistent hybrid cloud approach, reducing risk and complexity. Utility companies can also use the jointly engineered VMware Cloud Foundation on VxRail hyper-converged infrastructure (HCI) platform to simplify, streamline, and automate hybrid cloud operations

MANAGEMENT AND SECURITY

- Dell EMC Data Protection and Management solutions scan and map the network, identifying all connected Edge and IoT devices, using distributed analytics to detect unwanted actors by reporting anomalies, triggering a micro-segmentation of the instrument to isolate confirmed unauthorized activity, and addressing the vulnerabilities to prevent future issues

- VMware Pulse IoT Center simplifies getting started with Edge and IoT, automates management at scale, extends IT security standards to the Edge and IoT infrastructure, and optimizes the value of Edge and IoT data

- VMware NSX Data Center helps create appropriate communication tools, identify devices on the networks, and control data flow

INTEGRATION

- Dell Technologies Data Lake features an open architecture, best-of-breed storage technologies, and an extensive partner ecosystem

- Dell Boomi supports powerful real-time data and application integration across heterogeneous IT environments, and scales to meet the high-volume demands of mobile extract transform and load (ETL); and electronic data interchange (EDI) environments

Dell Technologies provides a comprehensive portfolio of Edge and IoT solutions, products, and services to prepare utility companies to meet the changing business challenges and evolving competitive markets. With better insights from optimized distributed analytics, electric companies can build a smart grid capability that tracks energy transactions, improves security, enables efficient resource allocation, and delivers new business models and revenue opportunities.

Learn more about Dell Technologies Utilities Solutions

Contact a Dell Technologies Utilities Expert