

# White Paper

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## **Dell Data Storage and Analytics Innovations Delivering an Efficient Internet of Things**

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## Introduction

The substantial impact of digital information on business over the past couple of decades is no secret. Companies are significantly more efficient thanks to the advent of electronic data and digital processing. For years, firms have attempted to quantify the impact of these technologies with statistics on the growth of data capacities, or the exponential increases in processing power. What may be even more impactful, however, is the rate at which data is becoming interconnected. The ability to integrate data from multiple sources offers firms the chance to achieve greater understanding of their businesses. This potential is at the core of the Internet of Things (IoT) movement. Across a broad range of industries, devices are being augmented with more compute and intelligence than ever before. The goal of this rise in intelligence is not simply to generate more data, but to leverage a broader data set and acquire the insights to become more efficient, more competitive and more profitable.

By collecting and analyzing data from a wider set of devices, sources, and locations, IoT workloads offer businesses value in the form of insights. These can help businesses better deliver innovation, improve customer experiences, or improve safety and efficiency at work and manufacturing sites. These are only examples of the benefits firms hope to achieve across a variety of industries, such as industrial controls and manufacturing, fleet management and logistics, energy, building automation, and even smart cities. These IoT solutions, however, often must be tailored to the specific demands of the business, unlike other more horizontally applicable IT solutions. It is this demand for customization that opens up opportunities for solution providers.

Increasing the amount of data collected is not only insufficient for successful deployment of IoT workloads, but also creates its own set of challenges. Business intelligence applications have more data to sift through, in addition to having to transmit, store, and protect it. All of this device-generated information is not created equal, either. Analytics workloads sift through large amounts of low value data to find the key assets necessary to provide insights. As a result, firms need to increase the precision with which they collect, analyze, and leverage data. Without this increased precision, increasing the amount of data available only serves to increase the burden of that data. The objective of IoT workloads is to achieve the business benefits that arise from timely insights—with an emphasis on *timely*—which lead to more accurate business decisions. Without increased data precision, decision-making can be paralyzed by an overload of information.

IoT workloads also shift much of the infrastructure responsibility away from information technology (IT) teams and toward the operations technology (OT) teams. Often separate from IT, OT organizations focus primarily on the manufacturing processes and the act of value creation with tangible, rather than digital, assets. Devices and sensors along with the software necessary to control and monitor plant or factory equipment are becoming more intelligent and more complex. Although factory devices that generate data have existed in some industries for a while, it is the demand to make this data accessible that creates the challenge. These additional complexities only serve to further increase the opportunity for solutions partners.

Dell and Intel, leaders in information technology, have recently augmented their broad technology portfolios of products and services to target the demands of IoT workloads and OT organizations. Dell has recently released a new intelligent Edge Gateway product targeted at helping to standardize and simplify the process of capturing, aggregating, and relaying device-generated data. The Edge Gateway is fan-less and ruggedized to be set up at the network edge near the devices, with a variety of I/O to connect traditional and modern protocols. The result can be deployed as a comprehensive solution in conjunction with Dell's storage portfolio and helps service providers and the organizations they serve to more efficiently deploy and manage IoT workloads. This new technology is made possible in part by the low-energy, dual-core Intel Atom micro-processing advances. In addition, Dell continues its strategy shift to become more partner-centric and integrate independent software vendor (ISV) partner offerings for such things as protocol integration, edge analytics on energy consumption, video management, etc.

## Challenges Facing Internet of Things Initiatives

For those firms seeking to enable IoT workloads, the path to success requires new understanding and new skills. The rewards, however, can be high. The opportunity to achieve a competitive advantage is significant, but motivation from the fear of disadvantage without insights from IoT technologies may be even greater. For instance,

the rise of device-generated data shifts a number of paradigms common to traditional IT environments, and creates a number of challenges:

- **Devices do not take holidays:** With a shift in focus from human-generated content to machine-generated content, data creation is happening automatically 24 hours a day, seven days a week. This shift has led to a substantial increase in the amount of data that has to be stored, analyzed, and communicated across sites. In many cases, the existing IT and OT infrastructures are simply not sufficient to support this potentially exponential increase in data.
- **Timely access is paramount:** While factory floors have been producing data for years, the information has often been isolated in storage silos and inaccessible to the larger organization. For firms wishing to take advantage of a wider range of information sources for analytics, the data residing within these silos must be accessible and communicated to a central location. This challenge is only exacerbated by the time component if all analytics are performed in the back-end, whether cloud or data center. If data is not analyzed in a timely fashion, it loses its value. Supporting dynamic communications from the network edge to the back-end and back again further increases the burden on existing data infrastructures.
- **Moving data is costly:** The phrase “data has weight” is common in enterprise storage communities. Communicating data across distances and sites carries a significant infrastructure burden. Increasing bandwidth across sites can be expensive. Managing the conflicting demands of increasing data growth, the demand for timely analytics, and limited communication bandwidth requires the ability to quickly discern critical information from non-critical information locally rather than at the destination.
- **Expansion of the security sphere is complex:** Increases in the amount of data collected and transmitted combined with an increase in the number of source locations exponentially increases the data security requirements. Some of the legacy industrial systems being connected to the Internet in IoT networks were never designed for the cyber exposure, and retrofitting them can be costly. Over the past few years, thanks in large part to the emergence of public and hybrid cloud, IT organizations have placed a renewed emphasis on data security. Infrastructure deployments for IoT workloads often expand the sphere of data infrastructure that must be secured and managed.

These are only a few of the challenges that firms face when starting an IoT initiative. While these challenges highlight some of the increased demands on the data infrastructure, quite possibly the most dramatic challenge will be the shift in organizational responsibilities. The management of complex data infrastructure has historically fallen on the IT team. In response, IT service levels are often associated with longer lead times as teams architect and deploy new solutions. For OT teams, the requirements are often much different. With demands for 24x7 data accessibility, quick deployments, and systems that simply work, OT teams often face much more stringent service level requirements and can be challenged by the complexities of IoT workloads. The net result signifies not only an increased responsibility for OT teams, but also a fundamental paradigm shift that presents opportunities for solutions partners to assist.

## ESG Research into the Interest in and Challenges of IoT

In early 2016, Enterprise Strategy Group (ESG) released the results from its *2016 IT Spending Intentions Survey*. This study included responses from over 633 organizations across North America, Europe, and Asia and covered a wide variety of IT topics and technologies. When asked about their organization’s IoT initiatives, almost one in five (19%) participants indicated that they already have an IoT initiative underway.<sup>1</sup> An additional 27% indicated that their organization is currently developing IoT initiatives and plan to launch them over the next 12 months (see Figure 1).

The study went further, attempting to better understand firms’ expectations with regard to their IoT initiatives. In terms of the anticipated impact of IoT, nearly half (45%) of organizations strive to gain operational efficiencies, 39%

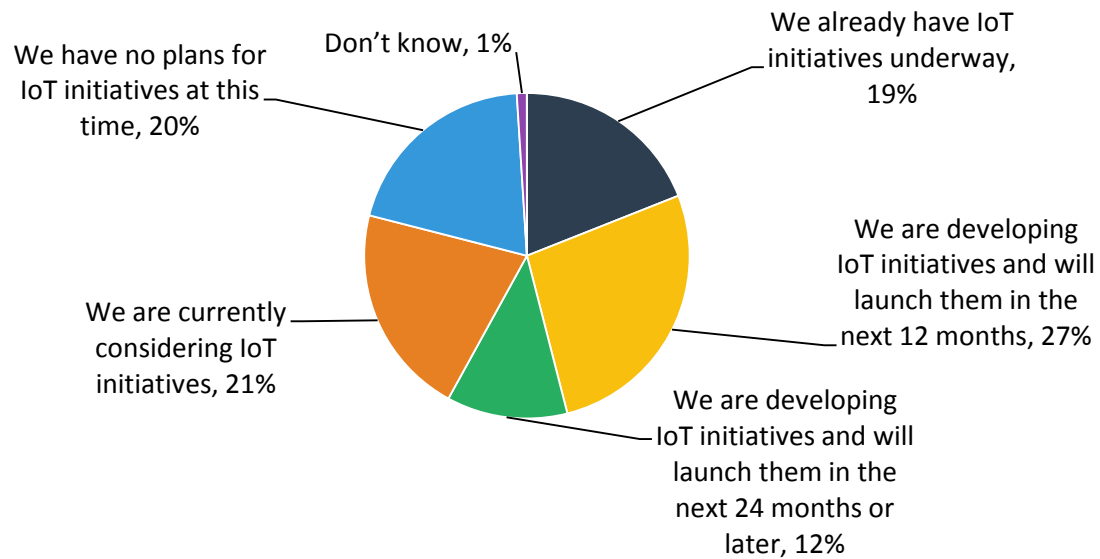
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<sup>1</sup> Source: ESG Research Report, [2016 IT Spending Intentions Survey](#). All ESG research references and charts in this white paper have been taken from this research report unless otherwise noted.

seek to provide better and more differentiated customer service, and 38% expect to get help developing new innovative products and services.

Figure 1. The State of IoT Initiatives

**How would you characterize your organization's Internet-of-Things (IoT) initiatives?**  
(Percent of respondents, N=633)

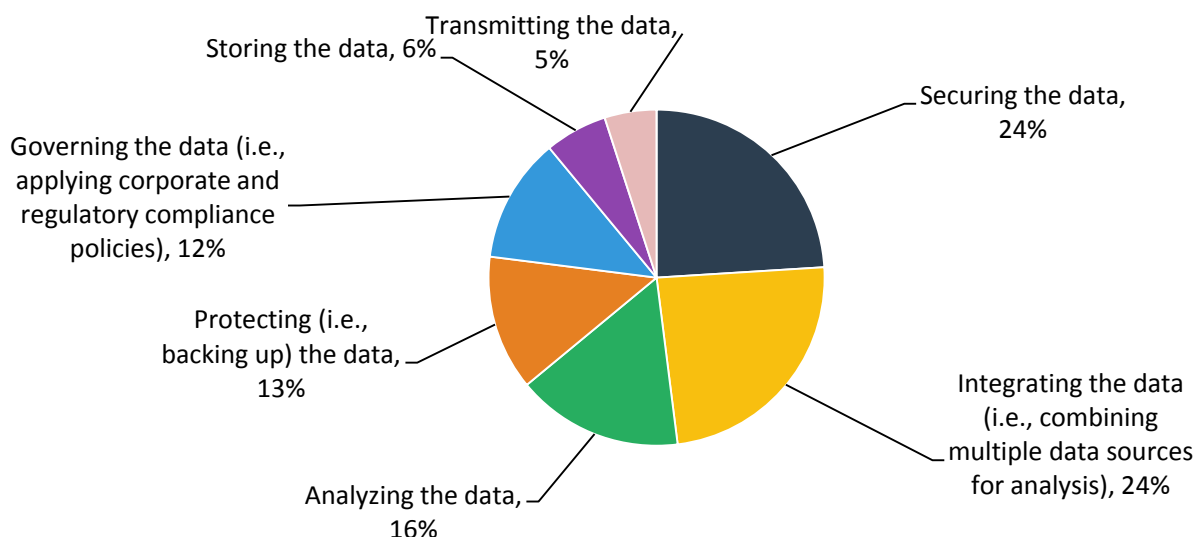


Source: Enterprise Strategy Group, 2016.

Study participants were also asked to identify the biggest technology challenges in collecting data as part of IoT initiatives. Nearly one-quarter (24%) of respondents have experienced—or expect to experience—either data security or data integration challenges (see Figure 2). Given the common objectives and subsequent overlap of IoT and big data initiatives, it is not surprising that 40% of organizations in aggregate believe that some aspect of analytics—whether integrating the data or actually analyzing it—is or will be the biggest impediment to IoT success.

Figure 2. Technical Challenges with IoT Workloads

**When you consider all of the data your organization collects or will collect as part of IoT initiatives, which of the following would you consider to be the biggest challenge from a technology perspective? (Percent of respondents, N=501)**



Source: Enterprise Strategy Group, 2016.

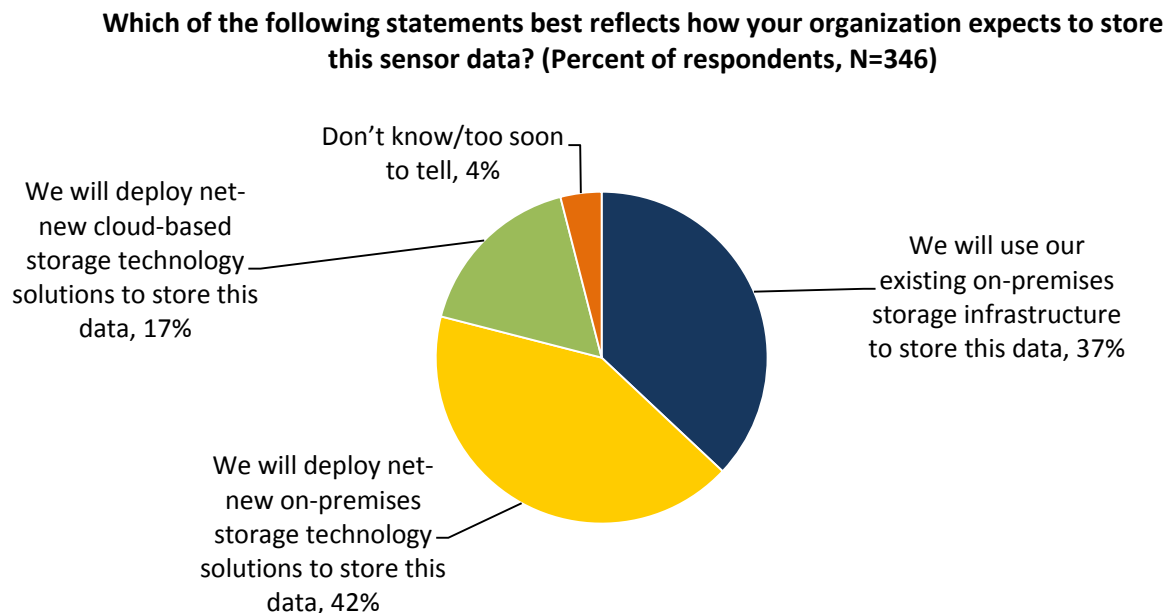
The combined set of results reveals a growing interest in IoT workload adoption—one driven by a desire to offer more competitive products and services. These workloads, however, come with concerns, the most prominent of which are data security and integration.

In a separate study conducted during 2015, ESG focused on enterprise storage industry trends. This study covered a wide range of storage technologies and industry trends, including how IoT initiatives were impacting storage spending. In this study, 42% of storage professionals indicated that they expect their organization to deploy net-new on-premises (instead of public cloud-based) storage infrastructure to support sensor data (see Figure 3).<sup>2</sup> This study focused on respondents' intentions and did not ask them to identify the factors leading to their preference for

**42% of storage professionals indicated that they expect to deploy net-new on-premises storage infrastructure to support sensor data**

on-premises deployments. It is possible, however, to speculate that some of the interest in the use of on-premises resources is motivated by a desire for greater levels of security as well as the cost of transferring large amounts of data to and from the public cloud. Regardless of the motivations, the research indicates that a significant percentage of firms are moving in the direction of deploying IoT workloads, and a high percentage of those organizations expect that those initiatives will require net-new investments in equipment. This combined effect helps substantiate the opportunity for solutions providers to deliver these implementations.

*Figure 3. Storage Infrastructure Expectations for Sensor Data*



Source: Enterprise Strategy Group, 2016.

Paradigm shifts in the industry, such as what we are experiencing with IoT, reveal a number of potential areas where solutions partners can find success. Areas such as infrastructure design and deployment, digital security, along with networking and communications, represent aspects where OT teams are expanding their understanding, and they will likely require assistance. Taking advantage of these rising opportunities may require partnering with the technology and services providers that are innovating specifically for IoT-based workloads. Dell, a leader in information and operations technology, has recently augmented its broad technology portfolio with solutions designed to address the challenges of IoT. This portfolio includes the intelligent Edge Gateway 5000/5100 offerings, which leverage Intel Atom processing technology to place low-cost and powerful compute resources in a form factor designed for locations often inhospitable to traditional IT infrastructure.

<sup>2</sup> Source: ESG Research Report, [2015 Data Storage Market Trends](#), October 2015.

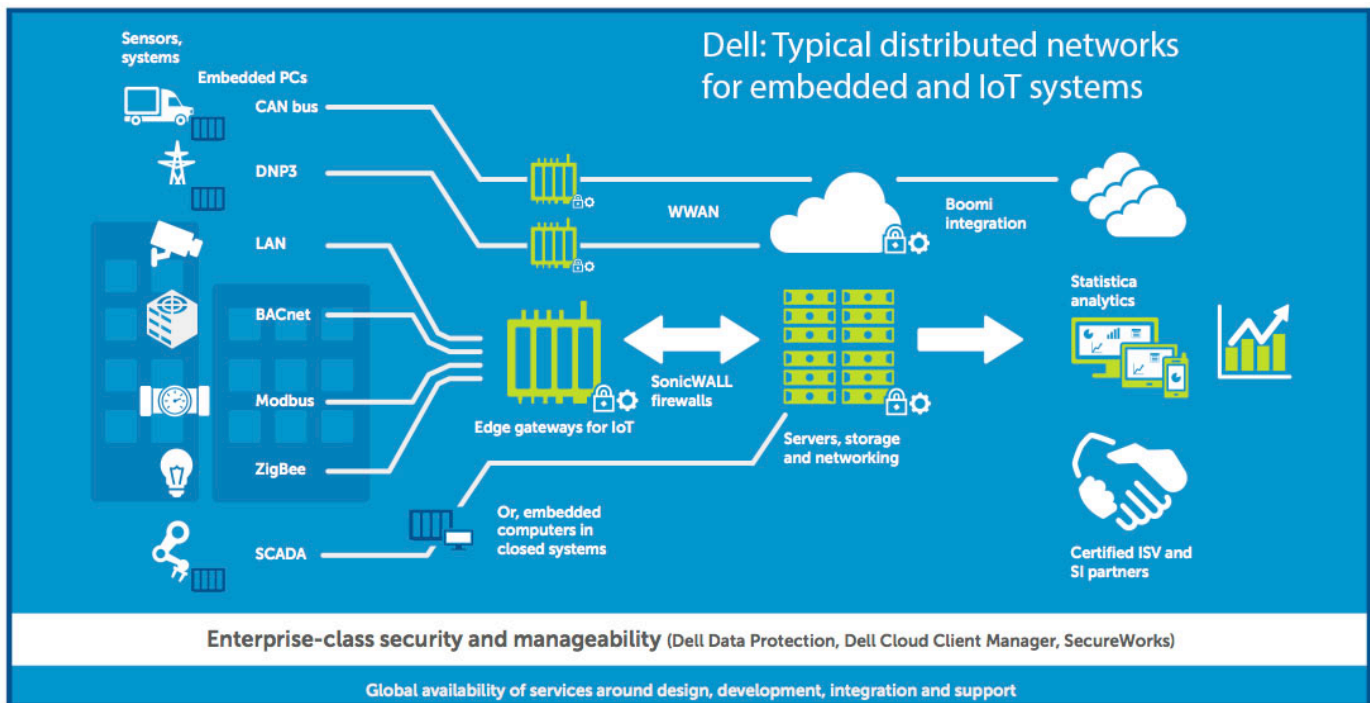
## IoT Innovation Powered by Dell and Intel

Leveraging advances derived from existing experience in servers, storage, and networking, Dell has initiated a new division within its organization. The goal of this organization is to design and deliver products and services to solve the specific challenges of IoT workloads. To accomplish this directive, Dell has invested in internal growth by amassing talent from key IoT vertical industries. One result of this new organization is an IoT-centric product portfolio of Edge Gateways, embedded computers, and associated ecosystem solutions. Additionally, Dell is leveraging its broader portfolio to enable IT and OT to secure, manage, connect, and analyze IoT solutions and data—developing new software, but also adapting its existing software capabilities to IoT. Dell expects that the solution partner community will play a significant role in deploying and supporting IoT workloads and infrastructure. In response, Dell is focused on developing a broad ecosystem of partners with IoT expertise in software and systems infrastructure as well as channel and services.<sup>3</sup>

As for the design of Dell's IoT Edge Gateway product, it leverages Intel's Atom system-on-chip (SOC) processing technology to achieve the low power consumption ideal for IoT sensor environments. In addition, Intel's strategy of leveraging a standard processing architecture instead of a custom ASIC design helps enable faster application development and greater workload stability to further reduce costs, the sum of which allows technology providers, such as Dell, to deliver innovative products designed for IoT workloads, such as the Dell Edge Gateway 5000/5100.

Figure 4 presents a representation of Dell's IoT framework. The left side of the framework (the edge) demonstrates data flowing from all the fragmented OT protocols, through the gateway, which normalizes it into IP traffic and offers local analytics. To the right of the gateway, the data is securely transferred to back-end systems located either in the cloud or the data center for distributed analytics depending on use cases and customer preference. With certified ISV partners incorporated throughout this taxonomy and systems integrator (SI) partners to provide the implementation, Dell offers a complete end-to-end solution

Figure 4. Dell IoT Framework: Featuring Dell's Edge Gateway 5000/5100



Source: Dell, 2016.

<sup>3</sup> [www.DellIoTPartners.com](http://www.DellIoTPartners.com).



## The Dell Edge Gateway 5000: Power and Security for IoT Workloads at the Edge

Dell's Edge Gateway 5000/5100<sup>4</sup> combines software and hardware innovations designed to address the specific challenges of IoT workloads. The product delivers these capabilities in a ruggedized, fan-less form factor optimized for OT organizations and the wide ranges of environments that they support, including expanded temperature ranges, IP65-rated rugged enclosures, and DIN-rail or wall-mounted environments. To achieve the competitive advantages offered by IoT insights, workloads need to incorporate a wide selection of data from a possibly wider assortment of sources and locations. The Edge Gateway integrates a wide variety of wired and wireless input-out connections, and partner middleware helps integrate multiple protocols. Dell's IoT-based solutions are designed to deliver the optimized infrastructure to help firms get the highest ROI by speeding up their return from greater intelligence. For solutions partners looking to offer IoT-based solutions, Dell's Edge Gateway 5000 provides a variety

### IoT Edge Gateway 5000/5100

- **Form Factor:** Fanless design. Optimized for wall and DIN-rail mounting.
- **Operating Temperature:** -30°C to 70°C relative humidity 5% to 95% non-condensing.
- **Integrated Security:** Secure boot, BIOS password, I/O port disablement, chassis intrusion alerting, and integrated data encryption.
- **Broad Input/Output Support:** Gigabit Ethernet; USB 2.0 and 3.0; Serial Interfaces: RS-232, RS-485, and RS-422/RS-485; Wireless: 802.11n Wifi +Bluetooth Low Energy; WWAN (3 G or LTE), in addition to modular I/O expansion.
- **Intel Atom Processor:** 2 cores.
- **Integrated Solid-state Drive Storage:** 32 or 64 GB.

of benefits, including:

**Ensures data security and privacy:** ESG's research highlights that one of the top two identified challenges of IoT is keeping content secure. With IoT, the collection of business-critical data outside of the data center has increased. The Dell Edge Gateway offers integrated data security capabilities, including hardware-level security features on the gateway itself, designed to help protect the network and the edge sensors from cyber-attack, such as secure boot, BIOS-level password control, and chassis intrusion alerting.

**Minimizes the cost of connected devices and a connected business:** Some device-generated data needs to be aggregated before the analytics can provide value. This requires the data to be moved, often from dozens, potentially hundreds, of locations. Building and deploying the infrastructure required to transmit all data collected can create a serious capital expense burden for any organization. The more devices and the more distributed the environment, the higher the capital expense can rise. Dell's Edge Gateway offers the compute performance necessary to run analytics at the edge. The Gateway allows firms to identify key data sets at or near the device and then, in a timely fashion, transmit only the more pertinent information across the wire. The net result reduces capital expenditures by reducing the

level of infrastructure required to communicate the information. Additionally, by reducing the amount of data applications have to sort through, business intelligence analytics can identify insights faster. By transmitting only the right data, businesses can optimize costs and speed up the time to return business intelligence.

**Designed for the edge:** Dell's Edge Gateway features a ruggedized, headless, fan-less hardware design to survive in conditions ordinary PCs or servers could not accommodate. A central tenet of IoT is that devices live outside the data center, and may literally even reside outside. Dell's Edge Gateway is designed for 24/7/365 uptime and long-term operation, with expanded temperature ranges (-30°C to 70°C). Dell form factor design centers on factory floors or outdoor HVAC systems at target environments. The Gateway is suited to wall or DIN-rail mounting. Additionally, since IoT workloads accept input from a wide range of sensors, many of which are outside the realm of traditional IT workloads, the Gateway supports a wide range of input/output options including Gigabit Ethernet, USB, Serial Interfaces, and a variety of wireless options, including mesh networking, Bluetooth LE, 3G/LTE, etc. Additionally, the Gateway support offers an I/O expansion module to support industry-specific I/O standards, when necessary. Also of interest, Dell supports remote management with its Edge Device Manager, an optional cloud-based management system, and through integration with offerings from Intel and Microsoft.

<sup>4</sup> <http://www.dell.com/us/business/p/edge-gateway>



Dell's advancements seek to distinguish the Edge Gateway from existing industrial gateway options, which are rarely intelligent and often leverage proprietary architectures, driving up costs. By leveraging a standardized design, firms and solutions providers looking to deploy IoT-based infrastructure can simplify deployment and management. The ability to leverage the same gateway device for a wide variety of implementations offers efficiency and simply eases the burden of securing and managing the ecosystem. This is the goal that Dell is driving to achieve with its Edge Gateway.

## **Plan Beyond the Edge with Server, Storage, and Networking**

Designing IoT infrastructure, however, is not limited to the edge. Architectures must incorporate the full data path from the edge back to the central repository at the data center including flexible server, storage, and networking solutions.

### ***Server innovations Delivering Converged Solutions for IoT Environments***

Many of the tenets that drive the move to IoT edge computing are also relevant to the supporting back-end infrastructure. In particular, Dell's converged infrastructure platforms can help data centers simplify the integration of new technologies. Though their integrated design, converged solutions can help IT organizations lower costs, improve agility, reduce complexity, and accelerate time to value. Convergence is particularly efficient when used to implement new infrastructure models, for example, private clouds. In the case of IoT, the enhanced agility permits the infrastructure to adapt to the wide spectrum of needs presented by IoT workloads, and to readily grow as demands or technology innovations dictate.

To maximize the value obtained from the enormous amounts of data produced by IoT workloads, it's critical that you implement the storage infrastructure as efficiently as possible. That is true for the edge as well as for the supporting infrastructure. To that end, Dell's converged platforms are designed to offer dense, high performance storage, with both solid-state storage and high performance caching as options. Moving the data closer to compute allows the IoT solution to deliver results in a timelier manner.

Another important point to consider is that in this era of IoT, data centers can no longer run effectively isolated in a silo. As such, seamless management across the resulting disparate infrastructure that makes up a modern enterprise is another indispensable key to success. Dell's converged platforms are tightly integrated under unified management. Dell's OpenManage software allows IT organizations to manage firmware, operating systems, workloads, clusters, and power requirements, from a single console and 100% agent-free. And Dell's Active System Manager (ASM) is a comprehensive infrastructure and workload automation solution that enables IT to respond more rapidly to dynamic business needs.

### ***Dell converged platform offerings:***

- **The PowerEdge FX converged architecture** is designed to give enterprises the flexibility to tailor their IT infrastructure to specific workloads with the ability to scale and adapt that infrastructure as needs change over time. It uses a 2U rackable chassis (FX2) with a range of modular server and storage "blocks" that can flexibly combine the density and efficiencies of blades with the simplicity and cost advantages of rack-based systems. These characteristics make it an effective back-end option for IoT processing.
- **The PowerEdge VRTX platform** integrates servers, storage, networking, and management into an optimized tower server chassis. VRTX is purpose-built to address remote office and branch office (ROBO) requirements. With M-series blades and a large, shared-storage capacity, VRTX gives remote offices the flexibility to grow at their own pace. VRTX can provide the ability to accommodate the explosion of data in IoT, yet keep the processing on-premises for speed and security reasons.
- **The PowerEdge M-series blade options** (based on the M1000e enclosure) offers capabilities such as scale-on-demand switch designs and the innovative Chassis Management Controller (CMC) to deliver energy-efficient, flexible, and manageable blade server implementations. PowerEdge blades and the M1000e tightly integrate compute, storage, and networking to bring greater levels of efficiency to the data center.

- **Dell's XC Series of Hyperconverged Appliances** powered by Nutanix software provide a portfolio of fully configurable 1U and 2U appliances, offering the performance to help speed customer access to data and applications in scalable deployments.

In addition, Dell offers hyperconverged offerings from VCE, the converged platforms division of EMC:

- **VCE VxRail Appliances:** a family of fully integrated appliances for VMware environments combining rich data services and systems management capabilities with VMware's hyperconverged software all in a single product family.
- **VCE VxRack Node and VxRack System 1000 Flex:** a transformational, software-defined way for customers to move from physical storage area networks (SANs) to hyperconverged engineered systems with the ability to scale up to thousands of nodes for massive scale with multiple hypervisor support, enabling quick deployment and flexible scalability.

### ***Scalable capacity for IoT with Dell Storage:***

The efficient data communication offered by Dell's Edge Gateway provides the potential to rethink these storage repository designs. Storage infrastructure for IoT often attempts to incorporate two diametrically opposed elements, high capacity and high performance. The glut of sensor data generated by IoT workloads demands large content storage capacity in a single scalable pool, as the use of smaller storage silos often creates too much management complexity.

For this data to provide meaningful value to the business, however, it has to be analyzed in a timely fashion, which means making the content accessible to analytics workloads, with sufficient performance. The result shifts the storage infrastructure paradigm from a high-capacity-optimized architecture to a low latency transactional-performance-optimized one. Without the necessary capacity support, the right data may not be accessible. Without the necessary performance, analytics cannot complete in a timely fashion and insights are delayed. Either way, opportunities are lost.

Accounting for these two separate demands often requires two separate storage architectures, one designed for high capacity and one designed for high performance, along with the infrastructure to move data between the two. The Dell IoT Gateway, however, optimizes the data streams at the edge, allowing the storage in the data center to be more efficient and require less capacity. This efficiency allows for a single storage architecture to suffice in many instances, such as the [Dell FS8600](#), leveraging Dell's SC series storage systems. The resulting infrastructure offers a scale-out file system with the integrated performance of flash storage.

### ***The Dell FS8600 Powered by Dell SC Series Storage Offers:***

- **Scalable pool of unstructured data:** As sensor data streams into the data center, a single pool of storage reduces complexity and simplifies storage management. Dell's FS8600 technology offers a scale-out file system namespace that supports the full Dell SC portfolio of storage options. The resulting solution can start small and scale to meet the demands of the environment, while leveraging multiple storage options to efficiently deliver the optimal blend of capacity and performance desired.
- **Combination of scale-out and scale-up:** Dell's FS8600 storage solution combines a scale-out file system with the ability to add capacity in a scale-up fashion. If a solution requires more performance, FS8600 controllers can be added online to increase performance. If more capacity is required, additional shelves of SC storage can be added for capacity. Capacity or performance can be added separately. If only new capacity is required, it can be scaled independent of performance. If more performance is required, it can be increased independent of capacity. The resulting design offers greater flexibility in deployment architecture and more efficient infrastructure scaling, as application demands change.
- **Cost-effective flash for performance:** By leveraging the intelligence embedded in Dell's IoT Gateway, only the pertinent data is sent over the WAN to the central data center for analysis, offering the potential to significantly reduce the amount of sensor data required for analysis. By reducing the amount of data

required at the central office, organizations can leverage higher performing tiers of storage, such as solid-state. When coupled with the automatic tiering available in Dell's SC series storage arrays, the combined Dell FS and SC solution is able to further reduce the effective cost of storage.

### ***Flexible Networking for IoT with SDN:***

In addition to the server and storage infrastructure, the network also serves as a critical component of a successful IoT implementation. In many cases, however, traditional networks are not designed to handle the sometimes-extreme demands of IoT. There is likely no single networking system that is going to meet the needs of every department in a large, diversified enterprise. For example, a car manufacturer will have far different needs in the data center than it will on the factory floor. One underlying network technology that can help IT and OT organizations reach their combined full potential, however, is software-defined networking (SDN).

A software-defined network provides the necessary capabilities to help organizations efficiently process the burgeoning amounts of data generated by IoT. Changes to network parameters can be instantly implemented from a central location to reduce bottlenecks. Schedules can be developed to allocate bandwidth for specific departments and applications at peak times. SDN also provides critical security functions ranging from granular policy enforcement to blocking network segments in the event of a security breach (extremely important when one considers the numerous entry points for cyber-attacks).

Just as SDN is essential to IoT, open networking is the indispensable partner to SDN. Dell is a leader in the market with an open networking foundation that allows customers to efficiently deploy new technologies. Because of Dell's open philosophy, Dell Networking hardware supports third-party networking software from innovative providers such as Big Switch Networks, Cumulus Network, IP Infusion, Midokura, and Pluribus Networks. By decoupling software applications from hardware, Dell makes networking more economical and gives customers considerable latitude in developing an IoT ecosystem that best fits their needs.

With solutions that range from small offices to large-scale enterprise campus networks, Dell offers a wide variety of solutions for a complete, secure, and easy-to-manage networking environment. Because Dell's systems are modular, IT organizations can use them as building blocks that can be precisely tailored as workload demands change over time. The Dell Networking hardware portfolio is designed to be optimized for next-generation leaf-spine and flat architectures and seeks to deliver efficiency, density, and performance. Dell's own networking solutions combine with Dell's open networking partners' advanced offerings to deliver a broad range of next-generation network and SDN frameworks, ensuring investment protection, direct access to open networking innovations, and freedom from proprietary lock-in. Dell Networking Operating System (OS10) includes an industry-standard command-line interface, ensuring that Cisco-trained networking staff can immediately be comfortable and productive. Dell Networking's design philosophy, combining open and standards-based systems with modularity and a future-ready approach, is a key component for organizations seeking to make IoT a reality.

### ***Advanced Analytics at the Edge***

Building its core infrastructure portfolio, Dell offers a wide variety of analytics capabilities, both from partners in the Dell IoT Solutions Partner Program and with its own Statistica offering. As previously mentioned, it is important to have the ability to distribute analytics throughout the solution stack, with analytics close to the "things" at the edge becoming increasingly important to achieve rapid results, reduce unnecessary consumption of network bandwidth, ensure business continuity during periods of lost connectivity, and minimize the burden of storing unimportant data.

The rise of smart machines and the Internet of Things (IoT) has led to connected devices producing new data streams across diverse applications, and new avenues of opportunity to provide analytic value to businesses. The ability to "listen" and analyze machine data in a live, real-time environment has the potential to add tremendous value across industries, whether through maximizing manufacturing process by predicting machine failure rates, enhancing customer satisfaction and business up-time by predicting and replacing components before they fail, or

increasing the real time social interaction between people and machines. Analytics at the edge provide new avenues to analyze and optimize machine-based data.

Dell has recently combined its Statistica offering with Boomi acting as a transport mechanism to allow users to distribute analytics across the edge, the data center, and the cloud. By enabling analytics to the edge, Dell is creating an opportunity to go beyond traditional live streams of information, which were historically used for reactive reporting and dashboarding purposes, into a proactive approach that can utilize patterns, models, and rules for detecting anomalies to run operations more efficiently with earlier detection of potential issues before they arise. Deploying analytics into an edge-based model complements an overall data intelligence strategy of extracting business value where and when it is needed most while reducing the centralized data load that can become inundated with machine data.

Given the inexpensive computing power available today, a “monitor everything” approach can be an often easier and more effective way to prioritize the importance of any deviations or slightest drift in thousands or tens of thousands of parameters. This “monitor everything” approach allows Dell to deploy an edge-based analytics strategy to identify specific issues or concerns that could be usefully addressed based on knowledge derived from the IoT data. The analytics strategies that are useful for IoT data are very similar and, in many cases, the same as those one would apply to solve analytics problems for any data set. In short, there are applications for:

- **Predictive modeling** – to predict failures, process problems, or anticipated demand.
- **Clustering applications** – to cluster parameters or equipment.
- **Anomaly or outlier detection** – to identify unusual operations, configurations of parameters, or heretofore unseen data patterns (intrusion detection).

In a typical deployment where edge-based analytics will add value, IT or OT organizations may see hundreds or even thousands of parameters that can be tracked and analyzed to produce a predictive outcome. Deploying an analytics strategy that can continuously monitor these parameters and then identify anomalies in the data set is enormously useful.

An edge-based analytics strategy complements Dell Statistica’s big data offerings, which include robust and easy-to-use tools for data mining, machine learning, sub second scoring of data, and advanced model building for predictive analytics. As organizations collect larger amounts of “big data,” which they may not be using, or are unsure how to use, valuable enhancements to current data sets or key insights may be missed completely. Dell’s enterprise-class data mining and predictive analytics tools are designed to serve the needs of the traditional data scientist role as well as a new breed of data-savvy business users often referred to as citizen data scientists.

In summary, Dell Statistica’s big data analytics portfolio includes necessary elements helping to distribute a holistic big data analytics strategy, where and when the data is needed, while providing enterprise class tools to serve a wider audience of data-savvy users.

## The Complete Package

Unlike typical IT workloads, IoT environments can be more custom in nature. Solutions and demands can vary greatly based on industry and based on the particular firm. Solutions for manufacturing and industrial controls often differ from those for transportation or those for municipalities. Additionally, solutions within a given field or industry may be radically diverse. The needs may differ in terms of what types of data they wish to collect, what type of workload they decide to deploy, and what type of analytics they wish to run. This complexity often translates into the need for a tailored solution approach and, in the process, creates an opportunity for service providers. The more custom the solution, however, the higher the cost will be. Leveraging standard components that can be adapted to the specific needs of the solutions, such as Dell’s Edge Gateway and server, storage, and networking portfolio, allows for solution providers to optimize their own delivery models and reduce internal costs. The end result is likely a more competitive, and possibly more profitable, solution offering.

Additionally, Dell Financial Services (DFS) can enable customers and partners to acquire the IoT technology and infrastructure they need while preserving capital for other business investments and spreading IT costs over several budget cycles. DFS has a wide range of options designed to make technology acquisition easy and affordable. DFS also offers a suite of flexible payment options, referred to as Scale Ready Payment solutions, designed to support technology acquisition in a flexible, cost-effective way. Lastly, DFS offers the capacity to facilitate an integrated end-to-end solution spanning hardware, software, and services.

Finally, as a global technology provider, Dell offers an industry-leading supply chain with global configuration and fulfillment services. This offers not only credibility, but also consistency in deployment, regardless of where the solution or the devices reside. The greater the consistency and the more predictable the service and deployment of the solution, the less expensive the solution becomes. Dell also has an established history of managing product transitions and overlap effectively. Building solutions on Dell products such as the Edge Gateway can be done without the fear of hardware availability or support vanishing without prior notice or without an established replacement.

## The Bigger Truth

As businesses become ever more reliant on data, competitive advantage shifts in favor of organizations that can wield that data more efficiently and effectively. The combination of IoT device-generated data and business intelligence analytics represents the next evolution in leveraging insights to improve productivity and business results. IoT solutions, however, are very different than many of the IT-based innovations of the past. Each workload may be different. This is the potential of IoT—the ability to offer a differentiated competitive advantage tailored to the specific needs of the business. The opportunity for firms is that, if executed properly, the results offer an advantage that is very difficult to duplicate.

This is in contrast to server virtualization, where the benefits of virtualization are easily duplicated across businesses, so any gains from those workloads were quickly eroded as the competition made similar deployments. The tailored nature of IoT workloads offers the potential for a much more sustained level of differentiation and competitive advantage. The challenge is that for many firms, IoT deployments are complex and often custom. If not deployed properly, the custom nature of the solution can drive up infrastructure costs significantly.

It is this custom element of IoT solutions that creates a significant opportunity for solutions providers. The complexity of IoT workloads demands an experienced professional to do the design and implementation, yet the custom nature of each workload makes it unlikely that the experience will be found within the business's own OT or IT organization. To maximize the potential of these opportunities, solution providers need to find ways to make these custom solutions less unique and more standardized.

By standardizing on flexible and powerful components, such as Dell's Edge Gateway along with its portfolio of servers, storage, networking, and software, much of the expense and complexity of deploying and managing IoT workloads can be eliminated. Leveraging common components and management can help reduce training time, management complexity, and service and support complexities—ultimately reducing the time and the cost for each solution. This translates into the ability to deploy more value-added solutions while reducing the cost burden for each one—allowing the solutions to be more competitive and potentially more profitable. Dell and Intel have a long history of standardizing technologies and making them more cost-effective, resulting in availability to a broader range of organizations. Recently both firms have turned their sights on IoT, which can only be a good thing for the OT organizations and the solution partners that support them.



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