

DELL TECHNOLOGIES DOUBLES DOWN ON ENABLING IOT INTELLIGENCE

FOCUS ON ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING MEETING IOT AT THE EDGE, CORE, AND CLOUD

OVERVIEW

The Internet of Things (IoT) is changing how industries do business and promises a significant return on investment (ROI) in operational efficiency, improved customer experience, risk mitigation, and enabling entirely new business models. Further, with increasing global economic and regulatory pressures there is growing demand for IoT solutions to address these challenges. Many IoT projects start with the need to gain better visibility into a process, but Artificial Intelligence (AI) and Machine Learning (ML) within IoT create new opportunities to further enhance insights and in certain cases automate decision-making. Although the notion of computing based on data collected from things was not born yesterday, the meteoric rise of IoT has recently made it practical because of smaller, faster, cost-effective computing, increased connectivity, and increased storage density. Devices can now store, manage, and analyze vast amounts of information across billions of distributed devices in real-time. Incorporating AI and ML into the IoT equation is a game-changer.

The business value of IoT is significant and can create immediate returns for many organizations. For example, in the automotive industry IoT solutions not only improve efficiencies and quality in manufacturing, but as companies deploy IoT applications and sensors within individual vehicles, analysis of collected data predicts when vehicles need maintenance. This lowers costs for the consumer and helps the auto maker improve front-end design and manufacturing processes. Further, by leveraging information across broader systems, IoT helps cities manage traffic congestion or improve response times during an emergency or incident. These types of deployments require many different technologies and areas of domain expertise to ensure systems support interoperability, security, and privacy. No one vendor can do it all. Pragmatic organizations choose the right solutions provider to help them determine the ideal open architecture and integrate the right partners to achieve their unique business goals.

The melee of connectivity standards, hardware types, operating systems and application environments – in addition to navigating the proliferation of general IoT

platforms – presents a significant challenge to many organizations as they try to design and deploy IoT solutions. Dell Technologies pioneered innovation, standards, and solutions across the industry to address this fragmentation and is involved in the Industrial Internet Consortium (IIC), OpenFog Consortium, and the [EdgeX Foundry](#) hosted by the Linux Foundation. Although these standards bodies achieve some success, the onus is on companies like Dell to provide leadership and move the industry forward. Seeded by Dell code, EdgeX Foundry is a vendor-neutral, open source project chartered to build a common interoperability framework for the IoT industry. Backed by over 60 organizations, including recent addition Samsung, EdgeX Foundry has a roadmap of bi-annual code releases and has formed an alliance with the IIC to collaborate on testbeds.

For the past three years, Dell built a strong presence in the market with its own purpose-built IoT products such as edge gateways and embedded PCs. It also built an ecosystem of over 90 technology and services partners to complement its infrastructure offerings, spanning from sensors to analytics. Additionally, through its OEM division, Dell has long-standing experience selling into operations technologies (OT) industrial solutions providers and OEMs. As a result, Dell claims to have amassed over 600 buying customers with IoT projects ranging in maturity from Proof of Concepts (PoCs) to large scale deployments. VMware has also made new investments in IoT in the form of its Pulse IoT Center offering, and other businesses within Dell Technologies have been making similar investments specific to IoT.

To more effectively address the challenges of navigating IoT, the company has announced a Pan-Dell Technologies IoT Solutions Division. The goal of this organization is to leverage the core strengths of the Dell Technologies family of companies - Dell, Dell EMC, Pivotal, RSA, SecureWorks, Virtustream, and VMware – together with offerings from their technology solutions partners and systems integrators – to deliver proven blueprints and reference architectures for valuable use cases and provide a one-stop shop for customers seeking consulting and deployment. The result is the first end-to-end, open IoT ecosystem in this highly fragmented marketplace.

THE SHIFT TO DECENTRALIZATION

The centralized vs. decentralized pendulum seems to swing about every 10 years for the data center (now the cloud). Initially, information technology (IT) managed compute centrally on mainframes within a data center, where it controlled all security, access, applications, and governance. PCs drove a period of decentralization but with the rise of the Internet and emergence of the cloud, organizations can now deploy virtualized

environments quickly and with just a few commands – and with no IT involvement. This makes centralization an attractive option for many companies. However, new technologies – for example, smartphones – combined with the onslaught of IoT devices and sensors make it impossible and impractical for all data to go into the cloud.

At times, weather or poor connectivity make networks unreliable. Remote sites or hostile environments sometime make data too expensive or too risky to backhaul, especially with the likes of drones, autonomous vehicles, and robotics where these systems are decentralized and need to make real-time decisions. You cannot wholly rely on the cloud to deploy your airbag or stop that spinning machinery in the event of an emergency – no matter how fast the connection may be. In short, consumer and business dependence on a growing number of edge devices increase the relevance and ubiquity of decentralized networks.

A LAYERED APPROACH FOR SUCCESSFUL IoT ENABLEMENT

There are three main components to Dell's ecosystem: The Edge, the Core, and the Cloud. Each represents a division of labor and intelligence. Dell Technologies significantly invests in solutions and services across all its brands to help customers innovate rapidly and simplify interoperability of distributed IoT solutions. To achieve this, it is essential to understand how data is processed, secured, and managed across each layer.

THE EDGE:

IoT data, by definition, originates from the physical world at the network edge. For example, this information could be data about energy usage from a smart meter; video and events from surveillance cameras, telemetry data from drones, process parameters from programmable logic controllers (PLCs) and so on. When deterministic, real-time response is required in physical systems, as in the case of an airbag, control decisions are applied at the Edge. In many cases, an edge gateway is required not only to enable these things (devices) with IP connectivity, but also to perform valuable functions for securing, parsing, processing, and packaging aggregated data to be sent elsewhere for further analysis. In other scenarios, things may deliver data directly to other parts of a distributed architecture such as the cloud. Organizations improve the efficiency of their cloud via the Edge by performing the initial data processing and analysis on endpoint devices at the source of the data.

As devices become smarter, smaller, faster and more powerful, many organizations deploy these systems at the Edge, outside of the cloud and data center. By moving much of the processing and analysis of data to these devices, they can not only communicate information about their operating environment, equipment health & performance, but also analyze data in real-time and act locally. Further, as ML and AI creep into edge devices, they are afforded with even more ability to process perishable information "while it matters" to send only meaningful data to the cloud or data center, thereby saving on bandwidth and overall latency for further data processing. The Edge is the critical checkpoint to ensure data pedigree and that information delivery is on time and as advertised. The Edge is also the largest attack surface for IoT and many bad actors have leveraged edge devices to attack critical components of an organization's infrastructure. Finding the right partner that can handle both analytics and security at the edge is paramount for IoT success.

Dell addresses compute at the Edge with its purpose-built embedded PCs to add intelligence to system-level things plus edge gateways that sit just upstream of sensors and systems. Dell EMC servers are also key components of edge compute for more in-depth analytics.

THE CORE:

The Core is the second layer of intelligence in the Dell Technologies IoT strategy. Dell defines the Core as on-premise hardware and software infrastructure that enhances capability for compute, analytics, storage, security, and manageability. Core compute consists entirely of server-class processing and spans micro-modular to full blown IT data centers. The blur between edge and core compute lies at server-class processing running immediately proximal to things (devices generating data).

Dell Technologies differentiates itself primarily at the Edge and Core. Dell recognizes IoT networks will, by nature, become more decentralized and distributed as the number of sensors exponentially grows. Dell moves some of the decision-making processes to a combination of the Edge and Core and reduces the amount of information sent to the cloud. This improves response times and performance and reduces backhaul costs. It is important to highlight that not all IoT solutions involve the internet and cloud. IoT involves any connection of a previously siloed system to a broader network to perform data analysis and achieve business gain. A chemical refinery, for example, would not typically connect its critical processes directly to the internet.

THE CLOUD:

Still, it is beneficial to transmit data from the Edge and Core to the Cloud. Companies collect, process, store and analyze high volumes of data from the edge in the Cloud. For Machine Learning and Artificial Intelligence algorithms to be efficient, they must be derived from massive amounts of quality data. Training deep learning algorithms requires sophisticated, large-scale processing across vast and disparate datasets.

The Cloud is another critical area of strength for Dell Technologies. Its ability to deploy data-centric solutions at scale across multiple environments - public, private, or hybrid - sets it apart from other solutions providers. Dell Technologies offers an end-to-end data processing and storage solution and benefits from a long legacy of partnerships and OEM alliances with leading applications and solution providers across the industry. Moreover, Dell's portfolio of solutions helps accelerate customer adoption and move proof of concepts (POCs) to production. There are only a few IoT technology solution providers that have the depth, breadth, partnerships, and scale to be successful in this market and Dell Technologies is a strong contender.

ONE SIZE DOES NOT FIT ALL

The Edge, Core and the Cloud do not constitute a serial continuum; instead, they form a symbiotic relationship between the three layers. The cloud is a powerful tool for deep learning and can train analytics in the edge and core. Additionally, the Core can act as a channel between the Edge and the Cloud and enables more powerful analysis and autonomous decision-making closer to the things and reduces the need for commands or information from a remote cloud.

In some instances, all decisions occur right at the Edge, in direct proximity to field devices and control systems. In other cases, server-level compute in the Core supplements decisions, but data still does not leave the premises due to security, regulatory or performance considerations. In the case of mobile assets such as connected vehicles, compute typically occurs at the Edge and in the Cloud. An example that could span the full continuum would be a distributed wind farming operation. One might deploy compute at the Edge to optimize the pitch and yaw of wind turbine blades locally, at the Core in local data centers for optimizing each wind farm in real time and in the Cloud to aggregate production metrics from all site operations, in addition to performing deep learning to make longer term performance gains.

Organizations optimize insights from analytics and respond to issues more precisely and efficiently with improved management of processing and storage orchestration at each layer of the stack. Moreover, with optimized data flows from disparate sources, machine learning algorithms improve pattern and anomaly identification. The symbiotic relationship between the Edge, Core, and Cloud establishes a foundation for continuous learning, richer datasets, faster responses, and a higher value of data.

SOMETHING FOR EVERYONE

Arguably, Dell Technologies has the industry's broadest portfolio of IoT infrastructure, and focuses on providing something for everyone based on their use case and computing needs. While Dell Technologies' industrial-grade embedded PCs and gateways are valuable in many use cases in manufacturing, energy and transportation, they may not be as attractive in deployments that don't need the ruggedized form factors and expansive I/O options.

Connected cars may not necessarily be an opportunity for Dell Technologies' purpose-built industrial-grade edge hardware, but assets from the rest of its portfolio may fit well in this use case. VMware Pulse, for example, can be applied to many verticals and use cases that need enterprise-grade management of things, gateways and beyond.

In addition to the breadth of its portfolio, one of Dell Technologies' strengths is its IoT Solutions Partner Program. The single program facilitates partner engagement across the entire portfolio of Dell Technologies businesses. For example, partners can leverage Dell Edge gateways and Dell EMC servers for storage and networking, VMware's vSphere for enablement of converged infrastructure and Pulse for management, Virtustream for cloud services, Pivotal Cloud Foundry for the development of scalable cloud applications and so forth. Dell Technologies businesses are also making further investments with projects like Nautilus for streaming-enabled storage, World Wide Herd for centralizing distributed Hadoop clusters (both from Dell EMC) and extensions to RSA assets to comprehend IoT security threats. While the Dell Technologies businesses will still operate independently to serve their customers – including in IoT use cases – the IoT Solutions Division will create the glue that federates the various assets from the overall portfolio along with partner offerings into reference architectures and solution blueprints that make it easier for customers to deploy secure and scalable IoT solutions.

USE CASES: DRIVING IoT VALUE AND INNOVATION

Turn over a rock, and you might just find another point solution for IoT. While there is tremendous innovation in the industry, there is also a significant delta between enterprises moving from POC to production. However, those organizations that have successfully deployed IoT are more innovative, efficient and intelligent as a result. Dell Technologies and its partners deploy many compelling case studies across various industries. For example:

COLD CHAIN RETAIL

An example of Dell Technologies value in IoT was with a UK based food retailer with over 3,000 stores. Working with a partner, IMS Evolve, Dell Technologies harnessed untapped legacy data as well as real-time information from their refrigeration units and building management systems. Their goal was to leverage their customers' existing infrastructure and data, combined with real-time data to pinpoint opportunities for reducing waste and while improving system downtime. Another area of concern was clogging the network with traffic from video surveillance, beaconing, and the additional load from Operational Technology (OT) sensors and controls. Dell Technologies and IMS deployed increased compute capacity at the edge to alleviate strain on the overall network

The combination of innovation from an IoT, Big Data, and OEM hardware solution demonstrated how IoT should work. The results gained in just over 2 weeks included: \$7M in energy savings from the reduction in cooling costs, 15%-20% in overall cost savings, 80% reduction in resource requirements for maintenance, 40% reduction in reactive maintenance, 49% reduction in stock loss, and a 30% reduction in customer complaints

Plus, by adding the additional compute power at the edge, the customer can manage their network resources more efficiently.

CONCLUSION

Dell Technologies' IoT vision incorporates the strength of its broad portfolio of companies, global scale, and the depth of its strong partner network. It demonstrates a commitment to facilitating standardization and openness to reduce fragmentation and enable customer choice. Dell Technologies has one of the broadest portfolios of technology services and solutions in the industry today. Combined with the new IoT Solutions Division and its partner program, it has the capability to serve as a one-stop

shop for complete end-to-end solutions. The Dell Technologies IoT strategy and Solutions Division represents a bold initiative and one that if executed properly, should pay significant dividends for both the portfolio of companies, their partners and the industry at large.

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