Digital Transformation:
Moving from Preventive to Predictive Maintenance Models in Transportation, Field, and Industrial Environments
I. Introduction

Digital transformation can seem like a daunting task in industrial environments. Connecting and leveraging legacy field equipment to extract data and improve operational efficiencies has traditionally been difficult, costly, and sometimes impossible due to severe environmental conditions. However, the industrial workplace has the opportunity to rapidly evolve as the Internet of Things (IoT) connects people and machines to devices and data. Teams managing industrial and harsh field environments are gaining new insights into traditional operations and discovering the previously unexplored value of data. With daily access to potentially billions of data points that can drive critical business decisions, selecting the right technology partner has a significant impact on the total cost of ownership (i.e., expense of servicing technology over time) and opportunity cost for your business (e.g., potential revenue, safety, etc.). To address these issues, data aggregation and analysis can be a key differentiator in the success and profitability of your business strategy:

✓ To gather this data, solutions must be as rugged as the equipment and the environment in which they are deployed.
✓ Once deployed, the equipment serves as a platform for additional data collection opportunities.
✓ Data-driven predictive maintenance models can reduce operating costs, increase revenue, and potentially improve employee safety.

Industrial organizations are now launching their own digital transformation initiatives to reduce equipment downtime, increase duty cycles, track assets, and enhance employee safety to name just a few benefits. To implement a digital transformation strategy, it is critical to keep data flowing and architect the right hardware solutions that provide immediate benefits and become more valuable over time. To be successful, organizations must be partnered with the right vendor. As a global leader in ruggedized industrial solutions, Dell can bring the same cost-effective, high quality, scalable solutions you’ve come to expect from your proven partner in the enterprise.
II. Preventive Maintenance vs. Predictive Maintenance

Preventive maintenance is typically based on fixed periods of time as a way to manage risk. While this may be effective for managing downtime, there are greater opportunities in implementing a predictive maintenance model rather than a preventive maintenance model. By collecting and analyzing data from equipment in the field, maintenance schedules can be optimized to minimize downtime or maximize the duty cycle of the equipment which ultimately translates into bottom-line savings. For example, Caterpillar reports saving a mining client over $600,000 in lost production costs by using predictive maintenance tools to reduce the downtime on one of its machines, according to Tom Bucklar, Caterpillar Director of Innovation & Digital. Another Caterpillar construction industry client increased its asset utilization by 15% through streaming data that Caterpillar collected and analyzed on ten-thousand pieces of equipment. The key to unlocking such seemingly hidden opportunities within one’s own industrial environment is found in collecting and analyzing mass amounts of data over time.

As organizations consider deploying predictive maintenance solutions in harsh real-world field environments such as construction, mining, or manufacturing, the cost of both deployment and support are important consideration factors in selecting the correct equipment. For example, acquisition cost is frequently the primary factor when implementing a solution in traditional, non-industrial enterprise deployments. However, in industrial and field environments, expenses associated with equipment downtime, including costs of repair and lost productivity, are often much higher than the device itself. In addition to costs associated with equipment failures, there is a very real impact on the safety of personnel that may be operating or working in the vicinity of equipment. The cost of maintenance cycles, worker safety and loss of productivity, add up rapidly over time.

When selecting devices, factors such as moving parts (e.g., fans, hard drives, etc.) significantly impact the mean time to failure (MTTF). Each of these failures and the associated downtime can be minimized by choosing solutions with solid state components, fanless design, and environmentally hardened (ruggedized) equipment such as the Dell Edge Gateway 3000 and 5000 series. With an operating range of -30°C to 70°C, flexible mounting options, IP50 rating to protect the internal components from dust and an overall design that conforms to military standards (MIL-STD-810G) for hardening against shock, vibrations, etc., organizations can deploy solutions without worry. In addition, the 5000 series offers more powerful processors and increased storage capability to meet a wide variety of deployment scenarios. Even simple tasks, such as routinely powering on and off devices, can positively or negatively impact the investment and equally as important, the valuable intelligence that consistent collection of data brings to operations.
III. The Intelligent Edge, from Product to Platform

With so many physical devices getting connected and the wide variety of interfaces and connectivity requirements, how does one leverage those investments over time? Ensuring that solutions have the flexibility to support a wide range of potential connectivity scenarios for additional applications and services in the future will maximize the investment. Further, transforming product investments into platforms is inherent in the value proposition of the intelligent edge concept in IoT, especially over the lifecycle of a deployment.

Major heavy equipment manufacturers such as John Deere and Komatsu have each embraced this concept of the intelligent edge by using data derived from their equipment to help optimize operations on behalf of their customers. In the case of John Deere, their software, JDLink, assists customers in tracking machines deployed in the field, determine which of those assets are working, if they are working properly, and the rate of the machine’s productivity and efficiency. Komatsu is assisting mining customers around the world to continuously monitor the performance of some of the largest equipment used in surface and underground mining, increase asset utilization and productivity, and deliver essential resources including energy and industrial minerals for the global economy.

Types of equipment being monitored by Komatsu include longwall mining systems, electric rope shovels, continuous miners, and wheel loaders. The data collected includes time-series metrics — machine pressures, temperatures, currents, etc. — alarm and event data, and other information from third-party systems. A single machine can have...
hundreds to multiple thousands of data metrics and generate 30,000-50,000 unique time-stamped records per minute.

While there is always an initial use case for collecting data in the field, the real value is in a “swiss army knife” approach of industrial IoT solutions that offer a wide spectrum of connectivity options and the flexibility to connect modern and traditional Information Technology (IT) and Operational Technology (OT) systems. “The Internet of Things has the potential to offer business value that goes far beyond operational cost savings, but rather becomes the foundation for crafting new ‘smart’ products and services. However, no single vendor in the IoT ecosystem can do it all. Our partnership with Dell exemplifies this by bringing together the best-in-class streaming, edge and predictive analytics capabilities of our Digital Business Platform and the purpose-built Dell Edge Gateways. This powerful combination enables organizations to monitor, manage and act on fast-moving, Big Data at the edge as well as in the cloud in an instant.” –Eric Duffaut, Chief Customer Officer, Software AG

Finally, no solution for industrial IoT connectivity would be complete without considering security from the onset. Dell Edge Gateway family of products are Trusted Platform Module (TPM) enabled, allowing for a wide range of security features including platform integrity, disk encryption, password protection, etc. to ensure a trusted computing environment. When coupled with enterprise skill sets, organizations can leverage existing security models and extend them to OT technologies commonly associated with industrial IoT deployments to provide secure and reliable IoT solutions as a part of digital transformation efforts.
IV. Longevity and Serviceability in the Field

An important element to maximizing the deployment lifecycle is ensuring longevity of the equipment being deployed. With exposure to environments that are subject to the most severe conditions of temperature, shock, vibration, dust, etc., the potential for equipment failure is a significant concern when deploying IoT solutions in the field. These in-field failures can significantly drive total cost of ownership (TCO) for industrial IoT solutions. Controlling lifecycle costs are critical to ensuring that pilot deployments are successful, scalable, and have the ability to reach desired objectives. Selecting devices that can handle the rigors of being deployed in such harsh environments can minimize post-deployment failures commonly associated with such conditions.

For example, a public entity in the United States turned to Dell when looking for a reliable solution for video surveillance in snow plows. With goals to provide valuable evidence in alleged collisions, support worker productivity and route completion, the organization placed a Dell Edge Gateway 3001 in the cab of their snow plows connected to video cameras in the vehicle to store up to 72 hours of video. In addition, this organization leveraged the same solution for creative uses including use of the vehicles as barriers at large events where public safety officers could access the video.

Deploying the proper solution is only one part of the device lifecycle. Ensuring that your hardware and software partners have the ability to service that solution for the intended life of the product is equally, if not more important. For example, will the hardware still be manufactured in three to five years? Will organizations be able to get parts to a job site in a timely manner to prevent lengthy downtime or gaps in data collection? These are important factors in managing a device’s serviceability in the field. Dell ruggedized IoT solutions address these challenges and more by helping to scale support through global service offerings that get an organization up and running quickly. You can expect rapid provisioning and shipping of multiple devices, ability to leverage a global footprint of skilled technicians, and a reduction in the overall window of time for repair through a wide range of maintenance options including remote diagnostics, return to depot, and onsite service.
V. Conclusion
There is finally a straightforward approach to digital transformation that leverages the same industrial equipment that organizations are already using, connecting that equipment with systems that are already familiar to IT organizations, and extending those systems to include environmental hardening and support from Dell, a trusted global leader.

When organizations are considering those first few steps, it is important to plan to achieve both short-term objectives of a single use case (e.g. diagnostic monitoring of service vehicles, etc.) and long-term benefits of leveraging the same deployed solution for multiple use cases over its lifecycle (e.g. vehicle condition, air quality, real-time location of equipment, vibration, etc.). Further, as organizations research solutions to address short-term needs, they should seize the opportunity to be strategic and select a solution with the flexibility to provide additional sources of data for future business insights that become a competitive advantage.

For over a decade, Dell has been a leader in developing, deploying, and supporting ruggedized solutions for the harshest of field conditions. Dell has a broad portfolio of solutions to meet immediate needs and serve as a platform for future opportunities that drive digital transformation for industrial environments. Dell solutions have a number of options for connecting to industrial systems and come integrated with their own array of sensors as well as a variety of network connectivity alternatives for nearly every environment. From the construction worker using a ruggedized laptop or tablet to the hardened edge gateways deployed in the harsh environments of construction or mining sites, the Dell ruggedized portfolio has the right solution for most field conditions.

More than ever, organizations are turning to IoT solutions to improve operational efficiencies, ensure compliance, create new business models or revenue streams, enhance customer experience, and/or improve the safety of employees and customers. However, before organizations can begin analyzing the data gathered from that technology, it must be reliably collected. When looking for a hardware partner to deploy your own industrial solutions, Dell and its ruggedized portfolio offer short lead times for sourcing whether you’re in need of one or many devices; you can begin deploying pilots immediately with the confidence that as your needs scale, Dell ruggedized solutions and support will scale with you. As a ruggedized platform with available storage, computing, and connectivity capacity for the future, organizations can automate the collection of additional data beyond the initial investment in the deployment use case. As deployments ramp up, you can trust Dell to provide the highest quality products, services, and support for years to come.

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