Converging Technologies are Changing Enterprise Asset Management
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Introduction

In a remote, hard-to-reach stretch of the pipeline, the leak started slowly, almost imperceptibly. The sensors were still reporting values within the tolerance range. However, a few days later, the measurement dropped below the lowest acceptable limit.

This out-of-tolerance condition triggered and automatically transmitted an alert to the company’s Oracle’s JD Edwards core system via the Condition-Based Maintenance application. As a result, the Surveillance Department immediately received an investigation notice. In response, the department promptly launched one of its UAVs (unmanned aerial vehicle). It flew over the length of the pipeline covered by the sensor, sending high-resolution images back to the surveillance team. The images confirmed the leak, though fortunately it was still contained to the immediate area.

To address the issue, the system searched for nearby technicians based on their current geo-locations and notified the nearest one. Because the new assignment had higher priority, the technician wrapped up his current work and moved to the location with the more urgent issue, only to discover a second issue. Using a wearable head-mounted display device the technician entered a new work order for this problem using the voice activation feature. However, the second repair required a part that was not available and was, in fact, on backorder with the supplier.

While the technician worked on the first repair, the parts department used its 3D printer to ‘print’ a replacement for the backordered part. The new part was loaded onto another UAV and flown to where the technician was working. This fabricated part would serve as a temporary replacement part to keep the issue from becoming worse until the backordered part arrived. The technician took pictures of the issues and the repair work using the wearable device and attached the pictures to the work orders. The last step before leaving the job site was to record his time and close out the work orders using speech-to-text capability.

This scenario might appear at worst far-fetched or at best futuristic, but is it? In fact, the technologies to support all these activities are available today.

The convergence of several innovative technologies already available or under development today will enable organizations to optimize the management of their operating equipment. For asset-intensive industries, such as oil and gas, mining, natural resources, and engineering and construction, the ability to increase equipment up-time and reliability has a direct impact on the bottom line. When a critical asset goes down or is taken off-line for maintenance, this event can result in the delay or stoppage of goods and services. Unexpected failure of a critical asset may result in collateral damage beyond the
scope of the initial failure. Anything that can be done to avoid that scenario is certainly worth considering.

In this business brief, we consider some of these technologies and their potential contribution to enterprise asset management in the modern corporation. Oracle’s JD Edwards has already enabled thousands of organizations to simplify, standardize, and optimize their ERP business processes in the areas of finance, procurement, manufacturing, capital asset management, and supply chain. The result of this automation has been better business decisions, cost savings, and increased revenue. Oracle’s JD Edwards is poised to assist these organizations in the adoption of these new technologies as well.

**Enabling Technologies for Asset-Intensive Industries**

The convergence of innovation in wireless communications, computing, material science, and electronics leveraged across the open global infrastructure of the internet is facilitating rapid gains in how organizations manage, inspect, and service their capital equipment. Applying these technologies can lead to a rapid ROI in terms of cost savings, increased equipment up-time, and increased revenue, thus maximizing the potential of organizations to build product and offer services.

Many of these innovative technologies are disruptive; they change our lives and the way we do business. These changes ultimately impact the global economy as well. This realization gives a competitive edge to companies that harness these innovative technologies with practical applications.

It is not uncommon that technological advances in communications, materials, electronics, and computing result in innovations that leverage multiple technologies, combining characteristics of some or even all of these. Innovations in one area lead to innovations in others, in turn advancing the initial innovation. Converging technologies produce iterative advances, for example UAVs leveraging innovations in robotics, photography, sensors, and wireless communications.

![Converging Technologies](image)

**Figure 1. Converging Technologies**
Communications

IP communications are becoming pervasive thanks in part to cell phones and Wi-Fi hotspots. Ubiquitous communications, the idea that data and voice communication must be available anytime and anywhere, are transforming life for individuals, governments, and corporations world-wide. Asset-intensive businesses typically have assets spread across several field locations and job sites. To access remote assets, communication is essential. Electronics that take advantage of wireless technologies, such as GPS, help organizations track asset locations and movement.

Strategies and solutions to handle disconnected communication modes address the gaps created by unreliable connectivity in remote locations. Near field communication (NFC) standards enable devices to talk to one another and share transactions and data. These standards are built on the basis of RFID.

Technicians in the field have special requirements to interface with their core systems. They are often in remote locations and need to rely on wireless connections. Since they work with their hands, their hands are often busy or dirty; yet, they still need access to important system information about the equipment or repair they are working on. Recent innovations in wearable technologies hold promise for exactly this situation. Head-mounted optical devices for computing and smartwatches will give access to core systems with simplified user interfaces. They provide voice-activated control and voice-to-text capability for hands-free computing. These devices have embedded technologies such as Bluetooth, camera, and GPS with wireless connectivity.

Electronics

The field of robotics has been around for a long time. Organizations have successfully employed them in fixed-plant manufacturing and seen tremendous cost savings along with gains in efficiency and product quality. Innovations in nanotechnology, thermal and high-resolution imaging, sensors and beacons, mobile communications, and pilotless aircraft have converged into what is known as unmanned aerial vehicles (UAV), also known as drones. UAVs have great potential for doing work in hard-to-reach or dangerous situations. Use cases are just beginning to be imagined, but initial obvious ones include surveillance, inspection, data gathering, delivery, internet service, photography, search and rescue, and disaster relief.

Understanding real-time conditions is important when monitoring asset operating conditions. The ability to detect a change in operating status before a critical asset breaks down can prevent catastrophic failure that results in collateral damage and extended downtime, beyond what would be experienced when an asset is taken off-line for maintenance. Sensors that monitor equipment and look for out-of-tolerance situations rely on wireless communications and access to the internet to connect with the back office from remote locations.

Advanced electronics are solving many different problems. These solutions result in cost and time savings, increased accuracy, and greater reliability or consistency. Obviously, any organization would benefit from these solutions, but asset-intensive organizations derive special benefit when it comes to operating their assets. For example, the diagnostic capability to support a predictive maintenance strategy has increased as a result of recent innovation and the reduced cost of sensors. Sensors can monitor almost any operating system. Vibration, viscosity, purity, temperature, wear, noise, flow, insulation resistance, pressure, current, polarity, and electrical signals are just some of the factors that can be measured and monitored. Sensors have become better, cheaper, and smaller. With the ability to leverage wireless communications across the internet, using sensors on mobile or remote equipment is very practical.
Computing

Sensors are typically always on and transmitting readings, thus producing a continual stream of data to be captured, curated, analyzed, visualized, and archived. Other types of data that are generated from continual monitoring include images and videos, sound files, RFID, software logs, and GPS coordinates, to name but a few. The challenge is not simply how to store and manage massive amounts of data, but how to work with it and derive meaningful information from it. The capacity to store information has increased dramatically since the 1980s. Today customers have choices when working with big data: They can use traditional relational database management systems or manage files and other unstructured data using NoSQL databases, which provide extreme horizontal scalability. Innovation in enabling technologies, such as advanced electronics and wireless communications, results in even more types and sources of continual-stream data. At the same time, the business need to monitor, communicate, and analyze real-time streaming data remains as critical as ever.

Computing practice is impacted not only by the technology but also by the users. As the workforce in many asset-intensive organizations is aging, the inevitable turnover will bring in younger, more tech-savvy workers. These new workers will have different expectations of how they interact with core systems, such as being able to collaborate, share, and interact across the web. The social web will find applications in commerce. Workers can collaborate across social media to help each other with new issues. Consider a technician installing a part from a new supplier for the first time. Using a mobile device the technician can access instructional videos, collaborate with a co-worker located somewhere else who has the skills and experience the technician lacks, or simply post and share experience and insights to help other technicians.

These workers will bring their device of choice to work. At the same time, workers do not want to carry multiple devices, nor do employers want to have to pay for expensive devices that become obsolete quickly. Web-oriented architecture with open platforms and standards will future-proof mobile applications. Cloud computing, or “anything as a service” (XaaS), will deliver solutions across the internet to the end user. Organizations will benefit from the economies of scale and reductions in IT spending. In fact, equipment technicians today can already leverage these converging technologies to make their jobs easier, more efficient, and safer than was previously possible.

Material Science

3D printing or additive manufacturing (AM) has been around since the mid 1980s, but the technology has significantly evolved over time. As prices have dropped greatly in recent years, 3D printing is gaining traction as being both practical and affordable. The materials that 3D printers use to fabricate things have evolved as well through advances in material science and in the technology to work with those materials. These advances have expanded the range of applications. Materials used in 3D printing today include various types of plastics, nylon, epoxy resins, silver, titanium, steel, wax, filament materials to imitate wood, and to turn infused carbon fibers into printable plastics for stronger and lighter materials. This capability is particularly relevant when using 3D printing to manufacture equipment spares since equipment can be complex and made up of all sorts of materials.

The evolution in 3D printing has made the technology much more practical, so much so that corporations can consider it as part of their strategy for maintaining their equipment. When a critical asset is down, time is money. Using 3D printing to address supply chain issues is a solution being considered for spare parts or even tools. The result may even be stronger, better or cheaper than the original. At the very least, it may provide a stopgap measure. Companies should consider the role that 3D printing can play when managing spares.
Putting the Pieces Together

Almost every asset-intensive organization can benefit from these technological innovations. For example, automating inspections enables organizations to reduce costs and reduce or eliminate travel time required for manual equipment inspections. Technology can assist in detecting failures before they occur, thus preventing damage and downtime. Prevention will help keep projects on schedule and within budget and keep production operations going. The impact to the bottom line is obvious, in addition to the increase in worker safety.

Let’s explore some specific challenges related to operating and maintaining assets, which can be addressed with these converging technologies:

Inspections and Surveys

Most inspections involve visual or imagery-related inspections, such as thermal sensors or high resolution photography. For example, UAVs are being used in Australia to inspect water reservoirs. Today, UAVs can complete a reservoir inspection in 2 hours, a task that used to take a team of 6 people an entire day. The technology attached to the UAV provides high-resolution close-up images, marked with geo-spatial coordinates and time/date stamps. Another example involves a large international oil and gas company operating in Prudhoe Bay, Alaska; as recently as June 2014, the company was authorized by the FAA to use UAVs with sophisticated sensors and imaging equipment to create 3-D models of roads, pipelines, and work pads.

Measurements and Monitoring

Maintenance supervisors know that assets fail despite regular periodic preventive maintenance. Switching to a condition-based maintenance strategy for critical assets can help detect impending failures before they take place. This approach involves continual monitoring of critical measurements and analyzing the system for out-of-tolerance situations. A large utility in Florida integrated the sensors on their mobile fleet of vehicles so that each day when the vehicles return to the lot for refueling, the data from their vehicles is automatically downloaded into Oracle’s JD Edwards, triggering preventive maintenance as needed. The proximity of the fuel nozzle to the opening of the gas tank initiates the automated communication download.

Equipment Tracking and Location

It is important for asset-intensive organizations to track mobile equipment that moves from point to point, for example in a large open-pit mine that may be many miles across. Likewise, when technicians are dispatched to the field to perform maintenance on equipment, it is important to locate all of the equipment within a defined proximity to where they are. An example is a municipality that has field technicians working on the town’s assets and infrastructure. Once a technician is on site it would be valuable to have access to the asset information for the equipment nearby. The “as long as I’m here, I should look at the other equipment at this location” scenario is important. Sensors, beacons, mobile devices, and wireless communication are valuable technologies for this scenario.

Supply Chain and Parts Availability

Having what you need, when you need it, and where you need it is integral to maintaining critical equipment. When a critical asset is down, time is money. It’s imperative to return that equipment to an operational status as soon as possible to minimize the disruption to the business. Remote locations present challenges to proper inventory stocking. And despite careful planning, sometimes shortages in the supply chain occur. Converging technologies are providing alternative resolutions to these challenges. Something as simple as a mobile device with applications that provide visibility into inventory availability can provide great benefits. Being able to ‘print’ a replacement part is a
solution being used today when the distance and time to get a part or perhaps even the cost of the replacement part are too great. And of course, UAVs could be used to deliver some parts or small tools to remote locations.

Worker Safety
Keeping your workers safe is not just a good idea, it’s mandated through regulations. Equipment failure can result in an unsafe environment. Being able to assess the situation remotely with imaging or sensors is a great way to ensure it is safe before dispatching a worker to take care of the repair. Sensors can warn a worker in advance that equipment is malfunctioning and thus prevent an injury. Sensors are used in mines not only to detect the environmental conditions, but also to track the whereabouts of both workers and equipment. Should an emergency arise, it's critical to know the last known position.

Realizing These Improvements with Oracle’s JD Edwards
Enabling technologies, while highly innovative, are tools to solve business problems in ways that were inconceivable in the past. To truly realize the business benefits of optimized equipment up-time, cost savings, increased revenue, and increased worker safety, these technologies should be seriously considered in the context of business processes for asset-intensive companies.

It is critical to have a vision for combining the deployment of today’s enabling technologies with a strategy to uptake and incorporate tomorrow’s emerging technologies as they become proved out for commercial usage.

Today customers can take advantage of the Oracle’s JD Edwards Condition-Based Maintenance module to issue alerts about equipment that has exceeded a tolerance limit. The system can automatically respond to the alert with predetermined rules-based logic and act accordingly. With the increased affordability of sensors and the number of situations where they can be used, with the emerging standards for data formats, and the increasing prevalence of big data solutions, customers are incorporating Internet of Things (IoT) and Machine-to-Machine (M2M) technologies as core components of their equipment operations and maintenance strategies. Oracle’s JD Edwards is investing in leveraging and embedding IoT and M2M technologies in our solutions.

Oracle’s JD Edwards advanced research and development is continually researching the latest innovative technologies and evaluating how and when to take advantage of these innovations so that solutions are available when customers are ready to employ them in the context of ERP business processes. JD Edwards EnterpriseOne Solutions already available today, such as Condition-Based Maintenance, mobile applications, Health and Safety Incident Management, combined with the open systems architecture and tools features such as Café One (for composite applications), watch lists, E1 pages, and integration tools are valuable for asset-intensive companies to operate and maintain their equipment and keep their workers informed and safe.

Conclusion
Oracle and JD Edwards have great solutions that have continually evolved to uptake these enabling technologies. We are investing in research and development of innovative technologies and are exploring ways to embed them as native solutions so that our customers will be able to rely on and grow with us as they prepare to run their businesses using enabling technologies.

As we have seen, predictive maintenance strategies are becoming increasingly sophisticated and technology-driven. Innovative technologies are disruptive, and in most cases radically disruptive! To think that they won’t transform our lives or the way we do business is not only naïve, but unwise. Consider businesses today that have failed to embrace the internet. In fact, are any left? Failure to recognize the potential of these disruptive technologies and to
prepare for their integration into standard business processes could be crippling. Companies that realize and harness the potential of these technologies with practical applications will have a competitive advantage. No one is immune from the impact of accelerating technological changes.

The landscape is littered with the remains of those who failed to acknowledge industry disruptions and, as a result did not prepare for and embrace the changes. For example, Blockbuster fell victim to its own outdated strategies while Netflix reinvented itself and is established as the clear winner - for now. Similar disruptions and failures to develop new strategies have been experienced by companies in many industries, from smartphone to digital imagery/photography to personal transportation.

Thinking back to the scenario that opened this business brief, it’s not futuristic or far-fetched at all. It represents the near term and is coming at us at full tilt. Companies have two choices: Embrace and exploit the disruption or avoid it and face the consequences at their own peril. Business leaders need to equip themselves to face this new world and ride this wave of innovation. Oracle’s JD Edwards is dedicated to be our customers’ ERP of choice today and poised to be their ERP of choice tomorrow, assisting them with measured, incremental means to manage the disruption.

To learn more about how you can leverage Oracle’s JD Edwards to create game-changing differentiated business solutions, contact your local Oracle representative.