THE WORLD TODAY IS ALREADY CONNECTED IN WAYS THAT ARE TRULY REVOLUTIONIZING HOW THE HUMAN RACE LIVES, WORKS AND INTERACTS. AND AS TECHNOLOGY EVOLVES, AND AS CARS, PHONES, APPLIANCES, MACHINES AND COUNTLESS OTHER THINGS ACQUIRE A DIGITAL HEARTBEAT AND JOIN THE MORE THAN 3 BILLION DIGITALLY CONNECTED PEOPLE AROUND THE WORLD, THIS REVOLUTION IS SET TO EXPAND EVER FURTHER AND EVER FASTER.
No industry will be unaffected. As many as 50 billion devices could be connected to the Internet of Things (IoT) by 2020 according to Cisco, including numerous industrial machines and devices. This will create unprecedented volumes of data and numerous opportunities for growth in the Industrial Internet of Things (IIoT). This is a technology revolution that will fundamentally change how industry operates.

But large-scale IIoT deployments have to date been few and far between. The reality is that the IIoT can be a challenge to implement. Enterprises must connect, identify and secure numerous different devices, machines and other things. They must capture, transmit and store data from those things. They must analyze and learn from that data, and integrate it into core operating and information systems. They must train customers, employees and partners in its use. And they must rethink business processes and measures of success.

No wonder, then, that many businesses are stuck in the “what, how, where” phase of their IIoT thinking. But there is a way forward. There is an approach that can quickly generate tangible and measurable value from the IIoT. It’s an approach that develops momentum within a business, which can act as a springboard to realizing true enterprise-wide value. It’s an approach that means deploying advanced analytics solutions “at the edge.”
Big data analytics is a well-established concept, enabling organizations to harness huge datasets and derive immediate insights. It lets them make smarter decisions and evolve more efficient operations. And when the IoT really takes off, ever vaster new datasets will become available for ever greater insights. But getting at that data, and transforming it into actionable insights, will bring new challenges. In this context, edge analytics offers something new. How do the two approaches compare?

**BIG DATA ANALYTICS**

Big data analytics is founded on the principle of “the more data the better.” It means capturing masses of data and applying sophisticated and advanced technologies, such as machine learning, to unlock the value buried in it. It is suited to situations where the value is unclear, the patterns and outcomes unknown and accuracy is influenced by the amount of data available. But it calls for large numbers of servers and other forms of infrastructure to support the huge volumes of data and the advanced analytics and computing power needed for machine learning to function. The scale of this infrastructure and capability is such that the accepted approach is to provide it in the cloud.

**EDGE ANALYTICS**

Analytics at the edge is different. It means carrying out the same kind of analysis, but moving more of it to the edge of the network. In other words, closer to the “things” that are the source of the new data. This could be a car, a washing machine or a fitness device. Or it could be a generator on an oil rig, some agricultural equipment in the field, or any other industrial device. Pushing as much computing workload as close to the edge as possible can bring serious benefits, particularly where communication costs are high or where instant action is needed. But today’s edge capabilities are still relatively unsophisticated, lacking anything like the computing power that cloud services can provide. New approaches therefore need to be found.
In today’s IoT, the edge is largely made up of individual sensors with little processing capability – a Fitbit fitness device, say – that send data to the cloud for computation. While these sensors might connect to a gateway or local edge device that performs some simple analysis as a first-level screening – determining how data should be treated, sending an alert if a threshold is breached, etc. – the computational heavy lifting is performed in the cloud.
The challenge in pushing computation closer to these edge devices is that their capabilities are dictated by their environment. They must, by definition, have a small processing footprint. The answer to this challenge is to design, build and deploy analytical models that address specific problems or objectives. In the process, new value-added capabilities can emerge.

Lone Star Analysis (LSA) is a pioneering company working with Accenture to deliver analytics at the edge. The sophisticated computational efficiency of its edge tool, AnalyticsOS, means it can operate complex analytics on a footprint consistent with edge requirements. Advanced predictive and prescriptive analysis can be performed with sufficient granularity to enable meaningful insights to be derived and actions triggered at the edge. A multitude of AnalyticsOS-enabled edge devices can thus work in conjunction with broader cloud-based analytics. Edge analytics could be used to optimize uptime and maintenance for an individual oil well, for example, while cloud-based models optimize across multiple locations at an enterprise level.
Performing sophisticated analysis at the edge means targeted condition- or prediction-based outcomes can be triggered at the level of individual components. And that means the root causes of any problems – and their solutions – can be identified by an edge analytics model. Consider the example of a $500,000 earth-moving machine. A model could be built that identifies and maps the relationships between the machine’s sub-assemblies and components.

The model would monitor and analyze data at the component level and would then run simulations to predict the future state of those components. In this way, the model would not only be able to predict a future failure but also the time to that failure at the component, sub-assembly or equipment level. And this can be done to any timescale desired – every second, minute or hour as the circumstances dictate.
Edge analytics thus means a business can:

**IMPROVE EQUIPMENT UP TIME AND EFFICIENCY**

Failure in a subsystem or component, or the impact of running a component in a degraded state, can be predicted in real time (and continually refined as more data is analyzed) and used to inform operational use and maintenance scheduling. Automated “self-correcting” actions that continuously optimize performance can also be triggered.

**REDUCE MAINTENANCE COSTS**

Equipment failure can be avoided through preventative maintenance undertaken when actually needed, rather than at fixed periods in a predetermined schedule. More repairs can be carried out on first visits by giving mechanics detailed instructions about the causes of a problem, what action is needed, and what parts are required.

**LOWER ITS SPARES INVENTORY**

Maintenance crews have an earlier and more precise visibility into future failures and breakdowns, making a spares inventory vastly more efficient.

Edge analytics models can be tailored to the requirements of an individual device or system. This might mean reading sensors directly associated with certain components and/or subsystems. Or it might mean inferring results based on known and validated calculations. The right sensor package for a particular asset will be guided by an organization’s desired business value – the model can define how an asset or system should be optimally configured to achieve a business goal for the minimum cost.
CRITICAL FAILURE

Failures in critical systems can have catastrophic results, in some cases including loss of life. Early warnings and the capacity to trigger immediate actions are therefore essential. By acquiring, monitoring and analyzing data at component level, edge analytics can identify a cause before its effect materializes, enabling earlier problem detection. So, rather than identifying and analyzing an effect (excessive motor bearing vibration, for example), edge models identify and analyze a cause at a granular level (a voltage leak, causing a bearing temperature spike, degrading the other bearings or causing vibration).

LSA edge models also enable high-volume and sophisticated simulations that provide accurate predictions of impact and failure. Early predictions of time to failure are thus possible. User-defined thresholds and triggers can also be specified and self-correcting actions can be automatically initiated.

ENVIRONMENTAL CONSTRAINTS

Edge models can be effective where there are environmental constraints in processing capability, connectivity and bandwidth. These constraints can be both physical (such as bandwidth) and cost-related (such as cost of connectivity or infrastructure).

In-flight aircraft analysis is an obvious example. Use cases range from early warning of minor maintenance issues all the way through to critical systems failures. But there are clear environmental constraints on an aircraft. While huge amounts of data are produced during flight, air-to-ground bandwidth restrictions mean very little is transmitted in real time. Instead, data is downloaded for analysis after landing.

Accenture’s initial focus has been on minor aircraft maintenance issues. We are developing models that can run on a very small processing footprint during flight, and which would monitor
and analyze data (from sensors or manual entry) from common items of failure to predict future failures, note actual failures and trigger notifications to ground maintenance crews. Those crews would then be able to proactively prepare for maintenance by sending the required part and scheduling a technician to meet the plane on landing – a great leap forward in expedited maintenance and minimizing delays.

**NEW BUSINESS MODELS**

Edge capabilities also enable the creation of smart machines that self-trigger actions, processes and outcomes. Consider, for example, the potential impact of edge analytics on just-in-time parts management. A remote piece of equipment could self-monitor and analyze its condition, and that of its sub-assemblies and individual components. An edge analytics model could then predict which components will fail and when, and assess that failure’s impact on the equipment’s operation. That could trigger part replacement notifications to be sent to the OEM, the equipment operator, and any third party (a dealer, say) that will carry out the replacement. The OEM could then dispatch the replacement part to the dealer, who could in turn confirm a maintenance schedule with the operator. Most importantly, the timing of each stage in this process would be determined by the original time-to-failure prediction made by the equipment.

The model is thus mutually beneficial for all participants. The equipment operator benefits from reduced downtime and an enhanced maintenance schedule dictated by actual maintenance needs. The OEM benefits from an automated notification and dispatch process and the opportunity to help ensure its branded part is used. And the dealer benefits from a closer, more efficient relationship with the operator and an opportunity to minimize its parts inventory.
The benefits of edge analytics’ problem-focused approach will initially be seen at the edge of the network. That means, in other words, optimization will first occur at the level of individual pieces of equipment. Realizing the wider benefits of edge capabilities across the whole of an organization will require analysis and optimization further up the chain.

Just-in-time parts management will, for example, maximize the uptime and utilization of each piece of equipment with edge capabilities. But optimizing maintenance scheduling and parts management across an entire fleet means aggregating all the individual equipment outputs and then applying more traditional forms of analytics. Most organizations will thus opt for a hybrid analytics approach, incorporating both edge and cloud capabilities, optimized for their individual requirements and circumstances.

But starting at the edge and working toward the center could be the quickest route to realizing material benefits for a business. Building and testing an edge model will offer a predicted benefits statement that can be used to build a wider business case. In this way, edge capabilities can be used to kick-start a wider program. They can represent the first step in an organization’s journey to capture the immense value that lies in the billions of connected devices set to join the Industrial Internet of Things.
ABOUT ACCENTURE MOBILITY

Accenture Mobility, part of Accenture Digital, plans, implements and manages mobility solutions for businesses and public organizations, including developing and implementing enterprise mobility strategies; incorporating applications and managed services; creating and delivering mCommerce solutions; and supplying credible, business ready Connected Product offerings. Accenture Mobility services are based on deep industry insights and technical expertise that help clients across all industries achieve growth, efficiency and manage a successful transformation as they adopt the tools of a digital business. Find out more by following @mobilitywise and visiting www.accenture.com/mobility.

ABOUT ACCENTURE

Accenture is a leading global professional services company, providing a broad range of services and solutions in strategy, consulting, digital, technology and operations. Combining unmatched experience and specialized skills across more than 40 industries and all business functions—underpinned by the world’s largest delivery network—Accenture works at the intersection of business and technology to help clients improve their performance and create sustainable value for their stakeholders. With approximately 401,000 people serving clients in more than 120 countries, Accenture drives innovation to improve the way the world works and lives. Visit us at www.accenture.com.

AUTHORS

Andrew Hopkins
andrew.d.hopkins@accenture.com