Eight Challenges From the INTERNET OF THINGS

The Internet of Things (IoT) may mean extended, real-time connectivity to many devices, opening up new avenues for intelligent products and services. However, for data executives, it also means new challenges not previously encountered in enterprises. Managing data—lately, known as "big data"—has always required a mix of technical and business skills. In the future, even big data as we've known it will swell exponentially as the IoT comes online. The business benefits from extracting and leveraging real-time, streaming data about people, products, and systems will be impressive. Data executives will need to adopt new ways of thinking and managing to ride the coming IoT wave.

Here are the eight key challenges that are shaping our IoT future:

1. MOST IOT DATA WILL REMAIN INACCESSIBLE FOR THE FORESEEABLE FUTURE

For starters, it will be a long time before enterprises will be able to fully tap into the increasingly rich vein of IoT data. There are countless devices, sensors, and systems that house data that is local, and will remain so for some time to come. The challenge will be to locate the data sources that are relevant to business requirements, and outfit these sources with network capabilities. Calculations from ABI Research estimate that the volume of data captured by IoT-connected devices exceeded 200 exabytes in 2014, and will grow to 1.6 zettabytes by 2020. However, the consultancy also estimates that more than 90% of IoT-generated data is stored or processed locally without a cloud element, rendering it inaccessible for analytics. The challenge is being able to surface this data for analytic purposes.

The good news is that it's getting easier every year to tap into these data sources. Remote tags and sensors have been in use for some time, and organizations have been collecting data from the field or point-of-sale locations. This data has typically been difficult to collect efficiently from remote locations and expensive to analyze in large quantities. The boom in wireless networks and connectivity is bringing accessibility to every corner of every enterprise and beyond. Plus, with the growth of cloud-based services, there are easy and cost-effective ways to store and manage this data. With the rise of open source data management tools and frameworks, it's now possible to process large volumes of this data for analysis cost-effectively as well.

2. IOT IS MORE THAN DEVICE DATA

IoT is typically associated with monitoring and collecting data from devices, including sensors, wearables, and mobile phones. However, organizations are looking to do more than simply monitor data. They see significant value in being able to get a clearer view of their markets and customer experiences to boost customer service, improve employee productivity, and better engage with partners. There are also benefits to be gained on a global scale in terms of greener uses of resources. A survey of early IoT adopters conducted by Verizon and *Harvard Business Review*, showed that many IoT initiatives are being driven by the need to improve customer service (51%), increase revenue from services and/or products (44%), improve use of field assets field (38%), and boost analytics (35%). The survey also found success so far in these efforts: 62% of respondents

say IoT has increased customer responsiveness; 58% say it increased internal employee collaboration; and 54% have seen better market insights.

3. IOT APPLICATIONS CREATE DIFFERENT VALUE IN DIFFERENT SETTINGS

IoT implementations—and the benefits realized—vary greatly from industry to industry. Manufacturing companies will see the greatest value from the start, according to a report by McKinsey Global Institute. Factories could realize potential value of up to $3.7 trillion by 2025, as machines, tools, and processes are tracked and analyzed.

For example, Airbus has launched a "Factory of the Future" initiative in which it intends to employ IoT technologies, along with smart machines and wearable augmented-reality devices to bring its systems together, and coordinate and share data. This will help manage the manufacturing and assembly processes for aircraft, which involves tens of thousands of steps that must be followed by operators, as well as for subassemblies that may have up to 400,000 points that need to be tightened down. Having these steps and tools online and digitized will save the manufacturer hundreds of thousands of dollars and ensure greater safety.

Additional business settings identified in the McKinsey study that will benefit from IoT include retail establishments, which will see value from automated checkout, layout optimization, smart CRM, in-store personalized promotions, and inventory shrinkage prevention; worksites, which will derive value from operations optimization, equipment maintenance, health and safety, and IoT-enabled R&D; and offices, where value will come from organizational redesign and worker monitoring, augmented reality for training, energy monitoring, and building security.

4. IOT BRINGS REAL-TIME INTO THE SPOTLIGHT.

Situational awareness—and the ability to react instantly to critical events as they happen—has long been sought by enterprises, and this is now possible with IoT. The challenge is to address the potential latency in sending data and application calls back and forth between devices and centralized systems. There are a range of systems that require real-time processing capabilities—from engine monitoring to onboard sensors to CRM applications extracting real-time mobile feeds.

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5. IOT EXACERBATES SHORTAGES OF HARD-TO-FIND ANALYTICS SKILLS

The greater volume of real-time data streaming in from all corners requires new classes of applications—and a new breed of analytical thinkers. Individuals who possess the training in statistics and mathematics that is required to become a data scientist are few and far between. Data management teams will need additional skills training to expand their positions within enterprises—from more traditional roles of maintaining and securing data to storytelling and business analysis. Business users also need to be brought up-to-speed with data analysis techniques in order to fully understand and take advantage of IoT's business potential.

6. IOT SHIFTS THE EMPHASIS BACK TO HARDWARE

While the future belongs to the "software-defined" data center, taking advantage of IoT is a hardware concern, as it will require greater investment in low-cost, low-power hardware. Enabling and leveraging IoT may mean building, equipping, and maintaining far-flung IoT environments. At this point, IoT manufacturers tend to have their own standards and protocols, and thus, it's still up to enterprises to figure out how their networks of data sources and devices will all interconnect and communicate. Falling prices for commodity hardware pieces—such as RFID sensors and storage—will help ease the costs associated with building out an IoT-enabled system.

7. IOT CREATES MANY PRIVACY AND REGULATORY CONCERNS

The growth of IoT means a far greater distribution of data and movement through countless devices that fall beyond the control of enterprise administrators. Devices on the internet are easily hackable, as they tend not to be equipped with robust security software. There is also the matter of data ownership, which is not clear if data is streaming between devices and cloud sites.

8. IOT REQUIRES OPENING ORGANIZATIONAL SILOS

Moving forward into IoT means that relationships between organizations and their customers will change, as will relationships that are internal to organizations. For example, an engine equipped with on-board sensors that are constantly streaming data back to a manufacturer means that the manufacturer will need to remain in constant contact with customers to provide alerts when equipment failure is detected, or new upgrades are required. This will require that product technicians and designers work closely, perhaps even on a day-to-day basis, with sales account representatives or customer service departments. ■

—Joe McKendrick

Objectivity

Missing Link—The Criticality of Analyzing Relationships Within the Industrial Internet of Things

B2B APPLICATIONS FOR THE IOT, collectively known as the *Industrial* Internet of Things (IIoT), are receiving increasingly significant economic investment because of their projected impact on business and the economy. Experts predict that IIoT solutions will dramatically increase productivity and efficiency, and enable new business models that could transform entire industries. By 2025, the IIoT could have an economic impact of almost $11.1 trillion (McKinsey and Company, 2015).

While the possibilities of economic transformation are exciting, the IIoT remains in its infancy. Although early adopters in Manufacturing and Oil and Gas are already seeing returns from operational efficiencies and productivity, 88% of respondents to a recent World Economic Forum survey reported that they "still do not fully understand its [IIoT's] underlying business models and longer-term implications for their industries."

A critical technical challenge to implementing an IIoT solution is the ability to take action on sensor data in real time. Traditional database management systems are designed to run one-time queries over finite datasets. However, IIoT applications involve streaming data, such as network monitoring, financial analysis, logistics, and sensor network-based data. IIoT applications are relationship-analysis based applications that require long-running, or continuous, queries over unbounded streams of data. At the same time, these IIoT applications must reference non-streaming resources, such as historical data in databases and machine-learning models.

The common element among IIoT applications is the need to support relationship and pattern discovery. The ability to analyze the connections between data points is the missing link that transforms today's typical Big Data stack into a system capable of delivering insights in real time. Solutions that enable relationship-based analytics are designed to integrate and organize data coming in from multiple sources in order to present a unified view of that data. However, it is very expensive, time-consuming, and technically challenging for an organization to build their own implementation.

To address this issue, Objectivity introduced ThingSpan, a purpose-built, integrated platform for deploying relationship analytics functionality within an IIoT application. ThingSpan supports pattern discovery by leveraging Hadoop with Apache Spark and supporting streaming messaging tools such as Kafka atop an object-oriented database designed for fusing data streams with non-streaming data sources. ThingSpan dramatically reduces the time, complexity, and cost of creating an IIoT application, enabling companies to achieve business insights from big data and real-time streaming data with high efficiency and at scale.

ThingSpan and relationship-based analytics have many critical use cases, including:

Utility Situational Analysis—Utilities organizations routinely collect and analyze data to make business decisions on how and where power should be distributed throughout their networks based on this analysis. The proliferation of smart meters and grid sensors, the rise of distributed generation resources like rooftop solar and behind-the-meter batteries, and the emergence of customers equipped with new technologies to manage and control their energy use are all bringing far more data under the purview of utilities than ever before. The sheer volume of this streaming data is already beyond the capacity of legacy data integration, management and analytic tools.

As a result, the ability to derive actionable insights from disparate data streams and sources in days versus weeks or months provides major competitive advantages. Systems that fuse streaming sensor data with transactional and historical data outside of traditional data warehouse and ETL tools are providing these benefits today in leading utilities companies, such as Pacific Gas & Electric and Florida Power & Light.

Logistics Asset Management—Logistics and transportation organizations, such as UPS, FedEx, Penske, and Con-way, have recognized the value of leveraging telemetric data from their logistical transports (cars, trucks, airplanes, etc.) to better manage routes and deploy more efficient predictive maintenance plans. For example, UPS has stated that the equivalent of saving 1 mile per driver per day results in savings of over $60 million per year.

In order to drive greater savings and productivity, these companies have heavily instrumented their transport vehicles to accelerate and improve their sensor-to-insight dataflow to drive better route and predictive maintenance systems. Leading organizations have deployed relationship analytics systems that fuse telemetric data (GPS, brake use, engine idle time) from their transportation fleet with historical, weather, traffic, customer inventory, geospatial (i.e., adverse terrains) and other transactional data.

These are just a few of the many use cases currently being evaluated by businesses around the world. Together, we expect to see these transformative technologies enable IIoT solutions that will revolutionize industries. ■

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