White Paper

Reducing the Time to Value for Internet of Things Deployments

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IDC OPINION

IDC projects the market opportunity for the Internet of Things (IoT) to reach $1.7 trillion by 2020, with the number of connected devices approaching 30 billion. While IoT's hype phase has put the spotlight on consumer applications such as wearable health monitors or connected home, IDC's research indicates that business-to-business (B2B) IoT activities represent the larger – and faster-growing – portion of the iceberg.

Regardless of where they are on the adoption curve, a clear majority of companies recognize that IoT will have a major strategic or transformational impact on their industries, their customers, and their own operations. For all the opportunity that IoT presents, many companies are nonetheless wary of the challenges and, to some degree, daunted by what they perceive as the cost, time, and resource commitments that a successful IoT deployment may involve. What they're looking for is an IoT road map that accelerates time to value.

The IoT value proposition is driven by the ability to translate vast quantities of sensor-based information into action – the faster, the better. IoT solutions that make it easier to securely connect devices, analyze real-time and historical data, and integrate to back-end applications represent an attractive option for companies seeking to hit the ground running and accelerate time to value.

IN THIS WHITE PAPER

This white paper describes the challenges and opportunities of implementing IoT solutions. While IoT has application for multiple industries and segments, this paper focuses on three sectors that demonstrate significant achievable value: manufacturing, transportation, and logistics. These represent areas where IoT has the potential to drive new levels of optimization in processes such as production planning, fleet operations, and supply chain management.

SITUATION OVERVIEW

Much has been said about the growing importance of IoT, which IDC defines as a network of networks of uniquely identifiable endpoints – or things – that communicate without human interaction. In a nutshell, IoT is about connecting things in new and better ways to enable transformation across a number of domains, from the way businesses make decisions to the way consumers go about their everyday lives. While a number of interrelated factors have contributed to IoT's emergence as a top-tier strategic priority for companies, arguably the most important factor is the projected explosion in

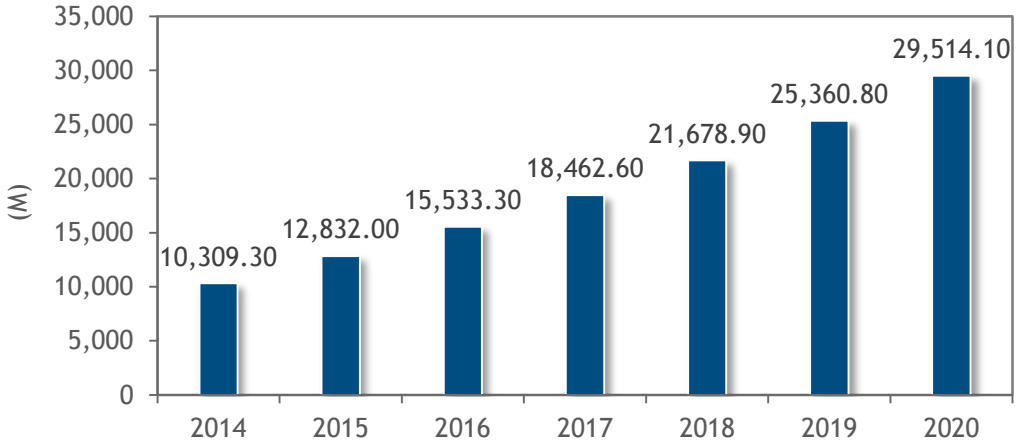
the volume of data generated by an ever-growing number and array of connected devices, along with a sharp increase in the variety and streaming velocity of that data.

IDC predicts that the worldwide installed base of IoT endpoints, or connected devices, will reach nearly 30 billion by 2020, representing a compound annual growth rate (CAGR) of 19.2% (see Figure 1). The roster of endpoints is both long and diverse, ranging from smartphones and networked entertainment devices to automobiles, building automation systems, smart meters and thermostats, medical electronics, and industrial controllers. Looked at another way, the number of connected endpoints added every *minute* is expected to grow from 4,800 in 2015 to 7,900 in 2020. IDC projects that in this same time frame, worldwide revenue associated with IoT deployments will grow from $779.9 billion to $1.7 trillion at a CAGR of 16.9%.

Therefore, it isn't a surprise that much of the IoT focus to date has been on consumer use cases such as wrist-mounted heart and blood pressure monitors, smart thermostats, and connected cars. While consumer use cases represent an important part of the IoT landscape, there's an increasing focus on the use of IoT in the enterprise realm as a driver of growth and transformation across a wide swath of industries. Manufacturers are using IoT to monitor their equipment and optimize their scheduling of predictive and preventive maintenance. Transportation companies are using IoT to capture and analyze fleet usage and driver performance to transform their fleet management practices. Retailers are using IoT to deliver personalized apparel recommendations to their customers. That's just scratching the surface.

FIGURE 1

Worldwide Internet of Things Installed Base, 2014-2020



Source: *Worldwide Internet of Things Forecast, 2015-2020* (IDC #256397, May 2015)

The shift, which reflects both the maturation and the evolution of IoT's enabling technologies such as cloud, mobile, and analytics, is also evidenced by IDC's research on IoT spending sentiment. In IDC's 2014 *Global IoT Decision Maker Survey,* 46% of respondents said they expected the enterprise sector to be the main driver of IoT spending compared with 47% that expected the consumer sector to be the main driver of IoT spending. Those numbers shifted significantly in the 2015 follow-up study, with 53% of decision makers pointing to enterprise as the likely growth hot spot.

An even more significant insight into the decision-maker mindset relates to the perceived competitive importance of IoT within enterprises. In the 2015 survey, 24% of respondents deemed IoT transformational to their enterprise, up from 21% the year before. Roughly 60% of companies called IoT strategic to their companies' future. So what's the takeaway? As IoT has matured and evolved, more enterprises are embracing its strategic and transformational value. And that's changing the expectation among both IT and line-of-business (LOB) decision makers of what IoT can do for their companies.

Although enterprises' adoption plans for IoT are driven by a variety of business goals, the desire to increase productivity stands out as particularly important, at 14.4% of respondents (see Figure 2). Other important business goals include faster time to market (11.3%), process automation (11.1%), and the desire to reduce costs and speed up decision making (9.9% each). These operational metrics have historically been of most interest to the business process owners within the lines of business. Mirroring a broader trend in enterprise technology decision making, the LOBs – whose roles are intrinsically tied to the fundamental challenges facing their businesses – are emerging as the principal drivers behind IoT initiatives.

FIGURE 2

Top Influences Driving Adoption of IoT, 2015

Q. What is the top factor that influenced/will influence your organization's decision to create a strategy or an investment in a connected sensor, system, or product solution?

n = 1,971

Source: IDC's *Global IoT Decision Maker Survey,* 2015

The scenarios that show how IoT initiatives specifically lead to business outcomes naturally depend on the unique business models and process flows of different industries. In a manufacturing environment, for example, IoT can drive increased productivity by monitoring and analyzing machine wear and tear, thereby

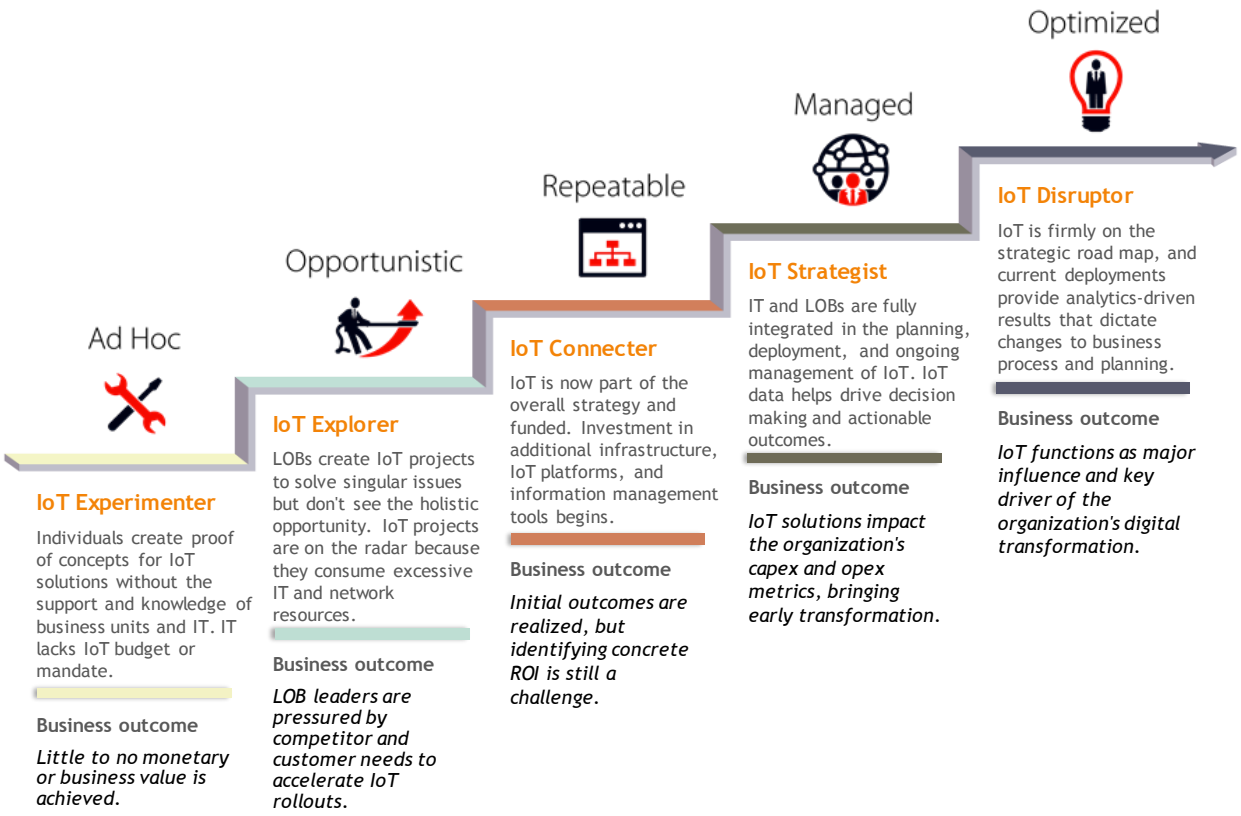
reducing the incidence of unplanned production line shutdowns. By comparison, a utility can use IoT to track crew locations and remote parts inventories to more efficiently dispatch technicians in the field, enabling them to tackle more jobs and waste less time driving around. In both cases, the use of instrumented devices provides visibility into operational data – including real-time insights into high-velocity streaming data – that had been invisible before, leading to better, faster, and proactive decision making.

The promise of IoT isn't limited to improving and speeding up existing decision-making processes. It's also in IoT's ability to support an altogether new level of decision making by providing enterprises with insights into situations that had never been observable before. Indeed, many companies today don't even realize the potential insights they could get from analyzing high-velocity data. IDC believes that this broadly defined use case will become an increasingly important driver of IT adoption as the technology continues to mature.

This raises the issue of how best to delineate the stages of IoT adoption such that companies can have a framework for mapping their own state of IoT maturity. IDC's research on IoT adoption patterns led to the creation of a maturity model known as the IDC MaturityScape for the Internet of Things. As outlined in Figure 3, the IDC MaturityScape model provides a fairly comprehensive framework for mapping a company's IoT adoption that incorporates factors such as IoT implementation scope, the state of internal funding, and the extent and nature of business results achieved.

FIGURE 3

IDC's IoT MaturityScape Stage Overview



Source: *IDC MaturityScape: Internet of Things* (IDC #259374, October 2015)

In addition to identifying how your business fits within the IDC MaturityScape, it is also important to identify how you can phase your IoT deployment to align with your organization's readiness, maturity, and budget to ensure objectives are achievable and the resulting outcomes deliver business value. The following outline identifies three phases, each of which can be deployed in a few months, delivering increasing levels of value:

- **Connecting devices and assets** to gather data, enable remote monitoring, and use big data and analytics for business-level validation
- **Applying real-time and predictive analytics and machine learning** to detect notifiable events from the high volumes of data to enable proactive decision making, driving improvements in product quality and service levels
- **Achieving service excellence** whereby IoT data is fully integrated and blended into enterprise processes and applications to enable new product and service offerings with a differentiated customer experience

A key takeaway is that just as there is no single prescriptive model for companies to adopt, grow, and mature IoT technology, there's no single way for companies to apply it based on their own situation. The general value of such models is that they can help companies establish their organizational readiness and engage with IoT in achievable steps of value. What both models *do* have in common is a focus on demonstrating business value as early as possible. While it's impossible to catalog all the pathways to business value in this white paper, certain use cases stand out as being particularly valuable exemplars of the goals, challenges, and key requirements of successful IoT implementations.

Use Case 1: Production Optimization in Discrete Manufacturing

- **Business problem/goal:** This manufacturer of diesel engines, filters, and other components — products that are embedded within trucks, locomotives, and heavy equipment — captures operational data from attached sensors. Its aim was to aggregate all these sensor readings into a big data repository to come up with predictive insights on when engines should be serviced. It also sought to identify patterns within this operational data that could help engineers in the design of their future engine products.
- **The IoT solution:** The diesel engine manufacturer created a telemetry-based IoT analytics system that stores engine performance and service data in the cloud and uses advanced algorithms to predictively diagnose engine problems in the form of fault codes. By analyzing its fault codes in real time based on data gathered from sensors in the field, the manufacturer can more rapidly create patches and fixes for engine software and manufacturing production.
- **The IoT benefit:** The actionable outcome of IoT big data and analytics is twofold. First, the solution enabled the diesel manufacturer to reduce the amount of time required to capture and analyze engine fault data to perform engine calibrations by more than 80%. Second, the solution significantly improved the quality of the company's embedded engine software, which had a direct impact on the company's market share.

Use Case 2: Product Quality Optimization in Process Manufacturing

- **Business problem/goal:** This pharmaceutical manufacturer follows a complex set of processes that are subject to extremely small tolerances. If the process goes wrong at any stage — either because of improper machine settings or production line temperatures — batches of drugs can be rendered unusable, thereby keeping the company from bringing them to market. The business goal of the company is to increase production yield by improving production quality control.

- **The IoT solution:** The pharmaceutical manufacturer uses equipment-mounted sensors to capture real-time machine settings and temperatures along its production line and stores the data for analysis. The data is supplemented by additional production data, extracted from enterprise resource planning (ERP) systems, such as maintenance schedules, historical production yields, and supplier shipment data — the latter reflecting the fact that quality problems could have originated with the supplier. Production engineers then run IoT analytics on the data to isolate the source of the problem.
- **The IoT benefit:** The actionable outcome is that IoT shortens the cycle for conducting fault investigation by more than 90%, which in turn enables far faster problem correction. The immediate business benefit is that IoT improved production yield by reducing unscheduled production downtime while reducing wastage and thus improving the bottom line. The extended business benefit of IoT here is that it lays the foundation for predictive maintenance, which enables production staff to keep the problem from ever happening in the first place. The ability to detect production problems early also helps minimize the risk of defective products entering the marketplace and the potentially large costs — in money and reputation — that can entail.

Use Case 3: Fleet Management Optimization in Logistics

- **Business problem/goal:** This rural energy services provider needs to optimize on two levels: first, to dispatch its drivers to perform deliveries, and second, for its technicians to perform scheduled and unscheduled repairs to heating, ventilation, and air-conditioning (HVAC) systems. This requires the company to balance the logistics associated with its trucks, parts, and personnel. Its business goals are to minimize so-called deadhead mileage — the movement of fleet vehicles in nonrevenue mode for sheer logistical reasons — and the travel downtime for personnel.
- **The IoT solution:** The energy services provider uses onboard sensors to track the location of its service vehicles and RFID to track the location of parts both in local warehouses and on service vehicles. The provider also uses sensors to remotely diagnose various functional parameters for its customers' HVAC systems. The IoT solution, which is integrated with the provider's dispatching application, uses IoT analytics algorithms to assign crews and vehicles based on their geographic location. When the central dispatching department detects an impending malfunction from remote sensor readings, the IoT solution automatically generates a service ticket and uses an algorithm to determine the field service team to which it should be assigned. In addition to the physical proximity to the job site, the algorithm also takes into account which trucks are carrying the parts needed to complete the job as well as parts located in nearby warehouses. Last, the dispatch algorithm can even determine when it makes sense for crews to perform a scheduled job early because they're "in the neighborhood."
- **The IoT benefit:** The actionable outcome is that IoT algorithms enable the energy services provider to maximize the utilization of its fleet and personnel. The immediate benefit is that it reduces nonrevenue travel time and the resulting fuel costs by more than 40% and enables the company to get the job done with fewer fleet vehicles. The extended benefit is that the provider can analyze data related to repair histories and installed base locations to look for patterns and insights that can be used to optimize service and maintenance schedules, route structures, parts inventory levels within warehouses, and parts ordering.

As the diversity of these use cases suggests, the mix of factors that define successful IoT implementations varies considerably — by industry, business model, and company-specific factors — and the potential paths to successful deployments are many.

FUTURE OUTLOOK

The preceding examples illustrate how the building blocks of IoT — specifically the combination of analytics and cloud — are helping establish the foundation for business transformation by presenting C-level decision makers with timely and concrete business outcomes. As IoT technology has begun to mature and the proof points have multiplied, IT and line-of-business executives have placed IoT in the top tier of their technology agendas, recognizing it as a strategic imperative to drive growth, improve productivity, and reduce costs. If the path to derive business value from IoT is a journey, connected devices are only the beginning. The key to a successful IoT strategy is to put in place the foundational elements required to get IoT going, from a clear business case and executive sponsorship to the means to analyze and ultimately act on IoT data.

IDC believes that enterprises at various stages of adoption — from contemplation to early implementation and beyond — need to recognize that the benefits of IoT don't come on the heels of a "big bang–style" rollout. They need to be generated early in the journey, and incrementally, for the business case to work. And while there is no single ideal model for putting in place an effective IoT strategy, all approaches need to reflect the overriding importance of shortening the span between data capture and business actions.

For all the data that is generated by instrumented devices, sensors, and the like, only a small share — roughly 1% — is currently acted on. Much of the data lies buried in spreadsheets and isolated databases that put it largely outside the reach of analytics and actionability. For the benefits of IoT to be realized, data needs to be where IT can do the most good: This can mean in centralized repositories where big data and analytics can be applied to extract insights that support business decision making, such as the optimization of transit schedules for a city or the analysis of weather data to support local flood warnings.

But in a lot of cases, the ideal place for IoT analytics is in close proximity to the applications and processes it can affect. On a factory floor, for example, production plans need to continually reflect what's going on in real time, whether unscheduled maintenance for a piece of equipment, a late raw materials shipment, or unacceptable deviations in product quality. In such cases, the ideal IoT solution keeps the analysis of these production and supply chain "events" as close as possible to the processes on which it can have an immediate impact, not in a distant data repository. This implies that the most effective way to capitalize on the analysis of this "data in motion" is to integrate it into enterprise applications, such as enterprise resource planning and supply chain planning.

Recent IDC research shows that enterprises are beginning to embrace the idea of moving more of the processing of IoT sensor data from centralized repositories in the datacenter to the edge of the enterprise. The share of companies that said they plan to centralize their IoT sensor data storage — rather than process the data in place or at the edge — fell from 53% in 2014 to 46% in 2015 (see Figure 4). IDC believes that this apparent shift in mindset, toward moving IoT data processing to the edge, reflects the growing realization that real-time business process impacts — the source from which companies derive real business value — require proximity to and integration with core applications. The projected explosion in the volume of data generated by instrumented devices also favors a move to the network edge to avoid datacenter bottlenecks that could threaten to degrade the performance of IoT-enabled applications.

Ultimately, however, IoT analytics is increasingly about *both* centralized and edge processing. It's less an either-or proposition than a continuum ranging from big data-type analytics — aimed, for example, at pattern seeking from large amounts of historical business or customer data — to streaming analytics of

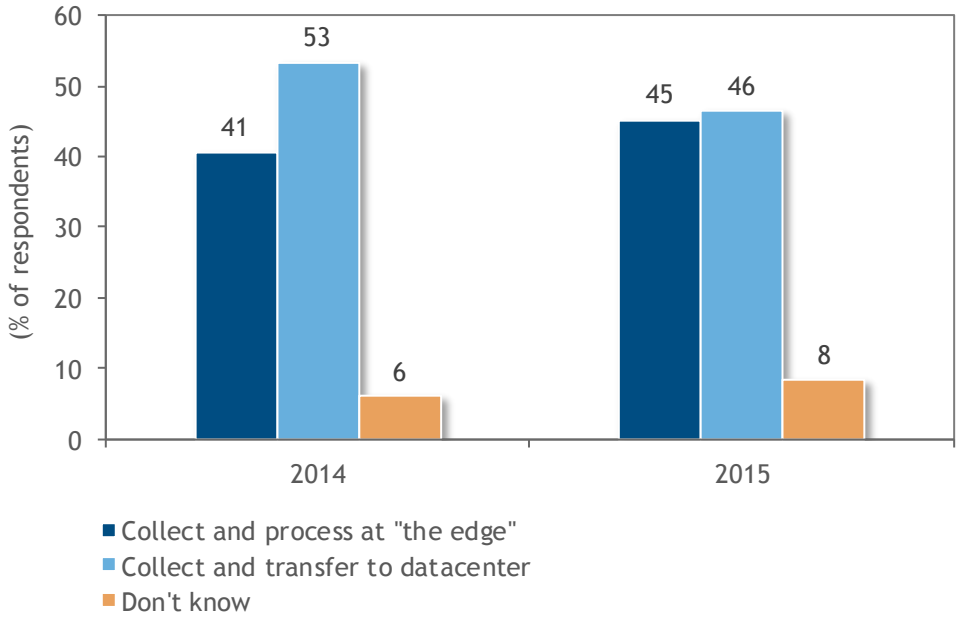
data in motion, such as real-time sensor readings. Machine learning fits squarely along this continuum because it performs a function that's central to the viability of IoT: the ability to filter through the enormous volumes of data to sift the signal from the noise and thus help companies condense it down to what matters.

In many cases, companies deploying sophisticated IoT solutions will require each of these analytical capabilities. For instance, quality control in process manufacturing requires the ability to not only detect slight production deviations as they occur but also, just as importantly, analyze the huge amounts of production data to understand which patterns indicate or predict production issues.

FIGURE 4

Plans for Managing IoT Sensor Data, 2014 and 2015

Q. How will your organization manage data generated by IoT sensors?



n = 2,350 (2015)

Source: IDC's *Global IoT Decision Maker Surveys,* 2014 and 2015

To handle the huge and ever-growing volume of data generated by IoT-enabled devices, companies will need access to powerful data-processing capability that can be provisioned rapidly, flexibly, and at low cost. For companies just starting out in IoT, flexibility and low cost are especially important. They see fixed, up-front costs as something to avoid while needing the capacity to scale up from perhaps hundreds of IoT devices at the outset to tens of thousands over time. That's why IDC sees cloud computing platforms as being integral to the development and adoption of IoT going forward.

CHALLENGES/OPPORTUNITIES

IDC believes that the rise of IoT is as inexorable as the factors that are driving it, including an explosion in the number of connected devices and the accelerating growth of mobile computing, cloud services, big data and analytics, and social networking. For companies embracing it, IoT holds the promise of a whole new level of business transformation, a range of new market opportunities, and a fresh source of competitive advantage. While IoT is a journey, companies can shorten the path to achieving measurable business value by adapting their strategies and solutions to reflect the opportunities and challenges surrounding IoT adoption.

Opportunities

Shortening the divide between streaming IoT data and business applications helps unleash the benefits of real-time analytics:

- **Facilitate integration.** Simplifying integration between cloud-based analytics and cloud- and premise-based business applications enables insights from IoT data to be put to work faster.
- **Enable process optimization.** Tighter integration enables more advanced process optimization involving multiple processes and systems. For example, when a sensor detects a remote equipment failure, it automatically creates a service ticket in the service cloud and uses mobile notification to alert a service technician in the field.
- **Move to predictive analytics.** Predictive analytics and practices represent the apotheosis of real-time IoT data integration, with asset management the ideal proving ground.

Challenges

Overcoming security challenges and reducing time to value will be essential to building support for IoT initiatives:

- **Enterprise security.** Companies recognize that the growth of IoT adoption is predicated on adequate security at all levels – endpoint, identity and access management, Web, messaging, network, and security and vulnerability management. In IDC's 2015 *Global IoT Decision Maker Survey,* nearly 30% of respondents listed security as a potential barrier to adoption in their companies.
- **Top-level support.** Significant IoT initiatives will typically require the strong support of C-level executives, and the surest way to achieve that support is to deliver quantifiable business value sooner rather than later. The business case – as well as the IoT deployment strategy – should reflect the need to minimize time to value.
- **Where to start.** To many companies considering IoT, the perceived scale – in devices, infrastructure, and integration – can be daunting, especially in terms of the potential for large up-front costs. Overcoming it means getting decision makers to understand how cloud changes the equation by providing low-cost access to processing resources that can be scaled up or down as demand dictates.
- **Organizational readiness.** IoT often leads to a convergence between operational technology (OT) and information technology (IT), especially at the edge of the network. Organizational structures may need to be adapted to reflect the increasing overlap between OT and IT, including potential changes in governance structures.
- **The need for scale.** The vast majority of enterprise systems have not been designed or built to accommodate the vast quantities of streaming data produced by connected and instrumented devices. This implies that many companies seeking to adopt IoT should be looking to utilize IoT platforms that help handle the vast quantities of streaming data.

Getting an IoT Foothold Through Existing Applications

IDC believes that for companies seeking to shorten their time to value for IoT, one of the most effective near-term strategies is to focus on those existing business applications that can be most rapidly and cost effectively integrated with cloud-based services. This notion is an important element of Oracle's IoT go-to-market strategy. In the discrete manufacturing, logistics, and transportation markets, for instance, Oracle has a very large customer base using its enterprise software products, such as JD Edwards and Oracle E-Business Suite. To make it easier for these customers to adopt IoT, Oracle designed its cloud-based IoT solutions with "prebuilt" integration into these enterprise applications. In addition to simplifying IoT deployments in manufacturing, logistics, and transportation, as well as a wide range of other industry segments, this approach is envisioned as a way to enable Oracle customers to reduce their time to value.

Another key element of Oracle's IoT strategy is its dual focus on real-time event processing and big data and analytics, capabilities that will become increasingly complementary as companies move further along the IoT maturity cycle. Within the Oracle IoT solution, the streaming analytics capabilities perform the real-time analysis of high-velocity data, including functions such as filtering, aggregation, correlation, and pattern matching. To minimize the latency of such transactions and maximize the value of the data, the Oracle solution can perform the analysis necessary to generate timely action at the gateway level, before it goes to back-end enterprise infrastructure. As such, the Oracle solution performs the value-enabling analysis as close to the data source as possible.

In the realm of big data and analytics, Oracle has a wide range of tools for business analytics, discovery, and in-database analytics. Oracle's big data management simplifies storage and analysis of diverse data from connected IoT devices. Oracle's other key strength is that the company seamlessly integrates new data in stores such as Hadoop or NoSQL with existing data warehouses.

ESSENTIAL GUIDANCE

While IoT continues to evolve, all the essential pieces are in place for enterprises to start the journey. It's important for companies to take stock of where it makes the most sense to begin, in a way that minimizes time to value. Other key recommendations include:

- **Start small, think big.** Early IoT initiatives should focus on smaller-scale projects – the low-hanging fruit within the business – where cloud-based analytics services can be quickly integrated with existing premise-based or SaaS applications.
- **Build support with early proof points.** Build a track record of generating IoT business value early to support the business case for expansion. Target a time to value of less than three months, rather than the more typical six- to nine-month horizon.
- **Shorten development cycles.** IoT development needs to be rapid, iterative, and adaptive, with a strong connection to, and community interaction with, the user base to enable continuous alignment with end-user expectations.
- **Capitalize on the complementary.** Initiatives such as big data and cloud implementations shouldn't be thought of as competing priorities; rather, they should be considered complementary priorities. Project planning, resource alignment, and business cases need to reflect this.

About IDC

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