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Unlocking the Promise of a Connected World: Using the Cloud to Enable the Internet of Things

How Smart Firms Are Gaining New Value from Device Data

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A Synergistic Pairing: Cloud Computing and the Internet of Things

Just about anybody who lives in the developed world has heard tales of a future in which every*body* and every*thing* will be linked by a vast interconnected system that represents the nexus of the physical and digital universes. Today, that future has arrived, and it's called the Internet of Things (IoT)*.* With Gartner predicting the number of connected things to reach 25 billion by 2020—and most analysts projecting the economic value derived from the system to be well into the trillions by then—the Internet of Things conveys enormous potential.[2] The trick comes in unlocking that potential.

With billions of sensors on millions of devices collecting information on everything from automobile performance to energy use, crop development, calories burned, and just about anything else one might want to measure, the IoT contains more information about the world around us than we've ever had access to before. The trouble is, this new wave of big data is coming from a multitude of devices and systems, and at a volume and velocity—not to mention range of data types—never seen before. To derive value from it all, enterprises need not only to collect this data but also to secure, analyze, and integrate it with enterprise applications and processes. Only then can organizations begin to realize the efficiencies, opportunities, reductions in cost, and improvements in products and customer service promised by the IoT. As you can see from Figure 1, that promise is already proving to be enormous.
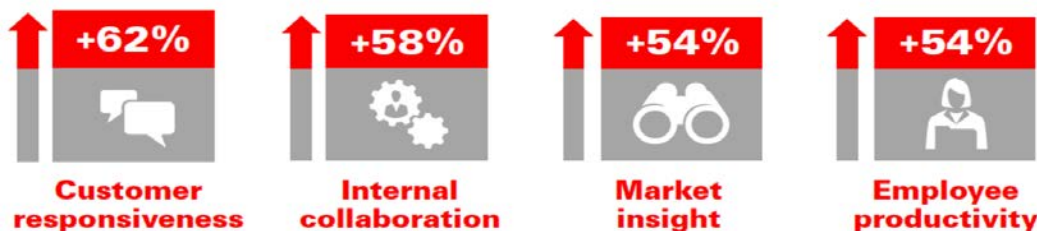
Figure 1. In the 2014 *Harvard Business Review* report "Internet of Things: Science Fiction or Business Fact?" global early adopters of the IoT were surveyed about their experiences. The majority pointed to tangible improvements in a variety of areas.

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1 "The IoT Revolution Promises New Challenges for IT"; May 14, 2015; http://www.cio.com/article/2922897/cloud-computing/the-iot-revolution-promises-new-challenges-for-it.html.

2 "Gartner Says 4.9 Billion Connected 'Things' Will Be in Use in 2015"; November 11, 2014; http://www.gartner.com/newsroom/id/2905717.
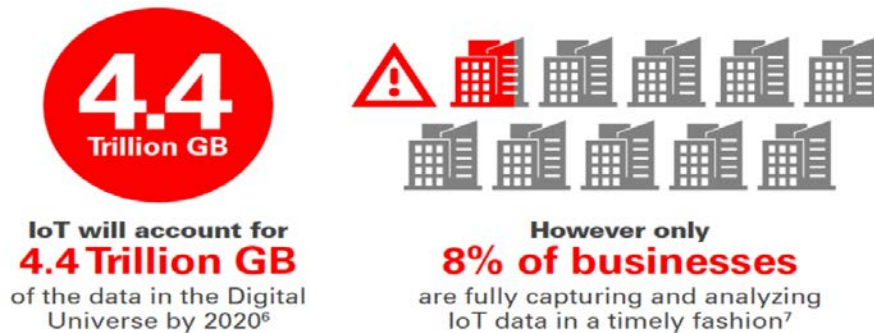
To tap into all that potential, organizations need a base from which to implement and deploy the IoT— a scalable, secure platform where data can be acquired and managed according to standards, integrated throughout the business, and analyzed and acted upon to improve operations and service. What's more, all devices must work together and be integrated with all other devices, and they must communicate seamlessly with all connected systems and infrastructure.

If you think this sounds like a big task—and a costly one at that—you might be right … but only in part. This is because in parallel with the emergence of the IoT, there has been a rapid shift to cloud-based computing. And the companies that are turning to the cloud to enable the IoT are finding that they can get up and running fast with a scalable platform as a service (PaaS) that lowers the cost of entry, leads to better resource utilization, and provides the agility required to accelerate innovation and get ahead of the competition. In other words, with a little help from the cloud, the IoT need not be so complex and costly after all.

Read on to find out how a cloud-based approach to the IoT can help eliminate the challenges and accelerate the benefits of this new technology paradigm.

First the Promise …

As the IoT has coalesced in recent years, at least half of the activity stemming from the new system has focused on four major areas: manufacturing, transportation, smart cities, and consumer devices.[3] Now, however, that picture is expanding.[4] With the number of sensors and connected devices growing exponentially—and the concept of IoT finally taking hold with line-of-business leaders and technologists alike—the new consensus is that within five years *all* industries will have rolled out IoT initiatives.[5]

4.4 Trillion GB

IoT will account for **4.4 Trillion GB** of the data in the Digital Universe by 2020[6]

However only **8% of businesses** are fully capturing and analyzing IoT data in a timely fashion[7]

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3 IDC press release: "IDC Reveals Worldwide Internet of Things Predictions for 2015"; December 3, 2014; https://www.idc.com/getdoc.jsp?containerId=prUS25291514.

4 Ibid.

5 Ibid.

6 EMC, "The Digital Universe of Opportunities: Rich Data and the Increasing Value of the Internet of Things," 2014.

7 Dimensional Research, "Internet of Things Meets Big Data and Analytics—a Survey of IoT Stakeholders," sponsored by ParStream, 2015.

And it's no wonder: the promise of all this data is nearly boundless. To get an idea of this, consider the following:

» A sporting goods manufacturer could put sensors in its rackets and bats to let athletes track and analyze ball speed, spin, and impact location to improve performance.

» A grocery chain could use Internet of Things data to monitor produce shipments—determining temperature, light exposure, and how much jostling its fruits and vegetables undergo en route to supermarket shelves.

» A boutique hotel could use Internet of Things data to track customer behavior, tailor services, and increase loyalty.

» A carmaker could install monitors in its vehicles so that the car itself could alert the driver when the tires need rotating or other routine maintenance is required, and then schedule an appointment with the dealership.

These examples represent just the tip of the iceberg in terms of the ways businesses are differentiating themselves with IoT. The point is if there's something that can be tracked or monitored via sensors to yield actionable data, chances are someone is already working on doing so via the IoT.

"Business leaders should elevate discussions from the 'Internet of Things' to the power of ambient computing by finding a concrete business problem to explore, measurably proving the value, and laying the foundation to leverage the new machine age for true business disruption."

"AMBIENT COMPUTING: PUTTING THE INTERNET OF THINGS TO WORK"
TECH TRENDS 2015 THE FUSION OF BUSINESS AND IT, DELOITTE UNIVERSITY PRESS

Then the Challenge …

So why is it, then, that only a fraction of businesses are fully capturing and analyzing their Internet of Things data? (See Figure 2.) A recent survey of digital marketers—nearly half of which are already taking advantage of IoT data—may point to some reasons. When asked to name the biggest impediments to IoT-based digital marketing programs, 40 percent of respondents cited the cost of implementing such programs; 21 percent cited a lack of executive support; and 20 percent cited a dearth of technical skills in-house.[6]

To deliver new (or improved) products and services based on the info and insight delivered by the IoT, many enterprises will need to re-evaluate both their business and their market. For some, this could mean fundamentally changing the way they do business—shifting from a transaction-based focus to a service-based relationship with customers. This is big stuff, and it involves buy-in from every level of the business.

To begin the process, organizations need to identify the *business value* of the IoT—in other words, will IoT data be used to reduce costs? Drive efficiency? Create new services? Once organizations have figured out this part of the equation, they can get down to the nitty-gritty of designing a flexible, standards-based IoT program that can scale with their business needs, incorporate data from the latest devices, integrate with their existing environment, and provide a platform for blending, enriching, and analyzing all the data collected. No big deal, right?

Wrong. It *is* a big deal, and unless organizations take the long view and go in with their eyes open to some of the obstacles to achieving the promise of the IoT, they are likely to fall short in their first attempts. The following section outlines some of the challenges associated with implementing an IoT platform—so that you can see how deploying that platform from the cloud can address them all.

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8 Channel Partners press release: "Big Data, IoT, Cloud Confidence Growing in Digital Marketing'"; July 28, 2015;

http://www.channelpartnersonline.com/news/2015/07/big-data-iot-cloud-confidence-growing-in-digital-marketing.aspx.

Scalability

The first thing to remember about the IoT is that it's not static. With devices and data proliferating at lightning speed, it's important to outline a growth strategy for your IoT solution that can accommodate that explosion, plus take into consideration the varying nature and velocity of that data. Perhaps the most challenging aspect of this is coming up with a platform for IoT development that can scale as needed and provide the elasticity required to handle the sudden (and often-unanticipated) spikes in loads that IoT data can trigger—without overwhelming budgets or workers. Ideally, an agile, iterative process to IoT development will enable the most-important items to be built and delivered early, with user feedback gathered along the way—in the process, keeping costs low. Outside of a cloud environment, however, this is difficult. The problem is, many existing infrastructures and back-end systems can't scale to support this type of development, much less allow you to seamlessly add devices to or remove them from the environment in real time; keep multiple environments secure, patched, and stable; decommission infrastructure without interrupting user activity; and pay only for what you use. The right cloud platform, on the other hand, can flex to meet your demands—supporting all of this and more.

Integration

You've got the devices. You've got the sensors. And now you've got the data—masses and masses of IoT data. However, until you start integrating that data with your existing applications and business processes, you're not gaining any value. And that kind of integration, unfortunately, can represent an enormous—and costly—undertaking if disparate devices and data are distributed across your physical and virtual environments but unable to communicate with one another. Once again, the right cloud platform can remove this obstacle by allowing you to connect existing sensors and devices to powerful analytics and business intelligence engines in the cloud so that you can get the right data into your back-end applications—at the right time—to make better business decisions faster.

Development and Deployment

It's fine to talk about business agility and the need to scale your IoT platform to grow with your business, but for many organizations just deploying an IoT solution represents a huge hurdle. This is not surprising when you consider that approximately 50 percent of companies will be forced to adapt their IT networks to accommodate immense increases in IoT data traffic, and that 1 in 10 companies simply will not be able to deal with the enormous wave of data predicted to form over the next three years, due to inadequate modernization and adaption of company networks.[7] And the challenges don't stop with the network or the numerous devices and communications protocols it must accommodate. With new IoT applications being developed at a furious rate, organizations need to be able to configure, update, and deploy them to their dispersed infrastructures at a similar rate. And they need to have all the middleware, databases, systems integration, and data management capabilities in place to facilitate this. The problem: This can add up to a great deal of infrastructure and cost—not to mention a huge drain on your IT staff. Yet without such an IoT platform in place, you forego the rapid innovation that comes with the ability to experiment with, collaborate on, and continuously improve your IoT solution. Only a cloud-based approach to the IoT—in which test environments can be spun up and decommissioned at will (and without additional capital outlay)—can facilitate the fast time to proof of concept needed to determine viability and value in today's connected enterprise.

9 IDC press release: "IDC Reveals Worldwide Internet of Things Predictions for 2015"; December 3, 2014;
https://www.idc.com/getdoc.jsp?containerId=prUS25291514.

Security

A world of newly connected devices at the edge of the network collecting a mountain of previously untapped data makes the ever-present threat of data breaches even more acute in the era brought about by the IoT. Indeed, with 2,122 data breaches across the globe resulting in 700 million compromised records for a cost of US$400 million in 2014 (according to Verizon's 2015 "Data Breach Investigations Report"), it's easy to see why security is a top-of-mind issue for every organization. All IoT data needs to remain secure, unchanged, and persistent at each stage of its existence—it's as simple as that. What's not simple is ensuring this in your network and communication infrastructure, back-end analytics, and database servers. Whether you deploy your IoT platform on premises or in the cloud, you need the expertise to remain abreast of the latest security issues and the skills to diffuse all of them. You must also be able to manage end-to-end security for data encryption and for user and device authentication.

And Finally, the Solution: A Cloud-Based Approach to the Internet of Things

There's a reason IDC predicts that within five years more than 90 percent of all IoT data will be processed by cloud service providers, and it all boils down to one word: *flexibility.*[8] Enterprises need an IT infrastructure that's flexible enough not just to deal with the wide range of sources and formats introduced by the IoT, but also to facilitate the service provider collaboration and joint development roadmaps IoT business models require. Only the cloud can offer this kind of flexibility.

To understand why this is the case, one only needs to look as far as the benefits the cloud has already delivered in other environments—namely lower development costs, less maintenance overhead, improved operational efficiency, and the ability to add and subtract new devices and data streams as needed to deliver a global, nimble solution base. Dig a little deeper, though, and you'll see that the cloud also addresses—and resolves—each of the previously described challenges associated with implementing the IoT in your business.

Scale with Ease

Freed from the physical constraints of on-premises environments—and the capital expenses associated with purchasing and maintaining the equipment therein—the cloud offers the perfect platform for IoT development and deployment. As organizations feel their way into the IoT, the cloud allows them to start small. Enterprises can purchase the cloud resources they need *when* they need them through subscriptions that are defined by service-level agreements (SLAs). They can then ramp up or down as needed—an essential ingredient given that the hundred or so connected devices an enterprise might need today could easily turn into tens of thousands in the not-too-distant future. These kinds of economies make the cloud uniquely suited to handle not just the anticipated onslaught of connected IoT devices but also the occasional spikes in data volume and velocity generated by them—*without* building out physical infrastructure that would at other times go unused. With the cloud provider covering power, cooling, and telecommunications costs—not to mention doing the heavy lifting of managing and maintaining the environment—enterprises pay for exactly what they need. As a result, they get optimized and flexible options for storage, analytics, communication, and enterprise integration on a cloud-based IoT platform that will grow to fit their business needs.

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10 IDC press release: "IDC Reveals Worldwide Internet of Things Predictions for 2015"; December 3, 2014;

https://www.idc.com/getdoc.jsp?containerId=prUS25291514.

"We believe IoT data will be created from a wide range of sources and data formats. As such, the better IoT solutions that have greater business values will have to integrate and process data from different repositories. Cloud computing providers will be better suited to this activity, rather than IT attempting to run it on premise or in a private enterprise environment."

VERNON TURNER
SENIOR VICE PRESIDENT, INTERNATIONAL DATA CORP.[8]

Integrate with Simplicity

The sooner organizations can start mixing IoT data with the information contained in their business applications and processes, the sooner they can begin to make good on the promise of the IoT. However, to do so, these applications and processes must be able to communicate seamlessly—whether they reside in the cloud or on premises, and whether they rely on relational data or the unstructured, high-velocity data unleashed by the IoT. The right IoT cloud platform can facilitate this, linking applications and processes through embedded preintegration, expert guidance, easy-to-use interfaces, and the ability to quickly transition deployments between cloud, on-premises, and hybrid environments. As a result, you get an IoT-enabled enterprise that's able to make better business decisions faster and respond to changing market conditions in real time. Simply. Easily. Swiftly. That's the true synergy between the IoT and the cloud.

Develop and Deploy with Speed

You're never going to be able to make good on the potential of your IoT data unless you're able to collect it in real time, integrate it into existing processes, and incorporate it in your customer relationship management (CRM), supply chain management (SCM), and other business-critical systems. Cloud-resident technologies enable this. Not only does the cloud provide an optimal platform for R&D (virtually guaranteeing the shortest time to proof of concept for your IoT applications), it also facilitates the efficient collection, storage, preparation, and analysis of all your data assets. In addition, because cloud providers typically maintain geographically distributed data centers with optimized routing and caching implementations, they're able to offer the best bandwidth and request/response times possible on a global scale. The result is fast, easy development and deployment as providers spin up test environments as needed and then automatically replicate your solution across servers and data centers according to demand. What's more, by building out your IoT solutions in the cloud now, you ensure that you have a scalable solution that will meet growing demands. Add to this the savings gained by IT outsourcing monitoring and support—and the layers of virtualization and elasticity gained (to meet growing and shrinking demand)—and it's clear to see why more and more businesses are looking to the cloud as their platform of choice for IoT deployment.

Secure Data and Devices with the Utmost Confidence

Despite the immense promise of the IoT, everyone from CEOs to customers continue to worry about the privacy of all that information shared across so many so-called "smart devices" and networks. What most people don't know, however, is that by choosing the right cloud provider for your IoT platform, you can go a long way toward alleviating your security woes. For starters, you are putting the security of your data into the hands of experts whose job it is to stay on top of the latest security threats. What's more, the cloud's centralization actually makes it easier to integrate device and user identity into IoT workflows. Finally, existing enterprise identity security can be leveraged to solve

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11 TotalCIO blog: "IDC Prediction for IoT 2015: It's a Doozy"; December 5, 2014; http://itknowledgeexchange.techtarget.com/total-cio/idc-prediction-for-iot-2015-its-a-doozy/.

security issues around authentication, authorization, and access control in a uniform way. For maximum protection, verify that your cloud provider offers the following:

» Guaranteed SLAs
» Physical security and best-in-class facilities with 24/7 environmental monitoring and alerting
» Security accreditations
» Disaster recovery
» Redundant power and networks, and no single points of failure
» Code reviews and third-party vulnerability assessments

With the right cloud provider, your mission-critical application services will have a delivery mechanism you can rely on and that has been validated in the most-demanding environments.

Conclusion

If it's not clear already, it should be: The cloud is where you need to be—not just to deliver your software, platform, and infrastructure as services, but also to make good on the promise of the world of connected devices and enriched data represented by the Internet of Things. Luckily for today's enterprises, Oracle is already there. Having invested billions of dollars in development over the last decade, Oracle offers an enterprise cloud that boasts the broadest collection of cloud services on the market, solutions at every layer of the cloud technology stack, and the ability to move applications and workloads between the cloud and on-premises environments with speed and ease.

Perhaps best of all, Oracle has the knowledge and expertise to help identify and implement a platform for the IoT that allows you to

» **Connect.** Collect data from any device in any market—reliably and securely—and accelerate your time to market with an open, secure, and scalable platform.
» **Analyze.** Perform real-time, big data, and predictive analytics to deliver the enriched enterprise data that enables you to identify new services and improve customer satisfaction.
» **Integrate.** Use open interfaces and preintegrations with Oracle's platform-as-a-service (PaaS) and software-as-a-service (SaaS) offerings to reduce total cost of ownership for IoT data-enriched applications and processes.

To learn more about how Oracle can help you unlock the promise of the Internet of Things, contact your local Oracle sales representative at oraclesales_us@oracle.com.

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