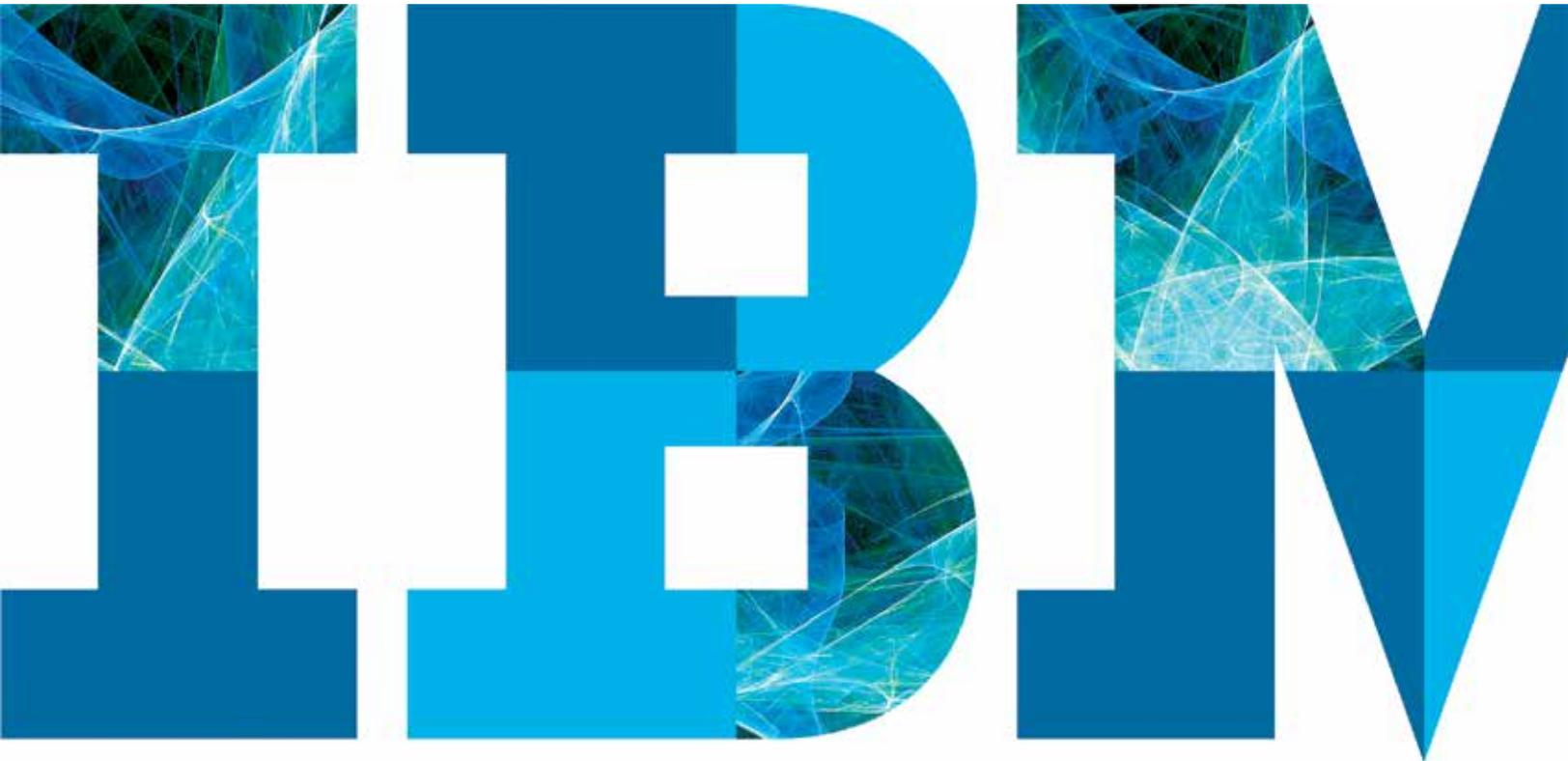


# Deriving business value from the Internet of Things

*Smart steps to take now*



According to Gartner, the **Internet of Things** (IoT) is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment.<sup>1</sup>

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*The Internet of Things is a disruptive force, one that will change business models, technology investments, consumer experiences and everyday life.*

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Today, billions of devices, sensors and chips—many of them simple, everyday objects—can communicate with us and with each other. Hospitals can monitor and regulate pacemakers long distance, factories can automatically address production line issues, and hotels can adjust temperature and lighting according to a guest's preferences, for example.

What's more, the potential applications for IoT are myriad. They include waste management, urban planning, environmental sensing, sustainable urban environments, continuous care, emergency response, social interaction gadgets, intelligent shopping, event management, predictive maintenance—and many others we have not yet imagined.

What is clear is that IoT is a disruptive force, one that will change business models, technology investments, consumer experiences and everyday life. And while we've been hearing about IoT for a while, today the stage is set for IoT to move quickly from hype to reality. Why? One of the primary reasons is the growth of mobile. Using the nearly ubiquitous smartphone or tablet, IoT applications can communicate with humans.

This white paper explores IBM's view of IoT today and our vision of future trends, what makes IoT revolutionary, and the steps you can take now to make sure your business derives the utmost value from IoT.

### **Understand the trend**

While IoT can be the stuff of futuristic fantasies, in reality, IoT will permeate every aspect of how a business operates and how we go about our daily lives. Already, IoT is transforming the way corporations and consumers interact with each other and their environment. Consider connected cars and smart appliances. Or IBM initiatives such as Smarter Planet and Smarter Cities.<sup>2</sup>

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While IoT is not new, it has moved to the forefront due to several converging factors:

- Devices and sensors are becoming smaller and cheaper; they can be powered by batteries that last many years.
- Connectivity is becoming cheaper and more ubiquitous. More than half the households in the US now have WiFi, telecommunications operators are offering economical ways for devices to communicate, and the Internet and the IPv6 protocol are enabling an expansion of communications.
- The proliferation of cloud services and infrastructure can satisfy some of the requirements for low variable cost, simplicity, short time to value, and high scalability.
- Mobility has enabled many IoT applications to use smartphones as the human interface to the machines being controlled and the data being provided. Mobile devices can themselves be used as sensors, and the line between mobile and other devices is blurring as device usage converges.

However, IoT is not just about new devices, productivity improvements or even connectivity. It is about the creation of new insights from all the data that connected devices generate. Consider this: More than three billion people will be using the Internet in the next year or so.<sup>3</sup> And in the near future, many more *things* than people will be using the Internet. All are transmitting data. But the *things* will not live up to their “smart” names unless we can harness analytics to help us find intelligence and insight in the data they are transmitting.

Gleaning wisdom from this intelligence is where your business can benefit. With the IoT trend gaining momentum, now is the time to develop a strategy and ready your infrastructure to take full advantage of the opportunities that lie ahead.



According to IDC, there will be as many as

**28.1 billion**  
IoT units installed by 2020.<sup>4</sup>

### Exploding growth

Over the next 15 years, the number of machines and sensors connected to the Internet will explode. According to IDC, there will be as many as 28.1 billion IoT units installed by 2020.<sup>4</sup> What’s more, IoT offers a huge value-add boost to the global economy: Gartner forecasts US\$1.9 trillion<sup>5</sup>, while IDC projects value-add of more than US\$7 trillion.<sup>4</sup>

Although these projections vary widely, it is clear that the impact is likely to be huge, presenting significant growth opportunities for businesses that take the lead in pursuing them.

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## Connected vehicles

Today's consumers are beginning to expect that the latest products will have IoT functionality built in. This is readily apparent in the automotive world. Today, the connected car is a luxury. Soon, it will become essential. In 2013, 10 percent of the worldwide production of cars was considered to be "connected." That is expected to reach 90 percent by 2020.<sup>6</sup>

The connected car has also created change and growth in other markets, such as insurance and traffic management. For example, SIM cards in cars can communicate data to insurance companies on how a vehicle is being driven or the place and time of an accident. Insurance premiums can then be priced based on driver behavior.

IBM has been working with automotive manufacturers around the world on connected car initiatives. Most recently, IBM has collaborated with Beijing TranswiseWay Information Technology Co. to build the largest connected vehicle platform in China. The cloud-based platform will use advanced analytics for applications that offer real-time, in-vehicle services to mobile devices, such as weather advisories, traffic alerts and alternate route suggestions. Using IBM IoT technologies, including IBM MessageSight, millions of trucks as well as tens

of millions of devices and sensors in vehicles will be connected to the Internet as well as to each other.

PSA Peugeot Citroën plans to use IBM MobileFirst and IBM Big Data and Analytics solutions to deliver new customized services to its automotive customers. This builds upon IBM's previous work with Sprint Velocity and Continental AG to reach the next era of connected cars. The two companies will integrate massive amounts of data from cars, mobile phones, traffic signals and other sources, analyze the data in real time, and then deliver the resulting information about current driving conditions to customers.

IBM MessageSight is an appliance-based messaging server designed to handle very large numbers of connected clients and devices, and to process high volumes of messages with consistent latency. In comparison with most of today's connected car solutions, IBM MessageSight requires low bandwidth and offers the speed and scale necessary for automakers to easily and economically connect maintenance and operational sensors back to dealers, or link mobile devices, security, navigation and locking or unlocking capabilities.

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## Develop a strategy: opportunities and challenges

Harnessing IoT data is about creating systems of insight. Business value is delivered via actionable insights in the physical world. New insights could lead to new sources of revenue, new ways to delight your customers and new markets.

Examples of ways in which IoT systems of insight are creating value include:<sup>7</sup>

- Vastly improved productivity in manufacturing at every stage as supply chain logistics are coordinated
- Smart appliances working with smart electric grids that run themselves or perform their chores after peak loads subside
- Subcutaneous sensors or implanted chips that provide patients' real-time vital signs to medical providers, caretakers and self-trackers
- Remote-control applications that allow monitoring and adjustment of household activities via a user's phone—from controlling appliances to alerting a user or first responder of a potential leak or a fire
- Ubiquitous sensors and GPS readouts that allow for smoother flows of city traffic; warnings and suggestions to commuters about the best way to get around traffic can perhaps be combined with smart alarm clocks synced to owners' eating and commuting habits and daily calendars
- Sensored roadways, buildings, bridges, dams and infrastructure that give regular readings on their state of wear and tear and provide alerts when repairs or upgrades are needed

How can your organization best address this growing wave of interconnected everything? Consider the opportunities and the challenges.

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### What are the opportunities?

Whatever industry or business you are in, IoT will have a profound impact on the direction you take and decisions you make in the coming months and years, ultimately transforming processes, bringing economies of scale and boosting productivity.

In healthcare, for example, hospitals will depend on the ability to use and access expensive test equipment via connected remote devices. They will be able to monitor the health of their patients remotely in their homes and potentially reach a broader number of patients. With the cost of hospital care and in-hospital stays continuing to rise, insurance companies and consumers will demand that these in-home services, facilitated by IoT technology, be made widely available.

Manufacturers of consumer goods and electronics have a tremendous opportunity to design and build functionality into their product set that is already revolutionizing how consumers use and interact with their products. This is an area where IoT can impact the consumer's life and provide a user experience that brings convenience, ease of use and high value to using the products.

Whether it is via a car, a fitness monitor—even a hospital bed—connecting to your customer via IoT is compelling; it provides a way to really understand customer needs and desires.



*“CIOs must embrace and help lead this [IoT] transformation. Doing so will require novel approaches and radical new thinking combined with unwavering attention to operational performance.”<sup>8</sup>*

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### **What are the challenges?**

As with anything new, there are challenges. Often, the biggest challenge is simply not knowing what we need to learn.

**Complexity of technologies.** IoT will disrupt traditional business processes. It will also impose new technology requirements including high scalability, real-time processing and continuous availability. Today, in the absence of standards, integration among varied components can be a challenge. Cloud-based service platforms can help by reducing time to value and the cost of providing insights, while a skilled integrator can bring the pieces together.

**Security, privacy and public safety.** The proliferation of IoT devices is attracting attackers and malware, with the always on, always connected characteristics of these devices making them perfect targets. The potential for disaster looms even greater, threatening widespread catastrophe and loss of life, as cyber criminals attempt to exploit connected automobiles or personal medical devices. Security must span the entire infrastructure to assure the safety of physical systems, both individual devices that comprise an IoT network and, through intelligent monitoring and management, the entire network.

**Managing and mining the data.** Aren't we already drowning in data? Now IoT will produce even more data, taxing our already complex enterprise information management systems. Massive data volume poses challenges associated with data collection, processing, storage, management and manipulation. Advanced analytics will be needed to provide meaningful insights from the data that connected devices generate. This will also drive new business optimization, delivering new capabilities in support of e-commerce, supply chain and customer experience management. Aggregating all the data and acting on its findings will be best achieved by capturing, analyzing and responding from the cloud.

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*Companies that choose not to incorporate IoT into their products and solutions risk becoming uncompetitive.*

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**Lack of skills to plan and manage.** Business leaders will need to acquire knowledge and develop strategies on how to best incorporate and leverage IoT technology in their IT infrastructure. Organizations will need to develop skills related to IoT, for example how to implement optimized sensor networks or how to deal with the data that connected devices generate. Organizations can also address the skills challenge by tapping into outside expertise.

### Learn about the benefits

Today, certain industries lead in the adoption of IoT. By percentage of total value-add to the global economy projected by 2020, according to Gartner, “the verticals that are leading its adoption are manufacturing (15 percent), healthcare (15 percent) and insurance (11 percent).”<sup>9</sup> In fact, because of the physical devices and types of insights already available, IoT has become mainstream for many industry solutions.

However, IoT concepts and associated benefits affect almost all industries. Cross-industry benefits include: product innovation, new revenue streams, cost savings, optimized supply chain, predictive maintenance and sales, understanding consumer behavior and providing a better consumer experience. Companies that choose not to incorporate IoT into their products and solutions risk becoming uncompetitive.

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Industries that lead in the adoption of IoT, according to Gartner:<sup>9</sup>



**Manufacturing**  
15%



**Healthcare**  
15%



**Insurance**  
11%

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IBM has been playing a leading role in the world of IoT for many years, in many capacities, including our Smarter Planet initiative. We have also helped a number of clients derive value from IoT.

### OhioHealth and IBM: Joining forces to prevent hospital infection

A first-of-a-kind network of wireless sensors coupled with real-time big data analytics that measure hand-washing practices is being used by OhioHealth to aid in the prevention of healthcare-associated infections (HAIs). HAIs affect one in every 20 patients in US healthcare facilities, resulting in 90,000 deaths per year, according to the Centers for Disease Control and Prevention.

The system uses sensors on hospital room washbasins to monitor each hospital staff member who enters the room. The pilot project in Columbus has already achieved more than 90 percent compliance with hand-washing standards, which is a 20 percent jump over previous practices and well above the 50 percent national compliance level.

IBM technology provides OhioHealth's hospital staff with new information and observations that were not available previously. Analyzing hand-washing data gives stakeholders deep insights into the compliance levels of different departments, shifts and job roles, as well as variations based on other social behavioral factors. The real-time information is used to alert hospital personnel when proper hygiene habits are not being followed so that corrective action can be taken to reduce patients' germ exposure.

Hand hygiene is cited as the most effective way to prevent the spread of infection, and hospitals are working aggressively to elevate hand-washing compliance to 100 percent.

### Data-driven agriculture solutions

Agriculture might not be the first place you'd expect to find IoT already at work, but for Georgia's Flint River Partnership, IBM is providing weather-forecasting technology that enables smarter irrigation and water conservation, enhancing water efficiency by up to 20 percent.

The Lower Flint River Basin is the epicenter of agriculture in Georgia, with its 27 counties contributing more than US\$2 billion in farm-based revenue annually to the region's economy. Together with the University of Georgia, IBM will support farmers in making more informed irrigation scheduling decisions to conserve water, improve crop yields and mitigate the impact of future droughts.

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*IoT solutions can help provide a more sustainable approach to agriculture and help meet the need to increase food availability to a growing global population.*

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The solution encompasses IBM Deep Thunder™ precision weather forecasting, offering farmers 24-hour access to critical weather information and relevant field data via mobile devices. SoftLayer®, an IBM company, provides a cloud platform for the management of data that automates irrigation recommendations, allowing farmers to determine how much water a specific crop needs at various stages of its life cycle.

For another agricultural producer, IBM is implementing a precision agricultural electronic system that provides specific inputs for each individual plant, including irrigation, nutrients and more, offering improved crop health and yield.

The USDA estimates that 90 percent of crop losses are due to weather. IoT solutions can help provide a more sustainable approach to agriculture and help meet the need to increase food availability to a growing global population.

### Gain expertise

Opportunities are waiting. To take advantage of them, now is the time to:

- Strategize on how to best make use of IoT in your business
- Prepare and upgrade your infrastructure
- Tap into needed skills and talent
- Enhance existing business processes or develop new ones

IBM can help. We have been involved with and led the development of IoT projects for many years across many industries and applications.



*IBM's thought leadership in mobility and its deep industry knowledge will enable the company to work closely with enterprises to create strategies for driving innovation... [and] competitive differentiation.<sup>10</sup>*

We can play a key role in helping you seize the IoT opportunity—whether it is helping to develop your strategy, implement your solution, or provide ongoing management of your IT infrastructure in support of your IoT business objectives. Here are a few of the services we offer:

**Infrastructure consulting.** IBM experts can advise and assist you on determining your optimal infrastructure strategy for IoT, including clear recommendations and plans for an efficient and security-rich infrastructure design and a roadmap for implementation.

**Application platform services.** We can assist you with the setup and management of your IoT application development platform, either on your premises or in the cloud.

**Network services.** IBM has extensive experience in the design and implementation of high-performance wireless networks to support IoT devices and mobile devices that interface with IoT applications and data. We can help design, implement and manage yours.

**Smart device implementations and rollouts.** We can help you determine the optimal way to incorporate IoT connectivity into your devices by utilizing SIM cards or other types of sensors. We can procure and deploy smart devices for you as a turnkey solution and help you incorporate new technology into your IoT infrastructure as it is developed.

**Device procurement and managed services.** We can provide ongoing monitoring and management of the devices that will be used within your IoT system, including repair and upgrades.

**MessageSight services.** Using IBM MessageSight, we can help you introduce new IoT protocols into your infrastructure, broker data exchange across multiple device types, and optimize the flow of data end-to-end.

**Analytics services.** We can assist you in performing analytics on the massive amount of data produced from IoT devices, correlating it with your back-end infrastructure to derive insights that can help you make better business decisions.

As the IoT evolves, IBM services will evolve to meet your continuing needs. Working jointly with IBM Research, we have engaged in projects that include the use of a new wireless IoT flexible connectivity platform, industry-specific cloud IoT service platforms, and IoT long-range signaling and control services for efficiently connecting IoT devices in a wireless infrastructure.

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### Semtech and IBM offer major distance boost for IoT

A joint solution comprising IBM Research Mote Runner® software and Semtech SX127x with LoRa™ creates an easy-to-use system capable of transmitting data up to a distance of 15 km (9 miles), depending on the environment. This compares with a maximum distance today of between one and two kilometers.

To make wireless sensor networks easier to program and use, IBM Research has developed the Mote Runner software development kit, which provides an open and programmer-friendly platform to connect sensor and actuator motes. The IBM and Semtech sensor platform utilizes Semtech's new LoRa (long range) modulation technology to enable huge range improvements, eliminating the need for repeaters and drastically lowering the cost of deployment. In turn, Semtech hardware requires extremely low power, making it ideal for battery-operated devices.

With demand for longer battery life, low cost, ease of use and longer distances growing as IoT grows, this significant advancement in wireless technology can handle millions of transactions per day, making it an ideal system to easily deploy any number of applications, from smart metering to remotely monitoring train tracks.

IBM Mote Runner has been widely used in a broad range of IoT applications, including monitoring snow accumulation in the Sierra Mountains and measuring air quality in cities. What's more, IBM has leveraged LoRa technology to develop a purpose-made IoT wireless infrastructure solution ideally suited for telecommunications and utility companies wishing to build a wireless infrastructure utility to offer the marketplace.

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## For more information

To learn more about IBM IoT services, contact your IBM marketing representative, IBM Business Partner or visit: [ibm.com/services/mobility](http://ibm.com/services/mobility)

To learn more about IBM's IoT initiatives, visit: [ibm.com/software/info/internet-of-things/#](http://ibm.com/software/info/internet-of-things/#)



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<sup>1</sup> *Gartner, IT Glossary*, [www.gartner.com/it-glossary/internet-of-things/](http://www.gartner.com/it-glossary/internet-of-things/).

<sup>2</sup> *IBM Smarter Planet*, <http://www.ibm.com/smarterplanet/us/en/#/default>; *IBM Smarter Cities*, [http://www.ibm.com/smarterplanet/us/en/smarter\\_cities/overview/](http://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/).

<sup>3</sup> *Internet Live Stats*, <http://www.internetlivestats.com/internet-users/>.

<sup>4</sup> *IDC, Worldwide and Regional Internet of Things (IoT) 2014–2020 Forecast: A Virtuous Circle of Proven Value and Demand*, May 2014, doc. # 248451.

<sup>5</sup> *Gartner, Forecast: The Internet of Things, Worldwide, 2013*, November 18, 2013.

<sup>6</sup> *Press release: GSMA Announces the Business Impact of Connected Devices could be Worth US\$4.5 Trillion in 2020*, February 2012, Machina Research and GSMA.

<sup>7</sup> The Pew Research Center Internet Project and Elon University's Imagining the Internet Center report, March 2014.

<sup>8</sup> *Gartner, Agenda Overview for CIO Research 2014*, January 2014.

<sup>9</sup> *Gartner Press Release, Gartner Says Personal Worlds and the Internet of Everything Are Colliding to Create New Markets*, November 11, 2013.

<sup>10</sup> IDC White Paper, sponsored by IBM, *Four Key Trends Impacting Mobile Infrastructure Strategy*, August 2014, doc. # AZW03004USEN.

