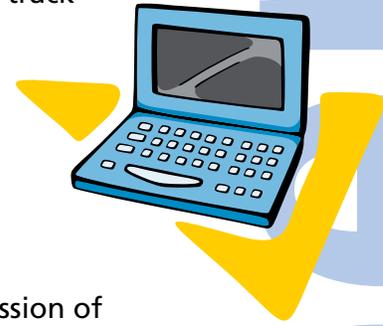


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The Internet of Things

Imagine a world where “smart” is not just limited to cellphones. Imagine, simply ... a smart world. This is a world where just about anything can “talk.” Big things, like bridges and seaports, to small things, like an item of clothing, can track movement and provide data on their uses and their needs. This is our future. And it’s not far away.



The phenomenon of a smart world is known as the Internet of Things (IoT). IoT is defined as “the interconnectivity between things using wireless communication technology to connect objects, locations, animals or people to the Internet, thus allowing for the direct transmission of and seamless sharing of data.”¹ In short, IoT turns traditional thinking about the Internet on its head. In the past, the Internet was about data created by people. Today and into the future, it’s going to be about data created by things.²

IoT is already here with items like Fitbit® and Apple Watch®, and it’s growing rapidly. It is estimated that by 2020, 50 billion smart devices will exist, meaning more things will be connected to the Internet than people.³ It promises to produce big, big data—much larger than the big data we’ve discussed for years.

To put it into perspective, 90 percent of all the data in the world today has been produced in the past two years, most of it generated by machines.⁴ In one small example of this, a business representative who participated in a Federal Trade Commission (FTC) IoT workshop said the company’s home automation device, which is used by less than 10,000 households, generates one piece of data every six seconds.⁵ That means those households collectively produce millions of pieces of data every hour.

IoT opens possibilities for better products, better data and better marketing. It also opens possibilities for privacy, security and data storage concerns. This Blue Paper® will paint a picture of what IoT will look like and which industries may benefit most. It will also describe the benefits and issues that surround IoT, providing businesses with considerations that need to be made, whether they make or use smart products.

¹ Leung, Stuart. “5 Ways the Internet of Things Will Make Marketing Smarter.” *Salesforce Blog*. N.p., 20 Mar. 2014. Web. 27 May 2015.

<https://www.salesforce.com/blog/2014/03/internet-of-things-marketing-impact.html>.

² Tamburini, Diego. “What Does The Internet Of Things Mean For Product Development?” *Industrial Automation Asia*, 4 Feb. 2015. Web. 27 May 2015. <http://www.iaasiaonline.com/index.php/sector-spotlight/item/139-what-does-the-internet-of-things-mean-for-product-development>.

³ Donston-Miller, Debra. “The Internet Of Things Poses New Information Technology Security Challenges.” *Forbes*. *Forbes Magazine*, 2 February 2014. Web. 18 May 2015. <http://www.forbes.com/sites/sungardas/2014/02/25/the-internet-of-things-poses-new-security-challenges/>.

⁴ Asay, Matt. “The Internet Of Things Will Need Millions of Developers By 2020.” *ReadWrite*. N.p., 27 June 2014. Web. 17 June 2015. <http://readwrite.com/2014/06/27/internet-of-things-developers-jobs-opportunity/>.

⁵ *Internet of Things: Privacy & Security in a Connected World*. Federal Trade Commission, Jan. 2015. Web. <https://www.ftc.gov/system/files/documents/reports/federal-trade-commission-staff-report-november-2013-workshop-entitled-internet-things-privacy/150127iotrpt.pdf>.

IoT: Yesterday and tomorrow

IoT traces its roots to 1949 when the bar code was conceived (it would take another three years for the patent).⁶ It wasn't until six years later that the first wearable computer was developed. This cigarette-pack sized device had one purpose: to predict roulette wheels. Tested in Las Vegas, the invention was kept under wraps until 1966.

Other wearable devices that followed had, perhaps, much more purpose. In a 1967 invention, a computer-driven display mounted on eyeglasses helped the hearing impaired read lips. A product we take for granted today—the Universal Product Code (UPC) label—helped clerks ring up grocery purchases for the first time in 1974.⁷

It wasn't until the early 1980s that computers and machines could talk to each other—the real birth of IoT. That's when a Coca-Cola[®] machine at Carnegie Mellon University checked inventory through an Internet connection.⁸ Such uses didn't become practical until it was possible to assign an Internet Protocol (IP) address to things.

The World Wide Web took hold of our work and private lives in the 1990s. It was at that time when technology professor Neil Gershenfeld prophesized that more things than people would use this new technology. Ten years later, technology pioneer Kevin Ashton got credit for first using the term “Internet of Things” in a 1999 presentation.⁹

We know today that what was discussed at the end of the last century now holds true. Jacob Morgan, who writes about the future of work, calls it a perfect storm, leading to true IoT.¹⁰ Internet and smartphone use is up while technology costs are down. At the same time, more items are being built with sensors and wireless Internet capabilities.

Now that we have the ability, the knowledge and the desire, IoT is expected to benefit consumers and businesses with better information and greater efficiencies.



⁶ Press, Gil. “A Very Short History Of The Internet Of Things.” *Forbes*. *Forbes Magazine*, 18 June 2014. Web. 17 June 2015. <<http://www.forbes.com/sites/gilpress/2014/06/18/a-very-short-history-of-the-internet-of-things/>>.

⁷ *Ibid*

⁸ *Ibid*

⁹ *Ibid*

¹⁰ Morgan, Jacob. “A Simple Explanation Of ‘The Internet Of Things’” *Forbes*. *Forbes Magazine*, 13 May 2014. Web. 18 May 2015. <<http://www.forbes.com/sites/jacobmorgan/2014/05/13/simple-explanation-internet-things-that-anyone-can-understand/>>.

Business Insider conducted a study on IoT and found:¹¹

- The mobile device market will more than double between 2015 and 2019, including smartphones, personal computers, tablets, connected cars and wearables combined.
- \$1.7 trillion in value will be added to the global economy by 2019 due to realized IoT efficiencies.
- Government will be the leading IoT sector by 2019.
- Growth in IoT will lead to increased efficiency and lower costs, its two primary benefits. Efficiencies will be gained by giving users control. A caveat is that security will be an issue.
- IoT lacks a common set of standards and regulations.

So, what could the future look like? Here are some possible scenarios:

- You are on your way to a meeting. Your car has access to your calendar and will give you the best route. If you are delayed for any reason, perhaps due to heavy traffic, your car would send a text to the other party to say you will be late.¹²
- Bridge collapses, like Minnesota's 2007 disaster, could be avoided with smart cement that senses cracks and stresses. This cement also could sense icy conditions and then send a warning to your car, instructing you to slow down. If you don't, the car will be smart enough to slow down for you.¹³
- You own a smart home. In the morning, you pop bread in the toaster and turn on the morning television news. A box on your television screen tells you the temperature and asks whether you want to start your car. In the meantime, you receive a text telling you the toast is done and you hear your daughter complain that the shower stopped. That's when you remind her that the showerhead is programmed to run a certain length of time to conserve water.¹⁴



The possibilities are endless. Let's take a look at the industries that are using IoT

¹¹ Greenough, John. "The 'Internet of Things' Will Be the World's Most Massive Device Market and save Companies Billions of Dollars." *Business Insider*. Business Insider, Inc, 14 Apr. 2015. Web. 27 May 2015. <<http://www.businessinsider.com/how-the-internet-of-things-market-will-grow-2014-10>>.

¹² Morgan, Jacob. "A Simple Explanation Of 'The Internet Of Things'" *Forbes*. *Forbes Magazine*, 13 May 2014. Web. 18 May 2015. <<http://www.forbes.com/sites/jacobmorgan/2014/05/13/simple-explanation-internet-things-that-anyone-can-understand/>>.

¹³ Burrus, Daniel. "The Internet of Things Is Far Bigger Than Anyone Realizes." *Wired*. Conde Nast Digital, n.d. Web. 18 May 2015. <<http://www.wired.com/2014/11/the-internet-of-things-bigger/>>.

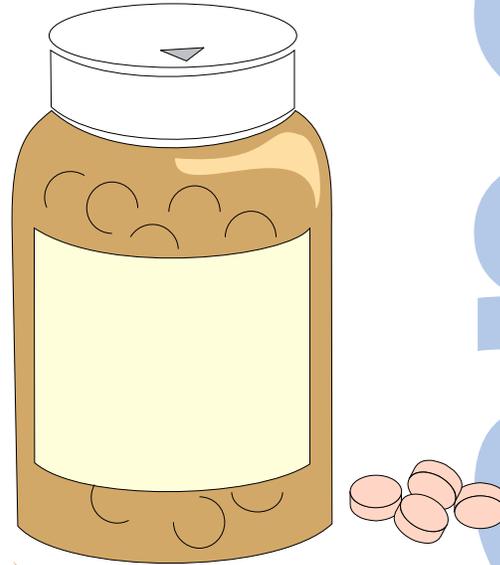
¹⁴ Sweatman, Will. "Ask Hackaday: The Internet of Things and the Coming Age of Big Data." *Hackaday*. Web. 18 May 2015. <<http://hackaday.com/2015/05/18/ask-hackaday-the-internet-of-things-and-the-coming-age-of-big-data/>>.

already and how more could benefit in the very near future.

IoT changing and possibly bettering the world

Agriculture, utilities and healthcare have led to usage of connecting technologies to retrieve data. In agriculture, companies monitor crops in real time to improve the quality and total yield, as well as to use pesticides, fertilizer and water wisely.¹⁵ Utilities are now using smart meters to measure gas and water use.

Great River Medical Center in Davenport, Iowa, has been a leader in IoT, according to an InfoWorld article.¹⁶ There, devices are connected to a central server with a database. Medications are bar-coded in single-dose packages. All of the medical center's medication management is connected: anesthesia workstations in the operating rooms, secure cabinets that track and dispense medications at nursing stations, and the inventory system that tracks medication and reorders when necessary. This automated system has increased patient safety and lowered costs. According to the medical center, medications are delivered faster, from an average 90 minutes down to 30 minutes, and pharmacy costs have declined by \$300,000 annually, in addition to a one-time inventory savings of \$400,000.



Amine Chouaieb, CEO of Chifco, a software company dedicated to IoT, believes the following five industries will be changed significantly by IoT:

Security for your home or office. The day is coming when you can check on your home while you are away, either to make sure you turned off the iron or you weren't robbed while on vacation.

Big data-based services. The variety of services will grow. Products will be connected to enhance their performance or to collect data for better marketing. Automotive industry. Chouaieb sees great potential for companies with fleet vehicles. These companies can track the movement, accidents, theft and consumption of their fleet.

Healthcare. Chouaieb sees promise for patients to monitor their own health. Information about a patient's particular ailment could be centralized, providing pertinent information to live healthier.

Energy consumption. Home and auto automation will tell us how much we

¹⁵ Violino, Bob. "The 'Internet of Things' Will Mean Really, Really Big Data." InfoWorld. 29 July 2013. Web. 18 May 2015. <<http://www.infoworld.com/article/2611319/computer-hardware/the--internet-of-things--will-mean-really--really-big-data.html>>.

¹⁶ Ibid

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consume and pollute the environment. Chouaieb considers this “a real green technology-based revolution.”



The overall IoT market will be divided among enablers, engagers and enhancers. These three kinds of companies will interact, working together to provide the technology and services needed by all—both to market the IoT and to deploy it for their own operations.

Business opportunities

We've seen how IoT will dramatically change the world in which we live. The possibilities for its implementation are endless. But what should businesses consider as we cross the tipping point of IoT?

According to an article titled “A Strategist’s Guide to the Internet of Things,” companies that want to enter the business of IoT will fall into these categories (Figure 1):¹⁷

Figure 1: IoT market categories

Let's take a look at each:

Enablers are likely to be the big players in the field—Cisco®, Google®, Hewlett Packard® and the like. Those companies that want to be enablers must measure their capabilities to determine whether they supply IoT to all industries or whether they choose a specific industry.

Engagers are the conduit between IoT and the marketplace. They will provide customer relations while collecting some data. These companies won't need to be sophisticated or need large storage capabilities. “They will know how to gain insight into customer needs and expectations, and how to use human-centered design to develop compelling services that change how customers behave,” according to the article. In the case of a customer owning a smart washing

¹⁷ Burkitt, Frank. “A Strategist’s Guide to the Internet of Things.” *Strategy+business*. N.p., 10 Nov. 2014. Web. 19 June 2015. <<http://www.strategy-business.com/article/00294?gko=a9303>>.

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machine, for example, an engager would offer energy-saving advice or perhaps offer discounted subscriptions for home-delivered laundry detergent. Enhancers will also provide services, but the services will be framed differently from those of the engagers. They will find new ways to get value out of the data. An example may be a health insurer that works with services that measure physical activity. That data would be combined with a customer's medical history to build individual insurance packages. It's highly suggested that companies that may play this role in IoT start planning now.

For those companies wanting to enter the IoT market, experts suggest taking the following into consideration:¹⁸

Your role in IoT as an enabler, engager or enhancer.

The market or industry you plan to enter.

Your abilities in customer engagement. Even without direct customer relationships, IoT will change customer experience. What capabilities do you have in customer experience design?

The IoT creates new opportunities for business through enabling:



Connected products and services. How can you make your current offerings connect to IoT?

Enhanced connections. Could you develop new services around data analysis? Could you form a new business model around this? Or, would you partner with other companies to serve this need?

Your organization's capabilities. How will you play within the IoT space? Do you need to make improvements or investments?

EMC Corporation and International Data Corporation (IDC) see many benefits IoT will bring to businesses, even those that simply use connected devices (Figure 2):¹⁹

¹⁸ Ibid

¹⁹ "The Digital Universe of Opportunities: Rich Data and the Increasing Value of the Internet of Things." *The Internet of Things: Data from Embedded Systems Will Account for 10% of the Digital Universe by 2020*. EMC Corporation, n.d. Web. 19 June 2015. <<http://www.emc.com/leadership/digital-universe/2014/view/internet-of-things.htm>>.

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enablers

Figure 2: The IoT creates new opportunities for business through enabling

This ability to gather vast amounts of data will open doors for new business lines, according to tech writer Dan Woods.²⁰ Companies may decide to offer services around connected products or develop new applications. In addition, research and development will be fast-tracked. With customer usage available in real time, companies can update features of current products and model future products to better meet customer needs.

Woods also anticipates customer knowledge will trump the actual sale. Today, the sale is currently a late step in the customer relationship process. He predicts it will become one of the first steps. With IoT, the information gathered from the customer after the sale will be of utmost importance because of the ability to provide ongoing services or complementary products. In fact, Woods says information will become more important than the purchase itself, so much so that prices will change or some products could be given away in exchange for customer data.



And this data will become a hot commodity. Today, 70 percent of large firms purchase data. By 2020, it's predicted that all large firms will do so from businesses that collect and/or sell data.²¹ Investment in generating data is expected to double.

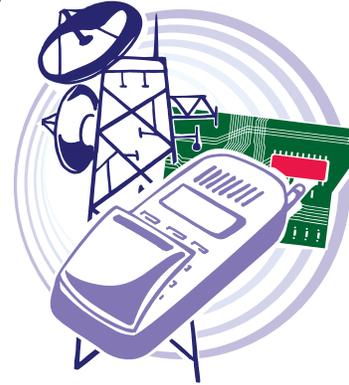
For those businesses that see a wealth of possibilities, tech entrepreneur Alistair Croll cautions them to take a step back before jumping into IoT. His line of advice mirrors that given to start-up entrepreneurs. The industry will be full of competitors. Don't jump on the device bandwagon because you can, and don't narrow your scope. Focusing on a single use or problem will glut the market, and "nobody's going to charge, manage and wear 50 devices."²²

²⁰ Woods, Dan. "How Internet Of Things Data Improves Product Development." *Forbes*. *Forbes Magazine*, 15 May 2015. Web. 18 May 2015. <<http://www.forbes.com/sites/danwoods/2015/05/15/how-internet-of-things-data-improves-product-development/>>.

²¹ Press, Gil. "6 Predictions For The \$125 Billion Big Data Analytics Market in 2015." *Forbes*. *Forbes Magazine*, 11 Dec. 2014. Web. 17 June 2015. <<http://www.forbes.com/sites/gilpress/2014/12/11/6-predictions-for-the-125-billion-big-data-analytics-market-in-2015/>>.

²² Croll, Alistair. "The Internet of Things Has Four Big Data Problems." *O'Reilly Radar*. N.p., 12 Jan. 2015. Web. 01 June 2015. <<http://radar.oreilly.com/2015/01/the-internet-of-things-has-four-big-data-problems.html>>.

Another issue that has not been addressed, according to Croll, is what he calls “datamandering.” While there are those in the tech world who want a single operating system for all things IoT, the reality is that likely won’t happen. This battle over data formats will lead to datamandering as vendors try to woo consumers toward one operating system, much like the cellular war between Apple® and Android®.



For marketers, IoT will produce a goldmine of information, not just from the data that will be generated, but also from the ability for consumers to provide feedback in real time on all types of platforms, including social.

Salesforce®, a customer relationship management provider, believes a company’s return on marketing investment will improve for five reasons:²³

1. Marketers can adapt messages specifically for product users. Likewise, users will be able to give immediate feedback. Marketers will become agile, refining marketing tactics expeditiously.
2. Companies will know where their prospects are in the buying process and will be able to provide them the information needed to close the sale.
3. Product downtime will be cut or maybe even eliminated as devices will be smart enough to know they are dying and have the ability to order an upgrade or replacement part.
4. Devices will be connected to social platforms, providing marketers opportunity to communicate with online communities that form around like devices. In addition, social media platforms can be mined for emerging trends.
5. We will know so much about users of products that irrelevant advertising will no longer hold a place in our society. Advertising can and will match users’ interests, behaviors and past purchases.

Mountains of data

The problem with having all this data is, well, having all this data. It is considered one of the largest barriers for organizations—knowing what to do with all of the information, from storage to analysis.

Analyzing every piece of the data captured will be impossible. Therefore, businesses will walk a fine line between spending too much time on data not

²³ Leung, Stuart. “5 Ways the Internet of Things Will Make Marketing Smarter.” *Salesforce Blog*. N.p., 20 Mar. 2014. Web. 27 May 2015. <<https://www.salesforce.com/blog/2014/03/internet-of-things-marketing-impact.html>>.

Barriers

needed and missing out on data that really is needed.²⁴ To overcome this, analysts will need a strategy in which the data is treated more like a supply chain rather than a warehouse. With a data supply chain, analysts can fill in gaps (yes, even more data may be needed) with data from partners or third parties or by creating new data.

The first step to any strategy is defining it, and the time is now. Business owners and leaders will need to consider how IoT will affect the business and then design an infrastructure to support IoT's data and analytics needs.²⁵ Those businesses that don't consider how to tackle this looming data problem may fall behind.

Need for people power

The future will be full of designers who create the things that connect to the Internet and software developers who will run the things that get connected. IoT's growth will not be defined by the number of devices, but by the number of developers. Today, 300,000 developers work in IoT, but the need will explode by 2020 when 4.5 million developers will be needed to keep up with demand.²⁶

Once the data is captured, we will need analysts. People will be needed to take the information generated to improve the design, operation, maintenance and marketing of products and services.²⁷ These analysts will need skills beyond compiling and making sense of the data. They will need to be good communicators—a trait not all will possess naturally. Because they will come to understand the data so well, they may naturally become the ones who need to tell the story behind the data.²⁸



It's likely there will be more demand than people available to fill the positions. Projections show that 39,000 new analytics jobs will be created by the end of 2015, yet only 23 percent of those will be filled.²⁹ In addition, 1.5 million

24 Violino, Bob. "The 'Internet of Things' Will Mean Really, Really Big Data." InfoWorld. 29 July 2013. Web. 18 May 2015. <<http://www.infoworld.com/article/2611319/computer-hardware/the--internet-of-things--will-mean-really--really-big-data.html>>.

25 Baldwin, Howard. "A Match Made Somewhere: Big Data and the Internet of Things." Forbes. Forbes Magazine, 24 Nov. 2014. Web. 09 June 2015. <<http://www.forbes.com/sites/howardbaldwin/2014/11/24/a-match-made-somewhere-big-data-and-the-internet-of-things/>>.

26 Asay, Matt. "The Internet Of Things Will Need Millions of Developers By 2020." ReadWrite. N.p., 27 June 2014. Web. 17 June 2015. <<http://readwrite.com/2014/06/27/internet-of-things-developers-jobs-opportunity>>.

27 Tamburini, Diego. "What Does The Internet Of Things Mean For Product Development?" Industrial Automation Asia, 4 Feb. 2015. Web. 27 May 2015. <<http://www.iaasiaonline.com/index.php/sector-spotlight/item/139-what-does-the-internet-of-things-mean-for-product-development>>.

28 Press, Gil. "6 Predictions For The \$125 Billion Big Data Analytics Market in 2015." Forbes. Forbes Magazine, 11 Dec. 2014. Web. 17 June 2015. <<http://www.forbes.com/sites/gilpress/2014/12/11/6-predictions-for-the-125-billion-big-data-analytics-market-in-2015/2/>>.

29 Violino, Bob. "The 'Internet of Things' Will Mean Really, Really Big Data." InfoWorld. 29 July 2013. Web. 18 May 2015. <<http://www.infoworld.com/article/2611319/computer-hardware/the--internet-of-things--will-mean-really--really-big-data.html>>.

managers will be needed to make decisions based on the data's findings.³⁰

If your company is unable to fill these gaps with recruits that have specific data skills, Network World has some recommendations:³¹

- Teach someone within your business the analytical skills. Knowing your business is most important, so train someone in data manipulation and statistics. If you already have more seasoned data analysts but need more, hire young talent who can be mentored and trained.
- Hire for potential. If you see a young, emerging superstar, bring them in and train them. Recent graduates with degrees in statistics, computer science and even physics tend to be good prospects.
- Hire Microsoft® Excel experts. Look for this ability, which can be transferred to different platforms when data stores get too large for Excel.



For those companies that won't fill the need with people, it's expected they will turn to automation. For example, it's predicted that by 2018, a significant number of businesses will be using visual data discovery tools.³² These tools will allow data miners to visualize results, perhaps with trend lines and charts, as queries are run rather than after the data is collected.

Bigger data means bigger risk

Collecting massive amounts of data comes with a bigger burden than just storage and analysis. Companies will need to formulate policies on how they will use the data and how they will secure the data, both for employees and consumers.³³

In its 2015 report on IoT, the FTC discussed its top two concerns with IoT—security and privacy. In an effort to curb the negative effects of all this connectivity, the FTC recommends businesses practice data minimization, which involves keeping only the information needed while disposing of the rest.³⁴ Large volumes of

30 Ravindranath, Mohana. "Why the Internet of Things Needs a Network of People." *Washington Post*. The Washington Post, 16 Feb. 2014. Web. 17 June 2015. <http://www.washingtonpost.com/business/on-it/new-skills-are-needed-to-work-on-internet-of-things/2014/02/14/b986fda4-94cb-11e3-84e1-27626c5ef5fb_story.html>.

31 Patrizio, Andy. "4 Ways to Beat the Big Data Talent Shortage." *Network World*. N.p., 23 Mar. 2015. Web. 19 June 2015. <<http://www.networkworld.com/article/2897617/big-data-business-intelligence/4-ways-to-beat-the-big-data-talent-shortage.html?nsdr=true>>.

32 Press, Gil. "6 Predictions For The \$125 Billion Big Data Analytics Market in 2015." *Forbes*. *Forbes Magazine*, 11 Dec. 2014. Web. 17 June 2015. <<http://www.forbes.com/sites/gilpress/2014/12/11/6-predictions-for-the-125-billion-big-data-analytics-market-in-2015/>>.

33 Palmero, Frank. "Internet of Things Done Wrong Stifles Innovation." *InformationWeek*. 7 July 2014. Web. 18 May 2015. <<http://www.informationweek.com/strategic-cio/executive-insights-and-innovation/internet-of-things-done-wrong-stifles-innovation/a/d-id/1279157>>.

34 *Internet of Things: Privacy & Security in a Connected World*. Federal Trade Commission, Jan. 2015. Web. <<https://www.ftc.gov/system/files/documents/reports/federal-trade-commission-staff-report-november-2013-workshop-entitled-internet-things-privacy/150127iotrpt.pdf>>.

data, the FTC says, would be paradise to hackers and potentially to companies as well, which may use the data in ways that exceed “consumers’ reasonable expectations.”

The FTC used the following as an example of data minimization:

Imagine a company invents a smart patch to gauge a person’s skin condition. The patch doesn’t need location information to work, but the company would like the information for development of a future product to treat specific skin conditions. A sound data minimization process, according to the FTC, would be to wait with data collection until the product is in place and then ask for consumers’ consent to gather location data. And, even then, the company should consider collecting only ZIP codes, rather than precise locations.

The FTC says several options are available to companies:

- Don’t collect data at all
- Collect only the data necessary
- Collect data that is not considered sensitive
- Remove specific identifiers, like birthdates or addresses
- Seek consumers’ consent for collecting data that may go beyond the product’s intended use



Hello data, good-bye privacy

Today, we worry about cases of identity theft when hackers obtain our private information. Tomorrow, when our cars and homes are connected, we may be shut out of both, literally, by someone who has hacked a way into the controls. Worse yet, a hacker could interrupt a medical device, disrupting a flow of medication, for example.

Wired writer Geoff Webb predicts a loss of privacy tomorrow that is much greater than today. The entire concept of privacy will be rewritten because we won’t “use” IoT, we will “live inside it—all day, every day.”³⁵ As we carry smart devices on our body—both inside and out—and use smart objects, a life of being offline and the ability to stop the flow of information from ourselves will cease to exist.

Because of this, businesses that produce or use connected devices need to set standards for security as well as plan for isolating, managing and securing each object on its own so that, if breached, it can be shut down independently.³⁶

³⁵ Webb, Geoff. “Say Goodbye to Privacy.” *Wired*. Conde Nast Digital, Feb. 2015. Web. 18 May 2015. <<http://www.wired.com/2015/02/say-goodbye-to-privacy/>>.

³⁶ Palmero, Frank. “Internet of Things Done Wrong Stifles Innovation.” *InformationWeek*. 7 July 2014. Web. 18 May 2015. <<http://www.informationweek.com/strategic-cio/executive-insights-and-innovation/internet-of-things-done-wrong-stifles-innovation/a/d-id/1279157>>.

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The FTC provides six steps companies should follow to provide strong security:³⁷

1. If you are building a device, design security measures at the start. Consider conducting a security risk assessment, practicing data minimization and testing security before launch.
2. Train all employees about good security.
3. For those hiring service providers, make sure they maintain reasonable security, and ensure you oversee their practices.
4. If risks are identified, implement a “defense-in-depth approach” that implements security at multiple levels.
5. Implement access controls to guard against unauthorized personnel gaining access to data.
6. Monitor devices throughout their lifecycle and provide patches if security is breached or is vulnerable.

Legislation around IoT has not made its way to Congress, but many experts say some legislation is needed. During the FTC workshop, participants agreed that, for now, legislation should focus on privacy and security by strengthening data security enforcement tools and notifying customers when security is breached.³⁸

The panel said that legislation should prohibit unauthorized access to data and to the devices. It also should implement privacy protections, like disclosing what data is being collected and for what purpose, and/or provide consumers the choice of having their information collected.

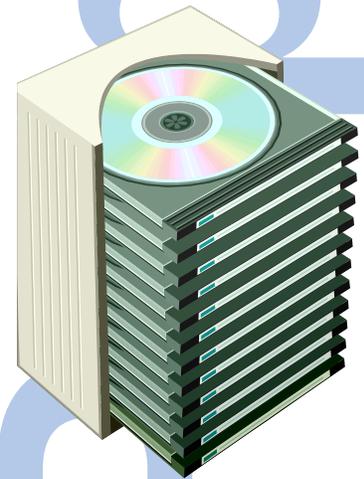
In the meantime, the FTC will enforce laws that currently pertain to IoT uses, provide consumer education as IoT expands, continue meeting with stakeholders to assist companies in implementing best practices and advocate with similar agencies and legislators to promote protection.

The fact of the matter is that we don't really know how IoT will affect our lives. As Webb points out, no one could predict that the 1800's advent of the steam engine would lead to a “standard time.”³⁹ Like many technologies before their time, it's expected that IoT will be an economic engine, churning out products and services we can't yet imagine. It has potential to bring us all great opportunity and, if not implemented and secured well, great risk. We may not yet visualize a world of IoT, but it won't take long to find out.

³⁷ *Internet of Things: Privacy & Security in a Connected World*. Federal Trade Commission, Jan. 2015. Web. <<https://www.ftc.gov/system/files/documents/reports/federal-trade-commission-staff-report-november-2013-workshop-entitled-internet-things-privacy/150127iotrpt.pdf>>.

³⁸ *Ibid*

³⁹ Webb, Geoff. “Say Goodbye to Privacy.” *Wired*. Conde Nast Digital, Feb. 2015. Web. 18 May 2015. <<http://www.wired.com/2015/02/say-goodbye-to-privacy/>>.



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