

# Internet of Things: It's Impact on the Society

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**Abstract-** The Internet of Things is an emerging topic of technical, social, and economic significance. With the advent of Internet of Things (IoT) there will be the major impact on the society as new services and applications developed by the integration of physical and digital world. Consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and other everyday objects are being combined with Internet connectivity and powerful data analytic capabilities that promise to transform the way we work, live, and play. The paper discusses current IoT uses, its challenges, risks, opportunities/future and its impact on society.

**Keywords – IoT, impact, Society, computer chip**

## I. INTRODUCTION

The Internet of Things (IoT) is an important topic in technology industry, policy, and engineering circles and has become headline news in both the specialty press and the popular media. IoT is the network of physical objects or things embedded with electronic devices, software technologies, sensors, and network connectivity, which facilitates these objects to collect and exchange data for availing various services. It is a concept demonstrating connected set of anything, any one, any time, any place, any service and any network connection. IoT is embodied in a wide spectrum of networked products, systems, and sensors, which take advantage of advancements in computing power, electronics miniaturization, and network interconnections to offer new capabilities not previously possible.

A Thing, in the Internet of Things, can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low -- or any other natural or man-made object that can be assigned an IP address and provided with the ability to transfer data over a network. These devices collect useful data with the help of various existing technologies and then autonomously flow the data between other devices. Current market examples include smart thermostat systems and washer/dryers that utilize Wi-Fi for remote monitoring.

IoT promises to offer a revolutionary, fully connected “smart” world as the relationships between objects, their environment, and people become more tightly intertwined. Yet the issues and challenges associated with IoT need to be considered and addressed in order for the potential benefits for individuals, society, and the economy to be realized.

Ultimately, solutions for maximizing the benefits of the Internet of Things while minimizing the risks will not be found by engaging in a polarized debate that pits the promises of IoT against its possible perils. Rather, it will take informed engagement, dialogue, and collaboration across a range of stakeholders to plot the most effective ways forward.

In today's times, everything can be connected to the internet and communicate in an intelligent fashion. It describes the future where everyday objects will be linked through wired or wireless networks, using Internet Protocol (IP) to connect to the internet and be able to identify themselves to other devices. As shown in figure 1, everything is interconnected with each other. This makes IoT even more significant because an object that can represent itself digitally becomes an object of something greater and more important significance.

## II. LITERATURE REVIEW

The term “Internet of Things” (IoT) was first used in 1999 by British technology pioneer Kevin Ashton to describe a system in which objects in the physical world could be connected to the Internet by sensors. [1] Ashton coined the term to illustrate the power of connecting Radio-Frequency Identification (RFID) tags [2] used in corporate supply chains to the Internet in order to count and track goods without the need for human intervention. Today, the Internet of Things has become a popular term for describing scenarios in which Internet connectivity and computing capability extend to a variety of objects, devices, sensors, and everyday items.

Internet of Things (IoT) is being next big thing after Internet itself. With the advance of numerous technologies including sensors, actuators, embedded computing and cloud computing, and the emergence of a new generation of cheaper, smaller wireless devices, many objects, or things in our daily lives are becoming wirelessly interoperable with attached miniature and low-powered or passive wireless devices (e.g., passive RF identification (RFID) tags).



Figure 1. IoT Interconnection with every sector

According to an emerging consensus, virtually every walk of life and industry sector will be transformed by the Internet of things (IoT) including manufacturing, supply chain management, health and wellness, transportation, agriculture, and household living, to name a few. According to McKinsey Global Institute – Business and Economics Research Arm of the Global Management Consulting Firm (excerpted from Disruptive technologies: Advances that will transform life, business, and the global economy, published May of 2013), the estimation of potential economic impact of the Internet of Things to be \$2.7 trillion to \$6.2 trillion per year by 2025 through use in a half-dozen major applications that we have sized. The largest impacts among sized applications would be in health care and manufacturing. Across the health-care applications it was analyzed that the Internet of Things technology could have an economic impact of \$1.1 trillion to \$2.5 trillion per year by 2025.

The Internet of Things (IoT) is quickly going mainstream. In fact, by 2020 there will be nearly 50 billion Internet addressable and aware devices — which translates into a \$14.4 trillion business opportunity, according to networking vendor Cisco Systems, Inc. [5].

The large-scale implementation of IoT devices promises to transform many aspects of the way we live. For consumers, new IoT products like Internet-enabled appliances, home automation components, and energy management devices are moving us toward a vision of the “smart home”, offering more security and energy efficiency. Other personal IoT devices like wearable fitness and health monitoring devices and network enabled medical devices are transforming the way healthcare services are delivered. This technology promises to be beneficial for people with disabilities and the elderly, enabling improved levels of independence and quality of life at a reasonable cost. [3]IoT systems like networked vehicles, intelligent traffic systems, and sensors embedded in roads and bridges move us closer to the idea of “smart cities”, which help minimize congestion and energy consumption. IoT technology offers the possibility to transform agriculture, industry, and energy production and distribution by increasing the availability of information along the value chain of production using networked sensors. However, IoT raises many issues and challenges that need to be considered and addressed in order for potential benefits to be realized. The survey on frameworks for Context Aware Computing for the Internet of Things defines the main context features, which are desirable in the framework, and identifies a large number of frameworks from research and commercial projects, which supports these features to some degree.

Some observers see the IoT as a revolutionary fully-interconnected “smart” world of progress, efficiency, and opportunity, with the potential for adding billions in value to industry and the global economy. [4] Others warn that the IoT represents a darker world of surveillance, privacy and security violations, and consumer lock-in.



Attention-grabbing headlines about the hacking of Internet-connected automobiles, [5]surveillance concerns stemming from voice recognition features in “smart” TVs, [6] and privacy fears stemming from the potential misuse of IoT data [7] have captured public attention. This “promise vs. peril” debate along with an influx of information through popular media and marketing can make the IoT a complex topic to understand.

From a broad perspective, the confluence of several technology and market trends [8] is making it possible to interconnect more and smaller devices cheaply and easily:

- a) **Ubiquitous Connectivity**—Low-cost, high-speed, pervasive network connectivity, especially through licensed and unlicensed wireless services and technology, makes almost everything “connectable”.
- b) **Widespread adoption of IP-based networking**— IP has become the dominant global standard for networking, providing a well-defined and widely implemented platform of software and tools that can be incorporated into a broad range of devices easily and inexpensively.
- c) **Computing Economics**— Driven by industry investment in research, development, and manufacturing, Moore’s law continues to deliver greater computing power at lower price points and lower power consumption. [9]
- d) **Miniaturization**— Manufacturing advances allow cutting-edge computing and communications technology to be incorporated into very small objects. Coupled with greater computing economics, this has fueled the advancement of small and inexpensive sensor devices, which drive many IoT applications.
- e) **Advances in Data Analytics**— New algorithms and rapid increases in computing power, data storage, and cloud services enable the aggregation, correlation, and analysis of vast quantities of data; these large and dynamic datasets provide new opportunities for extracting information and knowledge.
- f) **Rise of Cloud Computing**— Cloud computing, which leverages remote, networked computing resources to process, manage, and store data, allows small and distributed devices to interact with powerful backend analytic and control capabilities.

From this perspective, the IoT represents the convergence of a variety of computing and connectivity trends that have been evolving for many decades. At present, a wide range of industry sectors including automotive, healthcare, manufacturing, home and consumer electronics, and well beyond are considering the potential for incorporating IoT technology into their products, services, and operations.

### III. IOT AND SOCIETY

IoT made life simple. The Internet of Things will forever change our personal and professional lives. By 2020, there will be 50 billion connected devices communicating through the Internet. Devices can range from connected coffee makers, cars, or sensors on cattle to connected machines in a production plant. These devices provide data that offers new insights, and as they talk to each other, they develop their own intelligence and can advise customers about optimal ways to put them to use.

#### *Application areas of IoT –*

**Tuning your car:** As more machines speak to each other and systems integrate, you will no longer miss an oil change. Your truly “smart” car will preemptively reach out to your mechanic when it is time for the annual tune up or your tire pressure is running low, and by cross referencing your calendar, appointment suggestions will be delivered to you to confirm a time with one click.

- a) **Healthcare:** Healthcare is a sector where the IoT is already making a very useful contribution to society. With populations aging around the world, the ability to monitor and protect people in their homes lowers costs and increases quality of life.
- b) **Energy consumption:** High-energy consumption household appliances will adjust based on dynamic price signals to lower your electric bill. Thermostats and lighting will learn your habits to create the optimal setting based on your daily life, such as turning to your ideal temperature just before you arrive home. These gadgets will also sense when no one is in the house and turn off automatically to reduce wastes and costs.
- c) **Driving and traffic jams:** Driving will get a lot safer. Traffic lights will be able to adjust to real-time traffic conditions such as when an emergency vehicle is approaching. Road sensors will make changes to the speed limit based on weather and accidents, while also communicating directly to car dashboards about unsafe conditions (e.g. Slow down. The turn in a quarter mile is icy).
- d) **Grocery lists:** Smart refrigerators will sense when you are running low on staples such as eggs or milk and will automatically populate your grocery list. Stores will push reminders to add items to



- your list when it predicts you about to run out based on your historical purchasing behavior and average buying trends. When you are walking through the store, reminders will get pushed to you to ensure you never have to make that dreaded second trip.
- e) **Our morning alarm:** The traffic on your route to work and the weather will soon affect what time your alarm goes off. If there is an accident or road construction on your usual drive, your alarm will go off early and alternate routes will populate in your dashboard. Of course, your coffee machine will be in the loop to make sure you have your cup of joe for the road.
  - f) **Monitoring your baby:** Through their smartphones, parents will monitor their baby's breathing, temperature and activity. Babies will don connected onesies that will send an alert when there is anything abnormal. Of course, the other babies in your life will also reap the benefits of connectivity. Pet monitoring systems will allow you to monitor their activity and behavior from afar, so you can see how well your potty training is working and how honest your dog walker really is.
  - g) **What's on your body:** Wearable tech has perhaps gotten the most attention in the Internet of Things chatter to date. Many products are now in their second or third generations, offering sleeker designs and more integration with different systems. From monitoring activity during workouts to sleeping patterns to hearing aids, the devices that we "wear" are becoming much more sophisticated, connecting to all of our social media accounts, and tracking much more quality and quantity data.
  - h) **Improving Safety:** The budding number of sensors will detect and act on environmental and other contextual factors, such as weather; will be aware of who and how many people are around in its vicinity to change levels of input and output; and adjust to save resources and improve safety.
  - i) **Mobility:** Smartphones will become not only everyone's portal into the Internet of Things ecosystem (look no further than smartphone-controlled light bulbs), but a complete remote control to your life (if it isn't already). Every enterprise needs to take mobile even more seriously and have it as a key point of consideration of future connected efforts.
  - j) **Smart power grid:** Here is an area where the IoT is helping us wean ourselves from fossil fuels. Although still relatively cheap today, there is a finite supply of oil. At some point, society will have to transition to renewable energy be it solar, wind, hydro, or ocean currents. All these sources are variable, unpredictable, and geographically distributed, meaning information exchange to match supply with demand is crucial to making them financially viable.
  - k) **e-Learning:** To offset the replacement of low-skilled jobs by connected machines, humans need to move up the knowledge ladder to prepare for a future where robots do most of the manual labor. The IoT is a perfect vehicle for delivering education and training to millions of people in remote locations. This must be driven by the public sector, as it will be inherently a not-for-profit endeavor if it is to reach the masses, especially in developing countries.
  - l) **Building automation:** Similar to the smart grid, intelligent buildings that optimize energy usage, protect people from fire, and intrusion, etc., is a very positive application of the IoT.

#### IV. CHALLENGES AND OPPORTUNITIES OF IOT

The Internet of Things will encounter multiple barriers to adoption. Traditional inertia, budget priorities, risk aversion and other factors will prevent some companies from adopting IoT in the near future. Companies can identify and pursue specific opportunities to better serve their customers, open new businesses, reduce costs and provide new value that results in increased revenues.

In addition to the technical challenges around power, latency, integration and storage, there are a number of other issues critical to IoT adoption. These challenges will also provide new business opportunities for technology companies, middleware and tools developers, system integrators, device builders and cross-platform integration companies.

##### A. *IoT Key Challenge Areas –*

- a) **Security:** As the IoT connects more devices together, it provides more decentralized entry points for malware. Less expensive devices that are in physically compromised locales are more subject to tampering. More layers of software, integration middleware, APIs, machine-to-machine communication, etc. create more complexity and new security risks. Expect to see many different techniques and vendors addressing these issues with policy-driven approaches to security and provisioning.
- b) **Trust and Privacy:** With remote sensors and monitoring a core use case for the IoT, there will be heightened sensitivity to controlling access and ownership of data. (Note that two recent high-profile security breaches at Target and Home Depot were both achieved by going through third-party



- vendors' stolen credentials to gain access to payment systems. Partner vetting will become ever more critical.) Compliance will continue to be a major issue in medical and assisted-living applications, which could have life and death ramifications. New compliance frameworks to address the IoT's unique issues will evolve. Social and political concerns in this area may also hinder IoT adoption.
- c) **Complexity, confusion and integration issues:** With multiple platforms, numerous protocols and large numbers of APIs, IoT systems integration and testing will be a challenge to say the least. The confusion around evolving standards is almost sure to slow adoption. The rapid evolution of APIs will likely consume unanticipated development resources that will diminish project teams' abilities to add core new functionality. Slower adoption and unanticipated development resource requirements will likely slip schedules and slow time to revenues, which will require additional funding for IoT projects and longer "runways" for startups.
  - d) **Evolving architectures, protocol wars and competing standards:** With so many players involved with the IoT, there are bound to be ongoing turf wars as legacy companies seek to protect their proprietary systems advantages and open systems proponents try to set new standards. There may be multiple standards that evolve based on different requirements determined by device class, power requirements, capabilities and uses. This presents opportunities for platform vendors and open source advocates to contribute and influence future standards.
  - e) **Concrete use cases and compelling value propositions:** Lack of clear use cases or strong ROI examples will slow down adoption of the IoT. Although technical specifications, theoretical uses and future concepts may suffice for some early adopters, mainstream adoption of IoT will require well-grounded, customer-oriented communications and messaging around "what's in it for me." Detailed explanations of a specific device or technical details of a component won't cut it when buyers are looking for a "whole solution" or complete value-added service. IoT providers will have to explain the key benefits of their services or face the proverbial "so what."

#### B. IoT Opportunities –

Despite the challenges to IoT, there are lots of opportunities to adopt IoT. IoT participating technology companies producing hardware, software, services and integration are all likely beneficiaries.

- a) **Semiconductor Giants as Solution Providers:** Already, semiconductor companies are seizing the IoT moment. At the core of every IoT device is silicon of course. However, the most nimble and forward-looking semiconductor companies realize that providing packaged solutions in the form of micro- or pico-sized IoT devices represent a new revenue stream. They will be able to skirt obstacles such as security by keeping these a closed system.
- b) **Wearable Health Care and Smart Homes:** Already, a huge investment is being made in the healthcare sector in IoT-capable wearable health monitoring devices and supporting technology. Another growing sector is smart home monitors and security systems that rely on a multitude of sensors and actuators that send and receive data and commands remotely. These alone are projected to generate revenue of half a billion dollars in the next few years.
- c) **Unimagined Innovation:** The application for IoT sensors seems only limited by human imagination. Farmers are already using them to monitor crops and livestock and automating adjustments in food, fertilizer and pesticides. Retailers are utilizing IoT devices to monitor inventory, learn more about their customers and provide them with personalized information and offers. Cities are using IoT to monitor traffic and pedestrian flows, which they optimize via traffic signals or lane sharing.

#### V. CONCLUSION

The Internet of Things is a new wave of technology advancement in the early stages of market development. Like many preceding waves of technology evolution it is characterized by innovation, fragmentation, confusion, competitive jostling and emerging standards. Startups are shaking up the status quo as established technology companies react and adjust.

The IoT will leverage, embrace, extend and enhance cloud, big data, personal/mobile devices and social networks to provide more granular sensors and devices closer to the "edge." As it does so, it will provide entirely new applications and use cases that will drive new business models and revenue opportunities. It will also threaten many existing industries, markets and products.

It will likely collide and impact adjacent disrupting trends and markets. For example, the IoT has the potential to further accelerate the “sharing economy.” By providing new ways to track and manage smaller things, it will enable the sharing of new, smaller and less expensive items beyond houses, planes, cars and bikes. In some ways the IoT is the next logical extension of the “long tail” concept. It pushes devices and sensors to more granular levels and enables the creation of new uses, new applications, new services and new business models that were not previously economically viable.

IoT is transforming our daily lives and society as a whole in ways that go beyond the onset of the Internet. Although IoT faces significant headwinds as it gains speed, especially in areas such as security, privacy and testability, these will be overcome eventually.

Major companies such as Google, Cisco, Microsoft, Intel and many others are already contributing to IoT’s growth, but that does not mean there is not plenty of room for as yet unheard of startups to profit from recognizing both the challenges and opportunities of this new technology wave.

## V. REFERENCE

- [1] Ashton was working on RFID (radio-frequency identification) devices, and the close association of RFID and other sensor networks with the development of the IoT concept is reflected in the name of the RFID device company that Ashton joined later in his career: “ThingMagic.”
- [2] “Radio-Frequency Identification.” Wikipedia, the Free Encyclopedia, September 6, 2015. [https://en.wikipedia.org/wiki/Radiofrequency\\_identification](https://en.wikipedia.org/wiki/Radiofrequency_identification)
- [3] Domingo, Mari Carmen. “An Overview of the Internet of Things for People with Disabilities.”, *Journal of Network and Computer Applications* 35, no. 2 (March 2012): 584–96. doi:10.1016/j.jnca.2011.10.015.
- [4] Thierer, Adam, and Andrea Castillo. “Projecting the Growth and Economic Impact of The Internet of Things.” George Mason University, Mercatus Center, June 15, 2015. <http://mercatus.org/sites/default/files/IoT-EP-v3.pdf>
- [5] Greenberg, Andy. “Hackers Remotely Kill a Jeep on the Highway—With Me in It.” *WIRED*, July 21, 2015. <http://www.wired.com/2015/07/hackers-remotely-kill-jeep-highway/>
- [6] “Samsung Smart TV’s Voice Recognition Creates Privacy Concerns.” *CBS This Morning*. CBS News, February 10, 2015. <http://www.cbsnews.com/videos/samsung-smart-tvs-voice-recognition-creates-privacy-concerns/>
- [7] Bradbury, Danny. “How Can Privacy Survive in the Era of the Internet of Things?” *The Guardian*, April 7, 2015, sec. Technology. <http://www.theguardian.com/technology/2015/apr/07/how-can-privacy-survive-the-internet-of-things>
- [8] Susan Conant’s article “The IoT will be as fundamental as the Internet itself”, available at <http://radar.oreilly.com/2015/06/the-iot-will-be-as-fundamental-as-the-internet-itself.html> and Intel Corporation’s statement to U.S. House of Representatives hearing on IoT, available at <http://docs.house.gov/meetings/IF/IF17/20150324/103226/HHRG-114-IF17-Wstate-SchoolerR-20150324.pdf>.
- [9] Jon Koomey, A lecture about Internet device energy use and low power computing on “How green is the Internet?” summit available at <https://www.youtube.com/embed/O8-LDLyKaBM>
- [10] Chris Kocher, “The Internet of Things: Challenges and Opportunities”, <http://sandhill.com/article/the-internet-of-things-challenges-and-opportunities>
- [11] Optimus Information, “IoT Challenges and Opportunities”, <http://www.optimusinfo.com/iot-challenges-and-opportunities-3>