



Healthcare

White Paper

Leveraging Internet of Things to revolutionize Healthcare and Wellness

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Globally, expenditure on healthcare is drastically increasing, even as economies search for sustainable solutions. While advancements in medicine have promoted longevity, care for the aging population and the treatment of chronic conditions have compounded healthcare costs worldwide. Increased health awareness has led to the emergence of 'self-care' and 'healthcare advisor' disciplines. Moreover, stronger focus on fitness and the benefits of a healthy lifestyle has encouraged people to actively participate in their health management, whether they are hale and hearty or not. When it comes to their health, patients are now demanding more and are willing to take charge of their condition. This has fueled innovation that plays a key role in moving the point of care from the hospital or the physician's office to the patient's home. Delivering on this vision with the help of enabling technologies requires regularly capturing information related to a person's health, lifestyle, and other vital parameters, and sharing it with caregivers.

The Internet of Things (IoT) is a platform that enables the real time capture of information, facilitates collation and analysis of this information, and provides the ability to share it with various stakeholders to create a connected environment. It leverages devices that are capable of recording, assessing, and communicating data, which, in the case of healthcare, can include a patient's vital parameters. As technology evolves, more miniature and mobile devices will be available for non-invasive monitoring. Sharing this data with caregivers will enable the delivery of prompt and effective care, and consequently, improved patient provider relationships. This much needed disruptive innovation will help resolve the industry's current challenges and drastically improve health outcomes at lower cost of care.

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Understanding Internet of Things

The Internet is an accessible repository of data that has evolved with the data entry efforts of innumerable people. However, as Kevin Ashton, the person who first coined the term 'Internet of Things' (IoT) elaborates, people have limited time and energy to accurately and consistently put in data which limits the ability to gain access to the right data at the right time¹. Devices that can store and analyze information, measure attributes and communicate with each other effectively solve this problem, churning out a continuous flow of data that can be used to enable appropriate intervention.

There are no clear definitions of IoT as it is in a state of constant evolution. However, IoT can be thought of as a wired or wireless network of physical objects, with sensors and actuators embedded in them that enable the objects to understand the environment and communicate with each other, without requiring significant human intervention. IoT is not science fiction, nor is it a futuristic technology wave. It is a disruptive innovation which bridges interoperability challenges to radically change the way in which healthcare will be delivered, driving better outcomes, increasing efficiency, and making healthcare affordable.

IoT is an emerging trend which, supported by technological innovations, is fast gaining momentum. Within the healthcare space, there exist numerous devices such as blood pressure monitors, blood glucose monitors, weighing scales, thermometers, pulse oximeters, body composition analyzers, home electro cardiograms, pedometers, wrist bands and so on, which help measure and track key health parameters. IoT provides a seamless network for these devices to manage a continuous automated flow of information.

Assessing IoT Prospects in Healthcare

A quiet revolution is brewing across the healthcare industry. While heightened patient awareness has led to demands for better health services, care for senior citizens and treatment of complex chronic conditions have driven up the cost of care. Industry analysts predict that the following trends will shape the future of healthcare:

- Consolidate and ration health services to avoid fragmentation in quality of care and ensure it is evenly distributed
- Encourage general physicians to function as gatekeepers
- Support increased acceptance of the care manager or health coach as a middle-tier between patients and physicians
- Promote preventive measures
- Collect health data in a transparent manner
- Allow patients to take more responsibility for their health

[1] Kevin Ashton, *RFID Journal*, That 'Internet of Things' Thing (22 June 2009), <http://www.rfidjournal.com/articles/view?4986>, accessed 7 February 2014

Of these trends, the ability for patients to take more responsibility of their health, and the promotion of preventive measures are capable of disrupting current care delivery models.

Figure 1 illustrates the global forecast and trend of wireless connected devices by device type². As is evident, the sensors (more prevalent in the consumer space) are slowly outnumbering the hub devices (prevalent in organizations). These devices create more educated and informed consumers while allowing organizations to gain a better understanding of consumer behavior. Not surprisingly, a number of hospitals, patients, and healthcare organizations are therefore adopting innovative IoT driven healthcare systems and applications today.

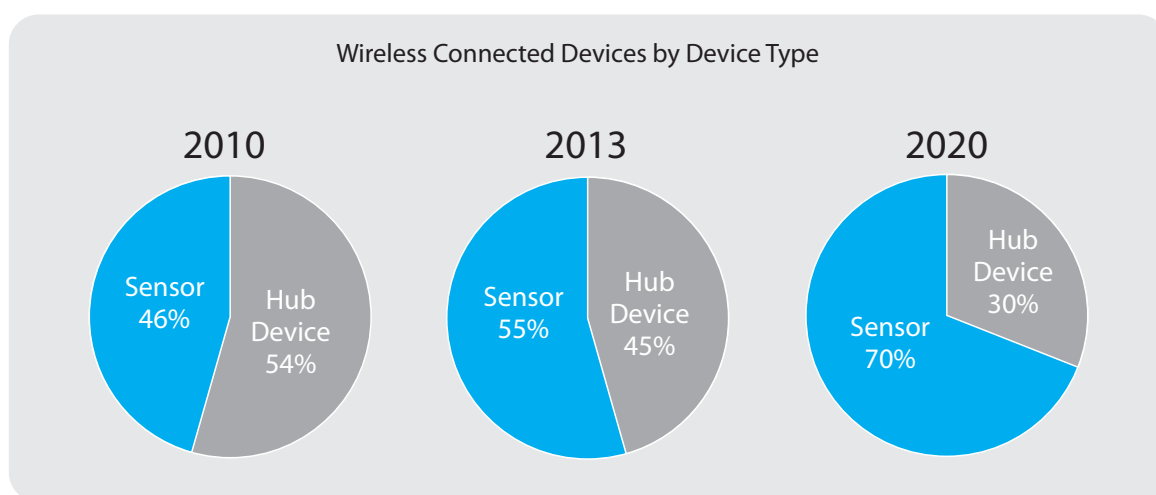


Figure 1: Forecast and Trend of Wireless Connected Devices by Device type
Source: ABI Research

IoT devices for wellness and fitness that were practically non-existent four years ago now enjoy wide market penetration. Forecasters say that by 2018, the total number of IoT devices in use will be equal to that of smartphones, smart televisions, tablets and PCs combined³. However, the information architecture in the healthcare industry has largely been static and schematic, which makes it challenging when new ways of creating value (such as the IoT) arise. Realizing the potential of the IoT calls for a disruption in the way information is architected, stored, retrieved, and used in the healthcare industry.

Care is moving from an episodic framework where each episode of illness is treated independent of other illness, to a longitudinal framework where care is based on a comprehensive view of the patient's health and medical condition. Moreover, there is stronger focus on the 'Meaningful Use' tenet of the Patient Protection and Affordable Care Act, which focuses on using certified Electronic Health Record (EHR) technology to improve the quality and efficiency of care, and promote consistency of care. These factors make it crucial to capture information about patients or members continuously at various stages, even more so for chronic patients who account for 70% of healthcare costs today. Additionally, geriatric care and assisted living have also witnessed a spurt in numbers of late. Today's healthcare world therefore needs to focus on delivering personalized care to individuals. In this context, IoT harnesses people centricity with technology to deliver enhanced results.

[2] ABI Research, Internet of Things vs. Internet of Everything What's the Difference? <https://www.abiresearch.com/whitepapers/internet-of-things-vs-internet-of-everything/> accessed 26 June, 2014

[3] Business Insider, January 2014, www.businessinsider.in/Heres-Why-The-Internet-Of-Things-Will-Be-Huge-And-Drive-Tremendous-Value-For-People-And-Businesses/articleshow/24615352.cms accessed 20 February 2014

The IoT platform can bring together people (patients, caregivers, and clinicians), data (patient or member data), process (care delivery and wellness), and enablers (fitness and medical devices and mobile applications) to deliver on the promise of better health outcomes. (Figure 2)

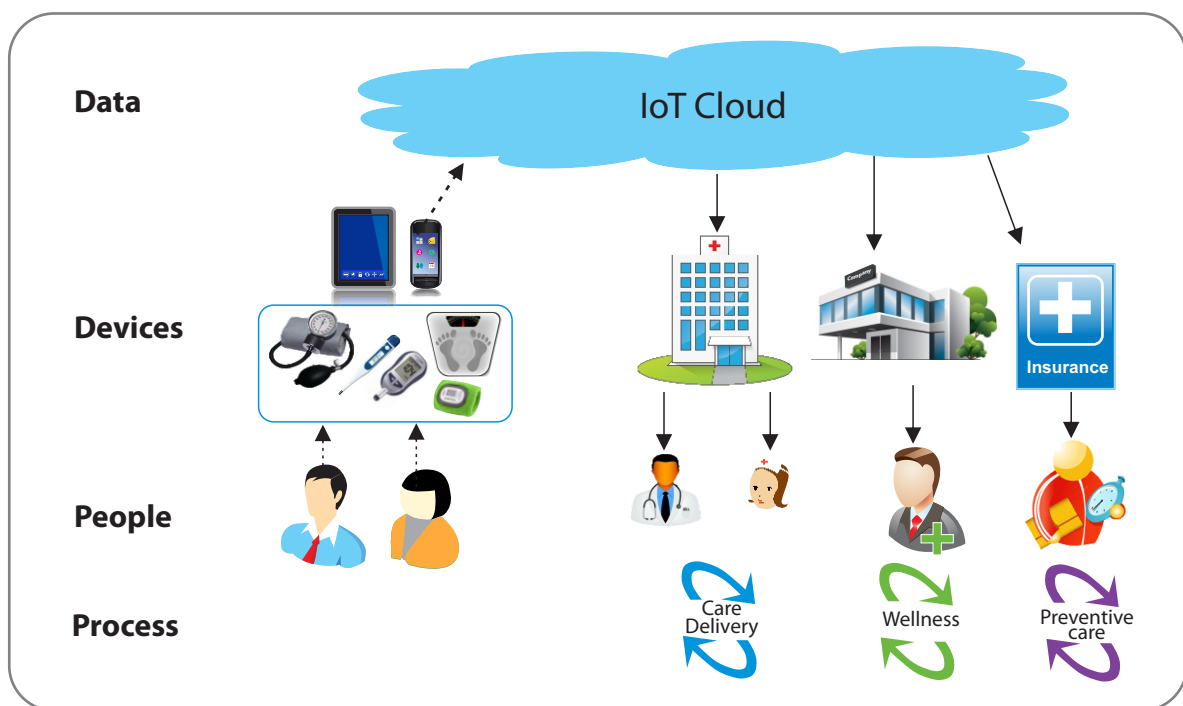


Figure 2: The confluence brought about by the Internet of Things

How Does the Internet of Things Help?

The impact of home-use medical devices and mobile healthcare applications that make up the IoT has been increasingly felt in the healthcare market. Apart from their use in managing health, they have also been used for disease prevention and fitness promotion. Some of the applications of IoT are:

Chronic Disease Management

Recent data from the Centers for Disease Control and Prevention shows that almost half of all American adults live with a chronic condition⁴. Today, chronic care has many shortcomings, and there is an urgent need to transform healthcare from a reactive model (reacting when a patient is sick), to a proactive one (keeping the patient healthy). This, in turn, requires the ability to continuously monitor patient data and intervene when necessary.

[4] Centers for Disease Control and Prevention, Chronic Disease Prevention and Health Promotion, www.cdc.gov accessed 12 February 2014

IoT bridges this gap through the use of devices that monitor a patient's physiological conditions (such as blood pressure for hypertensive patients, blood glucose levels and weight for diabetics, and so on). The periodic data sent in by these devices could be used to perform different analytics. For example, the nurse monitoring a group of 100 hypertensive patients could set a condition which could trigger an alert when the systolic or diastolic pressure of any patient in the group exceeds or falls below a threshold level. Physicians can also gain useful insight on what intervention has resulted in the maximum benefits for a certain type of patient, thus enabling 'evidence-based care'.

Remote Clinical Monitoring and Assisted Living

Currently, healthcare is event driven and quite detached, especially for patients who have to follow a regime but have no visibility into their health status until they meet a physician or health coach the next time. Centralized remote clinical monitoring of members of assisted living communities and geriatric care settings is fast emerging as a trend.

IoT offers the ability to remotely monitor the care being delivered to such patients and make constant course correction as needed. The elimination of manual data collection processes has sped up operations, while automation of information collection and processing has reduced errors, making remote monitoring an attractive option for providers and users. This degree of automation enables providers to transfer the tasks of routine monitoring and field administration to remote monitoring personnel, thus saving cost. Additionally, remote monitoring has successfully demonstrated results such as decreased member move-out rates, and increased staff productivity⁵.

Wellness and Preventive Care

In recent times, there has been a surge in the number of people who have taken charge of their own health and wellness. For example, people who are athletic, regardless of age, may want to record, track, and monitor data related to their fitness activities such as running, walking, and swimming.

The advent of IoT, necessarily as wearable technology, has made health supervision convenient. A person in the habit of running may wear on the wrist, on the arm, or just carry in the pocket, a device that is capable of measuring the distance run, the time spent running, the calories burnt by running, or even analyze imbalance in strides or running posture. For that matter, a subset of these parameters can easily be measured by a mobile application, bringing even smartphones into the purview of IoT. Such continuous availability of data allows the user to analyze and correlate many parameters, for example, determining that he is not depressed on days when he runs for more than 20 minutes. The possibilities here are endless.

[5] Centers for Disease Control and Prevention, Chronic Disease Prevention and Health Promotion, www.cdc.gov accessed 12 February 2014

Conclusion: IoT in Healthcare

The healthcare industry is undergoing a huge transformation in a bid to move towards affordable, accessible, and quality care. New applications and use cases, a result of cutting edge technology innovations, are being developed to address changing industry needs. Standards organizations are also working towards building communication compatibility among the wide range of devices that have operated independently thus far.

Gartner⁶ says the Internet of Things installed base will grow to 26 billion units by 2020. ABI Research⁷ has indicated that 36.5 billion devices will be connected wirelessly to the IoT in the same time frame. The number of devices that are not connected currently far exceed what is already connected to the IoT, indicating the limitless opportunities that this network can offer.

In order to maintain a competitive advantage, organizations will have to leverage the potential of IoT and adopt IoT driven systems and processes. This model of healthcare, which heavily relies on patient participation, and subsequent data analysis by microprocessors and microcontrollers, is set to change the way health services are delivered. This customer centric transformation is being fuelled by the need for innovation and disruption in healthcare. IoT is here to stay, and will continue to evolve fast, leading to impactful and positive changes for all stakeholders in the healthcare industry.

[6] Gartner Press Release, *Gartner Says the Internet of Things Installed Base Will Grow to 26 Billion Units By 2020*, December 12, 2013, <http://www.gartner.com/newsroom/id/2636073>.

[7] ABI Research, *Internet of Things vs. Internet of Everything – What's the Difference?*, accessed May 2014, - <https://www.abiresearch.com/whitepapers/internet-of-things-vs-internet-of-everything/>

About TCS' Healthcare Business Unit

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By streamlining and modernizing business processes and systems, TCS helps healthcare organizations realize operational efficiencies and reduce operating costs. We work closely with healthcare players to empower them to meet their consumers' demands for higher levels of service, quality of care, and new ways of interacting and engaging. Our advanced data solutions, analytics, and cutting edge digital technologies deliver a higher degree of customer centricity.

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