

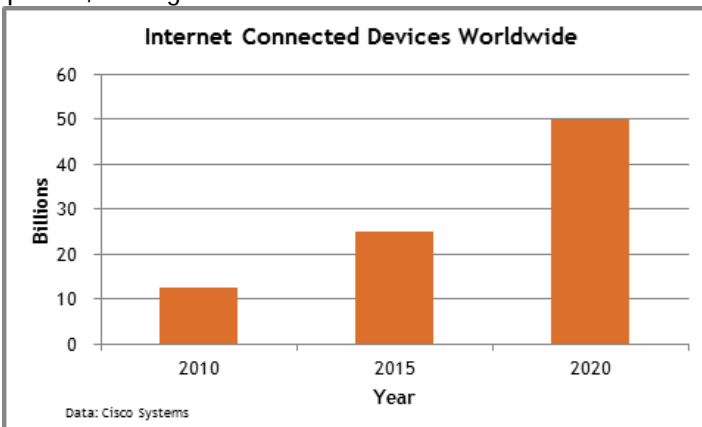
# VIEW

## The Internet of Things: A Confluence of Venture Opportunities

### Introduction to the Internet of Things

In recent years, ubiquitous connectivity coupled with the advancements in, and ever decreasing costs of, sensors, computing, storage and bandwidth have paved the way for a rapidly rising segment of information technology - the Internet of Things ("IoT"). The Internet of Things, at the most basic level, is the connection of uniquely identifiable electronic devices through the internet. Typically these devices include sensors for gathering and transmitting a variety of data, providing for greater contextual awareness. Accelerating beyond computers, smartphones and tablets, the IoT now extends to wearable devices, appliances, vehicles and other machines and components. In fact, the IoT can be comprised of virtually any electronic device that is able to connect to the internet.

An estimated 25 billion internet connected devices will exist in the world by the end of 2015.<sup>1</sup> By 2020, that number is expected to jump to 50 billion, equating to nearly seven internet connected devices per person. What are the driving forces behind this growth? For starters, the cost of computing power, as measured by the price per million transistors, is nearly 4,000 times lower today than it was two decades ago. Similarly, the costs of storage and internet bandwidth have fallen dramatically - storing one gigabyte of data now costs no more than a couple of cents and internet bandwidth costs have fallen by 98% in just over a decade.<sup>2</sup> Declining costs have coupled with technological progress, resulting in dramatic increases in processing power, storage and bandwidth.



<sup>1</sup> Cisco Systems Internet Business Solutions Group (IBSG)

<sup>2</sup> Deloitte University Press, From Exponential Technologies to Exponential Innovation - 2013 Shift Index Series

This in turn has ushered in the rapid growth and advancement of internet connected devices as well as cloud and mobile computing and data analytics. More value than ever can be realized from connected devices and information while hardware is advancing and experiencing shrinking form factors.

### The IoT Opportunity

Devices comprising the IoT can serve a very wide range of applications that have the potential to create unprecedented opportunities for businesses and investors. Areas that have already seen meaningful advancement span various verticals and include:

Consumer/Wearables: This segment includes established and evolving consumer electronics such as smartphones, tablets, televisions and wearable devices such as smartwatches. Increasingly, the wearable segment includes technology that can acquire data on aspects of a person's daily life and health, such as vitals, activity levels and sleep patterns - a movement commonly referred to as the "quantified self." Consumers are increasingly realizing tangible benefits from "smarter" technology. The proliferation of IoT in the consumer space has the potential for increasing opportunity in a wide range of applications including entertainment, communications, productivity and healthcare.

Home: The home is capable of supporting numerous IoT applications including home automation, control, security and energy management. Examples include lighting control systems, smart thermostats, remote surveillance and smart appliances. This has already become a space of great interest, with a diverse array of telecom, technology and industrial companies, mature and new, developing solutions. As sensors, controllers, actuators and interfaces develop further, IoT applications in the home are expected to advance and become more widespread.

Transportation: In the transportation space, the IoT has manifested itself primarily through advanced telematics technology which encompasses telecommunications, vehicular technologies, safety, electrical engineering

(including sensors) and computer science. The applications of telematics technology can include: vehicle tracking, fleet management, navigation, wireless safety communication, emergency warning systems, car sharing, insurance and other intelligent vehicle technology. Long-term, the confluence of IoT technologies in the transportation space may lead to advances such as self-driving vehicles. More broadly, intelligent vehicles and transportation networks can become safer and more efficient in the public and private transportation of goods and people.

**Enterprise/Industrial:** Enterprise applications of the IoT aid in the optimization of business operations through solutions that include enhanced customer support and services (in part through predictive maintenance), data management and analysis, supply chain management and logistics, and technology infrastructure management. For example, on the industrial front, components of machines, such as a jet engine of an airplane or the drill of an oil rig, can include sensors capable of transmitting valuable real-time data. At present only approximately 37% of IoT consumers are industrial - that number is expected to exceed 50% by 2017 as the bottom-line benefits of IoT solutions become more apparent and simpler to implement.<sup>3</sup>

Most IoT applications share commonalities which also represent areas of opportunity. For example, critical components for IoT devices across the spectrum may depend on shared technological advancements. The IoT also cannot function without sound infrastructure capable of proving support for a wide range IoT applications. Examples of broad opportunities afforded by the IoT include:

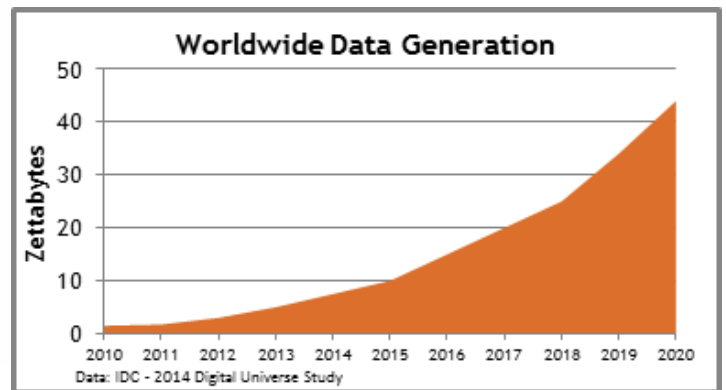
**Hardware:** Hardware used throughout the IoT (sensors, transmitters, processors, etc.) will need to continue to advance. Form factors will continue to shrink and become more efficient - from both a power consumption standpoint as well as in terms of intelligence and code efficiency. Hardware developments will likely spur new applications of IoT technology and also make existing applications more functional. Areas fostering innovation include open source hardware and new hardware platforms.

**Networks:** The proliferation of the IoT results in a tremendous dependency on connectivity, wireless and wired networks, and data centers. Networks must become broader, more agile and dependable to allow for ubiquitous,

reliable connections for billions of critical devices. Interoperability will also be important to allow hardware, software and cloud services to work better in combination and across platforms. For example, smart home devices currently include product suites from numerous companies which often do not work together, leading to a very fragmented market and end user experience. Opportunities exist for novel concepts and solutions to be applied to address network related challenges associated with the IoT.

**Security:** Security is critical as IoT devices become increasingly intelligent and permeate everyday life. Billions of devices must be protected from intrusion and interference that could compromise personal privacy and threaten public safety. Security must be implemented at both the device and network level. Intelligence that enables IoT devices must also be able to recognize and counteract threats. It is likely that security solutions will require an evolution and adaptation of measures that have proven successful in IT networks which will probably require innovation from both new entrants and incumbents.

**Data:** The rapidly increasing number of devices that comprise the IoT are expected to generate an unprecedented volume of data. The amount of data generated, replicated or consumed worldwide every year is anticipated to roughly double every two years between now and 2020, reaching 44 zettabytes (equivalent to 44 trillion gigabytes) that year, up from approximately 8 zettabytes today.<sup>4</sup> The IoT will be a significant contributor to this growth. A tremendous amount of data from an extraordinary number of input sources will have to be stored and then analyzed, presented and projected in a fast, near-real-time, and meaningful manner. Companies will have to develop new and more efficient ways to process data. Translating data into knowledge will be one of the major keys to harnessing the power of the IoT.



<sup>3</sup> Cisco Systems, Internet of Things World Forum - 2014

<sup>4</sup> IDC - 2014 Digital Universe Study

The IoT allows for unprecedented opportunities and connections to take place, many of which we may not even fully understand the impact of today. By 2022, the IoT is expected to have generated \$14.4 trillion in economic value as it quickly evolves from providing basic convenience to innovative opportunities. Those opportunities will certainly include the involvement of large players with an invested interest in the IoT such as Cisco, Samsung, Google, Intel, Apple, IBM, and GE, but will also unquestionably require innovation and disruption from new companies, which will in turn represent opportunity for venture capitalists.

### Internet of Things - Areas of Opportunity Startup/Company Examples

	Consumer/ Wearables	Home	Transportation	Enterprise/ Industrial
Vertical Market Applications	fitbit, GLASS, ATHOS, THALMICLABS, LUMO, iRhythm, wearable intelligence	nest, canary, ALARM.COM, vivint, leeo, EUGUST, dropcam, ZULU	ZENDRIVE, Airbiquity, navdy, Zbbe, AUTOMATIC, INRIX, Drivewyze, STREETLINE	enlighted, Nomi, elementurn, Airware, GridDirector, CLEARPATH, euclid, ROBOTEX
	Hardware	pinoccio, TESSEL, advanticsys, ARDUINO, seed, spark, Raspberry Pi	Networks	ARISTA, Jasper, SIGFOX, Ayla Networks, Axeda, lotera, azeti, ACKIME
	Security	Weaved, LaunchKey, Bastille, MOCANA, REP FALLON SECURITY, SafeLogic	Data	MAANA, PingThings, sqlstream, mnubo, DECISIONIQ, initial state, platfora, GAONIC, LogPoint

Fairview Capital Research

### Venture Capital and the IoT

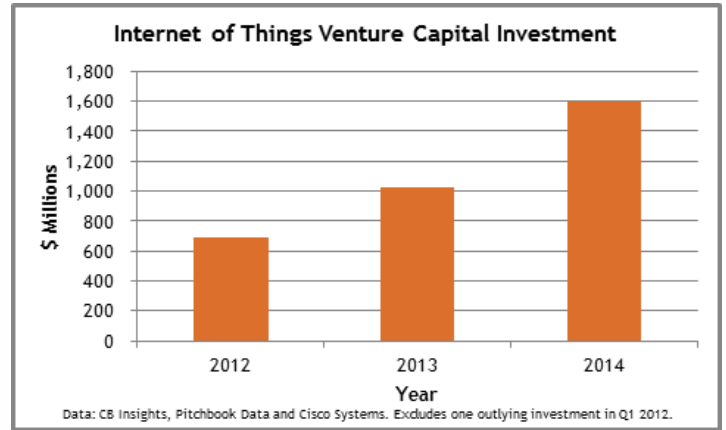
Venture capitalists have been quick to identify the opportunity that lies in the IoT and have begun to ramp up investment in recent years. In 2014, venture capitalists invested \$1.6 billion into IoT-related companies.<sup>5</sup> This is significantly higher than the just over \$1 billion invested in 2013 and just under \$700 million invested in 2012.<sup>6</sup>

Given the relative nascence of most companies developing IoT-specific solutions, it is no surprise that the significant majority of IoT venture investments - roughly two-thirds - are occurring at the seed or series A stage (compared to approximately half of overall venture investments).<sup>7</sup> Active venture capital investors in the IoT include traditional venture capital firms as well as corporate venture capital.

<sup>5</sup> Cisco Systems, Internet of Things World Forum - 2014

<sup>6</sup> CB Insights

<sup>7</sup> CB Insights and PWC Money Tree as of September 30, 2014



The level of corporate venture capital activity in the IoT space is higher than in other areas - strategic corporate venture capital investors account for approximately 32% of IoT investment, compared to between 12% and 20% of overall venture investment per year historically.<sup>8</sup> Often, corporations invest for strategic reasons, and in many cases end up as acquirers of venture-backed IoT companies. Another unique aspect to IoT investment and startups, particularly in the consumer space, is that many initially use crowdfunding platforms such as Kickstarter or Indiegogo to raise capital. This often serves as a way for venture firms to validate consumer demand prior to committing to an early stage investment.

Identifying and investing in high-potential IoT-related companies is a natural evolution for most venture capital firms engaged in information technology investing. These firms typically possess the necessary technical knowledge through backgrounds in areas such as engineering and computer science. Additionally, expertise and the ability to add value in areas such as sales and operations also translate well to the IoT space. As with any category of venture capital investing, to be successful in the IoT space, firms must possess respected reputations, relevant networks, strong sourcing abilities, and the ability to add value to an investment.

To date, IoT venture investment has come predominantly from firms that have incorporated IoT investing into their broader information technology investment practices as a new or iterative strategy or theme. In some cases, IoT investments fall under existing themes such as cloud computing, technology-enabled services, big data, energy efficiency or consumer technology. Dedicated IoT investment funds are just now beginning to emerge. For example, in

<sup>8</sup> Silicon Valley Bank Internet of Things Market Overview and Intelligence Report 2013 and NVCA-PwC Corporate Venture Capital Activity Data 2002-2011.

mid-2014 Kleiner Perkins Caufield & Byers and Google Ventures teamed up to launch an investment fund called the Thoughtful Things Fund aimed at companies developing solutions to build the connected home of the future. Another example is Chinese Internet security company Qihoo 360 which in late 2014 launched a \$60 million early stage IoT fund dedicated to investment opportunities in China, the US and Israel. As the number of IoT startups continues to grow and investment opportunities mature, more dedicated pools of capital may be allocated to the space.

Recent venture investments that have already proven fruitful help validate the IoT as an investment theme. One example is Nest, a home automation company that designs and manufactures sensor-driven, Wi-Fi-enabled, self-learning, programmable thermostats and smoke detectors. Nest raised just under \$150 million in venture capital funding from seven venture capital firms and strategic investors over four years and was acquired by Google in January 2014 for \$3.2 billion.<sup>9</sup> Subsequent to the acquisition by Google, Nest in turn acquired home video monitoring and security company Dropcam. Dropcam had raised around \$50 million from four venture capital firms and was acquired for \$555 million. The Nest and Dropcam acquisitions are reflective of large technology companies looking to build “full-stack” solutions in the IoT space capable of provide a suite of integrated products and services. Acquisition is often an efficient means of achieving this goal and many large companies have been actively acquiring IoT-related companies. In addition to Google, companies such as Samsung, Microsoft, Cisco and Honeywell have been active acquirers. This dynamic bodes well for innovative IoT startups developing sought-after solutions and the venture capitalists backing them.

Another example of a successful IoT investment, one illustrative of the infrastructure-related opportunities, is Arista Networks. Arista Networks is a supplier of advanced cloud networking services that leverage software to address tasks such as virtualization and big data analytics - solutions for the infrastructure critical for the development of the IoT. The company raised capital from multiple venture capital firms and held an IPO in June of 2014 achieving a market capitalization of nearly \$5 billion by year-end.

### Fairview and the IoT

Fairview expects the underlying fundamental trends supporting the rise of the IoT to endure. The pipeline of investment opportunities in the space is likely to accelerate in the coming years as a result. Already,

<sup>9</sup> Pitchbook Data

Fairview’s venture capital portfolios have developed meaningful exposure to many of the most innovative, transformative and high potential IoT companies. Fairview’s approach to investing in companies developing IoT related solutions has been through participating in partnerships sponsored by top venture capital firms best positioned to identify, access, grow and successfully exit companies in the space. From a return perspective, Fairview’s venture capital portfolios have participated in a substantial portion of the most significant venture-backed exits (M&A and IPOs) of IoT related companies to date. Looking ahead, the firm expects IoT investments to comprise a larger share of its underlying portfolio and for companies addressing the IoT opportunity to continue on an accelerated path of value creation.

### About Fairview

*Fairview Capital Partners is a leading private equity investment management firm specializing in demanding segments of the market. Founded in 1994, Fairview provides innovative, intelligent, investment solutions and services to institutional investors. Fairview manages \$3.5 billion through funds-of-funds, customized separate accounts and other innovative structures. The firm’s areas of focus include venture capital / growth equity, small to mid-market buyouts, emerging managers and frontier markets. For more information visit [www.fairviewcapital.com](http://www.fairviewcapital.com).*

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