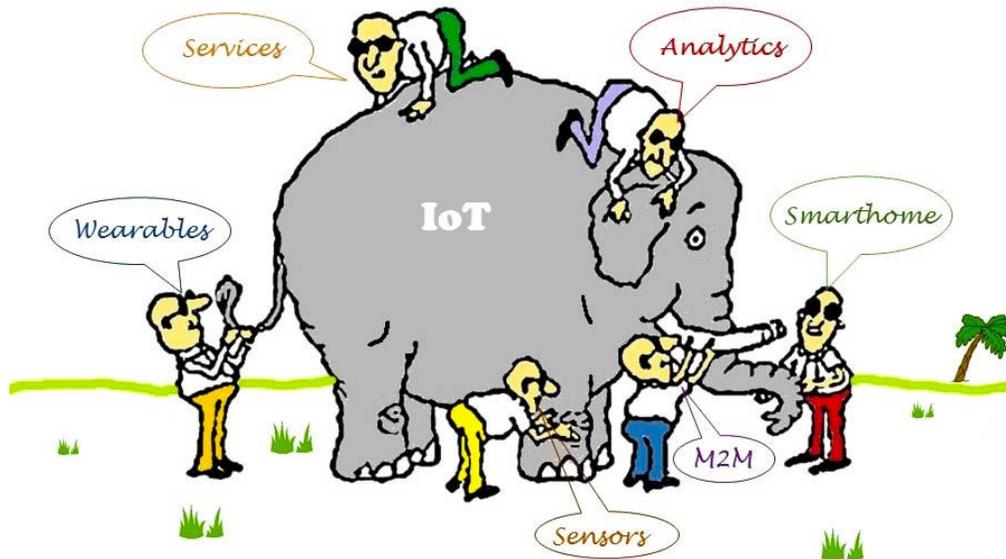


## THE INTERNET OF THINGS

### “Smart” Products Demand a Smart Strategy Using M&A for a Competitive Edge



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## Executive Summary

A great deal has already been written about the phenomenon being called “The Internet of Things,” or “The Internet of Everything.”

This report examines the Internet of Things (“IoT”) from three distinct vantage points. First, we examine the strategic, corporate M&A perspective, analyzing transactions completed for clues to where additional activity can be expected. We segment the market for IoT into several different components which we believe broadly correspond to the core elements of the “IoT Value Chain,” and which we believe will have quite different strategies and M&A outcomes. Then we take a look at the issue of standards and regulations and some of the implications for the development and adoption of IoT technology going forward. From there, we take a step back to examine potential market size estimates for various end markets, considering these markets from the standpoint of both information technology vendors (broadly speaking, “suppliers” – including everything from silicon to software) and end customers, be they consumer or industrial end markets.

Through the analysis of M&A activity, we identify various strategies already becoming visible and contrast the choices being made by various participants coming from different markets, skillsets and resources. By looking at the broader technology and market considerations, we believe we can gain a better understanding of both the opportunities and challenges that will arise over the next several years as companies adapt to these new technologies and their impact on relative competitive advantage. We have constructed a framework for examining transactions that have already taken place that we believe will also help predict potential future activity. We base our analysis on emerging trends and the capabilities and needs of not only the most active players but also several intriguing new entrants.

As we look at various predictions of market size we note a rather large disparity in these predictions among some of the sources we’ve found. We believe that while the precise magnitude of the opportunity may be somewhat elusive, the conclusion that it will be a large opportunity that will disrupt many markets and have extensive and long lasting ramifications in multiple industries is indisputable.

Finally, we explore the implications for longer term corporate strategy that arise from these disruptions. Many important and far-reaching decisions will need to be made and winners and losers will shake out over the next several years based on choices made both in anticipation of and in response to competitive strategies pursued by other market participants. Many of these competitive strategies will involve mergers, acquisitions and divestitures.

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Cover:

The parable of the blind men and the elephant illustrates that people can perceive complex things differently based on perspective.

It originated in ancient India some 2,000 years ago and become well known in the West when American poet John Godfrey Saxe wrote a poem called "The Blind Men and the Elephant." (For the entire poem, please see page 99 in the appendix.) We thought it was an apt diagram to illustrate the complexity that surrounds the Internet of Things.

We would also like to thank Ron Heller for his assistance and invaluable input.

## 1. An Overview of the Internet of Things

We have arrived at a critical juncture in the evolution of the Internet. By 2020, experts forecast that between 20-50 billion devices will be connected to the Internet with only one-third of them being computers, smartphones and tablets. The remaining two-thirds will be other “devices” – sensors, terminals, household appliances, thermostats, televisions, automobiles, production machinery, urban infrastructure and many other “things”, which traditionally have not been Internet enabled.

This “Internet of Things” (IoT) represents a remarkable transformation of the way in which our world will soon interact. Much like the World Wide Web connected computers to networks, and the next evolution connected people to the Internet and other people, IoT looks poised to interconnect devices, people, environments, virtual objects and machines in ways that only science fiction writers (and George Orwell) could have imagined.

Michael Mandel, Chief Economist for the Progressive Policy Institute, says, “The Internet has mostly transformed information-intensive industries like journalism, entertainment, communication. It becomes much harder to use the Internet to transform physical industries; it's much more complicated. You need a lot of sensors, big data capability to process it, ways of getting it to people to make decisions. Physical industries, like manufacturing and transportation, haven't been affected that much.” We agree with this opinion and note the (largely still-unrealized) potential of IoT to transform many more industries and boost economic activity.

Because much has already been written about IoT by a vast number of researchers, investors, journalists, and visionaries, we will attempt to distill the IoT universe down to a framework and series of key salient points from which business leaders and investors can contemplate strategic alternatives.

*Is IoT simply M2M  
with IPv6*

A fair question to ask at this point is how IoT differs from machine-to-machine (M2M), which has been around for decades. Is IoT simply M2M with IPv6 addresses or is it really something revolutionary? M2M, built on proprietary and closed systems, was designed to move data securely in real-time and mainly used for automation, instrumentation and control. It was targeted at point solutions (for example, using sensors to monitor an oil well), deployed by technology buyers, and seldom integrated with enterprise applications to help improve corporate performance.

IoT, on the other hand, is built with interoperability in mind and is aimed at integrating sensor/device data with analytics and enterprise applications to provide unprecedented insights into business processes, operations, and supplier and customer relationships. IoT is, therefore, a “tool” that is likely to become invaluable to CEOs, CFOs and General Managers of business units.

The excitement around IoT arises from a combination of multiple supporting elements: (a) faster, smaller and better microprocessors, sensors and cameras; (b) ubiquitous and low-cost cloud and wireless networks; and (c) powerful and inexpensive cloud computing and fast/big data analytics tools.

*Economic impact of IoT*

There are almost as many different forecasts for the economic impact of the IoT opportunity as there are forecasters. This is understandable given the immaturity of the space and broad range of industries and economic sectors that could be impacted. We have studied many of them and present some of the more insightful forecasts and surveys in the following pages.

Consultants' perspective:

A McKinsey Global Institute study suggests that the Internet of Things has the potential to create economic impact of \$2.7 trillion to \$6.2 trillion annually by 2025.

They have analyzed several industries and think that the largest impact would be in healthcare and manufacturing. We have tabulated some of their findings in Figure 1.

Figure 1: Impact of IoT on Healthcare and Manufacturing in 2025

Industry	Potential economic impact in 2025 (\$trillion, annually)	Estimated scope/size of problem in 2025	Estimated potential reach/penetration in 2025	Potential productivity or value gains in 2025
Healthcare	\$1.1 - \$2.5 trillion	\$15.5 trillion cost of treating chronic diseases	70-80% mobile penetration in patients who account for bulk of health-care spending	10-20% reduction in chronic disease treatment costs through remote health monitoring
		\$400 billion cost of counterfeit drugs, 40% addressable with sensors	Counterfeit drug tracking. Developed world:50-80%. Developing world: 20-50%	80-100% reduction in drug counterfeiting
		50 million nurses for inpatient monitoring	Inpatient monitoring. Developed world:75-100%. Developing world: 0-50%	0.5-1.0 hour time saved per day by nurses
Manufacturing	\$0.9 - \$2.3 trillion	\$47 trillion in global manufacturing operating costs	80-100% of all manufacturing	2.5-5.0% saving in operating costs, including maintenance and input efficiencies

Source: McKinsey Global Institute

### *\$19 trillion Value at Stake*

#### Industry perspective:

Two studies conducted by Cisco Consulting Services find that there is a combined total of \$19 trillion in IoT value at stake in the private (\$14.4 trillion) and public (\$4.6 trillion) sectors. Value at stake, according to Cisco, is the potential bottom-line value (higher revenues and lower costs) that can be created based on companies' and industries' ability to harness IoT.

Figure 2 captures where Cisco believes the \$14.4 trillion value at stake in the private sector will come from. (IoT will both create new value and redistribute value among winners and laggards.)

Figure 2: Some Key Drivers of IoT Value

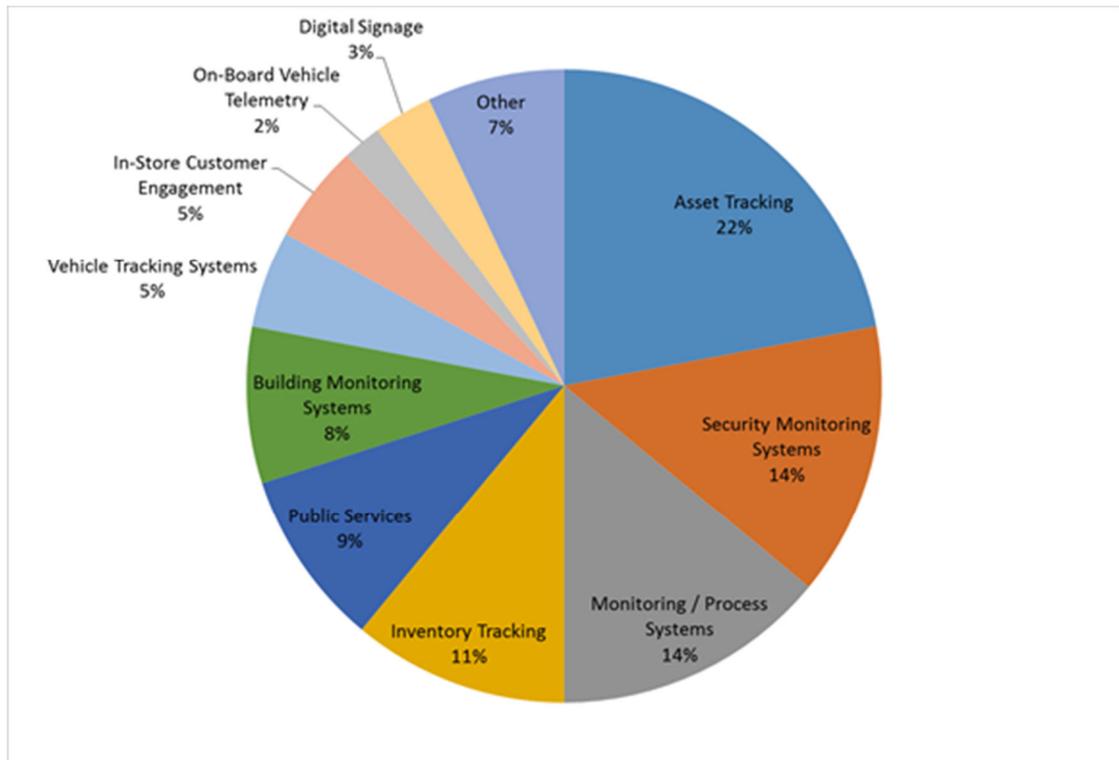
Private sector attribute	Value at stake over the next 10 years (\$trillion)	Benefits
Asset utilization	\$2.5 trillion	Better use of assets will improve execution and capital efficiency, reducing expenses and cost of goods sold
Employee productivity	\$2.5 trillion	Increased employee productivity will reduce person-hours and free knowledge workers to do more effective work
Supply-chain / Logistics efficiency	\$2.7 trillion	Process inefficiencies will be eliminated through supply-chain improvements
Improved customer experience	\$3.7 trillion	Improved customer experiences will build stronger relationships and bring more customers
Innovation	\$3.0 trillion	Tech innovations will increase return on R&D, reduce time to market, and create revenue from new business models

Source: Cisco

Industry survey: IDC, together with Telus, a Canadian national telecommunications company, surveyed 209 large and medium sized organizations across Canada in early 2014 to understand what IoT solutions have been implemented, their benefit and importance and deployment characteristics. The results of the survey (shown in figures 3-5) may provide insights into IoT sentiments in other advanced economies.

Some background: Canada, a member of the OECD and the G7, has the 11<sup>th</sup> largest economy in the world. The economy is dominated by the services industry, which makes up 72% of GDP and employs 78% of Canada's workforce. Manufacturing represents 13% of GDP and employs just over 10% of the workforce. The natural resources sector, which includes mining, forestry, agriculture, fisheries, oil and gas makes up roughly 7% of GDP and employees close to 4% of Canadians. (Source: Statistics Canada.)

Figure 3: IoT Solution by Application – Canada (IDC/Telus Survey)



Source: IDC/Telus

Figure 4: Top IoT Solutions by Canadian Industry

Industry	Solutions
Manufacturing	Process Monitoring/Control; Security Monitoring Asset Tracking
Primary (including Oil/Gas)	Security Monitoring Process Monitoring/Control
Distribution	Asset Tracking Vehicle Tracking
Retail	Asset Tracking Digital Signage
Financial Services	Asset Tracking Security Monitoring; Building Monitoring
Healthcare	Security Monitoring Telehealth; Inventory Tracking; Digital Signage
Government	Asset Tracking Public Services (e.g., weather monitoring)
Utilities	Asset Tracking Smart Meters

Source: IDC/Telus

Summary of the IDC/Telus survey:

- Surveyed 209 large and medium sized organizations
- Most IoT deployments considered tactical or strategic; only 13% are viewed as transformational
- Average number of devices deployed: 5,220
- 54% of projects used both wireline and wireless (mainly WiFi and 4G LTE) connectivity; wireless only solutions found in 28% of IoT projects
- Main platform/application developed internally
- Cloud or hosted solutions used in 28% of cases

Figure 5: Benefits of IoT Solutions - Canadian Industry

	Greater Productivity	Improved Quality of Service	Improved Security	Greater Reliability	Cost Savings	Faster Decision-Making
Manufacturing	#2	#1				
Primary (including Oil/Gas)	#2				#1	
Distribution	#2	#1				
Retail			#1	#2		
Financial Services	#1		#2			
Healthcare	#1	#2				
Government	#1			#2		
Utilities		#1				#2

Source: IDC/Telus

*IoT value chain*

Due to the great breadth in the number of industries which have begun to be or soon will be affected by IoT, we do not think that it is right to define IoT as a unified “market”. Rather, we view IoT in an abstract sense as a technology “wave” that will sweep across many industries at different points in time. Like the parable of “The Blind Men and the Elephant,” what “IoT” is depends on one’s point of view, and incomplete perspectives and hype will lead to costly and unrewarding strategies, as well as many poor investments both at the corporate and the venture levels.

As illustrated in Figure 6, the IoT value chain is broad, extremely complex and spans many industries including those as diverse as semiconductors, industrial automation, networking, wireless and wireline operators, software vendors, security and systems integrators. Because of this complexity, very few companies will be able to successfully solve all of the associated problems or exploit the potential opportunities.

Figure 6: The IoT Value Chain

*Broad, extremely complex and spanning many industries*



Source: WCP

- **“Things”**: This layer covers the sensors and sensor-related devices that are used to capture data from the environment, automobiles, trucks, airplanes, trains, machines, machinery, buildings and people. The semiconductor vendors are among the key suppliers of sophisticated IoT sensor technologies, which are then used by others to build consumer, business and industrial IoT devices. From a systems perspective, this layer also covers the platforms that are used to specify, design and build IoT devices.

- **Gateways/Networking Infrastructure:** IoT devices (including home consumer, enterprise or industrial) communicate with communications networks via this layer. The network equipment manufacturers provide the gateways and physical infrastructure for transporting sensor/device data over wireless and wired telecommunications networks. Gateways are also used to allow IoT devices to communicate with other IoT devices.
- **Wireless/Wired Communications Services:** Ubiquitous and inexpensive wireless and cloud services form the backbones for transporting sensor/device data to collection and analytics systems. We expect that service providers, while central to transporting this data, are angling to become more value-added players in the IoT value chain by trying to offer analytics and also looking hard for other ways of monetizing this data or otherwise capturing value.
- **Fast Data/Big Data Analytics:** The sea of data generated by IoT devices will need to be collected, stored and analyzed here. The sheer volume, data rate and the real-time nature of IoT data presents challenges for traditional RDBMS systems which were designed for static data sets. We are seeing both the established companies and many new startups build systems that can manage dynamic real-time data sets.
- **Enterprise Applications:** These are the CRM, BI, supply-chain, billing, procurement and other applications that are indispensable to running a business. IoT creates at least an order of magnitude more information than these systems are accustomed to, which presents an opportunity for innovators to challenge incumbents in the enterprise application space.

*Security & Privacy*

Unfortunately, there are also downsides to this type of empowerment. Two prominent ones are the security risks to critical IT systems and infrastructure and significant loss of individual privacy. We have already seen the harmful consequences of cyberattacks on the Internet, but believe that the much larger number of connected IoT nodes poses an even more serious threat that could damage or shut down infrastructure and potentially even impact GDP.

Consumers have so far been willing to share their Internet habits (browsing and mobile data as well as photographs and personal information like birthdays, as an example), and companies such as Google and Facebook have mined and exploited these nuggets of data to become juggernauts with market caps/cash of around \$362B/\$60B and \$208B/\$11B respectively (as of 02/09/15). IoT will generate even more private and intimate data, and we believe that the Internet giants will be eager to gather, mine, and monetize this data. It is very possible that Governments (at least in the EU) may step up to limit these privacy-sensitive activities.

IoT in the industrial space will result in tangible benefits, but the inherent “openness” of an IP-based network is fraught with security risks that are potentially catastrophic. Imagine the power grid or hospital systems being hijacked and the consequences on the economy and human life. We refer skeptics to read about the Stuxnet worm, which purportedly ruined one-fifth of Iran’s nuclear centrifuges. Chevron has found Stuxnet in its systems and the malware was believed to have infected a Russian nuclear plant. So, we would not be surprised to see industrial automation vendors looking to acquire valuable security expertise from the IP industry to thwart such attacks.

A search engine that has caused consternation is Shodan, which trawls the Internet looking for anything connected to the Internet including routers, servers, as well as IoT systems such as baby monitors, traffic light, security cameras, and home heating systems. “Google crawls for websites. I crawl for devices,” says John Matherly who released Shodan in 2009. Figure 7 is a Shodan map which shows exposed routers that contain a backdoor. We dread to think of the number of back doors that will exist once the projected 20-50 billion IoT devices are deployed.

Figure 7: Shodan Maps  
*Globally exposed routers that contain a backdoor*



Source: <https://shodanio.wordpress.com/2014/02/18/introducing-shodan-maps/>

Besides industrial systems, individuals are also at risk as evidenced by the recent cyber theft of health records of 80 million policy holders of Anthem Blue Cross/Blue Shield (including names, birth dates, social security numbers, addresses and employment information). The Wall Street Journal is reporting that Anthem chose not to encrypt sensitive personal information because doing so would have made it harder for employees to track health care trends or share data with states and health providers!

We fear that companies adopting IoT have little incentive to secure data generated by consumers' homes, cars, and wearables unless compelled to by regulators. The regulators appear to be waking up to these issues and in Section 3 we highlight initiatives by Congress, the FTC, the EU and UK's OFCOM. IoT companies that do not consider the privacy and security implications of their strategy do so at their peril.

A very good example of the issues involved relates to the automobile industry. A report released this month by Sen. Edward Markey (D-Mass.) raises a number of questions about the security of data collected by automobiles and transmitted wirelessly to both automakers and third party vendors. While various alliances of automakers including the

*“IoT-time”*

Alliance of Automobile Manufacturers and the Association of Global Automakers have begun to address the issue by publishing voluntary principles for use of these data, Markey’s staff found multiple instances of automakers recording data such as physical location, last location parked, and destination addresses fed into GPS systems, as well as vehicle diagnostic data, and then transmitting this data to themselves or third parties. Markey is seeking federal-level regulation on the collection and use of these data.

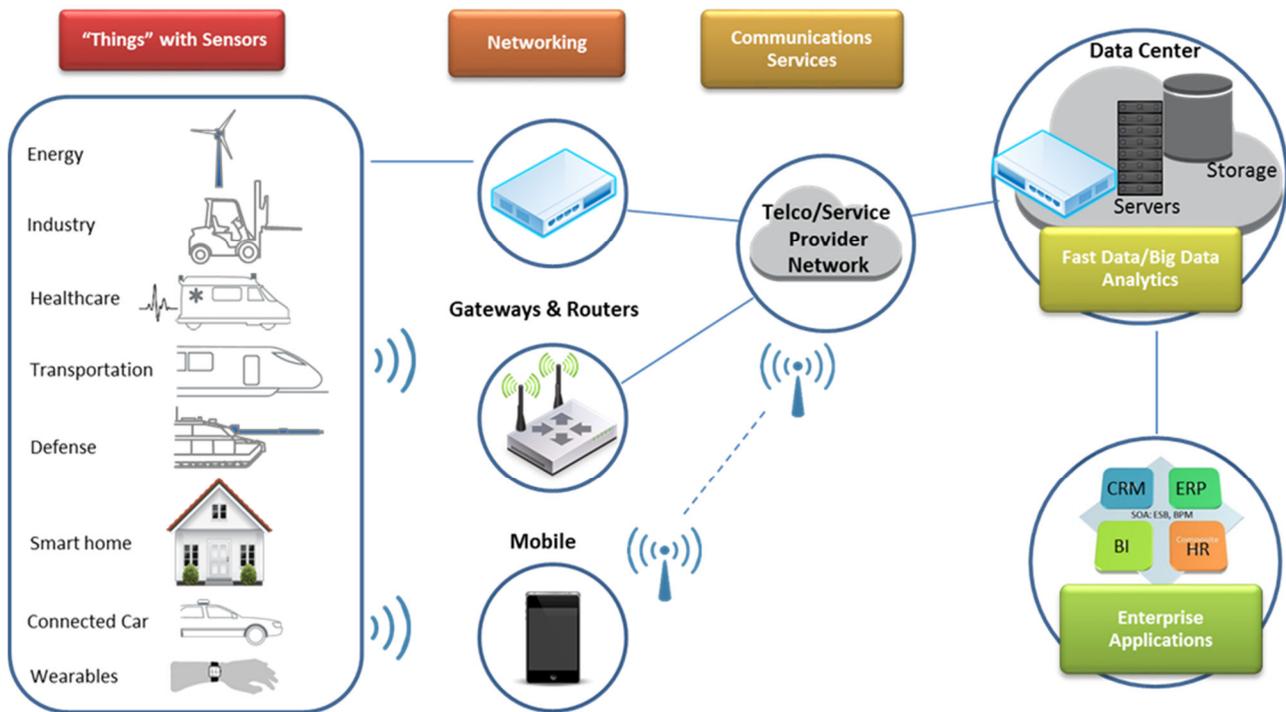
We have all become aware of the high velocity of change brought about by ‘Internet-time’ and the numerous losers and the handful of winners that have now emerged. We believe that “IoT-time” will lead to equally significant structural changes in all industries ranging from agriculture, to manufacturing, services, retail and government. Most aspects of society itself will be impacted by IoT as a result of the numerous ways that people can now connect and communicate with other humans, machines, organizations and their environments. This, combined with new ways for machines to connect to each other, will be transformative over the next several years.

Overall, however, we tend to agree with the views expressed in a recent paper in the Harvard Business Review. (J Heppelmann and M Porter *“How Smart, Connected Products are Transforming Competition”* HBR, November 2014)

This paper introduces the notion of “smart connected products” (SCP). In our view, the authors have avoided a lot of the hype and technical jargon that surrounds the Internet of Things, and have put forward a number of critical questions that Boards, CEOs and investors need to consider carefully. (We discuss their thoughts on IoT strategy in Section 3, later in this report.) At points of major strategic inflection, such as where we stand today, companies must assess how they will leverage a potentially transformative development like the Internet of Things. In multiple industries, companies are analyzing their existing products and services to see how they can be enhanced through IoT and developing plans for how they can add value and differentiate their products from competitors.

To remain competitive they will need to evaluate the capabilities required to compete in IoT. They will then be faced with the decision of whether to develop whatever is required internally, or seek to acquire the appropriate skills or products to be competitive in a new IoT enabled world. Important factors, such as Time-to-Market and internal skills will need to be weighed carefully to position the organization for success.

Figure 8: Enabling the IoT Value Chain  
*Requires a myriad of equipment and software*



Source: WCP

## 2. A Framework for Analyzing IoT Mergers & Acquisitions

In this section, we identify some of the bellwether IoT transactions that have been completed by the leading suppliers of IoT solutions in the technology and Internet market space. To facilitate our analysis, we have categorized the industry sectors into:

- **Home/Consumer** – Solutions sold to consumers for personal or in-home use, and the companies which support them.
- **The Industrial-Business/Enterprise Internet** – IoT technologies that target industrial customers, including mining and extraction industries, manufacturing, and generally anything sold to business customers as end users.
- **Semiconductors/Sensors** – IoT related semiconductors and associated components including sensors, microcontrollers, SoCs; all the building blocks of the physical technologies that support IoT.
- **Networking-Computing** – The physical networking gear (wired and wireless) that carries the data generated, stored and processed by IoT. Plus the software and computer systems needed for big data analysis and business intelligence.
- **Service Provider/Systems Integrator** – The wholesale and retail network operators that run the physical wired and wireless networks. And the systems integrators that help companies build, adapt and monetize their products using IoT networks.

*Using M&A to  
leapfrog competitors*

There has already been a considerable amount of IoT related M&A activity as companies position themselves to compete on an IoT enabled landscape. Google has always been very effective at using M&A as means of gaining competitive advantage and expanding into new markets. A good example of this is Google's original acquisition of Android which allowed the Company to become a major platform player in smartphones, which have evolved to be both an IoT sensor cluster (GPS, accelerometers, etc.) and remote control device.

Google is extending its Android Platform franchise into wearables and acquired WIMM Labs to enhance its capabilities here. WIMM Labs was a pioneer in developing an Android-based platform for wearables, such as Smart Watches. More recently, Google has turned its attention to Smart Home technologies through the acquisitions of Nest (smart connected thermostats), Revolv, and Dropcam.

Google has also been active on the industrial side of IoT with its acquisition of Boston Dynamics, a robotics design company that is best known for the development of BigDog, a quadruped robot designed for the U.S. military. In addition to Boston Dynamics, Google has also acquired a number other robotics and artificial intelligence startups. We are not surprised by these moves as robots could mimic the smartphone-IoT relationships now being observed in the consumer world and become the “robotic smartphone” for delivering industrial IoT apps and services. We think that this could be a way for Google to use its IP and data analytics expertise to enter the industrial IoT market and unseat existing vendors who have to support legacy non-IP M2M systems.

We also believe that Google, much like Apple, would like to position its technology to be a fundamental platform for connected cars. We believe this might explain some of the rationale for its acquisition of Waze. Finally, we believe that Google is also interested in Smart Cities, but has pursued a more organic approach via its broadband and Metro WiFi initiatives as well as Google Maps. The Internet of Things will allow Google to expand into new markets as well, providing a valuable stream of additional user data that can be leveraged in its core business. We don't believe that Google is alone when it comes to the Internet of Things and see competitors, such as Apple, Oracle, IBM, Cisco, and Microsoft developing similar strategies.

*Semiconductors are  
leading the way*

Semiconductors are a vital component of the IoT puzzle, and many of the companies in this industry have been at the forefront of developing components for IoT applications. Semiconductor vendors have been among the most active (and early) players in the IoT M&A space. Several have been actively buying targets with new capabilities in processing, sensing and communications, all of which are IoT segments that are projected to grow at 30% through 2020 versus the overall semiconductor market growth of around 7.5%.

We think that the buzz around “connected home,” wearables, and Google generally, tends to overshadow the enormous potential of IoT products in the industrial, manufacturing and retail worlds. The global industrial automation market is extremely large, amounting to \$170 billion in 2013 and projected to grow at 7% for several years. Companies in this space, such as GE and Zebra, have been quietly adding IP capabilities through internal development and acquisitions and we expect this to accelerate in the coming years, as vendors adapt their M2M systems to IP-based IoT networks.

In the table that follows, we show a framework for mapping these transactions. In subsequent sections and tables, we analyze the rationale behind a number of key M&A deals that have taken place within these sectors. In the appendix to this report, we list many of the other IoT M&A transactions that have occurred in recent years. We expect this list to keep growing.

Notes to the framework on the next page:

1. Efficiencies: Driven by financial metrics, increase market share, expand reach
2. Incremental: Desire to add new features to existing products and solutions
3. Brave New World: Bold attempt to enter new market segment that is unrelated to current business

### A Framework for M&A Analysis - Selected Transactions in the IoT Space

Sector/Goal	EFFICIENCIES <sup>1</sup>	INCREMENTAL <sup>2</sup>	BRAVE NEW WORLD <sup>3</sup>
<b>HOME/CONSUMER</b>		<p>Samsung/Quietside (ND)            Samsung/SmartThings (\$200M Est)            Jawbone/BodyMedia (\$100M Est)            Jawbone/Massive Health (ND)</p>	<p>Facebook/Oculus (\$2B)            Google/Nest (\$3.2B)            Google/Nest/Dropcam (\$555M)            Google/Nest/Revolv (ND)            Google/Waze (\$996M)            Google/WIMM Labs (ND)            Under Armour / Endomondo (\$85M)            Under Armour / MyFitnessPal (\$475M)</p>
<b>INDUSTRIAL-BUSINESS/ENTREPRISE</b>		<p>Echelon/Lumewave (ND)            GE/Wurldtech (ND)            Lockheed/Industrial Defender (ND)            PTC/ThingWorx (\$130M)            PTC/Axeda (\$175M)            Zebra/Motorola Enterprise (\$3.5B)</p>	<p>Google/Boston Dynamics (ND)</p>
<b>SEMICONDUCTOR/ SENSOR</b>	<p>Cypress/Spansion (\$4B)</p>	<p>ARM/Sensinode (ND)            ARM/Offspark (ND)            Atmel/Newport (\$170M)            Freescale/Xsens (\$61M)            Freescale/Zenverge (ND)            Intel/Lantiq (ND)            NXP/Quintic (ND)            Qualcomm/CSR (\$2.5B)            Silicon Labs/Bluegiga (\$61M)            Silicon Labs/Energy Micro (\$170M)            Silicon Labs/Ember (\$72M)            Silicon Labs/Touchstone (\$1.5M)</p>	<p>Intel/Basis Science (ND)</p>
<b>NETWORKING/ COMPUTING</b>		<p>Cisco/JouleX (\$107M)            Cisco/Tail-F (\$175M)            Citrix/Octoblu (ND)            Digi Int'l/Etherios (\$20.5M)            Ericsson/Telenor M2M (ND)            Gemalto/SensoLogic (ND)            Huawei/Neul (\$25M)            LogMeIn/Ionia (\$25M)            LogMeIn/Pachube (\$15M)</p>	<p>Belden/Tripwire (\$710M)</p>
<b>SERVICE PROVIDER</b>	<p>Kore/Raco (ND)</p>	<p>Comcast/PowerCloud (ND)            Sirius XM/Agero (\$530M)            Telit/ILS Technology (\$8.5M)            Telit/Motorola M2M (\$24M)            Verizon/Hughes Telematics (\$737M)            Verizon/nPhase (ND)            ViaSat/LonoCloud (\$2M)            Vodafone/Cobra Automotive (\$269M)</p>	<p>Buyer/Seller (Price paid).            ND = Not disclosed</p>

## Home/Consumer IoT – Selected M&A Transactions

The smart home has been discussed for decades. Honeywell introduced its classic T-86 round thermostat in 1953, and it is one of the world's most recognizable industrial designs and is still available today. It is probably not a coincidence that the Nest thermostat, thought by many to have initiated the current wave of interest in consumer-oriented home automation (as a result of Google's \$3.2 billion acquisition a little over one year ago) is similar in shape and appearance. But the functionality underneath represents the beginning of a different era. And, as we have already begun to see, Google's ambitions with respect to IoT may in fact extend across multiple domains.

### *Building the “operating system” for the connected home*

The Nest devices also connect with each other (as well as other enabled nodes such as your car or other relevant home equipment), and your utility, to make your home more comfortable and your energy consumption more efficient (and thus presumably less costly). Beyond that, Google's acquisitions of Dropcam (simplified in-home video and security monitoring) and Revolv (an early stage developer of a user-friendly home automation hub) illustrate their strategy with respect to the home automation space, using the smartphone as the primary user interface and offering a variety of useful functions under one unified product umbrella.

While it is still very early in the development of these new technologies, the market confrontation between Apple and Google is already clear. Apple has announced HomeKit and HealthKit. HomeKit is its home automation framework for developers, running on its IOS mobile OS, which aims to integrate multiple vendors of home products under one unified control framework that can be controlled from the Apple smartphone or tablet. HealthKit is a similar development framework for health and fitness application development.

From the user's perspective, these solutions, if successful, will unify the control of all sorts of disparate home environment elements into one (hopefully easy-to-operate) user interface.

The comparatively high dollar valuation paid for Nest Labs, and the scale of the opportunity in terms of the sheer volume of devices in consumer households that might be touched by an IoT-oriented technology, has

generated a lot of excitement. There is still, however, quite a bit of experimentation going on as to how best to approach this opportunity and do so profitably.

For example, Cisco, a company whose interest in connecting things is glaringly obvious, has had a few stumbles, having paid about \$600 million for PureDigital (maker of the Flip video cameras) and then shutting it down only two years later, and having acquired Linksys for \$500 million and then selling it off last year to Belkin, presumably for a lot less money, thereby essentially exiting the consumer business and returning to its more familiar turf in the B2B and service provider worlds. (A connected PureDigital camera would be similar to Dropcam - acquired by Google/Nest, and the Linksys routers could have become hubs similar to SmartThings - acquired by Samsung.) Cisco's Home Energy Controller, which was announced to much fanfare in June 2010, was quietly withdrawn in July 2011. The product, which supported both WiFi and Zigbee, was designed to communicate with other "smart" home appliances. It is not clear to us whether these efforts were simply too early or suffered from other more fundamental issues.

Figure 9: Thermostats and Home Control Units

*Established vendors like Honeywell, but Google's Nest has captured the imagination*



Honeywell



Google's Nest



Cisco's Home Energy Controller

Broadly speaking, the IoT is about the digitalization of the world around us and the accumulation of data for analytical purposes. Google and Facebook sell user-generated content (UGC) they acquire in exchange for "free" apps. Apple uses data as part of its overall strategy to build high margin products that people covet that "just work." Other players array themselves across the ecosystem either facilitating these

strategies or working with non-technical players to help them enable and connect their products to the IoT. Some companies angling for a role in the home include GE (in partnership with Quirky), Wink, Belkin, Honeywell, and Lutron.

Both Johnson Controls and Eaton Cooper, long term players in building and energy management, are scrambling to offer smart home and smart building controls. Eaton Cooper recently released a smartphone-based app to control its xComfort line of RF-based wireless home automation technologies. Johnson Controls has rolled out the Panoptix cloud based building efficiency platform that connects with its existing building management technologies to offer enhanced analytic capabilities to enable more efficient building management.

In addition to its acquisition of SmartThings (an open IoT platform technology player), Samsung has also acquired QuietSide (HVAC distributor), and claims these acquisitions are part of its IoT strategy, which aims to connect every electronic device Samsung makes to the Internet, but they have not yet convincingly made the case for why this is necessary or desirable.

### *Connected appliance*

Companies have to be able to leverage the rapidly declining cost of technology and the near ubiquity of internet connectivity to improve relationships with the consumer, find new sources of revenue, and gain differentiated competitive advantage. The Internet of Things allows them to take this to another level.

For example, in areas as mainstream as White Goods (refrigerators, washers, and dryers), we estimate that for less than \$20 per unit major manufacturers, such as Whirlpool, GE, Bosch and Haier will be able to embed WiFi connectivity solutions from companies such as GainSpan, Marvell, Murata, RedPine Signals and Silicon Labs that will allow customers to connect their appliances to the Internet.

What is the benefit of connected appliances? A closer relationship with the customer, the ability to instill deeper brand loyalty and the opportunity to influence future appliance purchases, a better user experience for the customer, the ability to remind customers to replace consumables (filters, etc..) and to alert them to the potential need for service.

We believe that over the life of a given product, through the sale of high-margin (>80%) aftermarket consumables and service, the OEM has an opportunity to capture approximately the same level of gross margin dollars as on the initial sale of the appliance, which tends to carry relatively low gross margins. We believe these factors provide strong motivation for White Goods OEMs (as well as other manufacturers who can exploit similar business models) to embrace the Internet of Things.

### *Wearables*

Apart from the home, another area of strong interest and activity on the consumer side has been in wearable devices. WCP advised WiMM, a maker of an Android-based wearable wrist computer, in its sale to Google in 2012. Apple has recently announced the Apple iWatch, which will leverage both HomeKit and HealthKit for wearable applications.

As Apple and Google move to consolidate their hold on the developer community, Jawbone has also attempted to build on its existing hardware strengths with the acquisitions of Massive Health and BodyMedia, extending their ability to use biometric data to help users improve fitness and health.

### *Crowdfunding as a source of innovation*

An interesting phenomenon in the home/consumer IoT space is the ability to start a company using founders' funds or crowdsourcing. Due to the ready availability of sophisticated communications and computing systems-on-a-chip (SoC), the cost of developing hardware has fallen dramatically, which allows entrepreneurs to rapidly come up with sellable products. Crowdfunding has been responsible for a number of products for the smart home, including lighting control, bulbs, locks, and energy management. We have also seen similar products emerge in the wearables arena including those that track health or improve performance at certain sports.

Nest Labs (Palo Alto, CA) and SmartThings (Washington, DC) are two examples of companies that began this way and then went on to be acquired by Google and Samsung respectively. The crowdfunded phenomenon is not confined to US-based companies. For example, LIFX, which makes smart bulbs, began in Australia before moving to Silicon Valley and raising a \$12 million Series A from Sequoia Capital. Another example is the wearables company, ActiveMind Technologies, which was bootstrapped in Ireland, but later moved to San Francisco to try and sell its golf wearable.

Given the complexities surrounding distribution and post-sales support needed in the consumer/home space, we expect to see the few successful companies to look to be acquired once they have proven product/market viability. We also expect many of the crowdfunded consumer/home companies to fail and simply fade away.

One of the more high profile crowdfunded projects was Pebble Technology, maker of the Pebble smartwatch, which raised more than \$10 million from around 69,000 people. The product now sells on Amazon for \$140. It will be interesting to see how Pebble fares once Apple releases its iWatch. We think that the threat of competition from bigger companies was a major factor motivating investors in Basis Science to sell that company to Intel.

Figure 10: Pebble Smartwatch

*An early entrant, but now facing competition from Apple, Swatch, Samsung and others*



### Selected M&A Transactions – Home/Consumer IoT

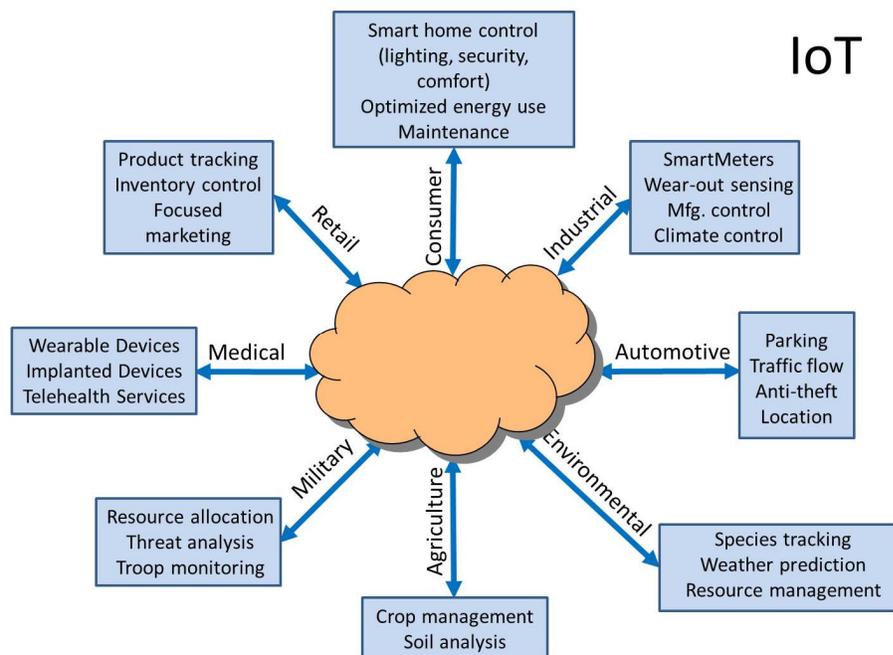
Acquirer	Date	Target	Price	Product	Rationale
Facebook	Jan-15	Wit.ai	ND	Voice recognition technology for wearable devices and Internet-connected appliances	<ul style="list-style-type: none"> <li>- Voice recognition technology will simplify entry of data into mobile devices which have small keyboards</li> <li>- To better compete against mobile devices from Apple (Siri) and Microsoft (Cortana)</li> <li>- Natural language control for keyboardless devices (e.g. set top box)</li> </ul>
Facebook	Mar-14	Oculus VR	\$2B	Virtual reality goggles	<ul style="list-style-type: none"> <li>- Part of Facebook's strategy of connecting people across devices and modes of communications.</li> <li>- Combining VR and social media</li> <li>- Puts Facebook into the hardware business</li> </ul>
Google/ Nest	Oct-14	Revolv	ND	Smart hub that controls lights, speakers, locks	<ul style="list-style-type: none"> <li>- Acquired Revolv for its smart home developer platform</li> <li>- Talent acquisition: experts in home wireless communication systems</li> </ul>
Google / Nest	Jun-14	Dropcam	\$555M / cash	Wi-Fi webcams and cloud-based storage	<ul style="list-style-type: none"> <li>- Allows Google/Nest into the home video-surveillance market</li> <li>- Complements thermostats and smoke detectors</li> <li>- Competition from traditional home automation vendors such as Honeywell.</li> </ul>
Google	Jan-14	Nest Labs	\$3.2B / cash	Smart thermostats and smoke alarms for homes	<ul style="list-style-type: none"> <li>- Nest thermostats provide insights into consumer energy use</li> <li>- Google plans to sell this data to energy providers to help them influence energy usage.</li> <li>- Gain foothold in the emerging market for Internet-connected household appliances.</li> <li>- Thwart competition from Apple, Microsoft, Amazon and others for control of the smarthome</li> </ul>
Google	Aug-13	WIMM Labs	ND	Smartwatch/wearables	<ul style="list-style-type: none"> <li>- Goal of making Android the leading platform for wearables</li> </ul>
Google	Jun-13	Waze (Israel)	\$966M	Israeli mapping and navigation company. A free social traffic and navigation app that allows users to share real-time traffic and navigation information (45M users at time of purchase.)	<ul style="list-style-type: none"> <li>- Plans to enhance Google Maps with Waze's traffic updates features and improve the Waze app with Google's search capabilities</li> <li>- Battle for consumer loyalty to mobile devices - Facebook and Apple were potential buyers.</li> <li>- Personalized maps to users needs</li> <li>- Global footprint: used in 190 countries</li> </ul>
Jawbone	Apr-13	BodyMedia	\$100M / Est	Wearable health tracking devices	<ul style="list-style-type: none"> <li>- Complements Jawbone's existing wearables technology with added expertise in body monitoring and health and fitness</li> </ul>
Jawbone	Feb-13	Massive Health	ND	Eatery app for the nutrition conscious. Expertise in using data to help people track their health	<ul style="list-style-type: none"> <li>- Combine Jawbone hardware with Massive Health's software to help users gather and quantify data related to eating habits.</li> </ul>
Samsung	Aug-14	SmartThings	\$200M / Est	Smarthome hub. Competitor to Revolv.	<ul style="list-style-type: none"> <li>- A hub component for Samsung's connected home strategy</li> </ul>
Samsung	Aug-14	Quietside	ND	Leading HVAC distributor for Samsung in USA and Canada	<ul style="list-style-type: none"> <li>- Part of the smarthome/smartoffice strategy</li> </ul>
Under Armour	Feb-15	MyFitnessPal	\$475M	Health Tracking app	<ul style="list-style-type: none"> <li>- Will complement the company's current software</li> <li>- Gives Under Armour 120 million users</li> <li>- Lock in customers with technology and services rather than t-shirts and shoes</li> </ul>
Under Armour	Feb-15	Endomondo	\$85M	Social Sports and fitness network	<ul style="list-style-type: none"> <li>- Generate revenue with premium versions and advertising</li> <li>- Compete against Nike activity tracking</li> <li>- Go to market faster with acquired tech talent</li> </ul>

The Industrial & Business/Enterprise Internet IoT – Selected M&A Transactions

We think the “buzz” surrounding IoT has so far been more focused on the home, consumer and wearables markets, and tends to overshadow the enormous potential of Internet Protocol (IP) connected products in industrial and business/ enterprise worlds. IoT in the consumer world is effectively a greenfield opportunity with no installed base and no dominant vendors, whereas there are many examples of connected products in this arena.

Our definition of the “Industrial and business/enterprise Internet” for IoT purposes refers to all non-consumer applications of the Internet of Things, ranging from smart cities, smart power grids, connected health, retail, supply chain and military applications. The technologies and solutions needed for creating smart connected products and processes share many common attributes across industrial and business verticals.

Figure 11: IoT Market Segments  
Potential to positively impact every industry and economic activity



Source: Chip Design

The predecessor to what we now refer to as IoT in the industrial-business/enterprise sectors is M2M, or “machine-to-machine” technology. This encompasses a wide variety of different proprietary communications and networking protocols, typically developed and maintained by a single vendor or a primary vendor with a group of licensees, all addressing one or more specific industry verticals. SCADA (Supervisory Control and Data Acquisition) and DCS (distributed Control System) are examples of communications systems that are widely used and well established.

*Industrial IoT is different than consumer IoT*

In the industrial and business/enterprise worlds, in contrast to the consumer domain, billions of dollars worth of investment in connectivity and control systems has already been made and these systems have been operating reliably in production environments, in some cases for many years. It is highly unlikely that these investments will simply be ripped out and replaced with Internet Protocol (IP) enabled Industrial Internet. Instead, vendors and their customers are likely to take a more evolutionary approach using new products to create bridges and overlays between the old and new worlds.

Also, in contrast to consumer-oriented strategies, industrial and business/enterprise vendors tend to be very focused on reliability and are more likely to give up open standards in favor of the higher functionality a dedicated technology stack can provide. Over time, however, this may change, as open standards become more ubiquitous and robust, and end users increasingly try to avoid long-term “lock in” and pursue competing solutions. Industrial-business/enterprise players also tend to be much more aware of and sensitive to issues of ownership of the data, and data security/intrusion prevention.

*Example: Mining*

The mining industry is good example of how IoT can offer significant and cost-effective operational improvements. IoT can improve safety, streamline operations, and dramatically enhance data collection. It is an industry that operates in hostile environments mostly in isolated areas, often deep underground, and typically 24 hours a day, using enormous and potentially very dangerous equipment. IoT can be used in a number of ways including:

- Mine safety: location and proximity sensors can be used to track equipment and miners to minimize the chances of either one being at the wrong place at the wrong time
- Autonomous operation of expensive trucks and trains: remotely connected trucks and trains with hundreds of sensors on them and guidance systems can operate 24 hours a day without the issue of human fatigue
- Data collection and visualization: sensors can collect real-time geological and equipment data that can be used on site by operators, as well as in operation centers that can be located in distant cities or even other countries to streamline mining operations
- Maintenance: sensors can feed predictive models with data that can then be used to do preventative maintenance on expensive equipment.

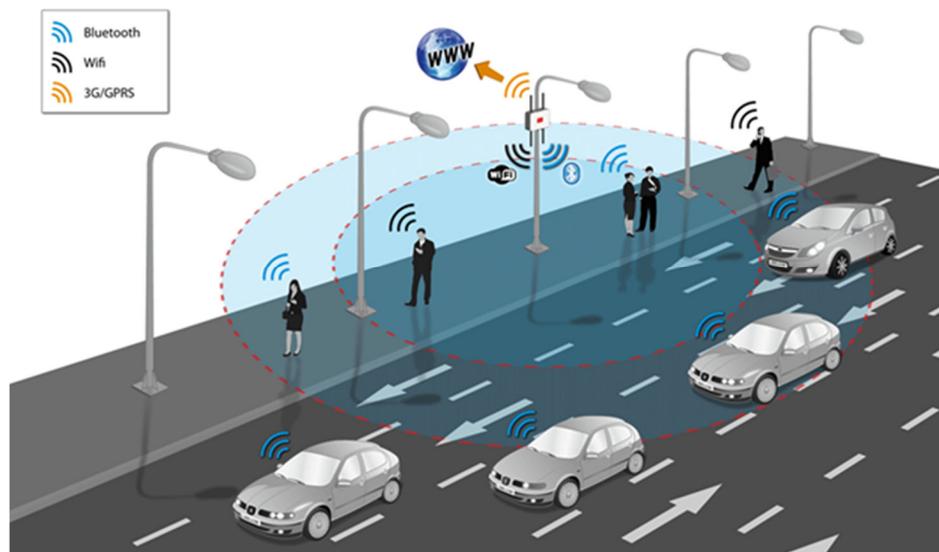
#### *Example: Retail*

Another business segment that should benefit from IoT is the brick-and-mortar retail industry. This industry, which has been disrupted by ecommerce giants such as Amazon, will have to look for creative ways to compete with online competitors by lowering costs, improving efficiencies and providing greater value to their customers. An area where IoT could have the greatest impact is in the management of supply chains and warehouses, where it could reduce inventory holding costs and optimize fulfillment times. IoT could also change the way retailers interact with their customers. A combination of smartphones, in-store sensors and opt-in customer data could be a treasure trove for fine tuning promotions and engaging customers in novel ways.

Smart Cities

Related to the overall industrial-business/enterprise space, "smart cities" has emerged as an area of focus, particularly for Cisco. There is good reason to believe that cities and other local government entities will be early adopters of IoT technologies, because the benefits are clear and the customers have long time horizons. Although cities worldwide operate under severe budget constraints, their long-term time horizon permits them to make calculated bets on new functionality if the benefits are compelling.

Figure 12: Smart Cities  
*Combinations of Sensors and Wireless Networks*

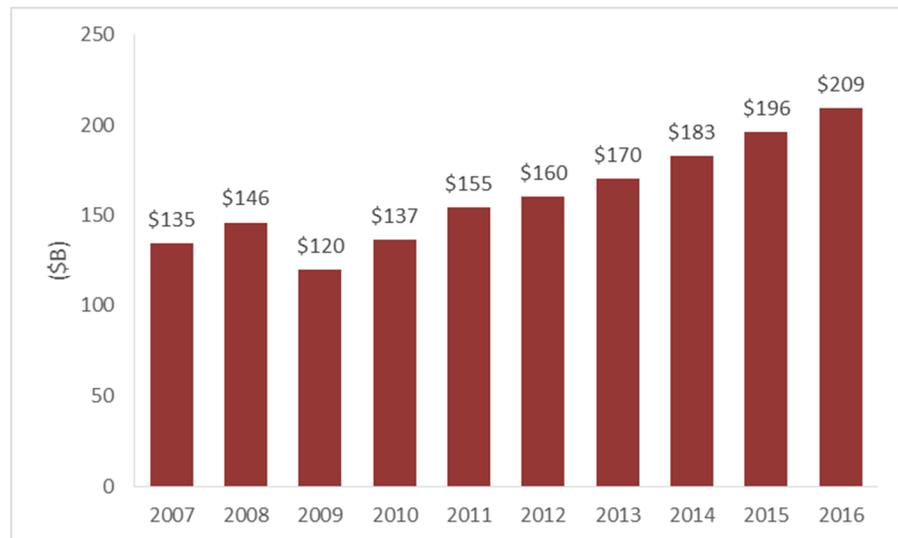


Source: Libelium

For example, street lighting offers many intriguing possibilities. Not only can cities manage their lighting more efficiently, reducing their power consumption and thereby the cost of operation, they can also use the light pole as a locus for sensing devices, connect them into a mesh network, and selectively activate or deactivate lighting for public safety reasons - switching on bright illumination at an accident scene, for example, and switching off illumination in terrorist situations where a tactical team benefits from darkness. Some M&A activity is likely as traditional players position themselves for the necessary technical sophistication to compete in this space.

The global industrial-business/enterprise automation market is extremely large, amounting to \$170 billion in 2013 and projected to grow at 7 percent for several years (source: IHS). IHS also forecasts that the industrial automation sector accounts for nearly 75 percent of all IP-connected devices.

Figure 13: Global Revenue Forecast for Industrial Automation Equipment



Source: IHS Technology

The companies in this space supply a wide array of process and control equipment and services to a broad spectrum of industries including energy, automotive, aerospace, utilities, retail and healthcare. These companies and their customers are continually looking for ways of improving efficiencies, lowering costs and increasing productivity. IoT with its sophisticated sensors, ubiquitous IP connectivity, and advanced data analytics has the potential to progressively transform these companies' products and their customers' offerings.

The figure on the next page represents a cross section of the leading suppliers of industrial automation companies worldwide.

Figure 14: Revenues of Selected Industrial Automation Giants

Company	LTM Revenues	Market Cap	Solutions
ABB (Switzerland/Sweden)	\$39B	\$46B	Robotics, power and automation
BorgWarner (USA)	\$8B	\$13B	Automotive industry components and parts
Bosch (Germany)	\$52B	NA	Automotive, industrial, energy, building products and consumer goods
Emerson (USA)	\$25B	\$39B	Products and services for industrial, commercial and consumer markets
Fanuc (Japan)	\$5B	\$32B	Robotics and computer numerical control systems
GE (USA)	\$148B	\$242B	Infrastructure services and industrial equipment.
Honeywell (USA)	\$40B	\$78B	Diversified technology and manufacturing company
Johnson Controls (USA)	\$43B	\$31B	Building efficiency, automotive efficiency and power solutions
Omron (Japan)	\$7B	\$8B	Control equipment, factory automation systems and related
Schneider Electric (France)	\$27B	\$44B	Energy management technology
Schlumberger (USA)	\$48B	\$107B	Services and technology to the oil and gas industries
Siemens (Germany)	\$82B	\$90B	Engineering conglomerate – broad Industry, energy, healthcare solutions
United Tech (USA)	\$65B	\$107B	Tech and services to the building systems and aerospace industries
source: CapIQ, as of 02/06/15			

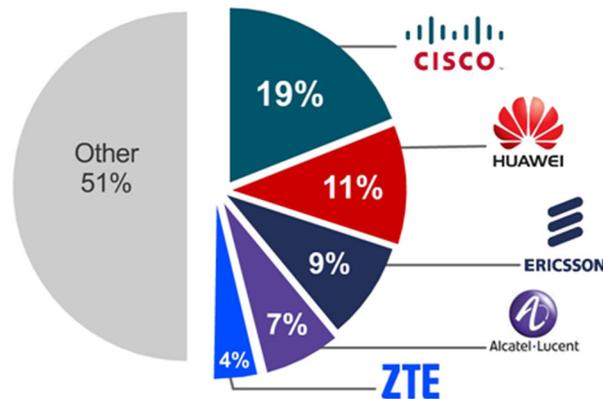
*Incumbency may not offer protection*

Large markets tend to attract competitors, and we think that the industrial automation market, already competitive, could attract newcomers from outside the industry that have requisite skills in Internet Protocol and data analytics – both essential to IoT. A likely scenario here could be gleaned by events that transformed the telecom equipment world, where, for nearly 100 years, a handful of companies – Lucent, Nortel, Alcatel, Siemens, Nokia and Ericsson – supplied proprietary TDM/PSTN equipment to telecommunications carriers worldwide. These (mostly regulated) telecommunications carriers sold their services to captive customers.

However, industry deregulation and the shift from traditional TDM/PSTN networks to IP-packet systems allowed the entry of new carriers, who drove prices down, and new equipment vendors such as

Cisco who were experts in IP networks. The added competition and the changes in technology transformed the telecommunications landscape into what we see today, dominated by digital wireless and wired services, and generally much lower prices. On the equipment front, the entry of Chinese vendors Huawei and ZTE has put additional pressure on more established vendors. In terms of the original vendors, Nortel went bankrupt, Alcatel merged with Lucent and dozens of others simply faded away. In terms of the non-Chinese vendors, only Cisco has maintained its dominance.

Figure 15: Top 5 Telecom and Datacom Vendors in 2014 – Based on Total Revenue



Source: Infonetics

Similarly, we think that in the industrial world, the shift (albeit gradual) from proprietary control systems and sensors towards open IP-based IoT systems could result in a more competitive environment with lower prices and profits. The more prescient industrial-business/enterprise automation vendors will adapt by acquiring technologies from smaller companies to bolster their physical products. Because in the new IoT world a lot of the economic value lies in analytics, we expect to see these companies building up their big data analytics capabilities both via acquisitions and through direct investments and partnerships with established big data software vendors.

### *Defense and IoT*

US military planners and those elsewhere have publically touted the benefits of IoT in all arenas, including national security, the battlefield, uniforms, supply lines and weapons systems. The US Defense Information Systems Agency (DISA) includes IoT on its list of technologies to watch.

Intelligent uniforms and wearables would improve the safety of soldiers and the ability to embed sophisticated sensors that can provide real-time information to provide better information to battlefield commanders.

The vast amount of information generated by military assets needs to be secured, and we expect to see strong interest in systems that encrypt and protect devices and transmission networks. We also expect to see the development of fast data and big data systems tailored for defense and national security applications, such as those from Palantir and Narus (recently sold by Boeing to Symantec).

### *A selection of IoT vendors*

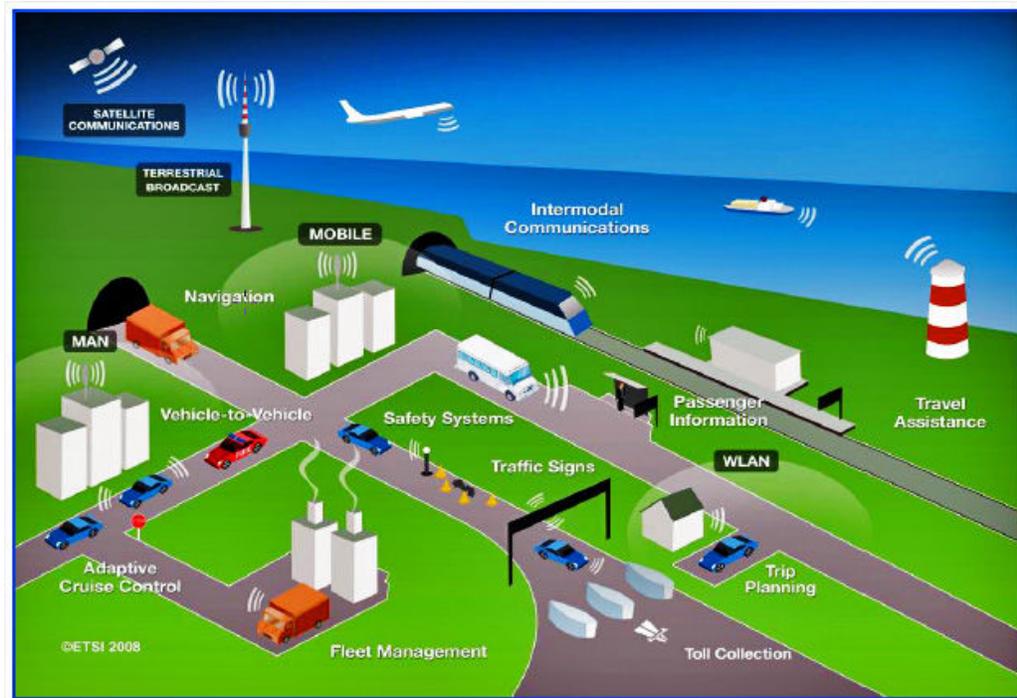
We have seen some interesting industrial IoT solutions emerge from smaller or startup companies and have listed some of them below. Some of these companies have received investments from larger vendors such as GE and Cisco.

An example is GE's investment of \$105 million in Pivotal, a "big-data" spin-off from VMware. To further bolster its industrial internet credentials, GE has also announced partnerships with AT&T (communications services), Cisco (networking equipment), Amazon Web Services (cloud computing), and Accenture (systems integration). In addition to the Pivotal deal, GE has also invested \$15 million in Mocana, whose cryptosecurity technology can be embedded in medical devices, consumer electronics and industrial automation.

In 2013, Cisco, together with NXP Semiconductors, announced an investment in Cohda Wireless, a developer of hardware, software and chipsets for connected cars that allow vehicles to form ad hoc mesh networks to communicate with each other and with infrastructure to prevent collisions and improve road safety. Cisco will license Cohda's software, while NXP will license the company's 802.11p radio designs.

IoT also has the potential to connect railroads with real-time information that improves safety, efficiency and customer satisfaction. Nomad Digital is one example of a company that provides remote monitoring and maintenance solutions for optimizing rail industry fleet management and operational performance. The company, with 50 customers worldwide, plans to offer a full range of real-time solutions to rail and transport operators.

Figure 16: IoT and Transportation  
*Offers innovative ways to improve efficiency and safety*



Source: Cisco

“Platform” players such as Ayla Networks, Arrayent, and Electric Imp are building technology solutions that will enable white goods manufacturers to add connectivity and functionality to their existing consumer products without needing to develop extensive internal expertise far removed from their core business strengths. White goods represent just one early use case; these platform technologies can add connectivity to anything that might benefit from it, for relatively low cost.

Japanese cloud-based mobile application development company Kii is extending its expertise into the IoT space and is a platform that features device management, analytics and a mobile backend. Arduino is a flexible open source hardware and software platform that can be used to create IoT devices. Veedims, a company with expertise in delivery of power and data through a single cable offers IoT platforms to OEMS and ODMs.

Bsquare, an established vendor of embedded solutions, has discovered opportunities in the IoT space with customers such as Ford, Honeywell, Microsoft and Coca Cola. Another long-time M2M vendor, Digi International, has evolved its products and services to support IoT. And with its acquisition of Etherios, Digi can offer its IoT customers a cloud computing platform for integrating machines and “things” into business processes via the Salesforce Service Cloud. Echelon sold its smart meter business to focus on IoT, and in August 2014, acquired Lumewave, a developer of network controls and software platforms for outdoor lighting.

Newtrax offers wireless network connectivity nodes that are used in more than 35 underground mines around the world. These battery powered nodes last more than three years and can be deployed by regular miners. The payback of these systems is typically measured in weeks. Sine-Wave has a software platform tailored to IoT applications and the company has worked with ArgonST/Boeing to build miner safety systems. Libelium has teamed up with IBM (Mote Runner) to offer a 6LoWPAN/IPv6 starter kit for applications in smart cities, health care and retail.

Percolata, funded by Google Ventures and Andreessen Horowitz, offers retailers the ability to detect in-store traffic and deliver data about the habits of consumers at physical stores. Percolata charges a one-time fee to install wireless sensors and a monthly fee to analyze the data gathered. An early customer is Uniqlo, with stores in the US and Japan, and the system will initially be used to better schedule staff to match estimated store traffic.

In the lighting industry, we are seeing some innovative solutions emerging from smaller companies, including Digital Lumens, Daintree Networks, Enlighted, and Redwood Systems, which was acquired by CommScope. Adura Technologies, a Silicon Valley based developer of RF mesh networking technology that allows light fixtures to communicate with switches, sensors and systems management software was acquired by Acuity Brands (Market cap: \$6.5B. LTM revenues: \$2.5B). Osram Sylvania acquired Encelium for its expertise in energy saving systems and software used in commercial lighting systems. Legrand, another established energy/lighting company in this space, has been systematically acquiring companies over the past 30 years.

### *Notable acquisitions*

PTC's acquisition of ThingWorx is a good example of a pure platform play for industrial-business/enterprise IoT. ThingWorx had already achieved success across multiple industry verticals, including mining, agriculture, process manufacturing, and food and beverage, as well as a variety of consumer sectors. PTC, already a player in industry and manufacturing, extends its reach to many new verticals as well as service providers with this acquisition.

PTC then added to its already strong position with the complementary acquisition of Axeda, bringing IoT connectivity services, software agents, and toolkits to enable companies to connect their products to the cloud, and then remotely monitor and service those products, all with robust and reliable security and performance.

As "Things" are increasingly connected to the Internet for monitoring and control, however, they become increasingly vulnerable to the same types of security breaches that we've already been experiencing in the consumer internet. The people who design, build, install and operate

this equipment have not historically needed to be IT/networking security experts and we expect to see combinations of acquisitions, partnerships and internal development activities to fill holes here.

An example is GE's acquisition of Wurldtech, which was motivated by GE's desire to improve the security of sensor networks associated with its major infrastructure equipment such as wind turbines or power plant gear. By adding Wurldtech, GE is able to sell security services and solutions alongside its traditional industrial equipment, addressing these new requirements for its existing customer base, and extending its reach into the IoT for the industrial space.

Another set of acquisitions is that by France-based security vendor Gemalto of SafeNet in August 2014 for \$890 million. SafeNet offers authentication and encryption technologies that can be used to protect network transactions as well cloud data and software. SafeNet's technology protects 80% of the world's intra-bank fund transfers and the company has 25,000 customers including governments and corporations such as Bank of America, Cisco, Dell and Hewlett-Packard. Earlier in 2011, Gemalto acquired SensorLogic for that company's cloud-based M2M service delivery platform.

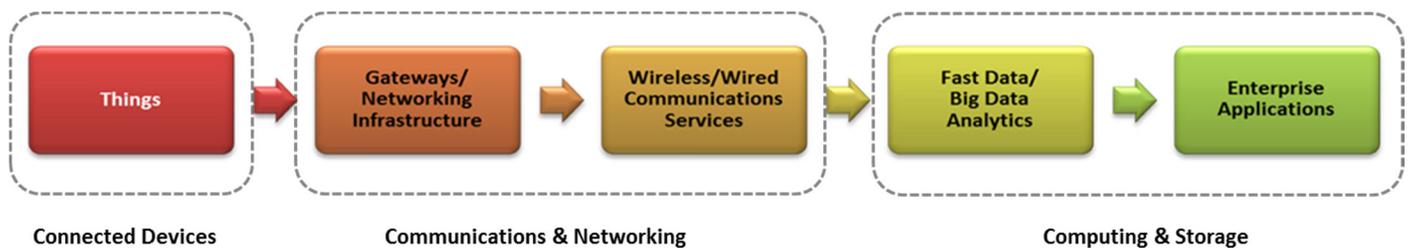
## Selected M&amp;A Transactions – Industrial-Business/Enterprise Internet

Acquiror	Date	Target	Price	Product	Rationale
Echelon	Aug-14	Lumewave	ND	Wireless solutions for control and monitoring of outdoor lighting	- Expansion into the wireless lighting controls space
GE	May-14	Wurldtech	ND	Cybersecurity for infrastructure for operations technology (OT)	- Cyber-security products that protect big industrial sites like refineries and power plants from cyber attacks - Systems to protect the Operations Technology that connects people, data and machines - Maximizing system uptime and mitigating exposure to vulnerabilities
Google	Dec-13	Boston Dynamics	ND	Robots for military and industrial applications	- Robots are becoming data driven and based around sophisticated sensors - Robots could mimic the smartphone-IoT relationship in the consumer world and become the platform for delivering industrial IoT products and services - A way for Google to use its IP/data analytics expertise and enter the industrial IoT market and unseat existing vendors who have to support legacy M2M asystems - In addition to Boston Dynamics, Google has acquired a number of robotics and artificial intelligence startups
Lockheed	Mar-14	Industrial Defender	ND	Cyber security solutions for control systems in the oil and gas, utility and chemical industries	- Protect critical infrastructure, such as electric power grids, chemical facilities, and oil and gas pipelines - Industrial Defender's expertise in cyber security for critical infrastructure is a natural extension to Lockheed's commercial cyber security business
PTC	Jul-14	Axeda	\$175M/ cash	Cloud-based IoT platform for applications that provides secure connections between devices and people More than 150 customers including AT&T, GE, Medtronic, Microsoft and Siemens Around \$30M in revenues	- Access to Axeda's customer base that includes mobile network operators, edge device and design-in device makers, systems integrators, and business systems/analytics providers
PTC	Dec-13	ThingWorx	\$112M/ cash + earn out of up to \$18M	Platform for developing applications for connected world Expertise in M2M	- Acquire an application development platform for connecting people, systems, and devices - To better support manufacturers creating and servicing smart, aconnected products - Access customers in a wide range of industries seeking to leverage the IoT, including telecommunications, utilities, medical devices, agriculture, and transportation, as well as an emerging partner network of IoT-enabled service providers - Positioning itself to become a major player in IoT/M2M platforms
Zebra	Apr-15	Motorola solutions Enterprise business	\$34B	Rugged mobile computers, tablets and WLAN products for businesses	- Motorola Solutions' mobile platform (\$25B in revenues in 2013) captures real-time data about physical assets, people, and transactions across the enterprise Zebra's enabling technologies (bar code labels and radio tags) provide visibility into business operations for deeper insights and smarter decision-making - By combining with Motorola, Zebra can better compete against competitors such as Honeywell - Broadens Zebra's portfolio of patents to around 4,500

### Semiconductor/Sensor IoT – Selected M&A Transactions

We believe that the semiconductor industry will be a major beneficiary of the growth of the Internet of Things. The industry will be a key supplier of the building blocks used by all of the industry sectors shown the following diagram: computing and storage, communications and networking, the “Things” or connected devices.

Figure 17: The IoT Value Chain



Source: WCP

In the case of Computing and Storage, we believe IoT will accelerate growth for many of the semiconductor companies that have benefited from the move to cloud computing by providing processors and DRAM for servers, Flash Memory to enable Solid State Storage, and other chipsets and communication ICs that are used in data centers. We view Intel as continuing to be a dominant beneficiary in this domain, provided it can continue to fight off challenges from companies trying to drive ARM-based processors into the data center.

One vital requirement associated with the shift to IoT is the real-time element that is critical to creating an acceptable user experience. When contemplating functions like process control in the industrial domain or responding to somebody ringing your video enabled doorbell, networks will need to be very dynamic and real-time in nature. This reality is driving a subtle re-architecting of network infrastructure to push some of the processing and analytics out towards the end of the network rather than centrally processing everything in the cloud. (Cisco calls this approach FOG computing.) We see opportunities for semiconductor companies to benefit from this shift as well. There are a number of

companies, such as Intel, Freescale, Marvell, and Texas Instruments that are architecting solutions for gateways. Traditional Comm IC providers, such as Broadcom, Cavium, AMCC, and PMC Sierra should also see opportunities to improve network performance. Ever-increasing bandwidth of optical communications will also be a driver for companies like Avago. In some cases, these companies may already be well positioned, but we believe that many will use M&A as a tool to position themselves.

We believe that the “Things” in the Internet of Things represent a major opportunity for innovation and will drive a lot of M&A activity. Many of the 50 billion Things or connected devices that industry analysts forecast will ultimately be connected to the Internet are relatively low cost sensors (video, temperature, pressure, audio, GPS, accelerometers, etc.). Many of these devices will be wirelessly connected by LTE, WiFi, Zigbee, and Bluetooth low-energy. To meet customer requirements, semiconductor companies will be required to provide low-power solutions that include microcontrollers, memory, analog circuits, power management, and wireless connectivity. This has been a long-term trend for leading microcontroller companies, such as Texas Instruments, Microchip, and Silicon Labs who have been aware of this trend and have been acquiring assets to enhance their core position.

Silicon Labs, for example, has been very active on the acquisition front to position itself for the Internet of Things. Recently, Silicon Labs acquired Bluegiga, a leader in Bluetooth and Wi-Fi connectivity solutions. The company acquired Touchstone Semi to enhance its position in power management and low-power analog. Through its acquisition of Energy Micro AS, Silicon Labs got access to low-power ARM processors and RF solutions. Silicon Labs also acquired Ember Corporation for leading silicon, software and development tools for 2.4 GHz wireless mesh networking solutions being deployed in smart energy, connected home, security, lighting, and many other monitoring and control applications. The Company also acquired Silicon Clocks, the developer of a MEMS process technology that allows for the fabrication of MEMS resonators and other sensor structures directly on top of standard CMOS wafers. Finally, Silicon Labs acquired ChipSensors Limited, an early stage technology company creating innovative single-chip CMOS sensors designed to detect temperature and humidity. WCP

represented Silicon Clocks and ChipSensors in their acquisition by Silicon Labs.

With this series of acquisitions combined with their own internal technology development, Silicon Labs has assembled an enviable portfolio of low-power processors, analog, power management, wireless technology, and sensors that can be used to develop low-power IoT devices.

We believe that in addition to assembling a strong suite of microcontrollers, embedded memory, analog, sensor and wireless technologies that semiconductor companies will look to enhance their embedded development tool offering either through acquisition or via partnering with companies, such as IS2T, that offers a very compact, high-performance IoT application development environment.

Powering the Internet of Things will be another area of innovation. We find it difficult to imagine a world of 50 Billion connected devices, many wireless, that will be powered by traditional batteries. In this area, we believe that innovative energy storage technologies from companies, such as Cymbet, as well as energy harvesting technology from companies, such as MicroGen, EnOcean, and Perpetuum will be important enabling technologies.

There has been a fair amount of Semiconductor related IoT acquisitions and we expect this trend to continue as companies position themselves to capitalize on this market opportunity. The following table highlights a number of recent IoT M&A transactions.

## Selected M&amp;A Transactions – Semiconductor IoT

Acquiror	Date	Target	Price	Product	Rationale
ARM	Feb-15	Offspark (Netherlands)	ND	SSL security for IoT applications	<ul style="list-style-type: none"> <li>- Offspark's SSL technology is embedded in sensor and communication modules and smartphones</li> <li>- Allows ARM to add cryptography to its IoT platform</li> </ul>
ARM	Aug-13	Sensinode (Finland)	ND	6LoWPAN and CoAP standards for low-cost, low-power devices	<ul style="list-style-type: none"> <li>- Adding Sensinode's technology will enable developers to easily create IoT applications running on ARM hardware</li> <li>- Licensing model to chip vendors that is similar to ARM's</li> </ul>
Atmel	Jul-14	Newport Media	\$140M + \$30M earnout over 2 yrs	High-performance, low-power Wi-Fi and Bluetooth chips	<ul style="list-style-type: none"> <li>- To gain access to chips with wireless radio capabilities</li> <li>- Integrated with Atmel's ultra-low power microcontroller for industrial, building automation and consumer products requiring small form factors and long battery life</li> </ul>
Cypress Semiconductor	Dec-14	Spansion	\$4B/Stock-swap merger	Spansion: microcontrollers for auto and industrial applications Cypress: Consumer electronics and IoT	<ul style="list-style-type: none"> <li>- Operating efficiencies, scale and better reach in key markets such as Japan</li> <li>- Microcontrollers for IoT, car, communication and industrial markets</li> <li>- More than \$135M in cost savings within three years, and the deal to be accretive to non-GAAP earnings within a year</li> </ul>
Fairchild	Mar-14	Xsens	\$61M	3D motion tracking products based upon miniature MEMS inertial sensor technology	<ul style="list-style-type: none"> <li>- Entry into new market: Xsens technology has been used by Hollywood for 3-D character animation, sports science, and robot and camera stabilization</li> </ul>
Freescale	Dec-14	Zenverge	ND	Fabless semi developer of HD content processing ICs	<ul style="list-style-type: none"> <li>- Enhance Freescale's content processing, storage and interoperability capabilities for a range of Video IoT applications and markets</li> </ul>
Intel	Feb-15	Lantiq (Germany)	ND But believed to be around \$280M	DSL and communications chipset/patents for broadband gateways	<ul style="list-style-type: none"> <li>- To develop residential routers and gateways tailored for smarthome applications</li> <li>- To better compete against Qualcomm smarthome offerings</li> </ul>
Intel	Mar-14	BASIS Science	ND	Wearable technology	<ul style="list-style-type: none"> <li>- Will become part of Intel's new devices group</li> <li>- Entry into the market with a leader in health tracking for wearable devices</li> </ul>
NXP Semiconductor	Oct-14	Quintic	ND	Wearable and Bluetooth Low Energy (BTLE) IC business	<ul style="list-style-type: none"> <li>- Create security and connectivity solutions for fast-growing IoT applications in health &amp; fitness wearables, mobile transactions, smart home and automotive</li> <li>- Brings customer traction with its bluetooth low energy solutions, especially in the Chinese eco-system</li> <li>- Able to range -low power connectivity standards for IoT - NFC, Zigbee and BTLE</li> </ul>
Qualcomm	Oct-14	CSR	\$25B / cash	Bluetooth chips for M2M and smartphone communications	<ul style="list-style-type: none"> <li>- Helps both companies in the connected devices space</li> <li>- Provides opportunities in the area of connected and high-tech automobiles and trucks</li> <li>- Allows Qualcomm to rapidly add a new segment outside mobile</li> </ul>
Silicon Labs	Feb-15	Bluegiga (Finland)	\$61M/cash	Low-power bluetooth, and WiFi modules	<ul style="list-style-type: none"> <li>- Access to ultra-low-power Bluetooth and WiFi modules and development tools for IoT applications</li> <li>- Bluegiga is expected to contribute \$25-28M in revenues in 2015 and to be accretive to 2015 earnings</li> </ul>
Silicon Labs	May-14	Touchstone Semi	\$15M / asset purchase	Low-power analog IC products	<ul style="list-style-type: none"> <li>- Adds valuable energy-saving analog technology and products to enhance company's embedded portfolio for the IoT, including MCU, wireless ICs, sensors and power management technologies</li> </ul>
Silicon Labs	Jun-13	Energy Micro	\$170M	RF/low-power chips for IoT, smart energy, home automation, security and portable electronics markets	<ul style="list-style-type: none"> <li>- Combines two leaders in nano-power MCU and wireless SoC design to accelerate the deployment of energy-friendly solutions across the Internet of Things and smart energy industries</li> </ul>
Silicon Labs	May-12	Ember	\$72M	Low power Zigbee and chip technology to create sensor networks and the Internet of Things	<ul style="list-style-type: none"> <li>- Acquisition of a team with proven wireless mesh networking expertise</li> <li>- Add Zigbee and related technologies to low-power RF and mixed-signal ICs for a high volume markets</li> <li>- Accelerates company's ability to offer complete IoT solutions to customers</li> </ul>

## Networking/Computing IoT – Selected M&A Transactions

The networking and computing segments provide the devices and software that are used to build the Internet and the emerging Internet-of-Things networks. These bits and pieces consist of many varieties of routers and switches that sit at different points in the communications network, dutifully moving bits generated by sensors, actuators and computers and stored in servers and disks. It also includes analytical software used for business intelligence, as well as big data schemas and database systems used to capture and manipulate the huge volumes of data generated by IoT.

The networking industry has been going through significant consolidation in the past decade, with Cisco retaining its position as the leading supplier of Internet plumbing gear. On the software side one of the main consolidators has been Oracle, which has completed around one hundred acquisitions including several large ones such as Peoplesoft and Siebel.

Cisco is an unabashed proponent of IoT, and we thought that it would be useful to examine IoT through this company's actions. Cisco's traditional networking competitors are struggling with their own problems and have been more muted in trumpeting these opportunities. However, Cisco's China-based competitor, Huawei, last year acquired Neul, a Cambridge, England based company that it plans to turn into a center for IoT development.

Cisco is not new to the IoT business. Its acquisitions of Linksys in 2003 and PureDigital in 2009 were early attempts at extending its business into the consumer electronics markets. Today, these transactions (totaling more than \$1 billion) would have been touted as IoT deals, as Linksys is similar to the smart home hubs acquired by Google/Nest and Samsung, and the PureDigital camera, with networking added, would have competed against Google/Nest's DropCam.

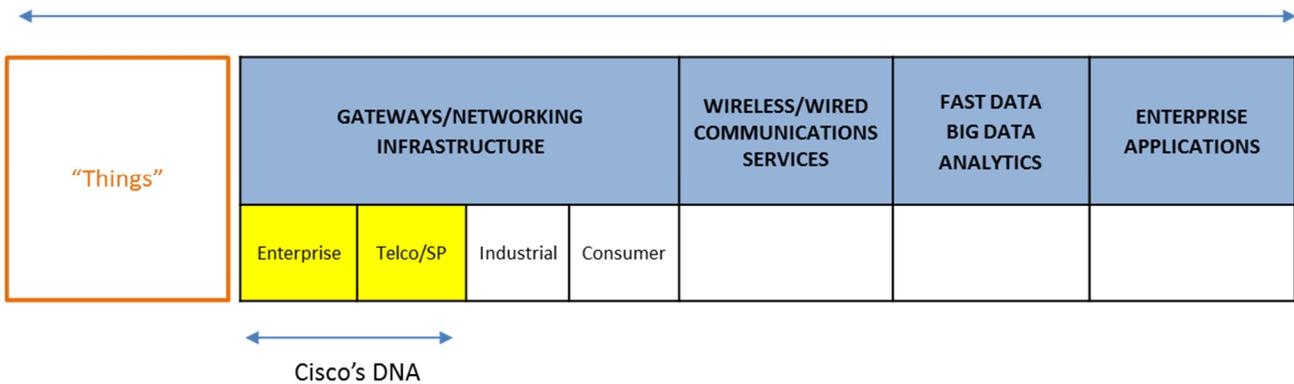
In June of 2010, Cisco announced a portfolio of products designed for energy management by utilities, consumers and businesses. The Cisco Building Mediator provided a network-based framework that interconnected building, IT, energy supply and energy demand systems. The Company also released a device called the Home Energy Controller,

designed to allow homeowners to communicate with power utilities and manage their energy consumption. In August of 2011, Cisco quietly shut down these programs.

The devices layer (“Things” in our representational model) includes sensors and actuators which bridge the gap between the physical and the virtual (data) environments, networking devices used to transmit this data, and platforms used to build data-sensing devices and applications. Networking equipment vendors such as Cisco provide the gateways for transporting sensor/device data over communications networks, and we represent this activity in our model as “Gateways/Networking Infrastructure”.

Cisco has proven itself to be very good at supplying networking equipment to enterprise and telco/service provider customers to build and operate their networks reliably (as shown in the chart.) It has done this at good gross margin levels and very steady profitability, and today has market shares between 50% and 70% of the switching, routing and datacenter markets.

Figure 18: IoT and DNA  
Internet of Things Value Chain



We think that Cisco’s experience with PureDigital and Linksys holds valuable lessons for many of the other players in the networking and computing industries when they move into areas that may not coincide with their core DNA. We commend Cisco for having the courage to explore new unrelated areas, but also for the willingness to rapidly abandon strategies that fail to deliver.

The opportunities around IoT are too big to ignore, and Cisco has since refocused its IoT efforts on smart cities and other industrial types of applications through a series of partnerships with companies such as GE, IBM, AT&T and Intel. To support IoT, Cisco will have to add additional traffic grooming and management to its product offerings. It will also have to offer network performance management (NPM) and application performance management (APM) tools to streamline traffic flows from “Things” over communications networks.

As an example, Cisco has added support for GE’s Predix platform to its industrial routers. Predix is a software platform designed to add intelligence to IoT endpoints. The combination of GE’s Predix and Cisco’s IOS framework will enable the collection and analysis of asset performance and operational data anywhere in the network.

It is unclear to us what role network equipment manufacturers can play in the fast data or big data spaces, i.e. other than getting the data there. Cisco, however, has been developing the novel concept of Fog Computing, a model that extends cloud computing and services to the edge of the network, reduces service latency, improves QoS and permits real time analytics. We will be watching developments here closely.

*Movers of data vs.  
marketers of data*

Google gives away its devices (at least the Android OS) and then monetizes the Analytics (AdWords) and Services (Play Store, YouTube, Google Apps). Facebook is agnostic as to device, and its market capitalization is based on mining and analyzing its large pool of users (> 1 billion). Both Google and Facebook have been minting money in their core businesses and the stock market has not penalized them for their expensive IoT related acquisitions of Nest and Oculus VR, respectively. In contrast to Google and Facebook, we do not think that Cisco or its brethren can convince the stock market that they can realistically expect to monetize analytical data a la Google and Facebook.

We think that our observations above hold true for most of the other networking and computing vendors. Huawei’s solutions will be clouded by perceptions of security risks, at least in several Western economies, and we expect it will be some time before the HP ship is stabilized. We also think that the computing and storage vendors (Dell, EMC, NetApp, Lenovo) will be constrained by their respective DNAs and will remain

focused on networking, storage and computing devices rather than branching further out into IoT related spaces.

### *Big Data and Fast Data*

If the projections for the number of IoT sensors/devices hold true (20 to 50 billion by 2020), we think the data generated could become one of the biggest growth drivers for big data analytics. Ford's Energi line of plug-in hybrid cars generates about 25 gigabytes per hour, which could increase to 250 gigabytes in future. (Is the Tesla Model S an automobile or a "Thing" with four wheels?)

We found this example cited by IBM of a power utility company on the challenges posed by IoT for data storage useful:

- A power utility company with one million customers historically may have stored one reading per month per customer for billing purposes, which translates to 12 million readings per year and can easily be stored in a relational database
- If the power utility wants to understand usage for load balancing, it will have to sample customer data more frequently, say 10 times per hour or every 6 minutes
- This means that each meter sends data out 87,600 times per year (10/per hour x 24/hours-per-day x 365/days-per-year).
- The data size per meter has grown 7,300 times (87,000/12 = 7,300)
- This is stored as a row in a traditional RDBMS
- If one million meters send in data, that's 87.6 billion new rows per year
- Loading and querying that much data would take too long and make the system unworkable

*IoT is really not about "Things"  
– it's about Data*

The volume and velocity of data will require software and systems capable of doing real-time analysis of this data and then expertise in arriving at insights. To address this real-time and volume challenge posed by IoT, several computing software vendors such as IBM, Oracle, SAP, and Splunk have been rolling out real-time data analysis systems that complement their traditional DBMS solutions. Software vendors, many of whom have transitioned their business models from one-time licensing to a SaaS and recurring revenue model, will also be looking for ways of monetizing the data in the IoT value chain.

Oracle may be one of the companies best positioned in the evolving data center, cloud computing and fast/big data worlds. Through its acquisition of Sun Microsystems, Oracle gained control over Java as well as server hardware for data centers. And since then, Oracle acquired several networking equipment companies including Acme Packet and Tekelec. It already offers a suite of analytics and business intelligence tools and has been willing to do acquisitions to fill holes or get access to innovative solutions.

IBM has launched the artificial intelligence based Watson cloud, which can also be adapted to IoT modeling and analysis. IBM has grand goals for Watson: \$10 billion in annual revenues in 10 years – but results as of last October have been underwhelming at less than \$100 million. In February 2014, IBM formed an alliance with AT&T to help cities and utilities integrate and analyze vast quantities of data from assets such as mass transit vehicles, utility meters, and video cameras. The companies will combine their analytic platforms, cloud, and security technologies to gain more insights on data collected from machines in a variety of industries. Perhaps partnerships like these might stimulate IBM's analytics business.

A variety of new techniques for dealing with the special challenges of large, real-time, unstructured datasets is required in the fast data/big data worlds. This includes a unified analytics platform, a distributed, massively parallel processing database architecture, and geo-distributed analytics to allow analytics to occur at the data source when data transport is impractical due to size or cost. Several startups such as Actian, Cloudera, ParStream, Platfora, Splice Machine and Sqrrl have emerged to offer solutions tailored to the needs of fast data/big data demands of IoT.

GE invested \$105 million for a 10% stake in Pivotal, a big data software company in August 2014. Through this partnership, GE is working to develop a software platform that the company can deliver as a service to industrial customers in aviation, transportation, healthcare, energy and manufacturing.

To address real-time capabilities, MapR technologies has partnered with Databricks to bring in-memory Apache Spark technology to its Hadoop product. MongoDB, which can be 1/10th the cost of relational databases, is being used by Bosch, Silver Spring and McAfee (Intel) to build IoT enabled applications.

IoT devices such as cars and oil rigs are often outside the range of wireless networks but still have valuable data that has been collected by sensors. Couchbase's Mobile NoSQL database gives developers new tools for building applications that store and process data for such situations. The company is working with a European auto manufacturer to capture and store sensor data that can be used for maintenance purposes.

Irish startup Davra Networks offers a cloud-based platform targeted at systems integrators and networking VARs that help them turn IoT raw data into usable business intelligence. Data is gathered, filtered and managed near the source before being sent to the big data/business intelligence clouds.

One application that has been announced is the integration of Davra's suite with Cisco's services router for fleet management. Davra's software communicates with Cisco's routers like the 819 ISR which provides real-time monitoring, tracking and management of large and small fleets. Vehicle telematics capture and send data such as fuel level, tire pressure, and maintenance details to improve safety and keep more vehicles in service. GPS tracking provides more efficient routing, faster delivery times and reduced driver fatigue.

## Selected M&amp;A Transactions – Networking/Computing IoT

Acquiror	Date	Target	Price	Product	Rationale
Belden	Dec-14	Tripwire	\$710M/ cash	Cyber security and compliance software	<ul style="list-style-type: none"> <li>- Belden, traditionally a supplier of cable and wires, plans to offer cyber security solutions via this acquisition</li> <li>- A primary goal is to help customers secure the enterprise and industrial IoT</li> </ul>
Cisco	Jul-14	Tail-F Systems (Sweden)	\$175M/ cash	Provision and management tools for service provider cloud and virtualization applications	<ul style="list-style-type: none"> <li>- To support a range of NMS/OSS needs including layer 2 and 3 VPNs, NFV and IoT applications</li> </ul>
Cisco	May-13	JouleX	\$107M	Software for tracking energy use by devices, data centers and buildings	<ul style="list-style-type: none"> <li>- Lets customers monitor energy use of all devices attached to a network</li> <li>- Part Cisco services strategy for IT energy management needs of all types of devices connected to the network</li> </ul>
Citrix	Dec-14	Octoblu (Skynet)	ND	IoT cloud-based platform Designed to run on a mesh of IoT networks	<ul style="list-style-type: none"> <li>- Access to an open source, cross protocol platform</li> <li>- API support for HTTP, REST, Webscokets, MQTT and CoAP</li> </ul>
Digi Int'l	Nov-12	Etherios	\$205M	Cloud-based platform for integrating machines into core business processes via Salesforce Service Cloud	<ul style="list-style-type: none"> <li>- New skills and tools for helping customers to integrate machines into CRM systems</li> </ul>
Ericsson	Apr-11	Telenor Connexion M2M	ND	Platform that enables network operators to provide M2M services	<ul style="list-style-type: none"> <li>- Expand Ericsson's offerings by getting access expertise and a cloud-based M2M platform</li> </ul>
Gemalto	Dec-11	SensorLogic	ND	Cloud-based PaaS for M2M applications like asset tracking, telematics, and equipment monitoring and service	<ul style="list-style-type: none"> <li>- Plan to use the SensorLogic platform to take complexity out of M2M deployments</li> </ul>
Huawei	Sep-14	Neul (England)	\$25M	Networking technology for IoT	<ul style="list-style-type: none"> <li>- Establish an IoT center in Cambridge, England</li> <li>- Access to Neul's IoT chipsets, base-station and cloud management systems</li> </ul>
LogMeIn	Apr-14	lonia	\$12M/ cash	A systems integrator specializing in connected solutions	<ul style="list-style-type: none"> <li>- Access to connectivity expertise related to Salesfocecom and Heroku</li> <li>- A template for building out an ecosystem of system integrators</li> </ul>
LogMeIn	Jul-11	Pachube	\$15M	Data brokerage platform that enables users to store, share and discover real-time sensor, energy and environment data from objects	<ul style="list-style-type: none"> <li>- Acquisition allows LogMeIn to extend its reach beyond computers and smartphones to IoT devices</li> </ul>

**Service Provider/Systems Integrator IoT – Selected M&A Transactions**

The advent of the Internet has been somewhat unkind to service providers, who have spent enormous amounts of money building broadband and mobile networks, only to see higher valuations assigned to companies that use those networks to deliver innovative internet, social and ecommerce services. (See table below)

*The rise of OTT apps*

Companies such as WhatsApp (owned by Facebook) offer free or extremely cheap over-the-top (OTT) messaging services that are eating into service providers' once profitable SMS products; and Skype (once owned by eBay, and now part of Microsoft) has been systematically cannibalizing international voice traffic. (TeleGeography estimated that in 2013, Skype traffic was almost 40% the size of the entire conventional telecom market.) Internet bellwethers, such as Google, Facebook, Netflix and Amazon, are heavily dependent on the expensive and sophisticated networks built by service providers, but it is they, not the service providers, who are being rewarded by the stock market.

Figure 19: Services Providers versus Internet Bellwethers – selected financial metrics  
*OTT vendors being disproportionately rewarded by investors*

	Service Providers		Internet Bellwethers			
	Verizon	AT&T	Google	Facebook	Netflix	Amazon
Market Cap (\$B)	\$198B	\$179B	\$358B	\$210B	\$27B	\$173B
LTM Revenues (\$B)	\$127B	\$132B	\$66B	\$12B	\$5B	\$89
Market Cap/LTM Revenues	1.5x	1.3x	5.4x	17.5x	5.4x	1.9x
Gross Margin %	61%	54%	61%	83%	32%	29%
R&D/Capex (\$B) (2014)	\$17,191	\$21,433	\$10,959	\$1,831	\$69	\$4,893

Source: CapIQ, as of 02/06/15

The problem facing service providers is well summarized by the comments of SingTel's CEO, Ms. Chua Sock Koong, who in a speech in Australia, pleaded with regulators to give service providers the right to charge WhatsApp/Facebook and Skype/Microsoft for the use of its telecommunications networks. SingTel owns Australia's Optus and in 2013 invested almost A\$1 billion in its wired and mobile networks.

Ms. Chua warned that such investments would be reduced unless regulators allowed SingTel/Optus to start charging over-the-top rivals such as WhatsApp and Skype for using the network. “The main problem we have as an industry is we have been unable to monetize this increased demand. ...average revenue per user (ARPU) has fallen. ...we stand the risk of being totally disintermediated.”

We think service providers have learned painful lessons and are trying to become more than “dumb pipes” for the IoT ecosystem by providing managed solutions for IoT app creation, management, monitoring and big data analytics.

Some examples:

- AT&T launched M2X Data Service - IoT managed services for developers and tools for enterprise developers to create new IoT solutions, plus a carrier-grade cloud data store for collecting, analyzing data from IoT devices.
- Verizon’s Connected Services offers wireless services and cloud computing services to help businesses manage data from sensors and M2M communications. In January 2015, Verizon launched an enterprise portal for managing digital certificate creation for large-scale IoT deployments ranging into the tens of millions. (Verizon announced that its 2014 revenues were \$127 billion of which \$585 million came from IoT/telematics.)
- Vodafone teamed up with health sensor vendor Lively to offer monitoring services targeted at older people.
- The KORE Wireless acquisition of RacoWireless, funded by ABRY Partners, a private equity firm, is an example of two traditional M2M vendors combining for scale and adapting to the emerging IoT services world.

In their quest to discover profitable business models, we expect service providers to invest in their IoT offerings through a combination of M&A and internal investment in a number of areas, including:

- Increasing scale and footprint via acquisition of M2M/IoT - oriented service providers and systems integrators
- Entering new verticals such as automotive, health tracking and premises monitoring
- Technology acquisitions specific to management, monitoring and billing of cloud-based IoT services.

### *Monetizing data*

While we think that these types of offerings will enable service providers to grow connectivity and service revenues, they will still struggle to become the "Googles" of the IoT world - i.e. collectors and monetizers of volumes of data. For one thing, their business customers are unlikely to relinquish control of proprietary data generated and would be hesitant to risk sharing that with competitors. Moreover, in areas like healthcare, strict regulations such as HIPAA may force service providers to remain solely transporters of data.

Verizon has been heavily criticized for using advertiser-friendly Unique Identifier Headers (UIDH) or "supercookies" to track subscriber activity on the web to build a pattern of interests, which it then shared with advertisers. The use of these supercookies, which cannot be removed by users, has come under fire from groups such as Consumer Watchdog and the Electronic Frontier Foundation (EFF), who have petitioned federal agencies to penalize Verizon and its partner, Turn, for failing to disclose their tracking practices. Under pressure, Verizon has relented and will offer users the option of opting-out from tracking. Privacy advocates are pressing further for Verizon to be forced to switch to "opt-in" as the default setting and are planning to keep up the pressure on Verizon and the other mobile network operators.

This is what the US Senate's Committee on Commerce, Science and Transportation said in a letter to Verizon's CEO – "While Verizon allows customers to affirmatively prohibit the sharing of information collected by these supercookies, it does not allow customers to remove the supercookies altogether, doing nothing to stop third parties from

exploiting their existence. Because of the threats to consumer privacy, AT&T wisely discontinued the use of similar mobile trackers, while Verizon has chosen to carry on.”

The type of data generated by IoT – regular bursts of small packets – makes it uneconomical to use the 3G and 4G networks which were designed to support bandwidth-hungry smartphones that support HD video. Connecting IoT devices to these types of networks can be expensive and a major drain on the batteries used to power many IoT devices.

To address these shortcomings, we are seeing the emergence of several new service providers who have built wireless networks dedicated to carrying M2M/IoT traffic. Some of the models look very similar to the ISPs of 1990s, who offered simple connectivity, but others look more like combinations of an ISP and the Amazon Web Services model for IoT.

Some of the interesting ones are Link Labs, Stream Technologies, On-Ramp Wireless and Sigfox, a company with networks in France, the Netherlands, Spain and (soon) Silicon Valley. We think that the list of M2M/IoT service providers will keep growing and the structure of the industry will parallel the history of the commercial ISP market – characterized by the entry of many companies, growth, and then consolidation, in order to extract efficiencies and to serve the needs of industrial/business customers with dispersed operations.

Another M2M vendor, Aeris, in partnership with Tech Mahindra (an IT and BPO systems integrator) announced its Jumpstart IoT solution designed to help mobile operators build scalable and profitable IoT businesses. Their combined service offerings include packaged applications like fleet telematics, healthcare, point of sale and utility communications. We expect Tech Mahindra’s competitors such as Infosys, TCS, Wipro, CSC, Accenture and HP Enterprise Solutions to announce similar plans.

### *Systems Integrators/PaaS*

Due to the complexity of IoT, many product and services companies are will look to outside parties such as IoT systems integrators for help in deploying and managing the IoT value chain. Jasper Technologies, based in Silicon Valley, provides a cloud-based software platform to help enterprises, automotive companies and mobile operators launch, manage and monetize the deployment of IoT on a global scale. Boston-based Xively, a division of LogMeIn, offers development tools, a platform as a service (PaaS), and professional services to enable businesses to connect products and operations to IoT networks. Others include Arrayent, Ayla Networks and Electric Imp, all of whom offer connectivity solutions and services to help companies connect their products to the cloud.

AGT International, based in Zurich, Switzerland, offers IoT analytics and applications, cloud solutions and professional services for a broad range of activities including manufacturing operations, traffic flow, hospital administration, school connectivity, city management and the safety of senior citizens at home. In early 2014, AGT and Cisco formed a smart city alliance. These two companies have been selected by the City of Hamburg to implement smart city pilot projects as well as port operations.

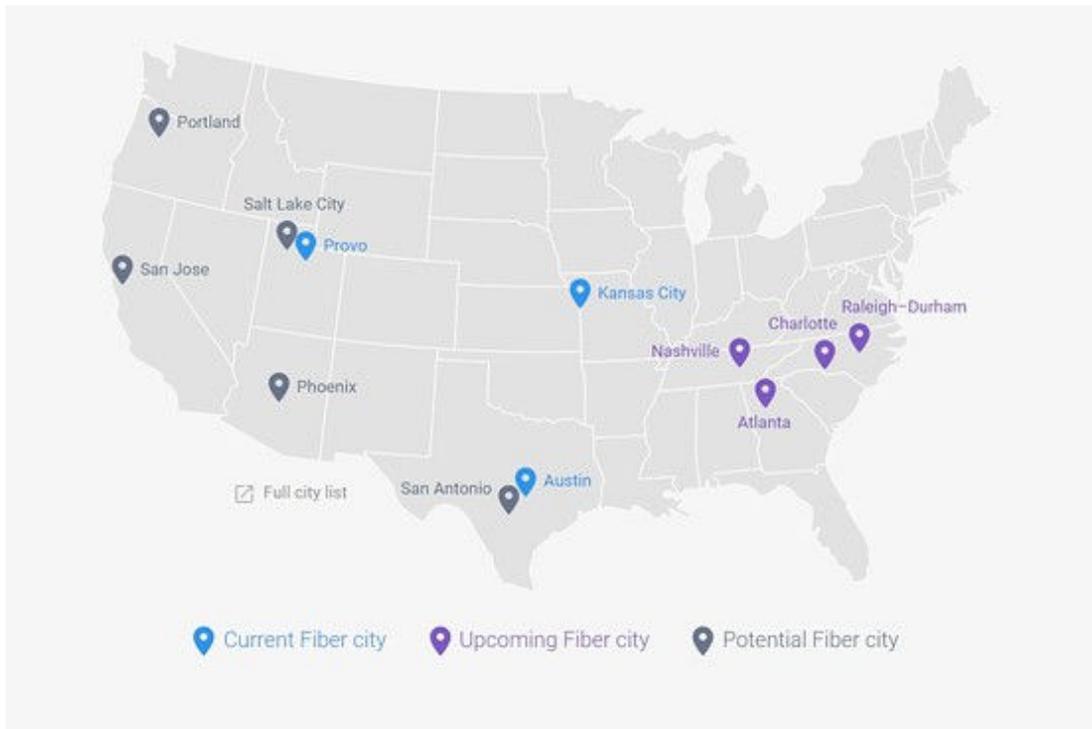
As companies transition from hardware business models to a service or subscription model they may also look to their traditional distributors such as Arrow Electronics, Avnet, Ingram Micro, Tech Data and Synnex for help. To remain relevant in the IoT world, these distributors will have to offer help in connectivity, cloud, analytics, security and business model development - skills that are typically found elsewhere at organizations such as Accenture, IBM and AT&T.

### *Is there anything Google won't try?*

We cannot leave this section without mentioning Google (the nemesis of so many "traditional" industries) and its activities in the service provider space. The company operates Google Fiber in Kansas City and has chosen 34 other cities as candidates for future expansion. The news that Google may offer wireless services to consumers as an MVNO (using Sprint's and T-Mobile's networks) could further complicate business for the likes of AT&T and Verizon.

This strategy would increase Google’s ability to collect even more consumer data, which it can then monetize via advertising, something which neither AT&T nor Verizon can do at present. Furthermore, such a network could also be used to deploy M2M/IoT services directly to consumers, industrial and enterprise customers.

Figure 20: Where Google Fiber is Going Next



Source: WSJ

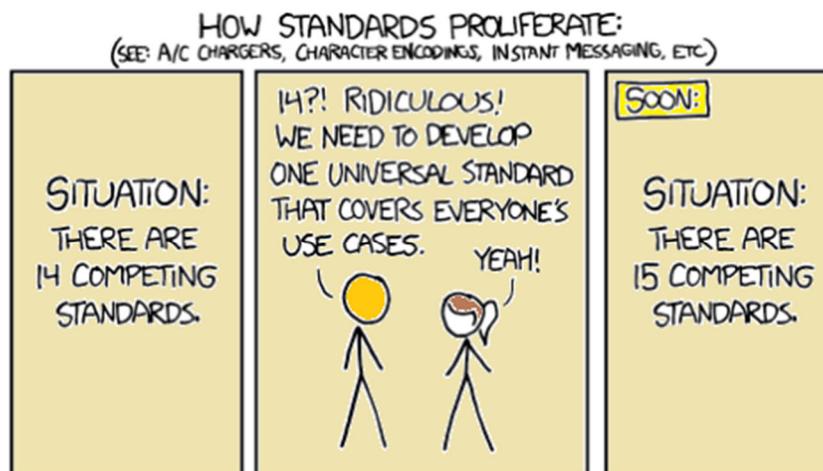
### Selected M&A Transactions – Service Provider/Systems Integrator IoT

Acquiror	Date	Target	Price	Product	Rationale
ABRY Partners (PE firm)	Nov-14	Kore Wireless Group (Telematics)	Majority ownership \$117M	Managed services for M2M/IoT	<ul style="list-style-type: none"> <li>- A play on the M2M/IoT market</li> <li>- Network footprint and customer base: 15 million wireless devices and 800+ acustomers</li> <li>- Roll-up strategy via the acquisition of Raco Wireless</li> </ul>
Comcast	Jul-14	PowerCloud	< \$50M est	Analytics software, web monitoring and wi-fi management tools	<ul style="list-style-type: none"> <li>- Make it easier for customers to connect devices to their home networks</li> <li>- Better compete against AT&amp;T 'Service Providers'</li> </ul>
KORE Wireless	Nov-14	Raco Wireless	ND	Helping companies build, manage and enhance wireless M2M applications	<ul style="list-style-type: none"> <li>- Become one of the largest MVNOs in the M2M/IoT PaaS market</li> <li>- Combination will have 3 million subscribers (1,500 customers) and presence in a110 global markets</li> </ul>
Sirius XM	Nov-13	Agero	\$530M	Provides connected vehicles, roadside assistance, and claims management services to auto manufacturers, insurance carriers and drivers in the US	<ul style="list-style-type: none"> <li>- Additional services for Sirius XM Connected Vehicle Services</li> <li>- Accelerate development of Sirius' connected vehicle services platform</li> </ul>
Telit	Sep-13	ILS Technology	\$85M	Provides software and services that link intelligent devices with enterprise applications and databases	<ul style="list-style-type: none"> <li>- Expand footprint in in the M2M value chain</li> <li>- Additional services and the ability to expand service offerings to small and medium sized customers worldwide</li> </ul>
Telit	Mar-11	Motorola's M2M modules business unit	\$24M	M2M applications and modules for GSM, GPRS, CDMA and WCDMA	<ul style="list-style-type: none"> <li>- Access to Motorola's M2M customer base and distributors</li> <li>- Telit estimates that the combined business would have revenues of \$180M in 2010</li> <li>- Simplify the supply chain for M2M customers</li> </ul>
Verizon	Jun-12	Hughes Telematics	\$737M	GPS tracking, communications and safety features in cars	<ul style="list-style-type: none"> <li>- Expand Verizon's capabilities in the automotive and fleet telematics marketplace</li> <li>- Verizon's global IP network, cloud, mobility and security plus Hughes Telematics' platform - for mHealth, asset tracking and home automation</li> </ul>
Verizon	Jan-12	nPhase	ND	M2M wireless communications and services for healthcare, manufacturing, utilities, distribution and consumer product industries	<ul style="list-style-type: none"> <li>- nPhase was a joint venture with Qualcomm and Verizon purchased the remaining 50% stake Tighter integration between nPhase and Verizon global business unit</li> <li>- The goal of the joint venture was to make it easier and faster for companies to get their M2M devices running on Verizon's network</li> </ul>
ViaSat	Apr-13	LonoCloud	\$2M	Cloud-based service platform to support IoT	<ul style="list-style-type: none"> <li>- Access to a cloud based PaaS for IoT</li> <li>- New technical capabilities, and the ability to shorten development cycles for new service offerings</li> </ul>
Vista Equity Partners	Aug-13	Omnitracs	\$800M	Fleet management software applications, information services, and hardware	<ul style="list-style-type: none"> <li>- Offer a portfolio of data-driven software, information and analytic solutions afocused on (i) driver safety, compliance and productivity, and (ii) operator planning</li> </ul>
Vodafone	Jun-14	Cobra Automotive	\$269	Security and telematics software.	<ul style="list-style-type: none"> <li>- Together, Cobra and Vodafone will be able to provide automotive and insurance acustomers with capabilities in telematics and managed M2M connectivity</li> <li>- It will strengthen Vodafone's ability to meet customers' expectations for connected car services</li> </ul>

### 3. Standards, Regulations and Projections

One of the predictable battlegrounds in any new information technology market relates to the standards that will be followed to allow various products to interoperate with one another. In addition to the standards that evolve out of marketplace competition and eventual dominance by one or more powerful suppliers, additional constraints are placed on product design and performance by government regulations. In this section, we begin with a very brief review of the current state of standards in the IoT space as well as the rapidly developing awareness of IoT on the part of government entities, who are already making themselves felt, particularly in the areas of security, privacy and wireless spectrum usage.

Later we explore some of the many forecasts made by various analysts and prognosticators about the size of the potential market opportunity presented by this IoT phenomenon. While much has already been written about IoT including rather wild predictions, we have found that there is some consensus around the number of connected devices that can be expected between now and say 2020 or 2025, and we examine some of the submarket forecasts to better understand the scale people are expecting in various industry verticals.



Source: <http://xkcd.com/927/>

## Standards or the Tower of Babel

### Competing Standards

- CDMA, TDMA and GSM in mobile phones
- VHS and Betamax in video recording
- Blu-ray and HD DVD in high definition DVD
- WiMAX and LTE in wireless broadband
- iOS and Android in smartphones

The technology industry has witnessed many standards wars and it appears that the Internet of Things will not be any different. Companies begin with a view that if they can only control a significant part of the technology stack, they can (i) ensure smooth and reliable performance of their products and services, and (ii) protect attractive margins for themselves.

As technology matures, overall reliability improves, and customers begin to focus more on “best of breed” products and force vendors to interoperate more seamlessly to avoid single vendor “lock-in.” Vendors today offer a diverse array of communications, analytics and data protocols optimized for their smart devices but potentially lacking the ability to communicate effectively with smart devices from someone else. In some ways, the IoT space continues to be a “walled garden.”

We believe there are at least seven different industry groups working on standards and the most optimistic timeframe currently for a “standard” to emerge is 2017. Below, we discuss some of the more significant efforts to create an IoT standard.

### AllJoyn/AllSeen Alliance

- Developed in 2011 by Qualcomm, who then signed over the source code to the Linux Foundation in 2013
- Target applications – Connected home. Smart TVs, audio, and gateways. Automobiles
- Platforms supported – Android, iOS, Linux, OpenWRT Windows, and OS X
- Around 100 member firms
- Transport-layer agnostic and supports WiFi, WiFi-Direct, Ethernet and Powerline. Other transports such as Bluetooth LE, 6LowPan, ZigBee and Z-Wave can easily be added

- Consumer brands which support AllJoyn – Electrolux, Haier, LG, Panasonic, Sharp, Sony
- Other supporters include Cisco, Microsoft, Bosch and Symantec

#### **Open Interconnect Consortium/IoTivity (OIC)**

- Promoted by Intel, Broadcom and Samsung. Other original supporters included Atmel, Dell, and Wind River, under the “IoTivity” moniker
- Seen as a counter to Qualcomm’s AllJoyn
- However, Broadcom quit after three months, allegedly over a disagreement about OIC’s licensing policies that include a RAND-Z provision (RAND with zero royalty) in which a company promises to license the intellectual property at no charge
- In response the Qualcomm-inspired AllSeen project added new language in January 2015 pledging not to sue over their patents
- Around 30 members

#### **Industrial Internet Consortium**

- Founded by Intel, Cisco, AT&T, GE and IBM in March 2014. Microsoft joined in June
- Brings together vendors from the industrial and IT sectors
- Approximately 100 members, including universities
- The goal is to improve access to big data with improved integration of the physical and digital worlds to unlock business value
- More policy oriented than the efforts by the other IoT standards groups like AllSeen, OIC and Thread

#### **Thread Group**

- Driven by Google/Nest, Samsung, ARM, Freescale, Silicon Labs, Big Ass Fans and Yale Locks
- Designed to support a wide variety of products for the home, including appliances, access control, climate control, energy management, lighting, safety and security
- Around 50 members
- Uses 6LoWPAN – Ipv6 over power-efficient 802.15.4 MAC/PHY
- AES encryption

- Supports over 250 devices on a network
- Short messaging conserves bandwidth and power

### Apple

Perhaps not surprisingly Apple has chosen a slightly different course, proposing its own HomeKit standard in September 2014. It remains to be seen how HomeKit will interoperate with AllSeen, OIC or Thread. Apple does, however, have some stringent guidelines for companies that wish to work with HomeKit:

- Apps must not use data gathered from the HomeKit APIs for advertising or other use-based data mining
- Apps using data gathered from the HomeKit API for purposes other than improving the user experience or hardware/software performance in providing home automation functionality will be rejected

As we've seen with past technology standards wars, industry heavyweights will likely line up behind each different approach. Over an extended timeframe, one effort will begin to gain leadership and eventually things will coalesce, hopefully leading to an outcome in which all IoT devices will be able to talk to one another.

## Regulators and IoT – Weighing Privacy and Other Issues

### *US Congress*

The Internet of Things will impact citizens and economies in much deeper ways than even the original Internet, and lawmakers and policy makers are starting to take notice. On January 13, 2015, the US Congress created a Congressional Caucus on the Internet of Things. Chaired by Reps. Suzan DelBene (D-WA) and Darrell Issa (R-CA), the IoT Caucus will seek to monitor public policy concerns of IoT, including the impact of electronic connectivity on individuals, as well as businesses in the health care and transportation sectors.

Rep. DelBene, “Policymakers will need to be engaged and educated on how we can best protect consumers while also enabling these new technologies to thrive.”

Rep. Issa, “Technology is revolutionizing the way consumers use cars, homes, workspaces, and everyday items. Emerging uses of Internet connectivity to these devices raise both opportunities and questions about regulatory policy, spectrum space, privacy, and more. It’s critical that lawmakers remain educated about the fast paced evolution of the Internet of Things, and have informed policy discussions about the government’s role in access and use of these devices.”

### *The FTC*

On January 29, 2015, the Federal Trade Commission released a report outlining recommendations to help protect consumers as they buy and use IoT devices. Security was one of the main topics, and the report includes the following recommendations for companies developing IoT devices:

- Build security into devices at the outset, rather than as an afterthought in the design process
- Train employees about the importance of security, and ensure that security is managed at an appropriate level in the organization
- Ensure that when outside service providers are hired, that those providers are capable of maintaining reasonable security, and provide reasonable oversight of the providers
- When a security risk is identified, consider a “defense-in-depth” strategy whereby multiple layers of security may be used to defend against a particular risk

- Consider measures to keep unauthorized users from accessing a consumer's device, data, or personal information stored on the network
- Monitor connected devices throughout their expected life cycle, and where feasible, provide security patches to cover known risks

The FTC also recommended that companies consider *data minimization* – that is, limit the collection of consumer data, and retain that information only for a set period of time, and not indefinitely. The report notes that data minimization addresses two key privacy risks: that (i) a company with a large store of consumer data will become a more enticing target for data thieves or hackers, and second, (ii) consumer data will be used in ways contrary to consumers' expectations. The general feeling among policy makers in the US is that any IoT-specific legislation would be premature at this time given the rapidly evolving nature of the technology.

### *The European Union*

Our discussions with lawyers from Field Fisher, a multinational law firm headquartered in the UK, has shed some light on how the European Union and the United Kingdom plan to address the issues surrounding IoT. The EU regulatory mindset is: the IoT can reveal 'intimate details'; 'sensor data is high in quantity, quality and sensitivity' and the inferences that can be drawn are 'much bigger and sensitive' especially when seen alongside cloud computing and big data analytics.

### *Ofcom*

On January 27, 2015, Ofcom, the UK's communications regulator identified several priority areas to focus on in order to support the growth of the IoT, including:

**Privacy:** Ofcom concludes that a "common framework that allows consumers easily and transparently to authorize the conditions under which data collected by their devices is used and shared by others will be critical to future development of the IoT".

**Network security and resilience:** Ofcom holds the view that "... there will be growing demands both in terms of the resilience of the networks used to transmit IoT data and the approaches

used to securely store and process the data collected by IoT devices”.

**Spectrum availability:** Ofcom concludes that “existing initiatives will help meet much of the short to medium term spectrum demand for IoT, but recognizes that, as IoT grows and the sector develops, there may be a renewed need to release more spectrum in the longer term”.

Overall, it seems there will be competitive tension between companies that emphasize privacy protection and companies whose strategy is directly aimed at collecting information and monetizing it through advertising and other means. The heavy hand of regulation will certainly be a factor in building out business models in IoT and it must be an integral part of any successful IoT strategy.

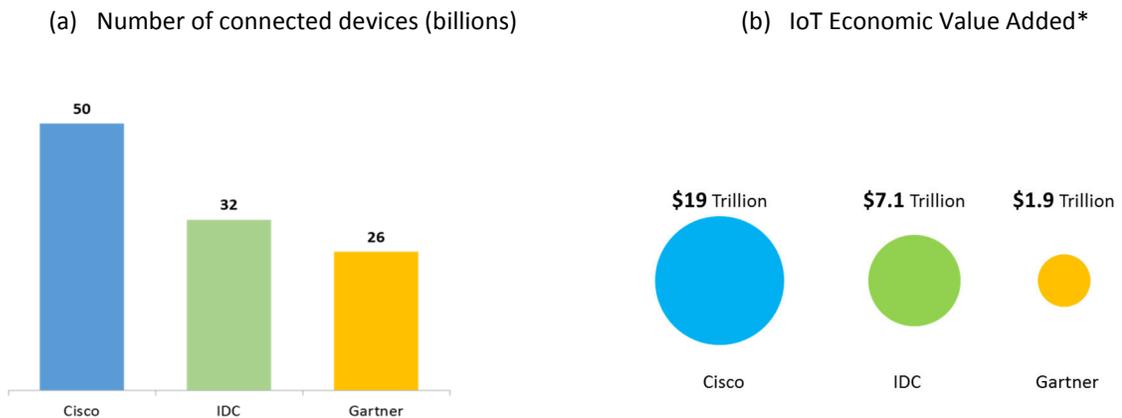
Recent experience of large scale data breaches (Target Corporation, Sony Pictures) has certainly raised awareness of information security issues, but we note that the majority of security breaches go unreported and unnoticed, and the degree of vulnerability of our entire economy to malware and cyberespionage increases geometrically as we connect more and more of our infrastructure to large scale public networks.

It is also important to consider use and misuse of information. Even outside of the context of security breaches, large amounts of personal data collected by wearable health monitoring devices could be used by insurance companies in discriminatory ways without appropriate regulation, for example denying coverage to certain individuals or classes of individual based on data captured from their wearable devices.

## A Sampling of Forecasts

As we've already noted, there are almost as many different forecasts for the size of the IoT market opportunity as there are forecasters. With that in mind, we have chosen a small selection of voices to illustrate the immense scope of what is at stake with IoT, as well as the breadth of opinion and the variety of viewpoints, which illustrate the immaturity of the space and the real risk of misdirected efforts. In short, huge opportunity rarely arrives without bringing real risks as well.

Figure 21: IoT Market Size Estimates by 2020  
*Widely varying forecasts but all point rapid growth and large opportunities*



Source: Cisco, IDC, Gartner. \*Economic value add = benefits derived by businesses through the sale and use of IoT technology

### Cisco

According to Cisco's Connection Counter, there are approximately 10,700,000,000 "people, processes, data, and things" currently connected to the internet. IoT is therefore already comprised of over 10 billion separate parts.

There will be about 15 billion devices connected by 2015, and around 50 billion by 2020, according to the Cisco Internet Business Solutions Group. Despite all these connections, however Cisco estimates that more than 99 percent of all physical objects that may one day join the network are currently still unconnected.

Cisco's analysis indicates that IoT is poised to generate \$19 trillion in Value at Stake (the combination of increased revenues and lower costs that is created or will migrate among companies and industries from 2013 to 2022) for the private sector over the next decade and \$14.4 trillion for the public sector over the same period.

### **McKinsey**

Analysts have predicted that the installed base for Internet of Things devices will grow from around 10 billion connected devices today to as many as 30 billion devices by 2020—an increase of about 3 billion new devices per year. Each of these devices will require, at a minimum, a microcontroller to add intelligence to the device, one or more sensors to allow for data collection, one or more chips to allow for connectivity and data transmission, and a memory component.

McKinsey Global Institute reports that the IoT business will have potential economic impact between \$2.7 trillion to \$6.2 trillion by 2025.

### **IDC**

The predictions from the IDC FutureScape for Internet of Things include:

- **IoT and the Cloud.** Within the next five years, more than 90% of all IoT data will be hosted on service provider platforms as cloud computing reduces the complexity of supporting IoT "Data Blending".
- **IoT and security.** Within two years, 90% of all IT networks will have an IoT-based security breach, although many will be considered "inconveniences." Chief Information Security Officers (CISOs) will be forced to adopt new IoT policies.
- **IoT at the edge.** By 2018, 40% of IoT-created data will be stored, processed, analyzed, and acted upon close to, or at the edge of the network.
- **IoT and network capacity.** Within three years, 50% of IT networks will transition from having excess capacity to handle the additional IoT devices to being network constrained with nearly 10% of sites being overwhelmed.
- **IoT and non-traditional infrastructure.** By 2017, 90% of datacenter and enterprise systems management will rapidly

adopt new business models to manage non-traditional infrastructure and BYOD device categories.

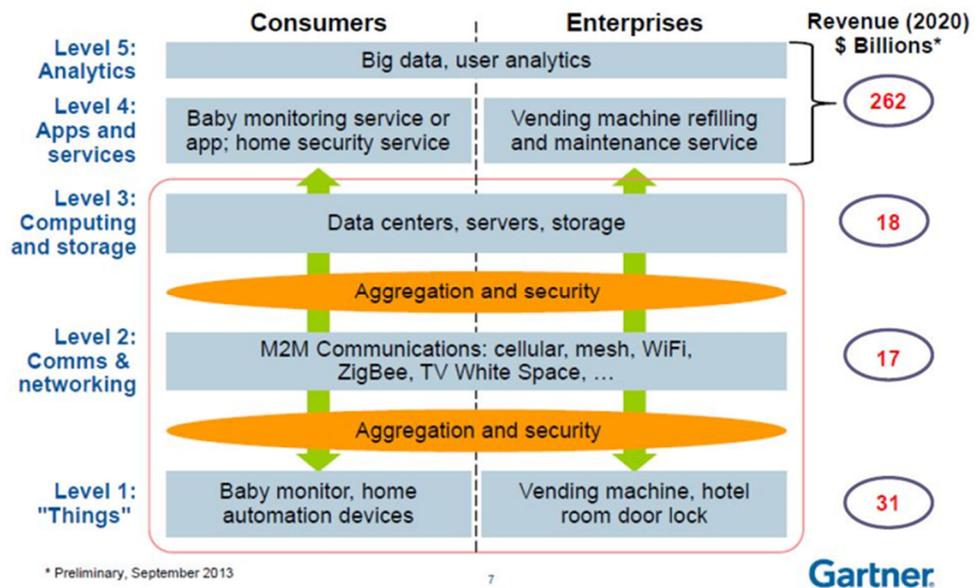
- **IoT and vertical diversification.** Today, over 50% of IoT activity is centered in manufacturing, transportation, smart city, and consumer applications, but within five years all industries will have rolled out IoT initiatives.
- **IoT and the Smart City.** Competing to build innovative and sustainable smart cities, local government will represent more than 25% of all government external spending to deploy, manage, and realize the business value of the IoT by 2018.
- **IoT and embedded systems.** By 2018, 60% of IT solutions originally developed as proprietary, closed-industry solutions will become open-sourced allowing a rush of vertical-driven IoT markets to form.
- **IoT and wearables.** Within five years, 40% of wearables will have evolved into a viable consumer mass market alternative to smartphones.
- **IoT and millennials.** By 2018, 16% of the population will be Millennials and will be accelerating IoT adoption due to their reality of living in a connected world

**Gartner**

Gartner, Inc. forecasts that 4.9 billion connected things will be in use in 2015, up 30 percent from 2014, and will reach 25 billion by 2020. The Internet of Things has become a powerful force for business transformation, and its disruptive impact will be felt across all industries and all areas of society. We agree with Gartner’s views (see figure 22 below) that analytics and services will comprise the bigger component of IoT revenues.

The IoT will bring into the digital security architecture dozens of new platform options, hundreds of variations on hybrid IT/IoT integration, new standards per industry, and a new view of an application. IT leaders will have to accommodate the differences in technologies across those areas and develop a multifaceted technology approach to IoT risk and security. In addition, with some machines producing enormous amounts of data and other sensors sending a handful of bits per day or week, IT leaders will need to balance digital business requirements with digital security realities.

Figure 22: IoT Market Opportunities Extend Well Beyond “Things”



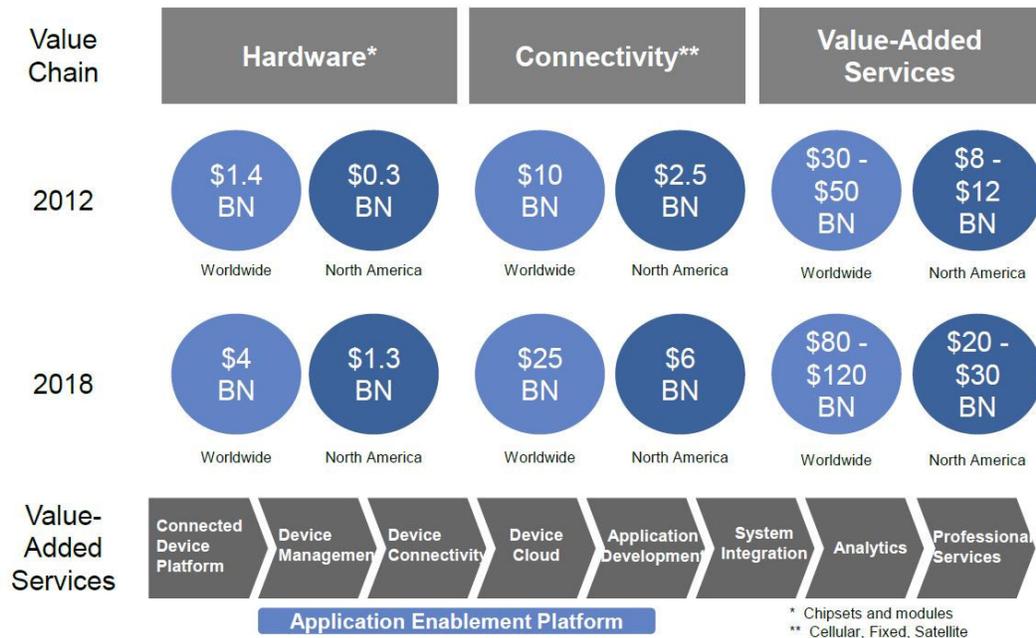
Source: Gartner

### ABI Research

ABI Research reckons the Internet of Things contains some 10 billion+ wireless connected devices today. But it's predicting this figure will triple in size to more than 30 billion devices in an Internet of Everything by 2020, as more and more objects are plugged into the network.

The charts that follow represent yet another set of forecasts. While the precise numbers and timing may be open to debate and refinement, they do point to enormous potential of IoT. The combination of big data analytics and IoT will positively impact a wide range of industries, with the biggest impact initially on the industrial/manufacturing sectors.

Figure 23 : M2M/IoT Value Chain – Projected Revenues



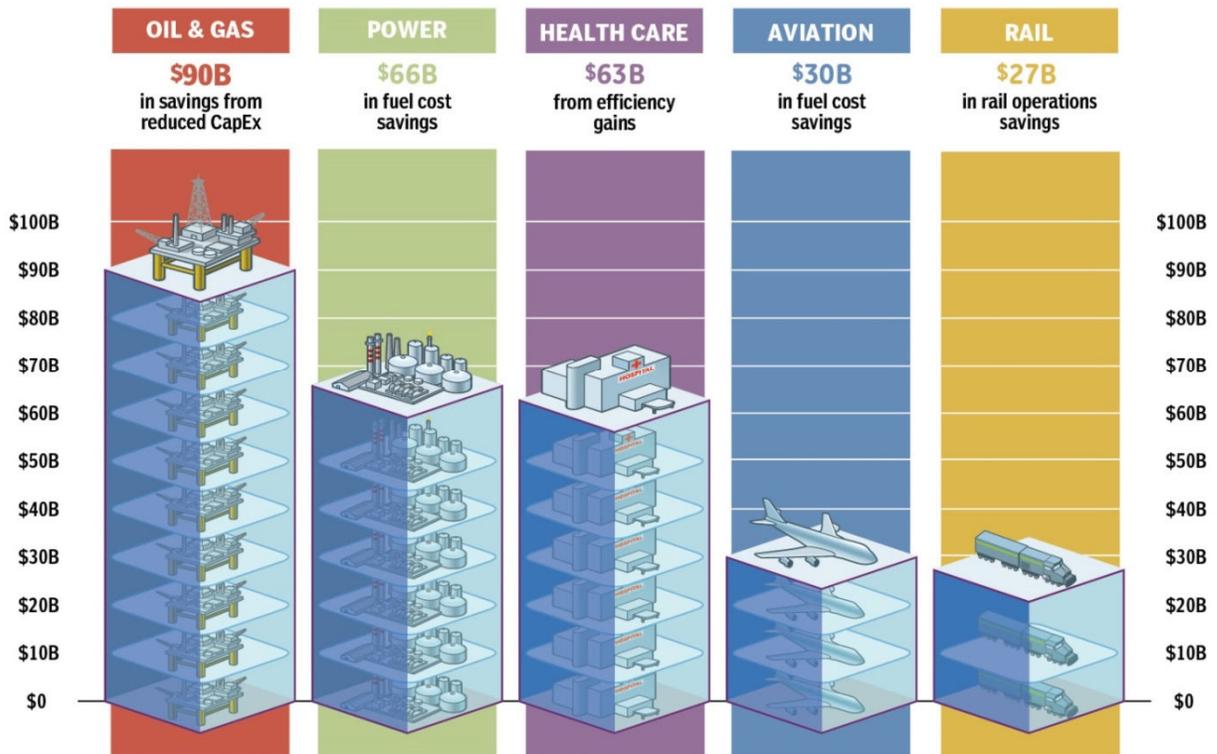
Source: ABI Research

The Industrial Internet – Power of 1%

GE estimates that a 1% improvement in efficiency in five selected industries could add up to \$276 billion over 15 years.

- **Oil and Gas:** By cutting fuel and operating costs, and by making equipment more available and productive.
- **Power Generation:** By monitoring equipment better and predicting other potential network problems.
- **Health Care:** By helping healthcare works locate and use mobile equipment more efficiently.
- **Aviation:** By planning more efficient flight paths and using smarter engines that inform crews when maintenance is needed.
- **Rail:** Optimizes operator response through real-time overviews of network operations.

Figure 24: GE and the Power of 1%

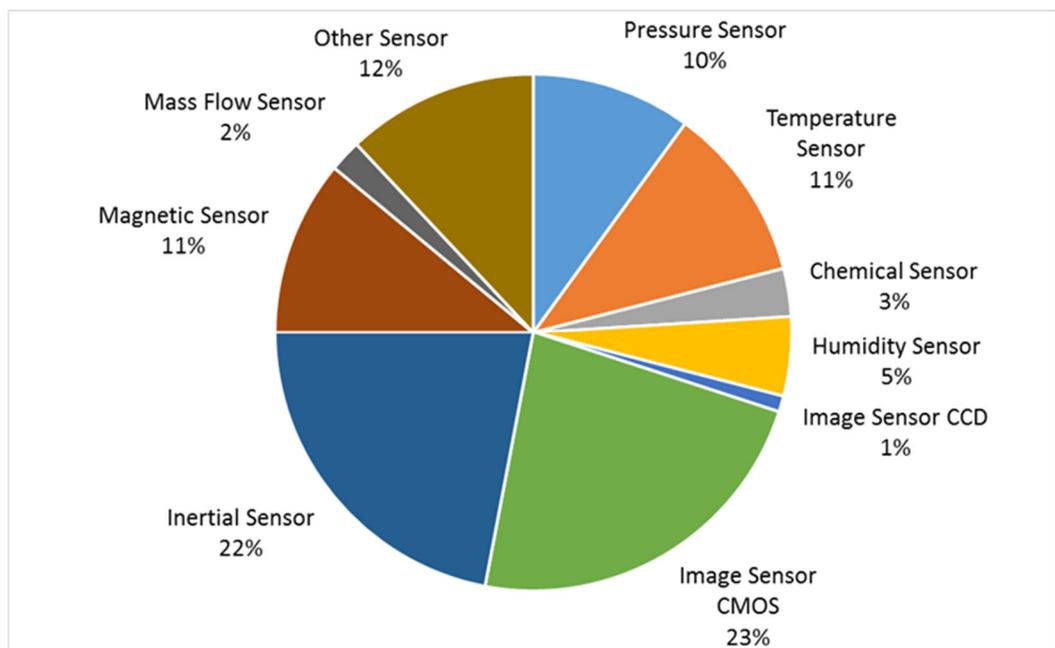


Source: GE

## Sensors – A Vital Component in Connected “Things”

With respect to IoT device components, sensors represent one of the key enabling technologies driving this market. Sensors fundamentally convert the analog information of an environment into the digital bits that can be transmitted, stored and processed by computers. Figure 25 forecasts the demand for IoT driven sensor technology in 2020.

Figure 25: IoT Enabled Sensors  
*Projected to generate \$10 billion in revenues in 2020*



Source: Gartner

The environment we inhabit is fundamentally an analog environment. The IoT requires that we acquire and digitize data from our analog environment (sensors), and then transmit, analyze, store-and-forward the data. This requires memory, microcontrollers (MCUs), networking chipsets, and the power to operate them all.

While sensors are a vital piece of the overall IoT ecosystem, they are not likely to represent the largest economic value of the overall IoT rollout. Rather, we believe the real market opportunity for semiconductor manufacturers will lie in the integration of sensors with other

components to form customized, turnkey solutions targeting the needs of the various vertical markets. As shown in the Gartner chart, inertial and image sensors will represent the largest revenue portion of the overall sensor market. While we are all familiar with cameras and smartphones intelligently displaying their images in portrait and landscape mode, many new applications combining the information from these sensors will be created. Examples include smart parking, auto collision avoidance, driverless cars, smart roads (automatic congestion avoidance) and home security.

Technologies for storing electrical energy (batteries, for now) and harvesting it (multiple solutions in the works) efficiently and cheaply will combine with sensor technologies to convert analog information (temperature, humidity, physical quantity, location, etc.) into digital information, which can be transmitted and stored in the cloud. At the data acquisition level, what is therefore required is a very low cost combination of a power source, one or more sensors, an MCU, and a wireless transceiver to deliver the data to the network.

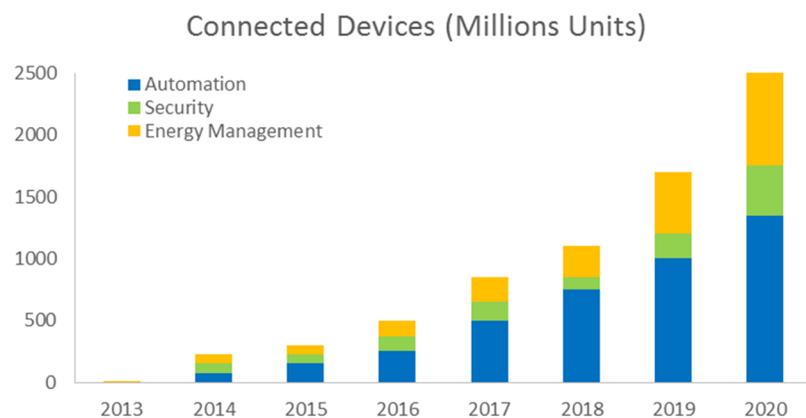
New sensor and semiconductor designs and manufacturing technologies (low-power chips, MEMS devices, etc.) will come to the fore as this market develops, creating opportunities for nimble players to position themselves strategically and reap the benefits. We've already mentioned energy harvesting and storage as critical pieces of the semiconductor infrastructure that will enable IoT.

Other complementary technologies will also be important, such as actuators – the things that actually do something after receiving an input or instruction from a sensor or a microcontroller. Today, they are power-hungry and bulky – they will need to get smaller and much more efficient. Technology for speech recognition and voice-control will also come into play, as well as new innovations around how the embedded software and firmware is created and managed on board the silicon.

## The Smart home – Finally here?

As we've already noted, a good deal of the early buzz around IoT involves IoT in the home and the consumer/lifecycle/wearables space. In part this is due to the universality of the experience of consumer technology – it touches us all as individuals, as opposed to industrial or M2M technologies, which are familiar only to specialists in the field. But we believe a more important reason for the fascination with home/consumer/wearable IoT technology is the simple fact that the very same forces that we've identified as important for IoT generally are essential for consumer-oriented IoT technologies.

Figure 26: IoT in the Smart home



Source: Gartner

For example, significantly lower cost sensors, systems and networking/transport combined with increasing penetration into the home of sophisticated technologies (smartphones, wired and wireless in-home broadband networking, etc.) are poised to enable multiple new functionalities and business models.

As shown in Figure 26, the three major categories of Security, Energy Management, and Automation will see significant growth over the next several years.

Today, most consumers have a plethora of TV remotes festooned with tiny buttons that are hard to read and not intuitive, one or more set-top boxes, and some home networking equipment, often provided by the same organization they obtain television or telephone service from, and perhaps a programmable thermostat or electric coffeemaker. To get to the next level of home automation requires navigating a profoundly confusing array of choices and competing solutions, many of which are not compatible with each other. IFTTT, a startup building a cloud-based platform for building simple rules-based formulas, called “recipes,” offers the ability to control connected home devices (among other things) with a single app.

A number of the incumbent providers of television, telephony, and broadband are vying for consumer attention in the home automation space. Fundamentally, IoT in the home requires broadband connectivity, LAN connectivity (wired and wireless) within the home, and the ability to configure the systems as well as control and operate the various elements in a user-friendly, non-technical fashion.

*Reducing complexity in  
the new smart home*

The IoT sets up an opportunity for consolidation and simplification of control of the home environment, using the already familiar interface of the smartphone or tablet, but it also promises much, much more. While we’ve described the opportunities brought about by connected appliances elsewhere in this report, we also want to stress that there is still plenty of room for different approaches to succeed, and for quite a few new applications that have yet to be conceived, let alone designed, implemented, and cost-reduced to the point where they are profitable to make and sell at a realistic price point.

The challenges will be in reaching agreement on interoperability standards and maintaining laser focus on applications that address a genuine need in a user-friendly fashion, be it for energy savings, the convenience of robotic cleaning, or home security in the form of electronic access control and surveillance and alarm systems, as well as navigating the issues around privacy and data security.

Within the last week, Samsung has garnered some unfortunate publicity about a change in the privacy policy for their “Smart TV” connected TV sets. Samsung has warned customers that the voice activation feature could eavesdrop on users while it is attempting to “listen” for user commands and in the process, transmit private information to third parties. And one day later comes word that the Samsung Smart TVs have been inserting silent Pepsi ads into private home videos every 15-20 minutes in some instances. Samsung has acknowledged this issue and described it as an “error,” but this has alerted consumers that their expensive new TV set may not be an entirely benign presence in the home.

Figure 27: George Orwell’s Telescreen\* becomes a reality in the smart home?

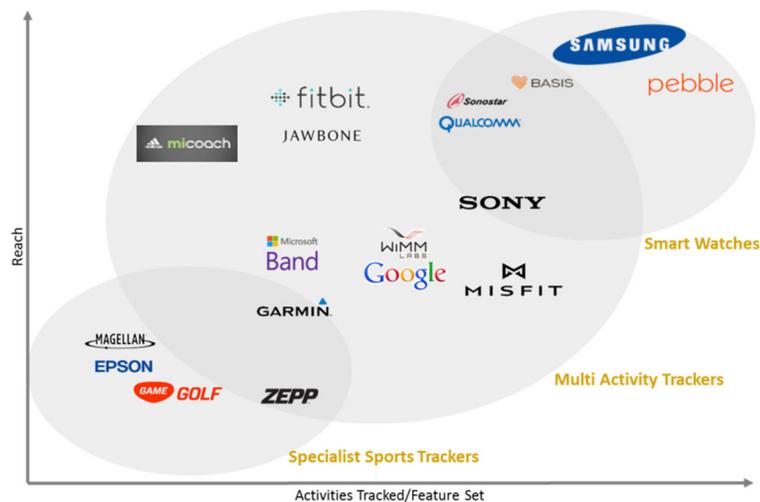


\* Telescreens, featured in George Orwell novel Nineteen Eighty-Four, are fictional devices that operate as both televisions and security cameras.

## Consumers and Wearables - The Connected Person

We have already seen rapid development of fitness sensor products and associated smartphone apps (Fitbit, Jawbone, Nike Fuelband, etc.) and expect to see a market distinction made between higher cost and functionality in true medical grade monitoring devices (glucose, blood pressure, other biometric data) versus these types of consumer fitness products. Due to a number of considerations - including overall cost, liability issues, the complexity of the health care industry structure, and technical challenges - we see the market for more sophisticated medical grade monitoring tools developing more slowly than simple fitness products.

Figure 28: Wearables Landscape



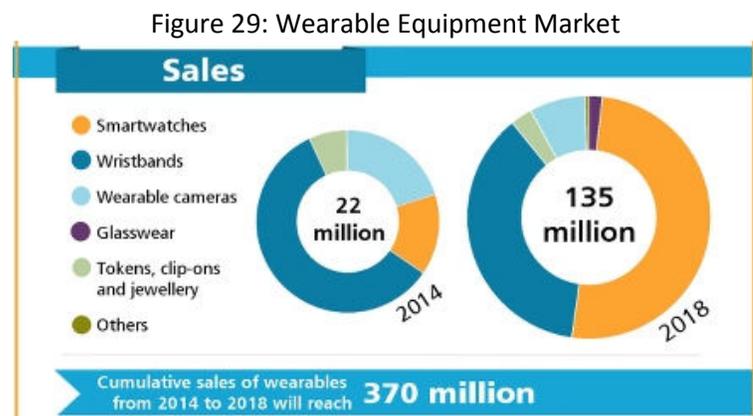
Source: Various industry and company sources.

As you can see in the chart above, there are many players in the wearables space including a number of startups such as Zepp (golf, tennis and baseball), Sensoria (sports socks and bras with sensors), and Strava (running and cycling). Projections for the number of units sold run into the billions. Apple, which is missing from the above chart, is scheduled to release the Apple Watch on April 1, 2015. It remains to be seen if Apple can repeat the success of the iPhone in the wearables market and maintain its premium price point strategy in this space. If it does, we think that many of the other players may end up

being relegated to the sidelines and force into intense competition on price and features.

The recent acquisitions of Endomondo and MyFitnessPal, both acquired by athletic apparel maker Under Armour, dramatically illustrate the intersection of the traditional “low tech” world of clothing with the high tech world of software and IoT. These acquisitions follow Under Armour’s 2013 acquisition of MapMyFitness, a maker of biometric measurement monitoring devices (for \$150 million), as part of its overall Connected Fitness platform strategy.

Intel’s recent push into wearables with its new MICA bracelet (introduced late 2014) and the acquisition of BASIS Science, a fitness tracker technology company, are further indications of keen interest in wearable technology.



Source: CCS Insight/EE Times

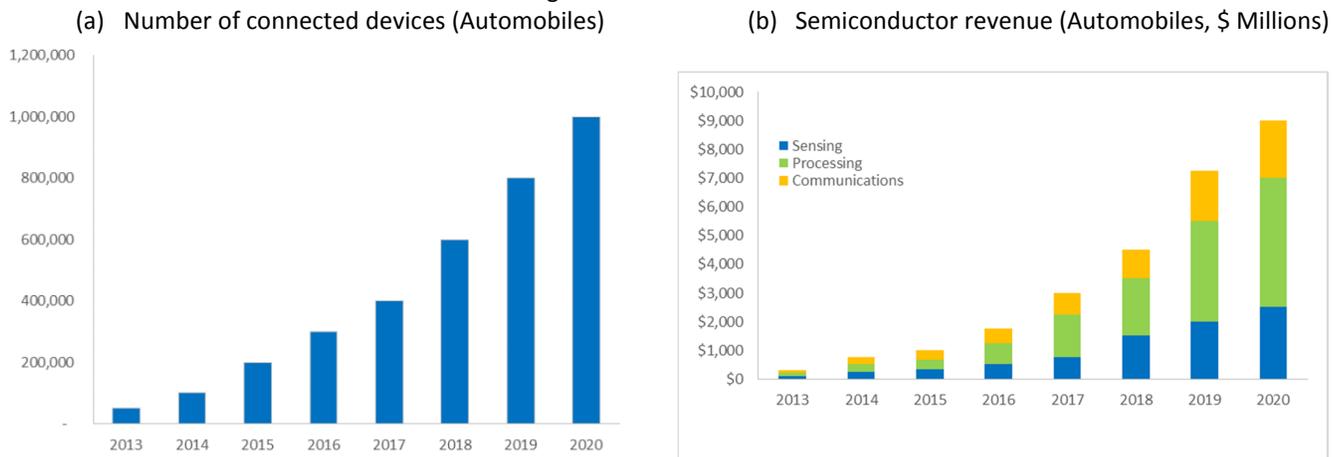
We would like to point the reader to a recent study from the University of Pennsylvania School of Medicine and published in the Journal of the American Medical Association, which looks at the question whether free smartphone apps (running on iPhone 5s and Samsung Galaxy S4) can be as accurate at measuring users steps as well as popular wearable fitness devices that cost more than \$100. Devices studied came from Fitbit, Jawbone and Nike’s discontinued Fuelband. The researchers found that the accuracy of free smartphone apps and wearables were about the same. Specialist wearables for sport and health may survive, but we suspect that generic wearables will face competition from smartphone apps and cheaper imports from China.

## The Smart and Connected Automobile

The “connected car” is widely discussed in the technology literature. We view IoT in the context of the car as an area likely to see significant activity in the near term.

In a recent McKinsey Quarterly interview, William Clay Ford Jr. (Executive Chairman of Ford Motor Company) said, “The role of a traditional automaker changes dramatically. We become a piece of the mobility ecosystem. In this new world, we need to figure out what we have to own and what we don’t and to be a great integrator of technologies and services.” (October 2014).

Figure 30: Automotive IoT



Source: Gartner

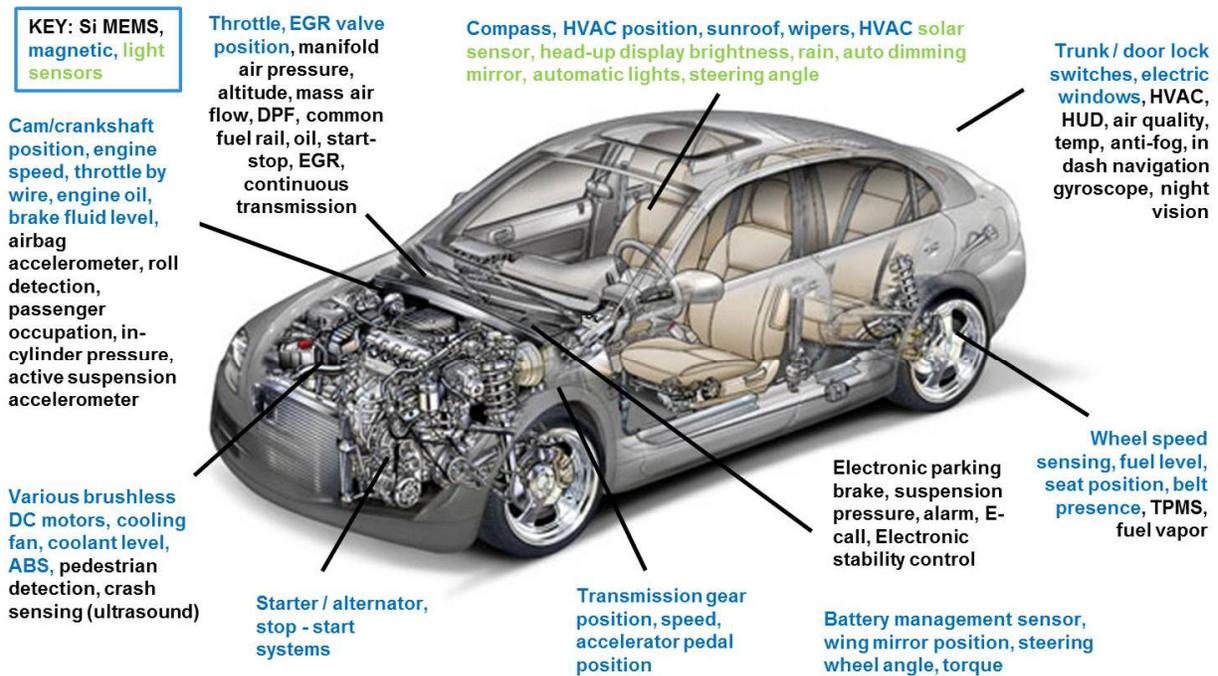
The car represents a unique platform because cars wear out faster than homes do, and therefore consumers buy new cars much more frequently than they buy new (in this case, meaning “newly constructed”) homes, and as such, the opportunity to build in new technology is correspondingly greater in the automobile sector. Moreover, the house and the car are generally the two largest financial commitments in a typical consumer’s life, and represent two of the three primary environments of a person’s existence and the two over which the consumer has the most discretion (the third space being the

work environment). The IoT technologies for automatically managing one’s environment and entertainment have a natural place here.

*Connected car – the “killer app”*

The car thus becomes both a “Thing” in the IoT as well as a gateway to the IoT in terms of its ability to connect the consumer to the larger IoT almost invisibly as it affords conveniences like GPS location-finding, smartphone-connected entertainment, sophisticated sensor-based collision avoidance, traffic re-routing, and so forth. In this way, the car has the potential to be the leading edge “killer app” for IoT technologies even more so than the connected home. Other IoT related applications will use sensors to monitor all sorts of aspects of the car’s operation to increase safety, predict preventive maintenance, and ensure longer service life.

Figure 31: Is this an Automobile or a Computer on Wheels?  
(Capable of generating up to 250 GB/hour of data)



Source: Chip Design

Over the next decade and beyond, we also expect that a fully or partially driverless car model will emerge, although it remains unclear how quickly such technology will be adopted as mainstream. Because the automotive industry is mature, design cycles are still comparatively long, and consumer control desires are high, we suspect that radical shift to the driverless car may be decades away.

We were at a recent IoT event where an executive from a Detroit-based car manufacturer said the following, “Our new competitors are the Internet companies such as Apple, Google and Tesla. They no longer just come from Detroit or Japan or Korea.”

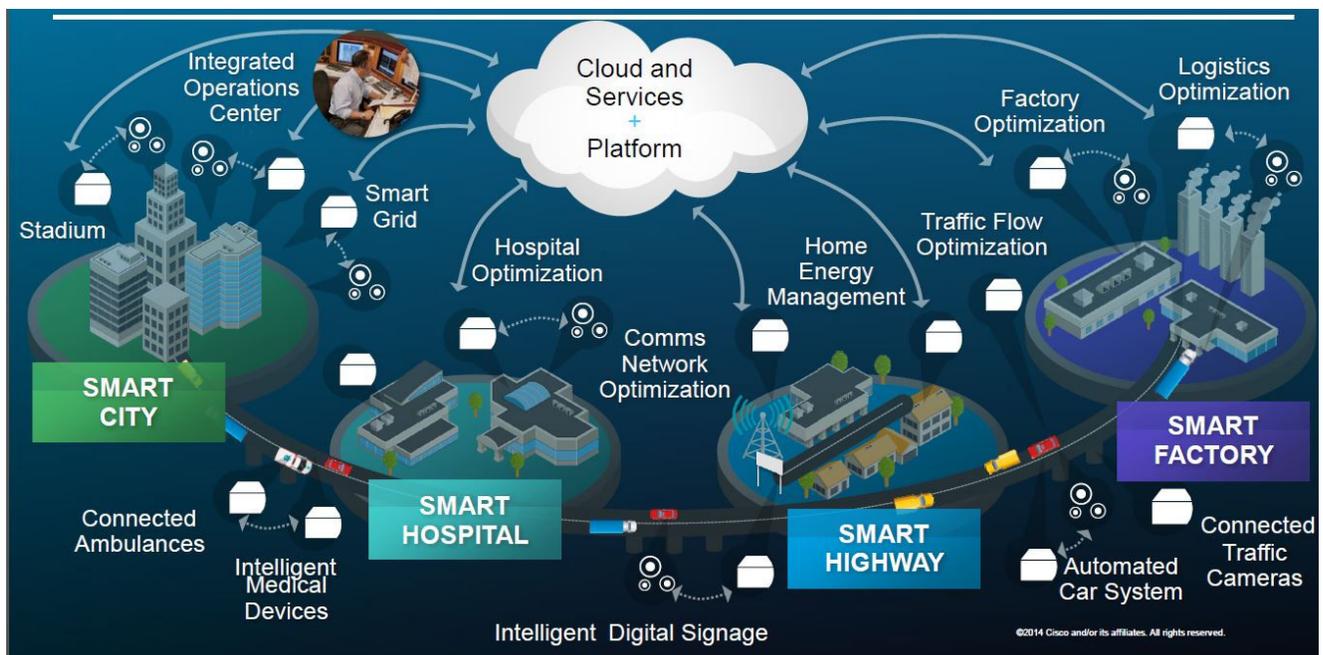
Many semiconductor companies no longer own their fabs, which can cost from \$3.5 billion for DRAM to \$10 billion for logic chips. Why should automobile companies have their own manufacturing plants? (A new automotive plant can cost more than \$1 billion.)

This headline from the Wall Street Journal (Feb. 13, 2015), “Apple Gears Up to Challenge Tesla in Electric Cars – iPhone maker has 100s working on design on a minivan like vehicle”, may have caused a few heart palpitations in boardrooms in Detroit and elsewhere. Skeptics at auto manufacturing companies only need to speak with executives (former executives?) in the music and mobile phone businesses to learn about how Apple revolutionized both these industries. Apple relies on contract manufacturers to build its products and it remains to be seen if the company would adopt this model to build something as complex as a car. But, as the semiconductor industry has shown, using third parties to build extremely complex products is indeed achievable.

Creating Smart Cities with IoT

We believe there is a significant opportunity for IoT technology to be deployed in the creation of what is now being called “Smart Cities.” The ability to use inexpensive sensors cross-connected into a network offers much finer control over the physical elements of the urban landscape – street lighting, public transportation, buildings and grounds, etc. This fine control affords the opportunity to reduce costs via cutting energy and resource waste as well as increasing public safety by controlling lighting and remotely monitoring activities.

Figure 32: Smart Cities  
*Tremendous potential to reduce costs, raise efficiencies and improve lives*



Source: Cisco

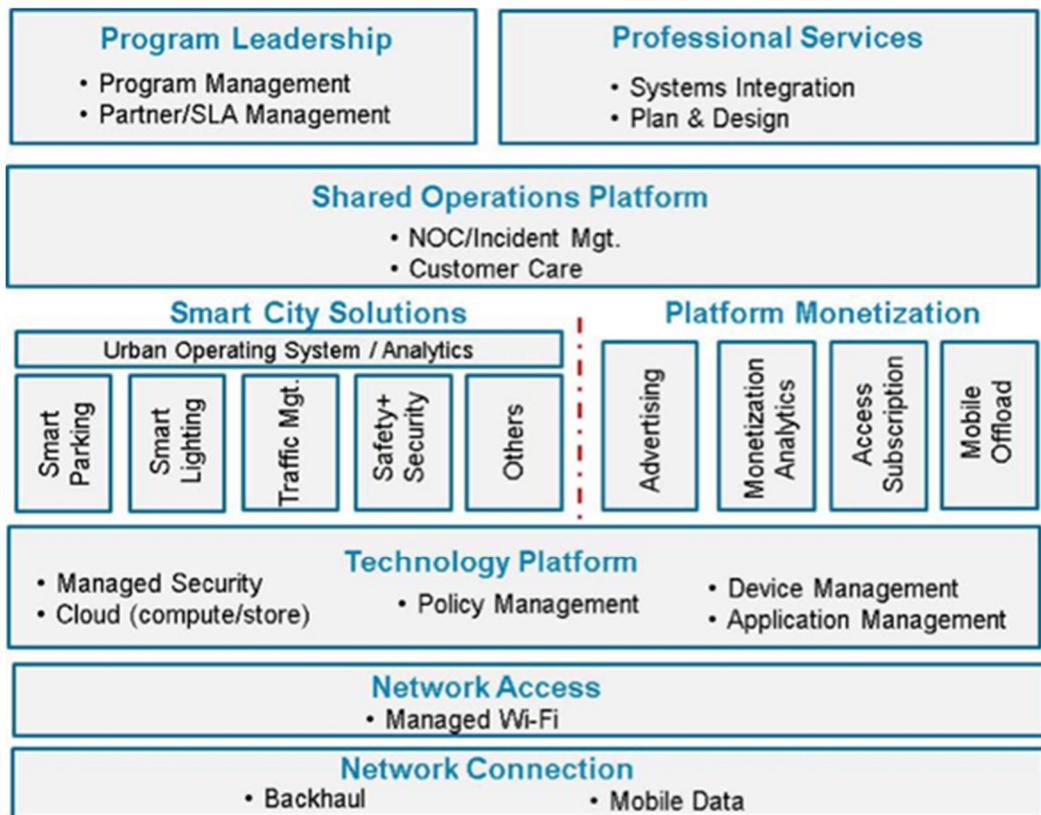
Much has already been written about smart grids, smart meters and their role in the re-engineering of the electrical power system. It is already clear that renewable energy, with its often unpredictable output levels, will require “smart” grid technology that will look much more like an interconnected mesh network of intelligent nodes rather than a

“dumb” network characterized by centralized large scale generation distributing power outward along a grid system with voltage transformers and simple circuit breakers.

Cisco has identified Smart Cities as a primary focus of its efforts to build out the IoT (see Figure 33, Cisco Smart City Business Architecture.) The Cisco Smart City Business Architecture identifies a set of essential requirements in a number of different business layers essential for delivering and operating a successful smart city initiative.

Figure 33: Cisco Smart City Business Architecture

*A way for Cisco to combine its networking prowess with the opportunities in smart cities*



Source: Cisco

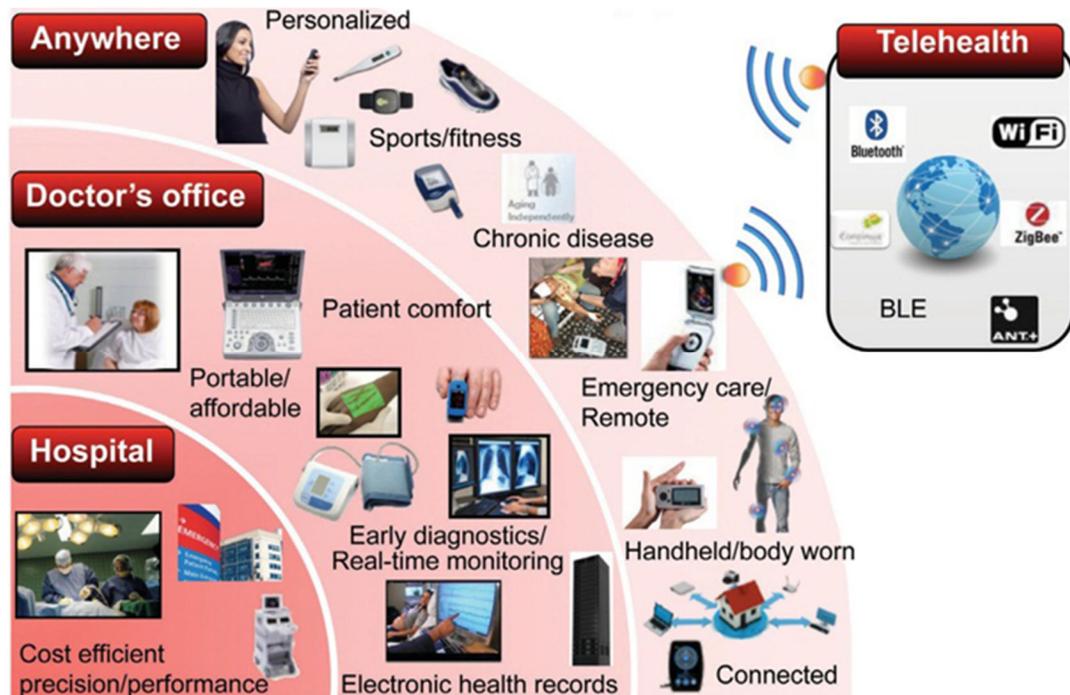
The Cisco smart city initiative for Seattle, Washinton included covering 30 per cent of the city area with a WiFi network and four key smart city solutions – traffic incident management, smart lighting, smart parking, and safety and security. Applying this theoretical model globally suggests an estimated \$7.5 billion annual revenue opportunity for technology vendors in the Smart Cities category. In making this estimate, Cisco is assuming that the solutions provided will include more than just a build/install element – that they will in fact be bundled as an installation with an associated annual service contract which will generate ongoing revenue for the vendors and ensure that the installation is properly maintained and continues to function as originally designed.

In addition to Cisco, other providers of “smart city” technology have emerged. A host of companies compete in the smart metering space, including Itron, Silver Spring, Siemens (eMeter), and Echelon, to name a few. Cyan Technology, a UK-based company, has demonstrated some interesting technology in the form of a mesh network that can be used to operate connected networks of electrical and gas utility metering as well as district (street) lighting and water. Ecofactor is a cloud-based home energy management platform that includes both smart home management and district/regional level analytics for demand response and load management.

## IoT - Revolutionizing Healthcare

There are massive potential advantages of IoT in the health care space (see figure below). These can be broadly divided into i) monitoring for prevention and maintenance of chronic patient conditions (e.g. glucose monitoring for diabetes), ii) impacts on hospital operations and procedures, analogous to the kinds of advantages IoT can provide in any production or service setting, and iii) impacts on the utilization, maintenance, and support of expensive and sophisticated complex medical diagnostic and treatment equipment.

Figure 34: Enormous Potential for IoT in Healthcare  
*Lowering costs, improving diagnosis, tracking assets, ...*



Source: TI

Maintaining and repairing sophisticated and expensive equipment like MRI scanners can require expensive service visits. Providing operational support remotely can improve both utilization and outcomes. According to [Salesforce.com](http://Salesforce.com), companies like Varian Medical Systems are seeing a 50 percent reduction in mean time required to repair their connected devices. Varian reduced service costs by \$2,000 for each problem

*Multiple opportunities in  
healthcare IoT*

resolved remotely, with 20 percent fewer technician dispatches worldwide. Elekta is also seeing excellent results from providing instant expert advice and “over-the-shoulder support” to their customers for Elekta radiation oncology machines.

In addition, connected machines can anticipate the need for replenishment of consumable supplies and potentially alert a central monitoring system to failing systems sufficiently ahead of failure that downtime can be reduced or even eliminated.

Centrally monitoring utilization of remotely connected equipment also allows efficient load balancing and makes possible higher overall utilization. Either patient wait times are reduced, or overall capital expenditures are reduced because the same number of machines can efficiently service more patients.

Due to being large places with many people and things moving about a great deal, hospitals pose a challenge with regards to keeping track of assets ranging from MRI scanners to \$60,000 beds. A Finnish startup, Ekahau, is leveraging WiFi real-time location systems to track expensive assets, patients and staff within hospitals. The technology can also be used to improve patient safety and automate workflow. Similar types of IoT technology can reduce hospital inventory expenses, maximize equipment utilization rates, shorten equipment search times, prevent theft, and automate hospital asset management and maintenance with real-time visibility into the location and status of medical equipment.

Aeroscout, part of Stanley Black & Decker, is another vendor that uses WiFi networks to track and manage the location and status of mobile assets and people in hospitals, as well manufacturing, mining and logistics.

On the operational level, connecting the vast array of devices that may be in use to care for a patient in the ICU can reduce the potential for dangerous or even fatal error. Today, many of these devices are completely independent of one another. Connecting these devices is not technically simple and the consequences of an error are high. While this is a challenging problem, the benefits are clear, and we believe this absolutely will happen.

Just as wearable fitness devices have captured the imagination of consumer oriented IoT advocates, more sophisticated personal monitoring devices create the possibility of better monitoring of chronic conditions like diabetes and congestive heart failure, improving patient quality of life and extending lifespan as well as reducing the cost of acute intervention by anticipating and preventing problems.

Of course, the potential of “Big Data” analytics in predicting, preventing and controlling epidemic disease is yet another innovation connected with IoT that has significant implications for public health. It is not difficult to imagine the aggregation of individual data on a long-term longitudinal basis dramatically improving the quality of science as it relates to disease prevention and management.

As we’ve noted elsewhere, security and proper safeguarding of personal data will be absolutely critical here. HIPAA is just the beginning of the scope of regulatory requirements that will need to be accommodated to operate successfully in the healthcare data space.

## Smart Connected Products and Corporate Strategy

The questions in the tables that follow are based on the paper published by J. Heppelmann and M. Porter: “How Smart, Connected Products are Transforming Competition” HBR, November 2014.

This paper has avoided a lot of the hype and technical jargon that surrounds the Internet of Things and the authors have listed a number of critical questions that Boards, CEOs and investors need to consider carefully. We have added our thoughts based on our own research as well as from discussions with many executives, entrepreneurs and investors.

Strategic Choice	Our Thoughts and Observations
Which set of smart, connected product capabilities and features should the company pursue?	<ul style="list-style-type: none"> <li>- With the hype and promise of IoT many companies may be tempted to smart enable many of their products before realizing the complexity involved in managing the IoT value chain.</li> <li>- The crowdfunding phenomenon has made it possible for young companies to develop interesting products for the home, consumer and wearables applications.</li> <li>- A lot of the excitement of IoT has been generated by M&amp;A transactions in the home/consumer space, and it would be premature to extrapolate this sentiment to the industrial-business worlds, where a more thoughtful approach is required. One that supports an existing installed base of solutions, but also working with customers who wish to benefit from IoT.</li> </ul>
How much functionality should be embedded in the product and how much in the cloud?	<ul style="list-style-type: none"> <li>- Embedding more functionality in the product raises costs and makes it difficult to add/update features.</li> <li>- Functionality in the cloud will require secure, reliable and responsive networks.</li> <li>- The relationship and dependability of the cloud vendor will be an important factor.</li> <li>- Due to privacy laws, clouds may not extend across national boundaries, e.g. between the US and the EU.</li> <li>- To some degree this choice will be driven by the nature of where and what the product is – products that operate in remote or inhospitable settings will inherently need to depend less on connectivity with the network.</li> </ul>
Should the company pursue an open or closed system?	<ul style="list-style-type: none"> <li>- Closed systems were the norm in Industrial systems and manufacturers will try and maintain this control even with the more open Industrial Internet to maintain or gain competitive advantage.</li> <li>- In the consumer world, Apple is notorious for imposing its closed system on willing customers and thereby charging premium prices. It remains to be seen if Apple can extend this to the smart home.</li> <li>- The lack of IoT standards could mean that the IoT markets end up being islands of closed systems.</li> </ul>

Strategic Choice	Our Thoughts and Observations
Should the company develop the full set of smart, connected product capabilities and infrastructure internally or outsource to vendors and partners?	<ul style="list-style-type: none"> <li>- We think that due to complexity of IoT products, many companies will partner with outsider vendors to develop and support their IoT products and service offerings.</li> <li>- Many are already outsourcing IT and manufacturing; doing the same for their IoT may not been seen as a big leap.</li> <li>- The downside will be that companies will then be forced to share some of the value with their supplies and partners.</li> </ul>
What data must the company capture, secure, and analyze to maximize the value of its offering?	<ul style="list-style-type: none"> <li>- Just like Billy Beane used statistics and analysis to build a world class baseball team, IoT allows almost every economic activity and industry to be monitored and analyzed more cheaply than ever before.</li> <li>- In the consumer realm, an equally impressive (and frightening) amount of data can be gathered about a person 24-hours a day. Ford’s Fusion Energi car produces up to 25 gigabytes of data per hour which could increase to 250 gigabytes in future.</li> <li>- The challenge for all IoT applications is to optimize the type and amount of data captured, and naturally, how then to secure it.</li> </ul>
How does the company manage ownership and access rights to its product data?	<ul style="list-style-type: none"> <li>- Like the technical standards, IoT data ownership standards are a work in progress with no resolution in sight.</li> <li>- Porter et. al. ask, “Who is the rightful owner of the data streaming from a smart, connected aircraft engine – the engine supplier, the airframe manufacturer, or the airline that operates the planes?”</li> <li>- Consumers may not wish to share their health wearable or driving data, or give up their rights.</li> <li>- We think that there will be a lot of questions that courts and lawmakers will have to grapple with.</li> </ul>
Should the company fully or partially disintermediate distribution or service channels?	<ul style="list-style-type: none"> <li>- IoT has the potential to reduce the role of middlemen and allow manufacturers to capture new revenues while building new relationships with end customers. What role would the Sears’ of the world play if white goods manufacturers forged direct relationships with their end customers. What is the future role for IT distributors such as Ingram and Tech Data?</li> <li>- The value of the middleman will surely be challenged in the IoT-enabled economy.</li> </ul>

Strategic Choice	Our Thoughts and Observations
Should the company change its business model?	<ul style="list-style-type: none"> <li>- The music industry sold vinyl records and then CDs. With the Internet came Napster and iTunes and consumers no longer wanted to buy an “album” on a CD, having discovered that they could purchase only the individual tunes they liked. Spotify, Pandora and their brethren offer the option of not buying any music at all.</li> <li>- Similarly, IoT could turn product sales companies’ business models upside down and force them to offer a product-as-a-service model, with lower levels of profitability and gross margins.</li> <li>- Their revenue models may have to shift from sales + maintenance to a recurring revenue model which tends to have different margin and profitability profiles.</li> <li>- Wall Street, which tends to look for year-on-year revenue and EPS increases, may punish these changes in business models. Hybrid sales/support models may be too complex and confusing to investors.</li> <li>- Would companies then have to resort to going private, something that Dell did to remake its business model and escape the burden of having to meet Wall Street’s quarterly expectations.</li> </ul>
Should the company enter new businesses by monetizing its product data through selling it to outside parties?	<ul style="list-style-type: none"> <li>- IoT may give other companies access to huge volumes of data that they may be tempted to monetize, but there are a few hurdles.</li> <li>- Google and Facebook have become wildly successful at monetizing user data and may view monetizing product data as the next frontier for them, making themselves imposing competitors for those choosing to monetize product data.</li> <li>- As some companies, such as Verizon, have already discovered, monetizing data without explicit permission from the generators of that data can lead to unwanted attention from regulators and negative publicity (see our earlier discussion of Verizon’s use of “supercookies.”)</li> <li>- In the industrial world, companies are unlikely to be willing to share any type of data with their arch-rivals. Examples here would include Cisco and Huawei, or Boeing and Airbus, or GE and Siemens. A platform player attempting to monetize this data for supplemental revenue may encounter strong opposition in this space.</li> </ul>
Should the company expand its scope?	<ul style="list-style-type: none"> <li>- The IoT value chain is broad and some companies may be tempted to expand beyond their core business areas to capture more revenue and profits for themselves.</li> <li>- As we identified when discussing Cisco’s DNA earlier in the report, this is not an easy thing to accomplish.</li> <li>- There will be bold companies, such as Amazon, which has expanded from being an e-commerce giant to a cloud services/infrastructure behemoth with a market capitalization in excess of \$170 billion. (Amazon recently acquired Annapurna Labs, an Israeli chip company, for \$350 million.)</li> <li>- We think many others will be cautious and play in different parts of the IoT value chain through partnerships, at least initially.</li> <li>- In any case, where to draw the line between core competencies and over-reach will be critical but also not necessarily obvious.</li> </ul>

## Concluding Remarks

As we've seen IoT can mean many different things. Much of the confusion, in our view, has to do with something very aptly described by the parable of the Blind Men and the Elephant – a great deal of one's comprehension of the IoT depends on one's existing understanding of the Internet, of technology, and of proven use cases in a familiar market or industry segment. What does seem indisputably clear, however, is that this is the beginning of a very significant technology build-out opportunity, perhaps as significant and far-reaching in terms of how we live and how our economies function as the Internet itself originally was.

Indeed, we could certainly argue that the Internet of Things is really just the regular, old Internet, but with many, many more nodes. This strikes us as an oversimplification. While there is little doubt that IoT is currently in the midst of a hype cycle, beneath the hype there is the probability of real revolutionary change. It really is far more than IPv6 and a bit of added data connectivity on existing platforms.

We believe there are real and very relevant differences among various market segments in terms of how IoT technology will be deployed, how it will prove to be useful, and how it will affect manufacturers, service providers and end users. In this report, we have tried to illustrate some of the ways market participants are already responding to these developments and some of the logic behind why there are so many differing points of view. We've looked both at how M&A activity can inform us as to what some of the more prominent players are thinking in terms of strategy, and at some of the business model implications of the sizable new markets that may emerge as a result of the new technologies.

Security considerations will be absolutely critical. The interconnection of equipment that represents vital and important infrastructure for life support and safety will need to be done in a thoughtful and highly secure manner. This represents both an opportunity and a threat for all of us in terms of the potential for benefits or misuse / abuse stemming from the ability to control assets electronically from a remote location.

Moreover, as with any big technology development, IoT brings with it both opportunities and threats. Incumbent giants with cozy business models will find that they may be challenged from unexpected corners, and that they may need to re-think or perhaps even cannibalize existing products and markets to ensure their long-term survival. So there will be an existential threat for some.

*Beware the geeks of Silicon Valley, even those bearing gifts.*

The Apples, Google and Facebooks have upended many industries and will be gunning for the large markets that some incumbents have controlled for so long. The structural changes that will result from the Internet of Things, especially the gleaning of business intelligence from fast data/big data pieces may be the catalyst that will allow them to become formidable contenders. Perhaps we may see a merger between a GE (minus its financial arm) and Cisco. Such a conglomerate could alter the global competitive landscape for decades.

Ultimately, the IoT should bring a new era of convenience, functionality, and utility to the way we live, travel, work and manage our health. The “smart” technologies will better anticipate our needs, reduce waste, and improve the overall quality of our lives, which will surely be a good thing, as long as we avoid the pitfalls.

## Appendix

### Companies mentioned in the report

ABB	Comcast	Honeywell	Newtrax	Sony
Accenture	CommScope	HP	Nokia	Splice Machine
Action	Couchbase	Huawei	Nomad Digital	Splunk
ActiveMind	CSC	IBM	NXP Semiconductors	Sqrrl
Acuity	Cyan Technology	IFTTT	Omron	Strava
Aeris	Cymbet	Infosys	On-Ramp Wireless	Stream Technologies
Aeroscout	Cypress Semi	Ingram Micro	Optus	Symantec
AGT International	Daintree	Intel	Oracle	Synnex
Alcatel-Lucent	Databricks	IS2T	Osram Sylvania	TCS
Amazon	Davra Networks	Itron	Palantir	Tech Data
Anthem	Dell	Jasper Technologies	Panasonic	Tech Mahindra
Apple	Digi International	Jawbone	ParStream	Telit
Arduino	Digital Lumens	Johnson Controls	Pebble	Telus
ARM	Eaton Cooper	Kii	Percolata	Tesla
Arrayent	Echelon	KORE Wireless	Perpetuum	Turn
Arrow Electronics	Ecofactor	LG	Pivotal	Under Armour
Atmel	Ekahau	Lenovo	Platfora	Uniqlo
AT&T	Electric Imp	Legrand	PTC	United Technologies
Avago	Electrolux	Libelium	Qualcomm	Varian Medical
Avnet	Elekta	Lifx	Quirky	Veedims
Ayla Networks	EMC	Link Labs	RedPine Signals	Verizon
Belden	Emerson	Lively	Salesforce	ViaSat
Belkin	Enlighted	Lockheed Martin	Samsung	VMware
Big Ass Fans	Enocan	LogMeIn	SAP	Vodafone
Boeing/ArgonST	Ericsson	Lutron	Schneider Electric	Whirlpool
BorgWarner	Facebook	MapR	Schlumberger	Wink
Bosch	Fanuc	Marvell	Sensoria	Wipro
Broadcom	Fairchild	Mocana	Sharp	Xively
Bsquare	Ford	MicroGen	Siemens	Yale Locks
Chevron	Freescale	Microsoft	Sigfox	Zebra
Cisco	GainSpan	MongoDB	Silicon Labs	Zepp
Citrix	GE	Murata	Sine-Wave	ZTE
Cloudera	Gemalto	Narus/Symantec	Silver Spring	
Coca Cola	Google	NetApp	SingTel	
Cohda Wireless	Haier	Netflix	Sirius XM	

## Recent M&amp;A transactions in the IoT space

#	Date	Acquiror	Target	Transaction Value (\$M)	TV/Revenue Multiple	Target Business Description
1)	02/04/15	Under Armour	MyFitnessPal	\$475.0	NA	MyFitnessPal operates an online nutrition and calorie counter database that allows users to record their food intake, and track calorie counting and food plans.
2)	02/03/15	Silicon Laboratories	Bluegiga Technologies	60.8	NA	Bluegiga Technologies develops Bluetooth-based access solutions and Bluetooth original equipment manufacturer (OEM) modules.
3)	02/02/15	Under Armour	Endomondo	85.0	NA	Endomondo operates Endomondo.com, a social sports and fitness network that enables the users to automatically track their sports data and monitor their performance over time.
4)	02/02/15	Intel	Lantiq	NA	NA	Lantiq, a fabless semiconductor company, provides semiconductors and supporting software for broadband communication and digital home applications.
5)	12/09/14	Belden	Tripwire	710.0	NA	Tripwire provides information technology (IT) security and compliance management solutions for enterprises, government agencies, and service providers.
6)	12/02/14	u-blox	Lesswire	NA	NA	Lesswire designs, develops, and manufactures products and solutions for wireless data transmission and information utilization on mobile devices.
7)	12/02/14	Citrix	Octoblu	NA	NA	Octoblu develops a machine-to-machine cloud-based platform for real-time connections and communications management across systems, people, and physical devices.
8)	12/02/14	Freescale Semiconductor	Zenverge	NA	NA	Zenverge, a fabless semiconductor company, develops content networking ICs for service operators and consumer electronics companies in the United States and internationally.
9)	12/01/14	Cypress Semiconductor	Spansion	2,182.2	1.5x	Spansion designs, manufactures, develops, and sells embedded systems semiconductors worldwide.
10)	11/24/14	ARM	Offspark	NA	NA	Offspark provides specialized consultancy in the areas of Cyber Security, Digital Espionage, Cryptography and High-Tech Business Development.
11)	10/24/14	Nest Labs	Revolv	NA	NA	Revolv provides a home monitoring and control solution that connects various wirelessly-enabled household items.
12)	10/15/14	Qualcomm	CSR	2,376.4	2.7	CSR, a fabless semiconductor company, designs and develops semiconductor integrated circuits primarily in Asia, the Americas, and Europe.
13)	09/19/14	Huawei	Neul	25.0	NA	Neul develops a wireless network technology for the use of television (TV) white space spectrum.
14)	08/19/14	Echelon	Lumewave	NA	NA	Lumewave provides wireless solutions for control and monitoring of outdoor lighting technologies.
15)	08/18/14	Samsung	Quietside	NA	NA	Quietside engages in the import, sale, marketing, and distribution of heating, air conditioning, and refrigeration equipment used in homes and businesses to wholesale distributors in the United States and
16)	08/14/14	Samsung	Physical Graph	200.0	NA	Physical Graph provides home automation products. It offers SmartThings app that enables users to lock and unlock their doors from anywhere.
17)	08/13/14	Intel	LSI	650.0	5.8	LSI comprises Internet-of-things (IoT) and other emerging technologies and builds systems-on-a-chip (SOCs) for networking infrastructure.
18)	07/23/14	PTC	Axeda	175.5	NA	Axeda provides a cloud-based service and software for managing connected products and machines and implementing machine-to-machine (M2M) and Internet of things (IoT) applications.
19)	07/14/14	Comcast	PowerCloud Systems	NA	NA	PowerCloud Systems provides software platforms for enabling Networking-as-a-Service (NaaS).
20)	07/08/14	CEVA	RivieraWaves	19.0	4.8	RivieraWaves offers wireless intellectual property (IP) portfolio for Bluetooth and Wi-Fi technologies.

#	Date	Acquiror	Target	Transaction	TV/Revenue	Target Business Description
				Value (\$M)	Multiple	
21)	07/07/14	Atmel	Newport Media	\$170.0	4.0x	Newport Media, a fabless semiconductor company, develops and sells integrated radio frequency system-on-a-chip solutions for broadcast communications, wireless connectivity, and cellular
22)	06/20/14	Nest Labs	Dropcam	555.0	NA	Dropcam provides Wi-Fi video monitoring camera and cloud services.
23)	06/17/14	Cisco Systems	Tail-f Systems	175.0	NA	Tail-f Systems provides configuration management software for networking equipment and network management systems.
24)	06/16/14	Vodafone	Cobra Automotive	269.3	1.3	Cobra Automotive provides vehicle-centric solutions worldwide.
25)	05/19/14	u-blox	connectBlue	28.1	2.1	connectBlue provides industrial and medical wireless solutions.
26)	05/09/14	General Electric	Wurldtech Security	NA	NA	Wurldtech Security provides cyber security testing and remediation solutions to critical infrastructure suppliers, system integrators, and end-users worldwide.
27)	04/30/14	LogMeIn	Ionia	7.5	NA	Ionia operates as a system integrator specializing in connected solutions.
28)	03/25/14	Intel	Basis Science	NA	NA	Basis Science develops health and heart rate monitors for fitness and wellness needs.
29)	03/12/14	Lockheed Martin	Industrial Defender	NA	NA	Industrial Defender develops cybersecurity, compliance, and change management solutions for the control systems in electric utility, chemical processing, transportation, water, and oil and gas
30)	03/06/14	Fairchild	Xsens	61.0	NA	Xsens provides 3D motion tracking technology and products.
31)	01/13/14	Google	Nest Labs	3,200.0	NA	Nest Labs designs, develops, manufactures, and sells solutions to address home energy consumption.
32)	12/30/13	PTC	ThingWorx	130.0	NA	ThingWorx provides a development and runtime platform for building Internet of Things and M2M applications.
33)	12/13/13	Google	Boston Dynamics	NA	NA	Boston Dynamics, an engineering company, engages in building dynamic robots and software for human simulation.
34)	11/24/13	Apple	PrimeSense	NA	NA	PrimeSense develops 3D machine vision technologies for digital devices.
35)	11/04/13	Sirius XM	Agero	530.0	NA	Agero provides connected vehicles, roadside assistance, and claims management services to auto manufacturers, insurance carriers, and drivers in the United States.
36)	09/04/13	Telit Wireless	ILS Technology	8.5	NA	ILS Technology provides software and service-based solutions that link intelligent devices with enterprise applications and databases.
37)	08/30/13	Google	WIMM Labs	NA	NA	WIMM Labs offers a wearable platform that enables developers and licensees to build various wearable applications and devices.
38)	08/27/13	ARM	Sensinode	11.7	13.0	Sensinode develops and supplies end-to-end software technology solutions for the Internet of things.
39)	06/11/13	Google	Waze Mobile	966.0	NA	Waze Mobile provides Waze, a community-based traffic and navigation mobile application.
40)	05/29/13	Cisco	JouleX	107.0	NA	JouleX provides energy management software solutions to enterprises.



#	Date	Acquiror	Target	Transaction Value (\$M)	TV/Revenue Multiple	Target Business Description
41)	04/30/13	AliphCom	BodyMedia	NA	NA	BodyMedia develops wearable body monitors that collect physiological data for use in improving health, wellness, and fitness.
42)	04/12/13	ViaSat	LonoCloud	\$2.0	NA	LonoCloud develops and operates a cloud-based service platform to support the Internet of things.
43)	02/04/13	AliphCom	Massive Health	NA	NA	Massive Health, doing business as The Eatery, develops iPhone applications that enable to see users' meal in the feed, and rates and comments on the meal.
44)	12/20/12	CalAmp	Wireless Matrix USA	52.9	1.5x	Wireless Matrix USA, provides wireless data solutions and services for business critical applications.
45)	11/01/12	Digi International	Etherios	20.5	2.3	Etherios provides cloud computing services for customer relationship management, system integration, training, and custom application development.
46)	06/01/12	Verizon Enterprise Solutions	HUGHES Telematics	737.4	9.2	HUGHES Telematics a telematics services company, provides a suite of real-time voice and data communications services and applications for use in vehicles in the United States.
47)	05/21/12	Silicon Laboratories	Ember	72.0	NA	Ember develops wireless mesh networking technologies.
48)	01/05/12	Verizon Wireless	nPhase	NA	NA	nPhase provides machine to machine wireless communications and services for healthcare, manufacturing, utilities, distribution, and consumer product industries.
49)	12/20/11	Gemalto	SensorLogic	NA	NA	SensorLogic provides cloud-based, wireless, machine-to-machine (M2M) service delivery platform-as-a-service software for M2M applications.
50)	07/20/11	LogMeIn	Pachube	15.0	NM	Pachtube, a data brokerage platform, enables users to store, share and discover real-time sensor, energy and environment data from objects.
51)	04/21/11	Ericsson	Telenor Connexion's M2M	NA	9.2	Telenor Connexion's M2M technology platform is a service that enables operators to provide M2M connection beyond smartphones and laptops

75 <sup>th</sup> Percentile	\$542.5	6.6x
Mean	454.1	4.8
Median	130.0	3.3
25 <sup>th</sup> Percentile	26.5	2.0

## Recent private placements in the IoT space

#	Date	Investors	Target	Transaction	
				Value (\$M)	Business Description
1)	01/13/15	Startupbootcamp Internet of Things & Data	Teraki	NM	Teraki develops software solutions for B2B market that can profit from core advantages for their IoT applications.
2)	01/09/15	Salesforce Ventures	2lemetry	\$4.0	2lemetry operates an Internet of things (IoT) platform and technology company.
3)	12/10/14	Goldman Sachs Group; New Enterprise Associates	MongoDB	100.0	MongoDB designs and develops open-source databases for big data, content management and delivery, customer data management, Internet of Things, single view, Database-as-a-Service, mobile applications, product and asset catalogs, security and fraud applications, and social and collaboration applications.
4)	11/19/14	CrossLink Capital; Pantera Capital Management	LaunchKey	4.1	LaunchKey provides a mobile identity and access management platform that secures enterprise-class applications without the hassle or liability of passwords.
5)	11/04/14	Intel Capital	AnDAPT	NA	AnDAPT, an analog and digital adaptive platform technology company, provides analog and digital adaptive solutions for enterprise power electronics to build on-demand mixed signal analog application specific standard products and adaptive power management devices to lower system power consumption without needing ultra-high volumes.
6)	10/01/14	Nippon Telegraph and Telephone	Preferred Networks	1.8	Preferred Networks, also known as PFN, operates as a software development company that focuses to apply real-time machine learning technologies to new applications in the emerging field of the Internet of Things.
7)	09/10/14	Bessemer Venture Partners	Bastille Networks	2.5	Bastille Networks, a security company, develops software and sensor technologies to detect and mitigate threats affecting the Internet of Things (IoT).
8)	09/05/14	Wayra Argentina	LESS Industries	NA	LESS Industries provides cloud based telemetry services.
9)	09/05/14	InflexionPoint Technologies	RelySys Technologies India	NA	RelySys Technologies India develops products in the areas of machine to machine communication and Internet of things for enterprise/industrial grade remote monitoring and automation, and security and surveillance applications.
10)	09/02/14	Accel Partners; Helion Venture Partners	Grid Ant Technologies	3.0	Grid Ant Technologies develops Cubeit, a collaborative operating system for the Internet of things.
11)	08/25/14	Hunan TV & Broadcast Intermediary Co	Jiangsu Wootide Technology	19.9	Jiangsu Wootide Technology develops and operates Internet of Things (IoT) and cloud computing solutions, including construction, integration, and operation of IoT and cloud computing platforms.
12)	06/30/14	Inventure	Cyberlightning	NA	Cyberlightning, a 3D Internet company, provides controlling and monitoring solutions for the Internet of Things (IoT) networks in the Smart City context.
13)	04/30/14	CrossLink Capital; Voyager Capital; Cisco Investments	Ayla Networks	14.5	Ayla Networks owns a cloud-based connectivity platform for the Internet of things.
14)	04/02/14	Temasek Holdings	Jasper Technologies	50.0	Jasper Technologies develops cloud-based platforms that enable enterprises and mobile operators to launch, manage, and monetize Internet of Things (IoT) service businesses in the United States and internationally.
15)	03/27/14	Wellington Financial	SOA Software	10.0	SOA Software provides API management, API security, and cloud integration solutions.
16)	02/11/14	Alsop Louie Partners	DeviceAuthority	NA	DeviceAuthority offers technology and products to enable high-assurance authentication for machine-to-machine (M2M) and multi-factor security applications.
17)	01/31/14	Partnerinvest	ProAnt	NA	ProAnt provides embedded and external antennas for smart metering and smart home solutions.
18)	12/12/13	BitChemy Ventures	Altiux Innovations	2.0	Altiux Innovations, a product engineering, OPD, and innovation services company, offers information technology solutions for industrial, telecom, mobile and wireless, consumer electronics, and healthcare verticals.

#	Date	Investors	Target	Transaction	
				Value (\$M)	Business Description
19)	11/04/13	Big Basin Partners	Tempered Networks	NA	Tempered Networks provides connectivity solutions for critical infrastructure, industrial control systems, and the Industrial Internet of Things applications in water, energy, petroleum, manufacturing, and other industries.
20)	10/30/13	Odyssey Venture Partners	Econais	NA	Econais designs and manufactures smart wireless modules for Internet of things and machine to machine wireless connectivity.
21)	10/02/13	New Enterprise Associates; Sequoia Capital; Red Hat	MongoDB	\$150.0	MongoDB designs and develops open-source databases for big data, content management and delivery, customer data management, Internet of Things, single view, Database-as-a-Service, mobile applications, product and asset catalogs, security and fraud applications, and social and collaboration applications.
22)	09/11/13	Startupbootcamp	iThings4U	NM	iThings4U offers a platform that provides application developers with tools to create applications and services connected to the Internet of Things.
23)	08/23/13	Mayfield Fund; RRE Ventures; U.S. Venture Partners	Electric Cloud	12.0	Electric Cloud provides enterprise continuous delivery solutions to automate and accelerate software build, test, and deployment processes.
24)	08/20/13	JMI Equity; Mitsui & Co.; Wipro	Axeda	12.0	Axeda provides a cloud-based service and software for managing connected products and machines and implementing machine-to-machine (M2M) and Internet of things (IoT) applications.
25)	06/30/13	Dublin Business Innovation Centre; Delta Partners	Davra Networks	2.0	Davra Networks, an enterprise software company, develops network automation, machine to machine (M2M), and internet of things solutions for communications networks.
26)	06/05/13	CrossLink Capital; Voyager Capital	Ayla Networks	5.4	Ayla Networks owns a cloud-based connectivity platform for the Internet of things.
27)	06/08/13	Wipro	Axeda	5.0	Axeda provides a cloud-based service and software for managing connected products and machines and implementing machine-to-machine (M2M) and Internet of things (IoT) applications.
28)	03/15/13	Bridge City Ventures	Smart Mocha	NM	Smart Mocha enables technologies for the emerging hardware and software 'Internet of things'.
29)	01/27/13	Lion Wells Capital	SeeControl	NA	SeeControl operates as an M2M communications and Internet of things (IoT) business applications platform software company.
30)	01/15/13	Divergent Ventures; Hyde Park Ventures; Chicago Ventures	TempoIQ	3.2	TempoIQ provides the monitoring, analysis, and storage of sensor data for clients' applications.
31)	12/31/12	Omidyar Network; Gray Ghost Ventures	Range Networks	NA	Range Networks develops and builds a software-defined multiprotocol Internet protocol wireless platform.
32)	12/20/12	Microsoft Ventures	TalentCloud	NA	TalentCloud offers cloud computing solutions to agricultural farmers in China.
33)	12/19/12	Hercules Technology Growth Capital	Polyera	6.0	Polyera operates as a technology company that develops flexible transistor technologies that enable novel electronics form factors and advanced electronics manufacturing processes worldwide.
34)	12/07/12	Kima Ventures; Ludlow Ventures; VegasTechFund	LaunchKey	NM	LaunchKey provides a mobile identity and access management platform that secures enterprise-class applications without the hassle or liability of passwords.
35)	11/14/12	Red Hat; Intel Capital	MongoDB	NA	MongoDB designs and develops open-source databases for big data, content management and delivery, customer data management, Internet of Things, single view, Database-as-a-Service, mobile applications, product and asset catalogs, security and fraud applications, and social and collaboration applications.
36)	11/05/12	LBBW Venture Capital; High-Tech Gründerfonds Management	Synapticon	NA	Synapticon provides advanced components and engineering services for cyber-physical systems.

#	Date	Investors	Target	Transaction	
				Value (\$M)	Business Description
37)	09/26/12	Safeguard Scientifics	ThingWorx	\$8.0	ThingWorx provides a development and runtime platform for building Internet of Things and M2M applications.
38)	09/17/12	In-Q-Tel	MongoDB	NA	MongoDB designs and develops open-source databases for big data, content management and delivery, customer data management, Internet of Things, single view, Database-as-a-Service, mobile applications, product and asset catalogs, security and fraud applications, and social and collaboration applications.
39)	09/11/12	Junsan Capital	RML Technology	3.6	RML Technology designs, develops, tests, and markets microwave, RF SOC IC products, and sensors.
40)	08/23/12	SOFTBANK Ventures	nTels	1.4	nTels provides solutions and platform services to wired, wireless, communications, and broadcasting service providers.
41)	08/15/12	LaunchHouse Accelerator	iOTOS	NM	iOTOS operates an 'Internet of Things' platform to control various products and appliances with a smart phone.
42)	07/13/12	Arch Venture Partners; Madrona Venture Group; Intel Capital	Impinj	27.8	Impinj provides ultra high frequency radio frequency identification (RFID) solutions for identifying, locating, and authenticating items.
43)	06/19/12	Sigma Partners; Oplink Communications; Zebra Technologies	GainSpan	19.0	GainSpan engages in designing and marketing ultra-low power embedded Wi-Fi semiconductor and software solutions for smartphone monitored and controlled devices, and the Internet of Things applications.
44)	05/23/12	New Enterprise Associates; Sequoia Capital	MongoDB	42.2	MongoDB designs and develops open-source databases for big data, content management and delivery, customer data management, Internet of Things, single view, Database-as-a-Service, mobile applications, product and asset catalogs, security and fraud applications, and social and collaboration applications.
45)	02/17/12	Hercules Technology Growth Capital	Hillcrest Laboratories	4.0	Hillcrest Laboratories, also known as Hillcrest Labs, is a global supplier of software and hardware for motion-enabled products.
46)	01/31/12	TechStars	TempoIQ	NM	TempoIQ provides the monitoring, analysis, and storage of sensor data for clients' applications.
47)	01/18/12	Benchmark Capital; Sequoia Capital	Jasper Technologies	20.0	Jasper Technologies develops cloud-based platforms that enable enterprises and mobile operators to launch, manage, and monetize Internet of Things (IoT) service businesses in the United States and internationally.
48)	12/31/11	Dublin Business Innovation Centre, Investment Arm	Davra Networks	2.0	Davra Networks, an enterprise software company, develops network automation, machine to machine (M2M), and Internet of things solutions for communications networks.
49)	12/05/11	Sigma Partners; In-Q-Tel; Intel Capital	GainSpan	18.0	GainSpan engages in designing and marketing ultra-low power embedded Wi-Fi semiconductor and software solutions for smartphone monitored and controlled devices, and the Internet of Things applications.
50)	11/28/11	Innovacom Gestion	IS2T	3.4	IS2T designs, develops, markets, and sells virtual application platforms.
51)	09/01/11	Sequoia Capital; Union Square Ventures	MongoDB	20.0	MongoDB designs and develops open-source databases for big data, content management and delivery, customer data management, Internet of Things, single view, Database-as-a-Service, mobile applications, product and asset catalogs, security and fraud applications, and social and collaboration applications.
52)	07/31/11	Shenzhen Capital	Monternet	NA	Monternet provides mobile data applications.
53)	02/14/11	Safeguard Scientifics	ThingWorx	5.0	ThingWorx provides a development and runtime platform for building Internet of Things and M2M applications.

**The Blind Men and the Elephant**

John Godfrey Saxe (1816-1887)

It was six men of Indostan  
To learning much inclined,  
Who went to see the Elephant  
(Though all of them were blind),  
That each by observation  
Might satisfy his mind.

The First approached the Elephant,  
And happening to fall  
Against his broad and sturdy side,  
At once began to bawl:  
"God bless me! but the Elephant  
Is very like a WALL!"

The Second, feeling of the tusk,  
Cried, "Ho, what have we here,  
So very round and smooth and sharp?  
To me 'tis mighty clear  
This wonder of an Elephant  
Is very like a SPEAR!"

The Third approached the animal,  
And happening to take  
The squirming trunk within his hands,  
Thus boldly up and spake:  
"I see," quoth he, "the Elephant  
Is very like a SNAKE!"

The Fourth reached out an eager hand,  
And felt about the knee  
"What most this wondrous beast is like  
Is mighty plain," quoth he:  
"'Tis clear enough the Elephant  
Is very like a TREE!"

The Fifth, who chanced to touch the ear,  
Said: "E'en the blindest man  
Can tell what this resembles most;  
Deny the fact who can,  
This marvel of an Elephant  
Is very like a FAN!"

The Sixth no sooner had begun  
About the beast to grope,  
Than seizing on the swinging tail  
That fell within his scope,  
"I see," quoth he, "the Elephant  
Is very like a ROPE!"

And so these men of Indostan  
Disputed loud and long,  
Each in his own opinion  
Exceeding stiff and strong,  
Though each was partly in the right,  
And all were in the wrong!

### Woodside Capital Partners (WCP) – Who We Are

- A global, independent investment bank that delivers world-class strategic and financial advice to emerging growth companies in the Software, Hardware and Internet sectors
- Founded in 2001.
- Over \$8 billion in transaction value
- M&A, strategic partnership and corporate finance advisory in:
  - Software and Internet Technologies
  - Digital Media and Advertising
  - Hardware: Semiconductors, Electronics, and Enabling Materials
  - Special Situations
  - Cross-border Transactions
- Silicon Valley-based, with offices in London
- WCP Research team - offers technology research serving buy-side institutional investors and technology industry executives.
- 25 professionals: backgrounds as entrepreneurs/CEOs and from top investment banks.

### Selected WCP IoT-Related Transactions

 SALE OF COMPANY  Android smartwatch	 SALE OF BUSINESS UNIT  Wireless - LTE	 SALE OF COMPANY  Asset tracking
 SALE OF COMPANY  MEMS for timing	 CAPITAL RAISE Island Shore Investments Energy & power management	 SALE OF MONTAVISTA AUTOMOTIVE ASSETS  Connected car
 STRATEGIC INVESTMENT  Printed RFID	 STRATEGIC INVESTMENT  Sensors & clocks	 SALE OF COMPANY  Humidity sensors

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