Internet of Things (IoT) 2018 –
Market Statistics, Use Cases and Trends

CONTENTS

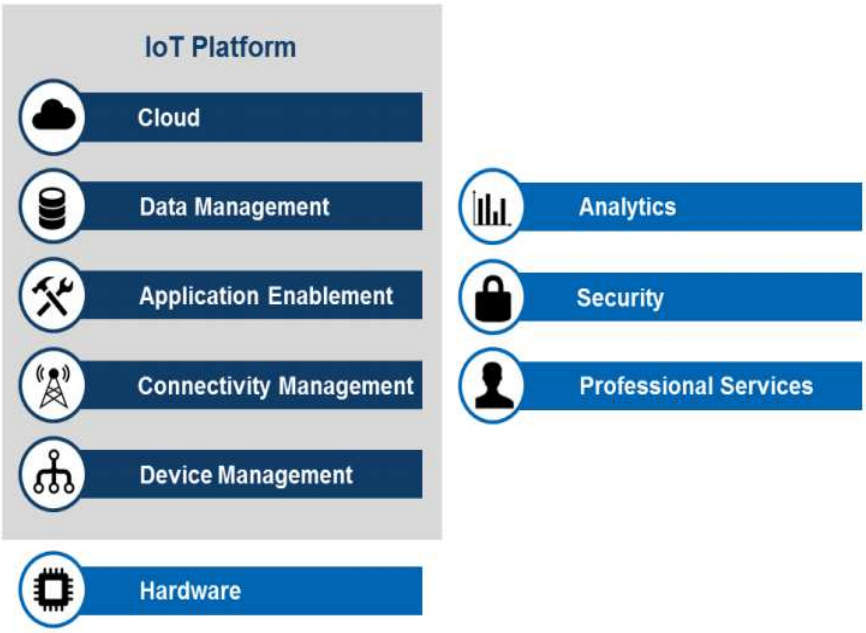
1. What is IoT

The Internet of Things (IoT) is essentially a system of machines or objects outfitted with data-collecting technologies so that those objects can communicate with one another. The machine-to-machine (M2M) data that is generated has a wide range of uses, but is commonly seen as a way to determine the health and status of things – inanimate or living.

Source: Techtarget

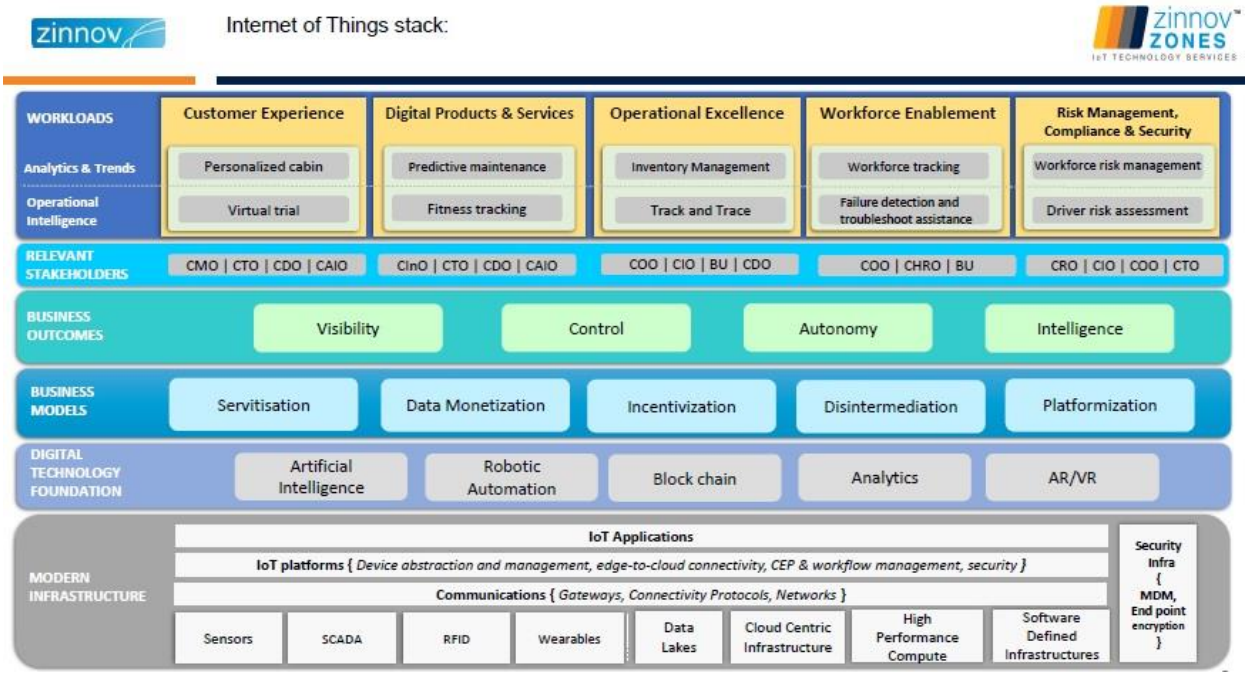
1.1 IoT Platform

The main purpose of IoT platforms is to reduce the complexities for IoT developers, service providers, and implementers. Think of an iceberg; most of the ice mass is submerged below the waterline. Similarly, many, if not most, IoT applications share a large percentage of core functionality. Functions such as rules for thresholds and alerts, multiprotocol support, over-the-air firmware downloads and remote diagnostics are largely the same whether the IoT application is a fleet management service or a smart meter deployment. Much like the visible tip of the iceberg, the aspects of the IoT application that are truly unique and differentiated are typically quite a small portion of the overall application.



Source: IHS Markit

1.2 IoT Stack



Source: Zinnov Zones for IoT Services 2017

1.3 Advancements in IoT

IoT is likely to penetrate into familiar industries in ways people have barely thought of, opening up a whole host of new opportunities and potential new threats. Some examples of what people may be about to see coming up sound fairly obvious while others almost sound like the realms of science fiction.

It's worth taking a brief look at some of the, perhaps unexpected, ways in which IoT could change various industries across the next few years.

Farming

New IoT-enabled practices such as remote monitoring of crops, equipment and livestock, and obtaining statistics on livestock and produce, looks likely to play a role in helping farmers meet the world's food demands over the coming years.

Advertising

Smart drink bottles, are already offering marketers a window to analyze consumer behavior by enabling access to purchasing and consumption habits. As one example, when consumers scan Diageo's connected whisky bottles with a smartphone, they can easily access promotional offers such as discounts

on future purchases, receive suggested cocktail recipes and be supplied exclusive content according to their needs.

Hospitality

Hotels are already starting to introduce facial recognition that can allow managers and providers to know who the customer is before they arrive and check in. Sensors and emotion recognition cameras will also help hotel employees predict if a guest is hungry and provide food recommendations based on their personal preference – making custom meals available even before they've asked for them. Such personalization is also set to extend to all aspects of a guest's room, including automated temperature and light settings upon arrival.

Smart buildings

IoT applications will help grow margins for building developers and enable more efficient building operations, enhanced tenant relationships and new revenue generation opportunities. Smart buildings will deliver unprecedented energy and cost savings alongside new levels of occupant comfort.

Retail

The retail world (as people currently know it) is about to change as a result of the IoT, with the process of physical shopping and e-commerce increasingly set to meld. Rather than visiting stores (which obviously have a limited amount of physical space), consumers will soon be able to try on hundreds of different outfits using augmented and virtual reality headsets, thus potentially accessing much larger catalogues with an experience close to that of actual shopping. Already, high street stores such as Gap are trialling connected AR changing rooms across selected stores, with over 10 billion items of connected clothing set to join the internet of things by 2020.

Healthcare

The usage of the IoT in healthcare (the industry, personal healthcare and healthcare payment applications) has sharply increased across various specific Internet of Things use cases. At the same time we see how other healthcare IoT use cases are picking up speed and the connected healthcare reality is accelerating, even if hurdles remain.

Source: i-scoop

Manufacturing

Many manufacturers are already using IoT solutions to track assets in their factories, consolidating their control rooms and increasing their analytics functionality through the installation of predictive maintenance systems.

To this effect, Canonical believes that the future of IoT, and the realization of many of the applications listed above, will ultimately depend on achieving a greater degree of unity between the IoT's various components; running sensors, edge devices, computers and cloud and infrastructure components on a common (and highly secure) code base, with a single, highly automated and centralized method of providing security updates.

Source: Information Age

1.4 IoT Ecosystem

According to Business Insider, the IoT ecosystem is comprised of an entity (smartphone, tablet, etc.) that functions as a remote to send a command or request for information over the network to an IoT device. The device will then perform the command or send information back over the network to be analyzed and displayed on the remote.

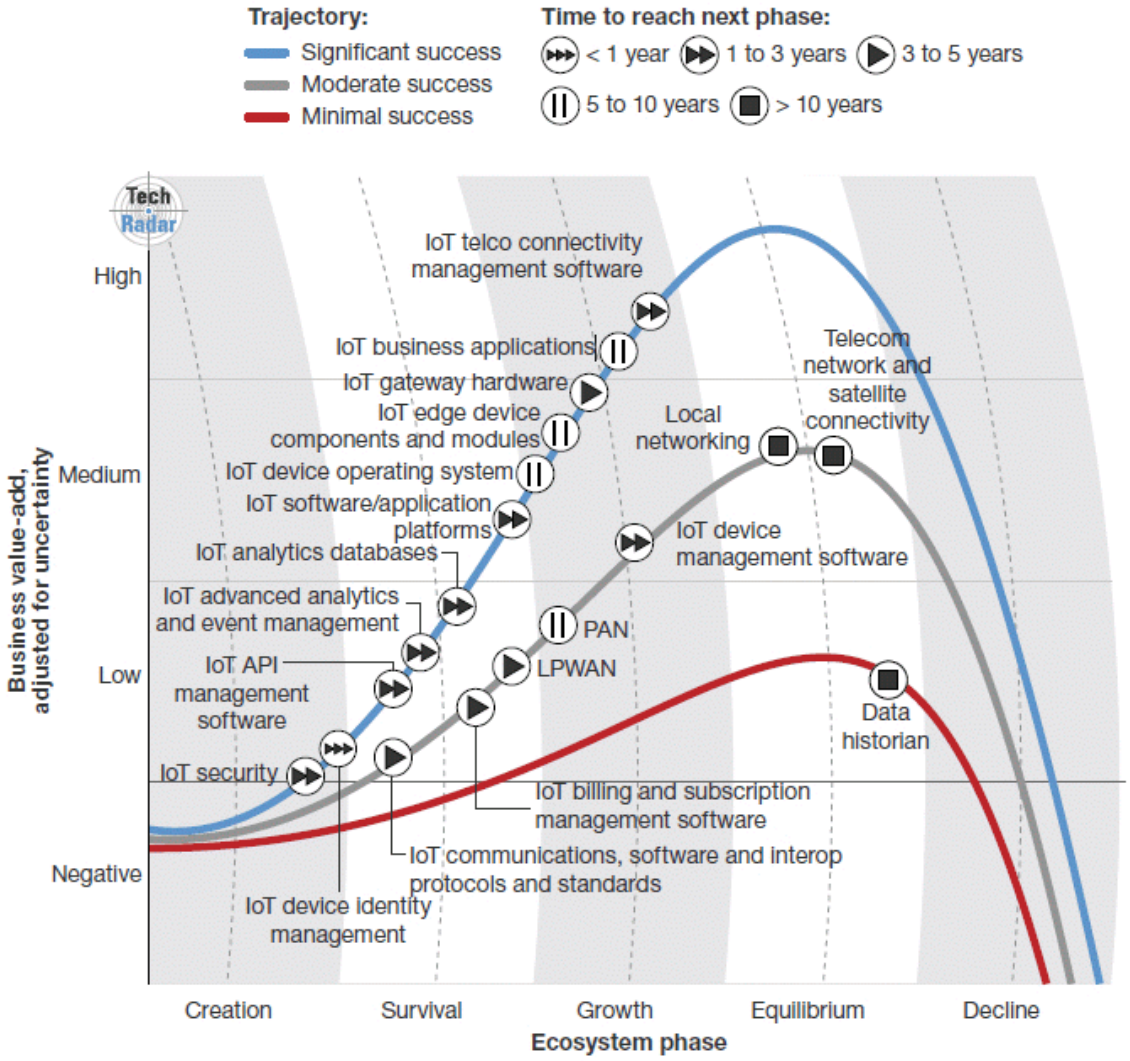
IoT Ecosystem Opportunities

With over 24 billion devices expected to be installed by 2020 according to Business Insider, the IoT ecosystem will touch almost every industry, including transportation, insurance, utilities, telecom, healthcare, smart homes, oil and gas and more. The investment in these opportunities over the next five years is expected to result in $13 trillion return on investment (ROI) by 2025.

Realizing the IoT Potential

The main barriers around the Internet of Things remain security, implementation and technological fragmentation. Horizontal management for IoT addresses several of these concerns. A standards-based, horizontal platform allows for greater access control to give control over Internet of Things devices and sensors. Organizations are able to manage data with end-to-end authentication and scale solutions across all vertices without having to be a solution for each application.

Source: IoT Innovation

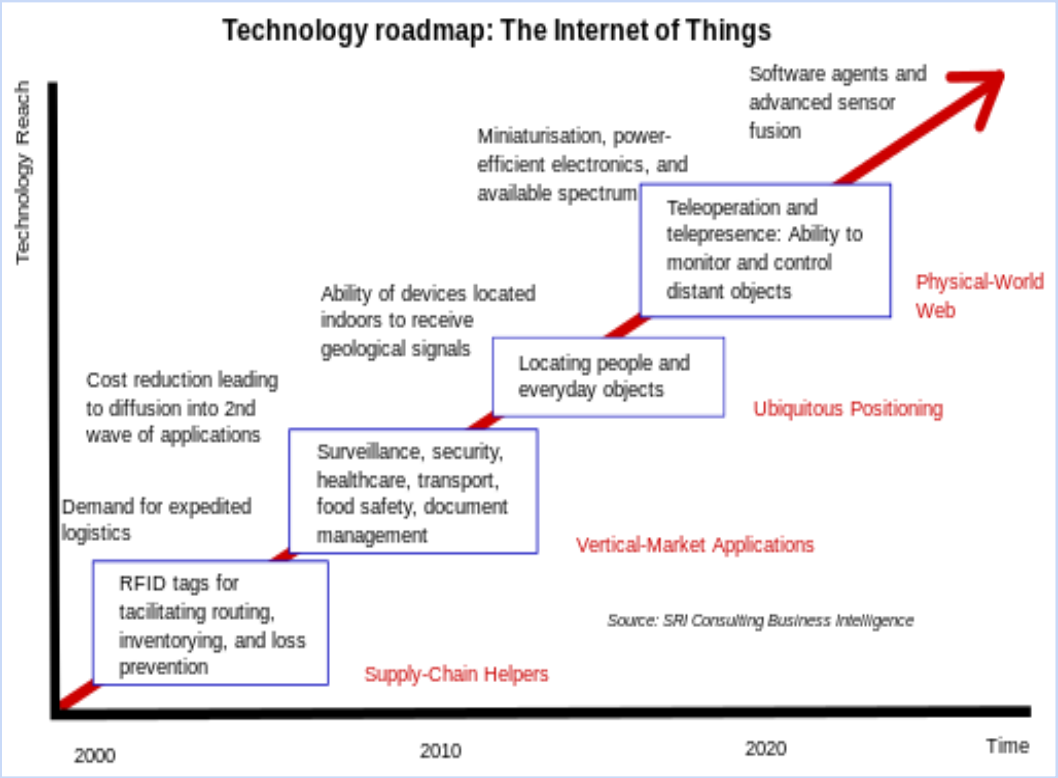


Source: Zdnet

1.5 IoT Technologies

The technologies and principles of IoT will have a very broad impact on organizations, affecting business strategy, risk management and a wide range of technical areas such as architecture and network design.

Source: Gartner



Source: Wikipedia IoT Technology Roadmap

The Top 10 IoT Technologies are

IoT Security

Security technologies will be required to protect IoT devices and platforms from both information attacks and physical tampering, to encrypt their communications, and to address new challenges such as impersonating "things" or denial-of-sleep attacks that drain batteries. IoT security will be complicated by the fact that many "things" use simple processors and operating systems that may not support sophisticated security approaches.

"Experienced IoT security specialists are scarce, and security solutions are currently fragmented and involve multiple vendors," said Mr. Jones. "New threats will emerge through 2021 as hackers find new ways to attack IoT devices and protocols, so long-lived "things" may need updatable hardware and software to adapt during their life span."

IoT Analytics

IoT business models will exploit the information collected by "things" in many ways — for example, to understand customer behavior, to deliver services, to improve products, and to identify and intercept business moments. However, IoT demands new analytic approaches. New analytic tools and algorithms are needed now, but as data volumes increase through 2021, the needs of the IoT may diverge further from traditional analytics.

IoT Device (Thing) Management

Long-lived non trivial "things" will require management and monitoring. This includes device monitoring, firmware and software updates, diagnostics, crash analysis and reporting, physical management, and security management. The IoT also brings new problems of scale to the management task. Tools must be capable of managing and monitoring thousands and perhaps even millions of devices.

Low-Power, Short-Range IoT Networks

Selecting a wireless network for an IoT device involves balancing many conflicting requirements, such as range, battery life, bandwidth, density, endpoint cost and operational cost. Low-power, short-range networks will dominate wireless IoT connectivity through 2025, far outnumbering connections using wide-area IoT networks. However, commercial and technical trade-offs mean that many solutions will coexist, with no single dominant winner and clusters emerging around certain technologies, applications and vendor ecosystems.

Low-Power, Wide-Area Networks

Traditional cellular networks don't deliver a good combination of technical features and operational cost for those IoT applications that need wide-area coverage combined with relatively low bandwidth, good battery life, low hardware and operating cost, and high connection density. The long-term goal of a wide-area IoT network is to deliver data rates from hundreds of bits per second (bps) to tens of kilobits per second (kbps) with nationwide coverage, a battery life of up to 10 years, an endpoint hardware cost of around $5, and support for hundreds of thousands of devices connected to a base station or its equivalent. The first low-power wide-area networks (LPWANs) were based on proprietary technologies, but in the long term emerging standards such as Narrowband IoT (NB-IoT) will likely dominate this space.

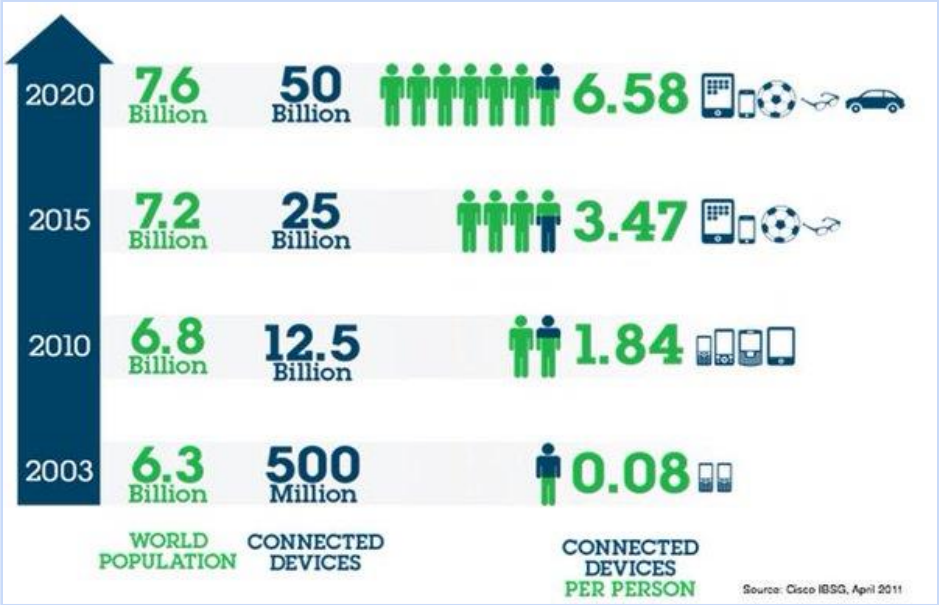


Figure: IoT Usage

IoT Processors

The processors and architectures used by IoT devices define many of their capabilities, such as whether they are capable of strong security and encryption, power consumption, whether they are sophisticated enough to support an operating system, updatable firmware, and embedded device management agents. As with all hardware design, there are complex trade-offs between features, hardware cost, software cost, and software upgradability and so on. As a result, understanding the implications of processor choices will demand deep technical skills.

IoT Operating Systems

Traditional operating systems (OSs) such as Windows and iOS were not designed for IoT applications. They consume too much power, need fast processors, and in some cases, lack features such as guaranteed real-time response. They also have too large a memory footprint for small devices and may not support the chips that IoT developers use. Consequently, a wide range of IoT-specific operating systems has been developed to suit many different hardware footprints and feature needs.

Event Stream Processing

Some IoT applications will generate extremely high data rates that must be analyzed in real time. Systems creating tens of thousands of events per second are common, and millions of events per second can occur in some telecom and telemetry situations. To address such requirements, distributed stream

computing platforms (DSCPs) have emerged. They typically use parallel architectures to process very high-rate data streams to perform tasks such as real-time analytics and pattern identification.

IoT Platforms

IoT platforms bundle many of the infrastructure components of an IoT system into a single product. The services provided by such platforms fall into three main categories: (1) low-level device control and operations such as communications, device monitoring and management, security, and firmware updates; (2) IoT data acquisition, transformation and management; and (3) IoT application development, including event-driven logic, application programming, visualization, analytics and adapters to connect to enterprise systems.

IoT Standards and Ecosystems

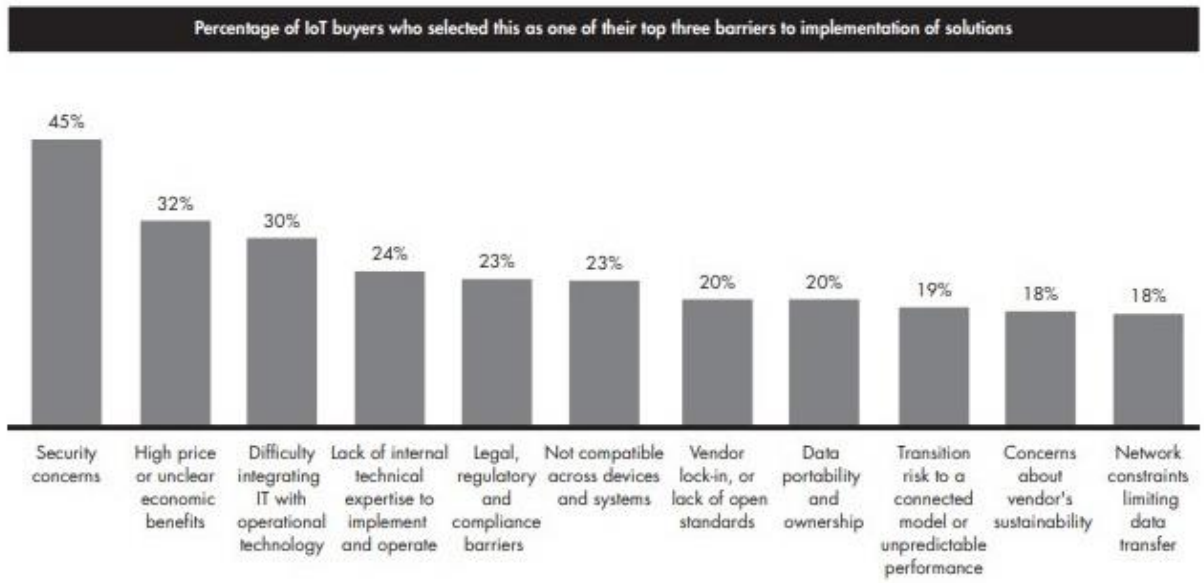
Although ecosystems and standards aren't precisely technologies, most eventually materialize as application programming interfaces (APIs). Standards and their associated APIs will be essential because IoT devices will need to interoperate and communicate, and many IoT business models will rely on sharing data between multiple devices and organizations.

Many IoT ecosystems will emerge, and commercial and technical battles between these ecosystems will dominate areas such as the smart home, the smart city and healthcare. Organizations creating products may have to develop variants to support multiple standards or ecosystems and be prepared to update products during their lifespan as the standards evolve and new standards and related APIs emerge.

Source: Gartner

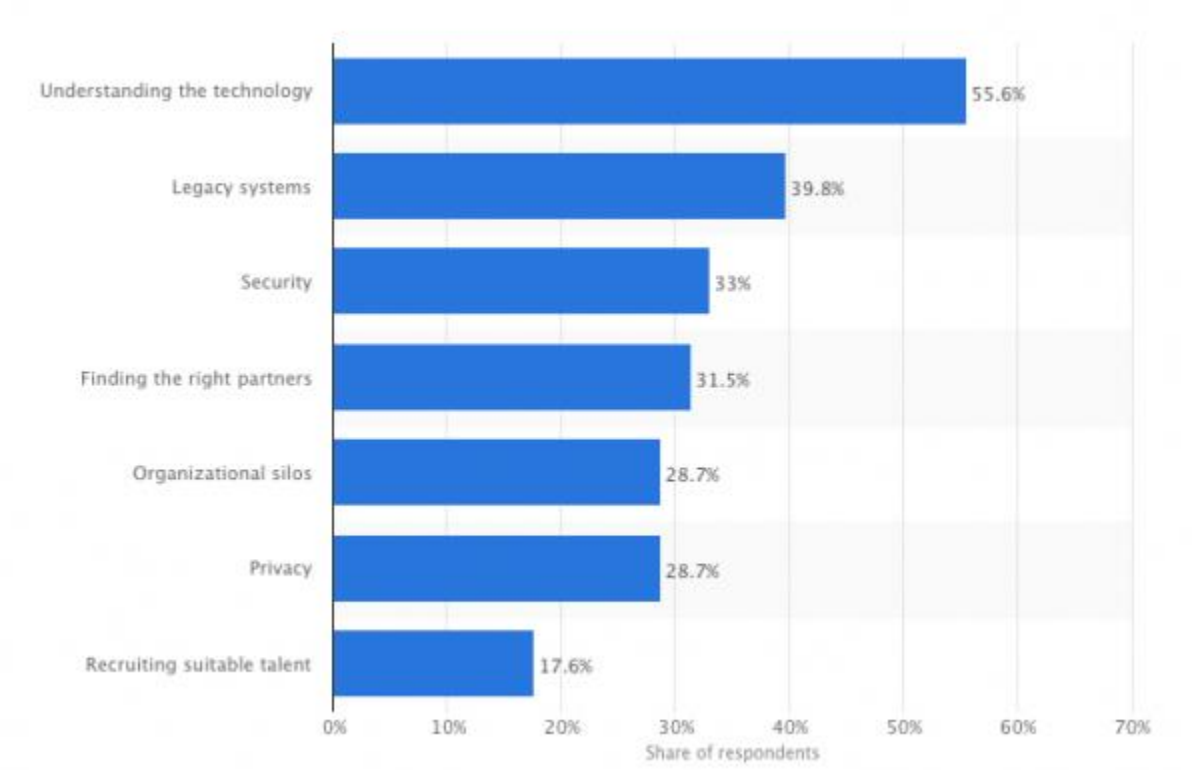
2. IoT Challenges

In spite of their enthusiasm for IoT, customers are concerned about security, integration and ROI

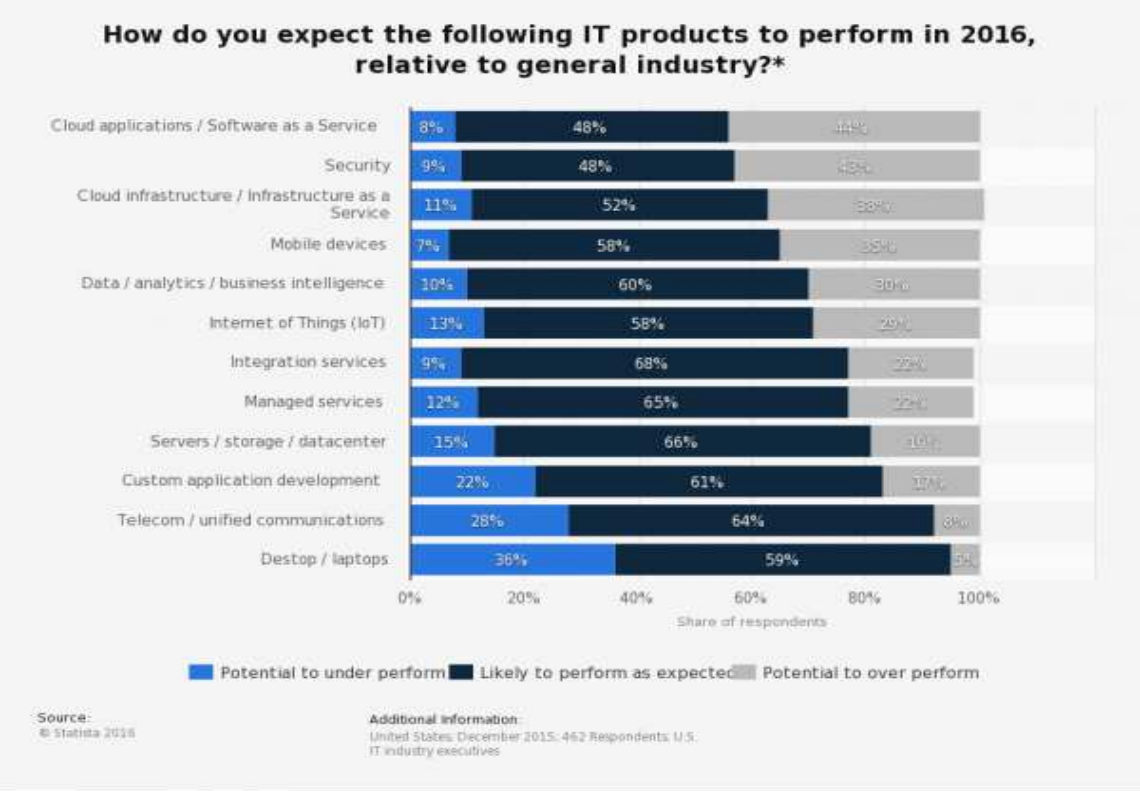


Source: Bain IoT customer survey 2016 (n=533)

The biggest challenge slowing IoT adoption — according to 55.6% of respondents — is understanding the technology (Statista).



Source: Ironpaper



Source: Ironpaper

Security Challenges

Proliferation of numerous nodes and devices being added to networks present malicious actors with innumerable attack vectors and possibilities to carry out their evil deeds, especially since a considerable number of them suffer from security holes.

Scalability issues also contribute to the creation insecure IoT products. The fact is that many security solutions being used today have been created with generic computing devices in mind. IoT devices often lack the computational power, storage capacity and even proper operating system to be able to deploy such solutions.

Privacy Challenges

Some of the data that IoT devices collect are very sensitive and are protected by legislations such as the Health Insurance Portability and Accountability Act (HIPAA) in the U.S. and are fundamentally different from our browsing and clicking habits. Yet the necessary precautions aren't taken when storing the data or sharing it with other service providers. Vendors and manufacturers must either discard this data or remove the Personally Identifiable Information (PII) to make sure that consumers aren't damaged in case of data breaches.

Connectivity Challenges

At present we rely on the centralized, server/client paradigm to authenticate, authorize and connect different nodes in a network. The future of IoT will very much have to depend on decentralizing IoT networks. Part of it can become possible by moving functionality to the edge, such as using fog computing models where smart devices such as IoT hubs take charge of time-critical operations and cloud servers take on data gathering and analytical responsibilities.

Other solutions involve the use of peer-to-peer communications, where devices identify and authenticate each other directly and exchange information without the involvement of a broker. Networks will be created in meshes with no single point of failure. This model will have its own set of challenges, especially from a security perspective, but these challenges can be met with some of the emerging IoT technologies such as the Phantom protocol, or leveraging the success of other tried and tested models such as the blockchain.

Compatibility and Longevity Challenges

As an industry that is going through its baby steps, IoT is growing in many different directions, with many different technologies competing to become the standard. For instance, we currently have ZigBee, Z-Wave, Wi-Fi, Bluetooth and Bluetooth Low Energy (BTLE) all vying to become the dominant transport mechanism between devices and hubs. This will cause difficulties and require the deployment of extra hardware and software when connecting devices.

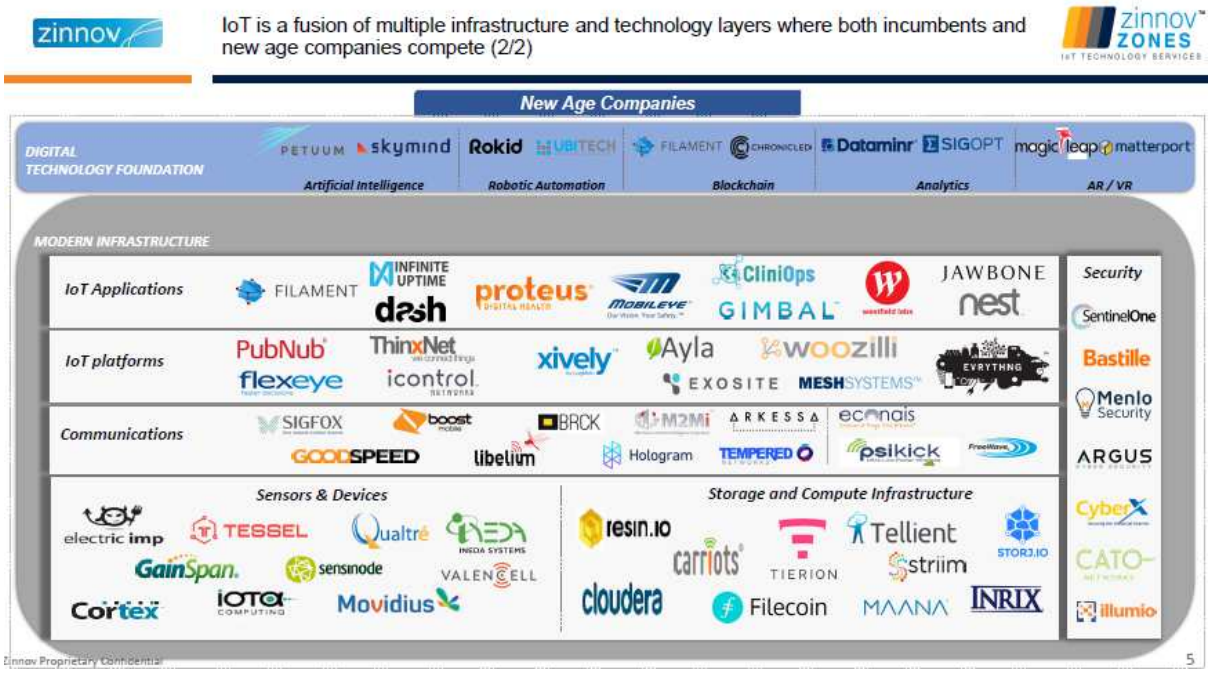
Other compatibility issues stem from non-unified cloud services, lack of standardized M2M protocols and diversities in firmware and operating systems among IoT devices.

Source: Sitepoint

2. Key IoT Players with their IoT Products and Platforms

To get the statistics and forecasts, we have studied research reports, whitepapers and eBooks from below companies:

Source: [Zinnov Zones for IoT Services 2017]



Source: [Zinnov Zones for IoT Services 2017]

Sr. No.	Company	Description
1	SAP	SAP's in-memory S/4HANA enterprise resource planning (ERP) software suite allows customers to gain real-time insights from the data collected from connected sensors. The platform also allows third parties to develop IoT applications via open APIs. In addition, SAP launched Leonardo in January 2017 as a standalone IoT platform, offering its customers a service which tracks data from connected sensors to gain insights quickly. Then in July SAP expanded Leonardo as a "digital innovation system", across a whole spectrum of enterprise problems.
2	GE	GE Digital's platform-as-a-service (PaaS) offering, Predix, is a software platform that integrates machine-generated data with traditional and cloud databases. GE already has products for hospital operations management, airline fuel optimization and Grid IQ solutions for utility companies. Other industrial suppliers like Schneider Electric are making a big IoT push, too.

Sr. No.	Company	Description
3	Rolls Royce	Like GE and Accenture, British manufacturing firm Rolls Royce uses IoT enabled sensors in its jet engines to monitor performance and discover any problems before they become an actual problem. Rolls Royce uses Azure Stream Analytics and Power BI, which enables it to pull sensor data from its engines and connect it with information from air traffic control, including route data, weather and of course fuel usage from the aircraft itself, to get a fuller picture of the health of its engines.
4	Dell	Dell announced a specialized IoT division, to be headed up by VMWare CTO Ray O'Farrell, in October 2017, with the intention of offering customers a full stack of hardware, software, security and consulting to get their IoT projects up and running.
5	ARM	The company's low-power designs have been the mainstay of consumer items like smartphones and set top boxes for years now, making it well positioned to branch out into the IoT ecosystem with designs that can be used in low-powered connected sensors.
6	Bosch	Bosch has a well-established business in creating micro electromagnetic sensors – MEMS – and the company decided to put IoT at the centre of its strategy in 2015, when it launched its Internet of Things Suite. You'll now find Bosch sensors used in the home – thermostats, for example – but also in more unusual cases like maintaining the best temperature for growing asparagus, to monitoring racing car data. In March 2016, Bosch launched a cloud service to boost its IoT plans and keep up with competitors such as AWS.
7	Cisco	American networking giant Cisco provides IoT infrastructure across a wide range of industries, including connected factories, utilities and smart grid, oil and gas, aviation, mass transit, maritime, rail and roadways. The company also offers field network infrastructure for the monitoring and control of energy distribution, management and application enablement, embedded networks, and IoT-enabled cyber security products. Cisco is also doing work in creating smart cities.
8	Ingenu	Ingenu provides a combination of machine to machine and IoT services to a range of companies. For example, British–Dutch oil and gas company Shell saved over $1

Sr. No.	Company	Description
		million through its 'Digital Oilfield' project in Nigeria.
9	Amazon Web Services	AWS has a variety of platforms, including Amazon Kinesis, Amazon S3, Lambda, Amazon Machine Learning, and Amazon DynamoDB to build IoT applications. The cloud plays a big part of the internet of things, and the biggest infrastructure cloud player out there is Amazon Web Services. AWS also enables its users to create their own IoT applications that can control IoT sensors data remotely.
10	Centrica	Centrica partnered with SAP to create a range of services aimed at business customers who provide insights from IoT enabled sensors so they can better manage industrial assets. Its debut service will focus on Panoramic Power wireless sensor technology, combined with analytics from Centrica's Distributed Energy and Power business unit.
11	AT&T	AT&T is making big strides to position itself as the network for the IoT. It has had many partnerships with other companies on this list, including Cisco, GE, IBM and Intel, and is attempting to be the de facto network provider to connect all of these devices. AT&T is investing in fleet management, energy management, connected cars and a variety of other industries.
12	Fujitsu	Fujitsu Global's push into IoT covers the full gamut of the industrial internet, including smart utilities and energy, smart manufacturing, transportation and logistics, and retail. It also sells analytics services so businesses can make sense of all the data their sensors are generating. The company covers the entire ecosystem and provides cloud and network infrastructure too. Fujitsu partners with other companies that are heavily invested in IoT, too, including Intel, Microsoft, and Cisco.

Sr. No.	Company	Description
13	Google	Google made waves in the IoT market when it bought Nest for $3.2 billion, which sells thermostats and fire detectors that are “smart”, meaning they learn energy usage patterns and interact with their owners. Google also provides capabilities for businesses to manage data via its Google Cloud Platform service.
14	HPE	In 2015, HPE acquired networking vendor Aruba Networks for $3 billion in an attempt to tap into the Internet of Things market, immediately broadening HPE’s portfolio of hardware like routers and switches. The company now offers IoT bundles through the Universal IoT Platform. And in February 2017, HPE bought Niara – a behavioral analytics company that it hopes will complement the ClearPass network security portfolio it picked up from the Aruba buy.
15	Intel	IoT is an enormous focus for the American chipmaker. The Intel IoT Platform is a scalable and interoperable reference model that connects devices with one another and delivers that data to the cloud. Intel’s IoT products can be found in buildings, smart cities and connected cars.
16	IBM	IBM has a variety of products in this area including a messaging platform for machine to machine (M2M) data named MessageSight, along with MobileFirst, which gives objects mobile capabilities, and BlueMix, a development platform for apps that can manage IoT data collection and analysis. IBM also has the 'cognitive computing' of its AI platform Watson to differentiate - and now offers an IoT platform that makes use of Watson's capabilities.
17	Microsoft	Microsoft wants to make the internet of things applicable to everyday business. It’s doing this through a variety of products, including customized Windows Embedded operating systems meant to collect and analyze data, as well as via products in its Azure cloud, such as Intelligent Systems, an offering that offloads heavy data analysis to the cloud. In May 2016, Microsoft acquired Italian IoT startup, Solair to 'help customers harness the power of the internet of things'. Solair promotes IoT projects across the manufacturing, retail, food and beverage and transportation sectors.

Sr. No.	Company	Description
18	Oracle	The company has a suite of services, including a platform for enabling Java in embedded sensor devices, a middleware platform for creating applications to capture the data, and databases to store it all. Oracle aims to provide real-time IoT solutions.
19	Qualcomm	Qualcomm helped create AllJoyn, an open source IoT framework for connecting devices that is now managed by the Linux Foundation. While there are many efforts to enable devices to connect to the Internet, Qualcomm says that having a common open source standard protocol, such as AllJoyn, for uniting those devices is important. Qualcomm has focus on automotive, wearables, healthcare and education.
20	Salesforce	Salesforce.com says IoT is not just about connected machines; it's about connected products and marketing, too since IoT presents a new opportunity for marketers to glean deeper insights into their prospects and customers.
21	Samsung	South Korean powerhouse Samsung makes its own IoT infrastructure equipment like IoT gateways and Low Power Wide Area technologies that make use of unlicensed spectrum, but it also has a consumer IoT division that focuses on products for the connected home. The SmartThings Starter Kit, for instance, includes connected plugs and motion sensors that link back to a central hub, all of which is then available to view through an accompanying app on your phone.

Source: Scyllogis

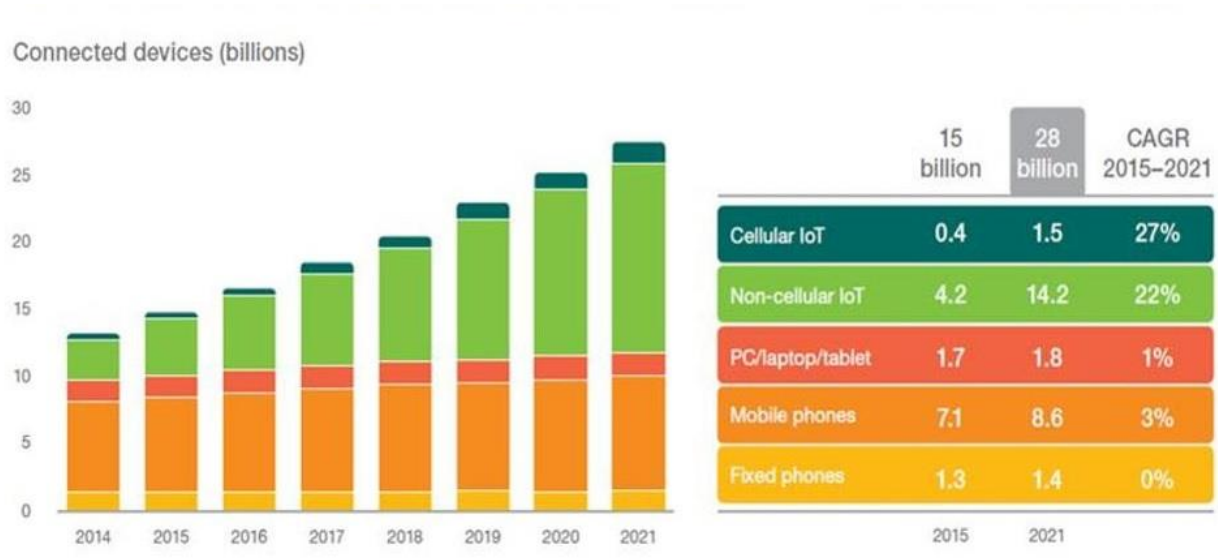
3. Predictions

To get the statistics and forecasts, we have studied research reports, whitepapers and eBooks from below companies:

- ✓ Ericsson Mobility Report 2016
- ✓ Gartner Report 207
- ✓ IHS Markit
- ✓ Forrester
- ✓ McKinsey
- ✓ Zinnov Zones 2016
- ✓ BCG
- ✓ GE Digital
- ✓ Bains IoT Survey 2016
- ✓ IDC FutureScape Worldwide IoT Predictions 2017

3.1 Ericsson Mobility Report 2016

Internet of Things (IoT) sensors and devices are expected to exceed mobile phones as the largest category of connected devices in 2018, growing at a 23% compound annual growth rate (CAGR) from 2015 to 2021. Ericcson predicts there will be a total of approximately 28B connected devices worldwide by 2021, with nearly 16B related to IoT. The following graphic compares cellular IoT, non-cellular IoT, PC/laptop/tablet, mobile phones, and fixed phones connected devices growth from 2015 to 2021.



	15 billion	28 billion	CAGR 2015–2021
Cellular IoT	0.4	1.5	27%
Non-cellular IoT	4.2	14.2	22%
PC/laptop/tablet	1.7	1.8	1%
Mobile phones	7.1	8.6	3%
Fixed phones	1.3	1.4	0%
	2015	2021	

Source: Ericsson Mobility Report 2016

3.2 Gartner Report 2017

Gartner, Inc. forecasts that 8.4 billion connected things will be in use worldwide in 2017, up 31 percent from 2016, and will reach 20.4 billion by 2020. Total spending on endpoints and services will reach almost $2 trillion in 2017. Regionally, Greater China, North America and Western Europe are driving the use of connected things and the three regions together will represent 67 percent of the overall Internet of Things (IoT) installed base in 2017.

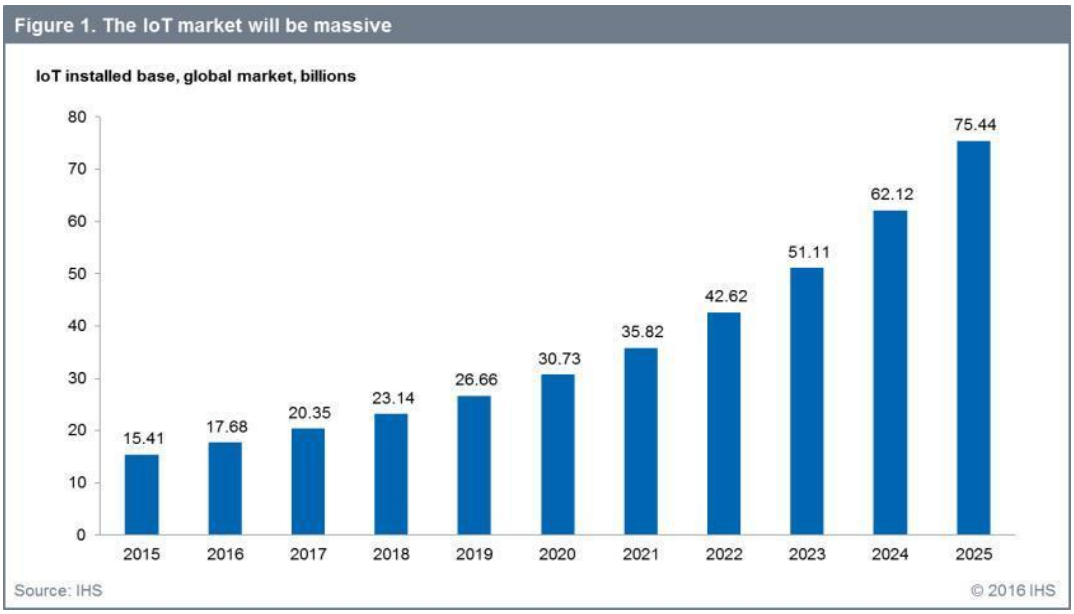
Table: IoT Units Installed Base by Category (Millions of Units)

Category	2016	2017	2018	2020
Consumer	3,963.0	5,244.3	7,036.3	12,863.0
Business: Cross-Industry	1,102.1	1,501.0	2,132.6	4,381.4
Business: Vertical-Specific	1,316.6	1,635.4	2,027.7	3,171.0
Grand Total	**6,381.8**	**8,380.6**	**11,196.6**	**20,415.4**

Source: Gartner (January 2017)

3.3 IHS Markit

IHS forecasts that the IoT market will grow from an installed base of 15.4 billion devices in 2015 to 30.7 billion devices in 2020 and 75.4 billion in 2025



Source: [IoT platforms: enabling the Internet of Things, March 2016] (free, opt-in, PDF).

3.4 Forrester

Forrester predicts fleet management in transportation, security and surveillance applications in government, inventory and warehouse management applications in retail and industrial asset management in primary manufacturing will be the hottest areas for IoT growth.

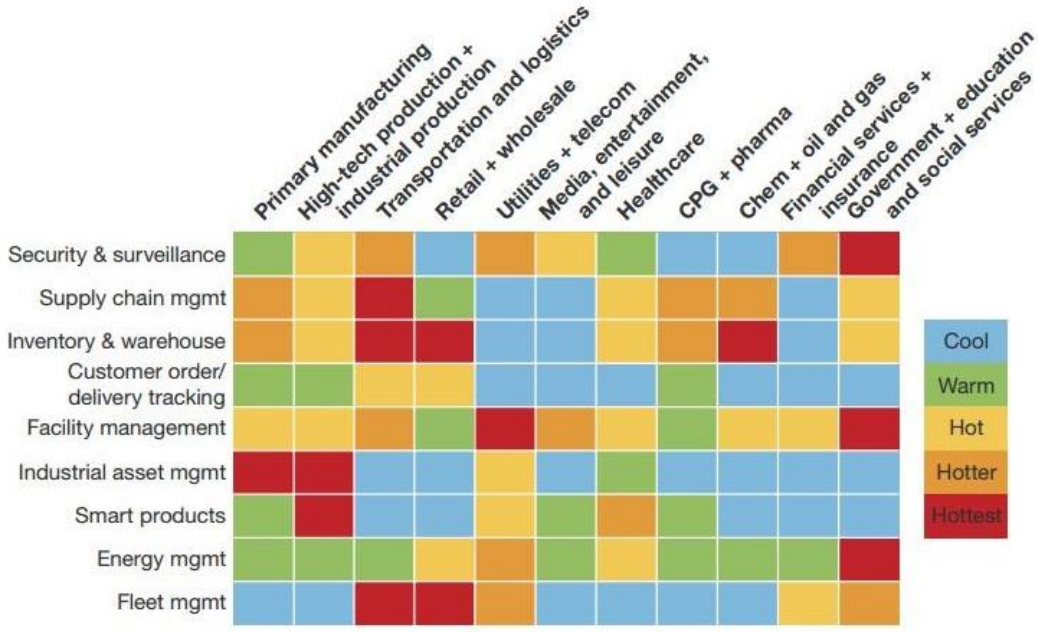


Figure: Heat map of key IoT opportunities varies by industry and application

Source: Forrester, courtesy of Cloudera (reprint) The Internet Of Things Heat Map, 2016 Where IoT Will Have The Biggest Impact On Digital Business by Michele Pelino and Frank E. Gillett January 14, 2016

3.5 McKinsey

McKinsey estimates the total IoT market size in 2015 was up to $900M, growing to $3.7B in 2020 attaining a 32.6% CAGR.

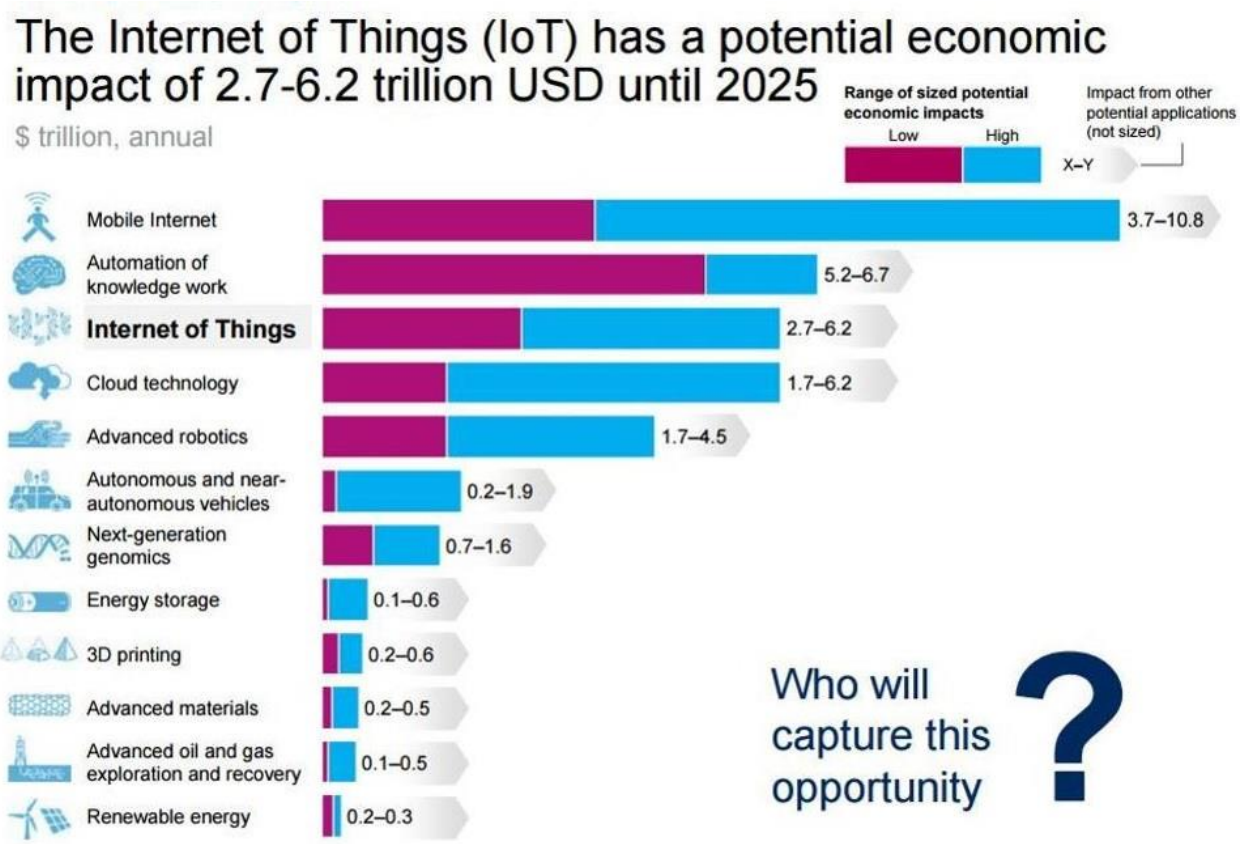
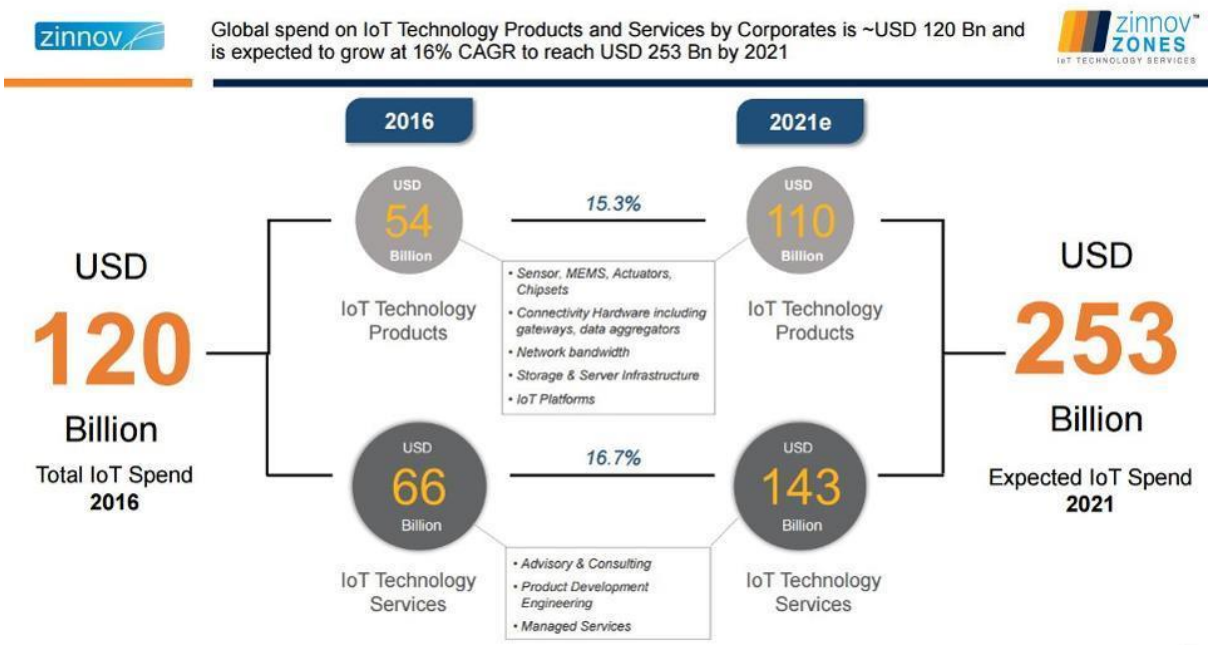


Figure: The IoT Platform Opportunity

Source: Internet of Things The IoT opportunity – Are you ready to capture a once-in-a-lifetime value pool? Chris Ip (叶远扬) Hong Kong IoT Conference 21 June 2016

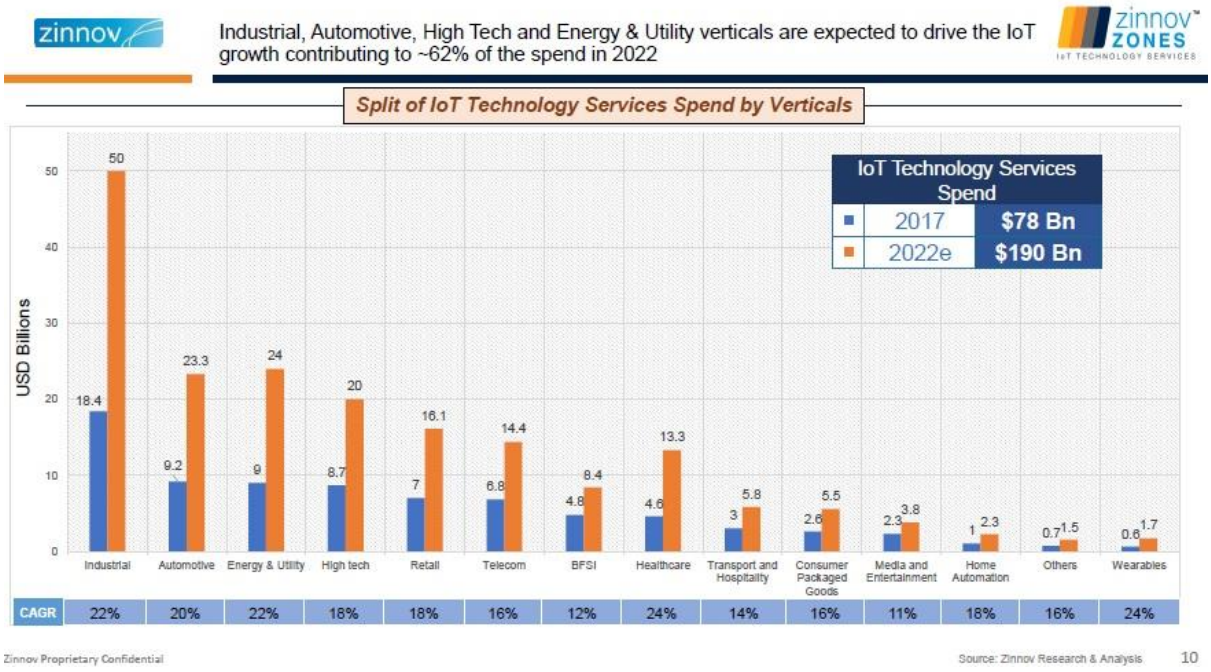
3.6 Zinnov Zones 2016

3.6.1 Global spending on IoT technology-based products and services by enterprises is predicted to reach $120B in 2016, growing to $253B in 2021, attaining a 16% CAGR.



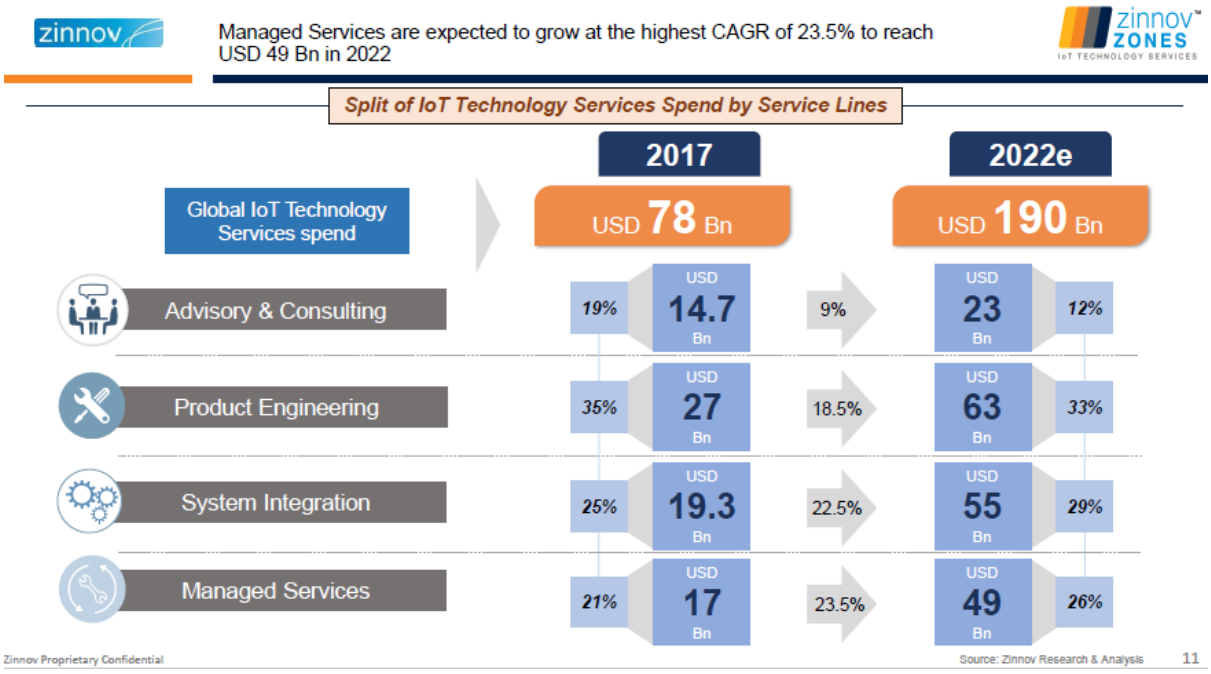
Source: Zinnov Zones 2016 – Internet Of Things Technology Services.

3.6.2 Industrial, automotive, high-tech and energy & utility verticals are expected to drive IoT growth contributing to ~62% of spend in 2022



Source: Zinnov Zones for IoT Services 2017

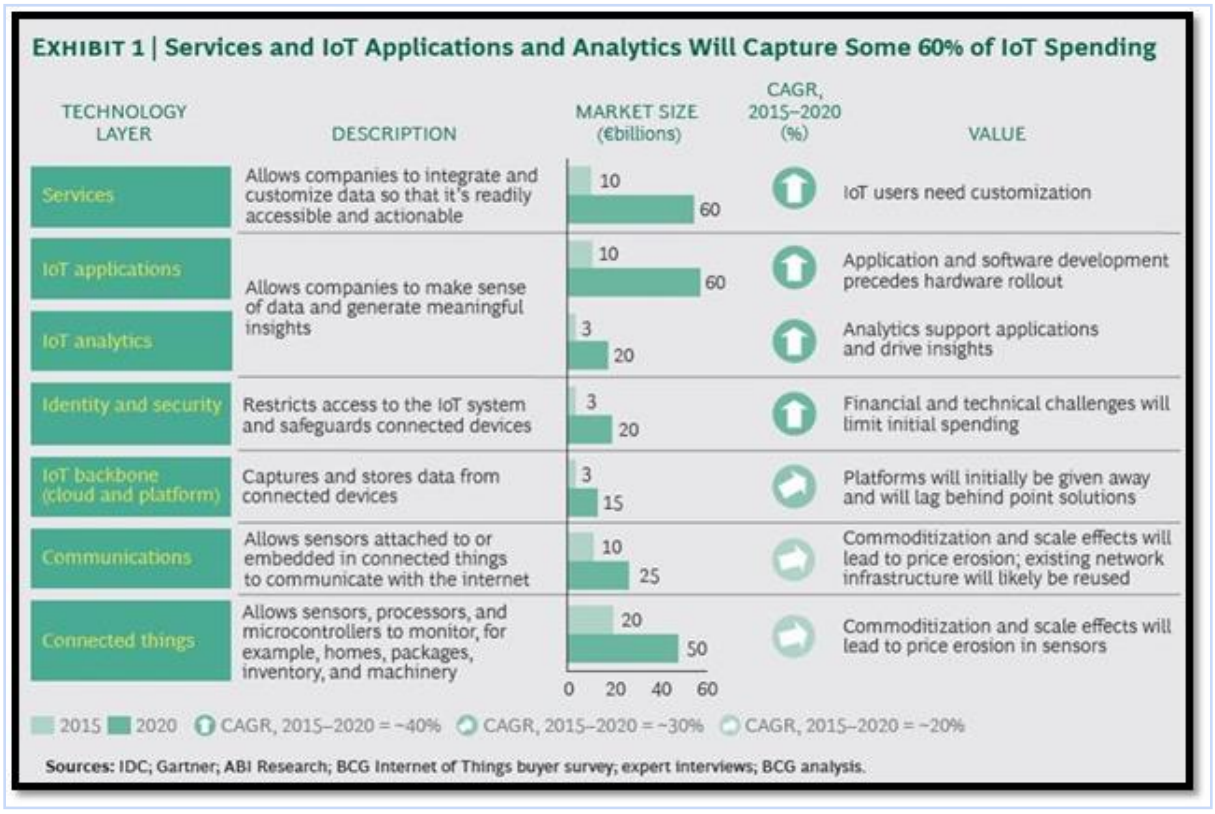
3.6.3 Managed services are expected to grow at the highest CAGR of 23.5% to reach USD 49 Bn in 2022.



Source: Zinnov Zones for IoT Services 2017

3.7 BCG

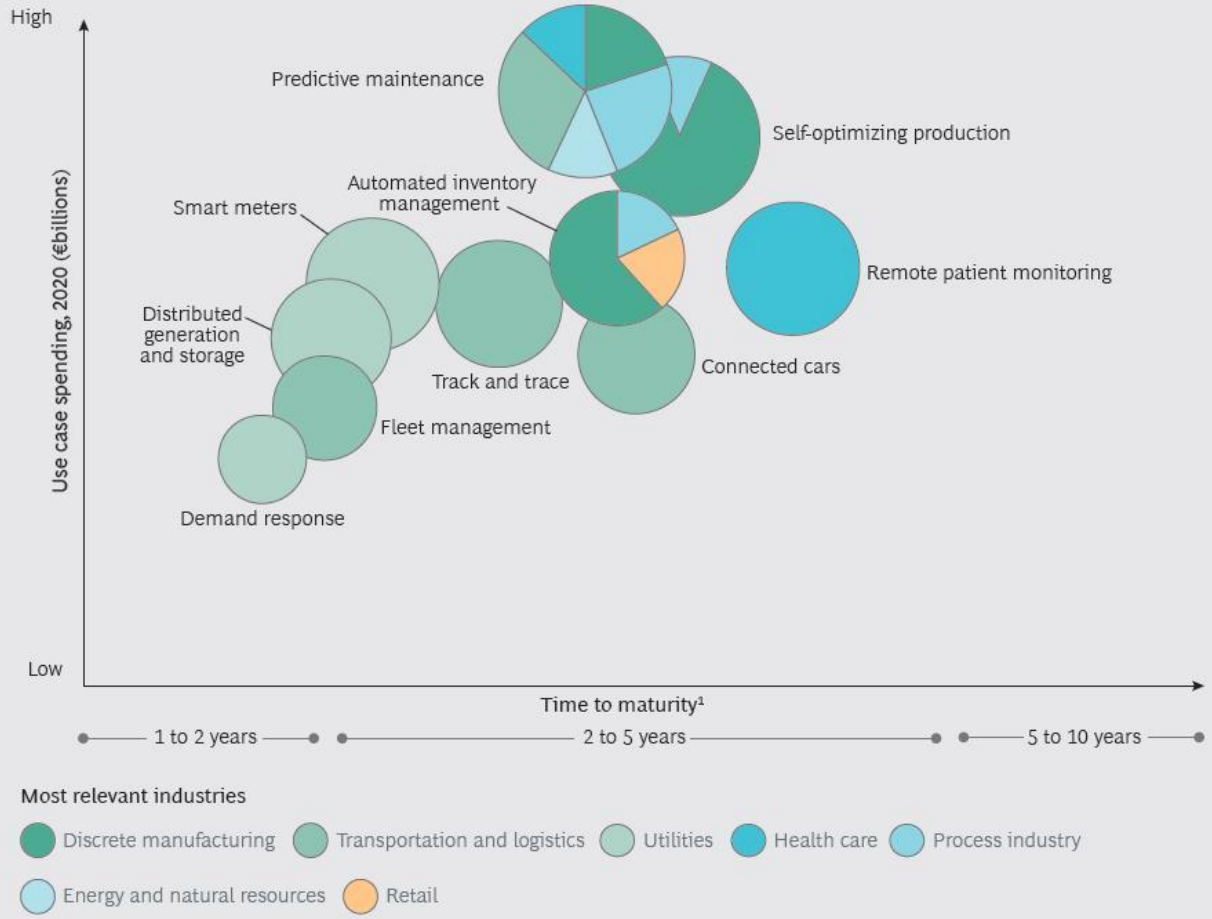
3.7.1 Between 2015 to 2020, BCG predicts revenue from all layers of the IoT technology stack will attain a least a 20% Compound Annual Growth Rate (CAGR). B2B customers are the most focused on services, IoT analytics, and applications, making these two areas of the technology stack the fastest growing. By 2020, these two layers will have captured 60% of the growth from IoT. Each of these two top two layers is predicted to generate €60B ($64.1B) in spending by 2020.



Source: Forbes

3.7.2 Predictive maintenance, self-optimizing production, and automated inventory management are the three top uses cases driving IoT market growth through 2020. Business leaders are asking how IoT can help their companies increase customer satisfaction, improve quality, support new business models (such as data-driven services), and reduce costs. In response to this, BCG completed an extensive analysis of use cases. They found the ten most valuable use cases include the ability to use sensors to predict when machinery will need to be repaired, self-optimizing production, automated inventory management, remote patient monitoring, smart meters, track and trace, connected cards, distributed generation and storage, fleet management and demand response. The following graphic compares the ten use cases by predicted spending level by time to maturity.

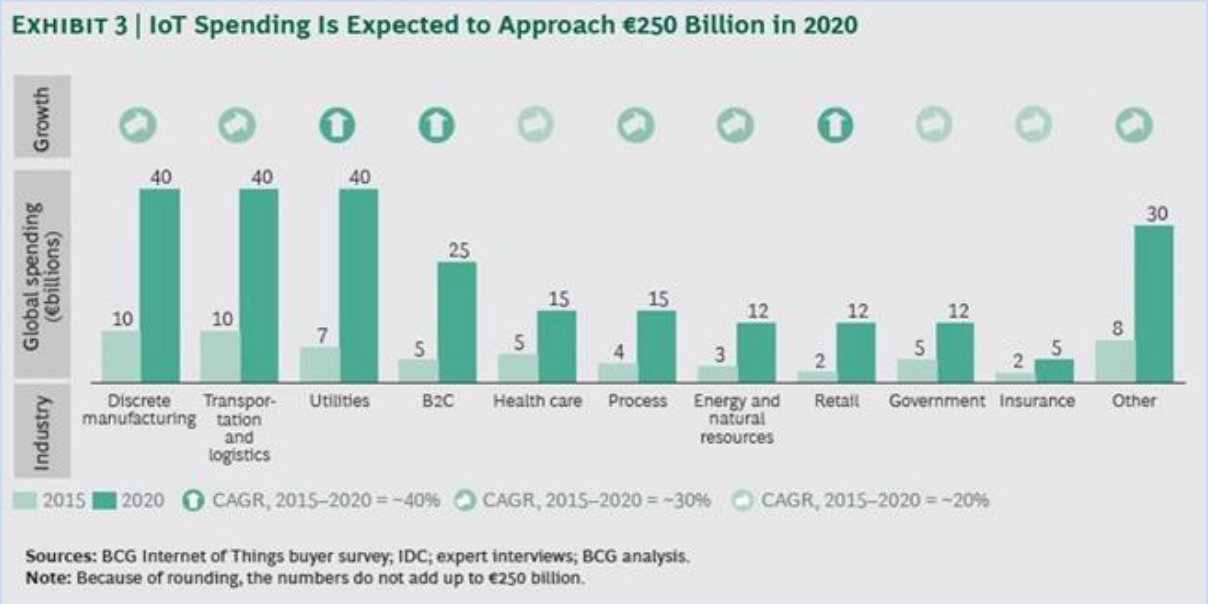
EXHIBIT 2 | Ten Use Cases Will Drive IoT Growth Through 2020



Sources: BCG Internet of Things buyer survey; IDC; expert interviews; BCG analysis.
Note: The bubble sizes indicate relative amounts of spending.
¹Productive and scaled use within real-life settings (that is, no pilots). To capture opportunities, vendors must quickly ramp up activities. The timing of commercial viability for these use cases was derived from responses to a survey question: "When do you expect to productively use [name of use case]?"

Source: Forbes

3.7.3 By 2020, 50% of IoT spending will be driven by discrete manufacturing, transportation and logistics, and utilities BCG predicts that IoT will have the most transformative effect on industries that aren't technology-based today. The most critical success factor all these use cases depend on are secure, scalable and reliable end-to-end integration solutions that encompass on-premise, legacy and cloud systems and platforms. Companies to watch in this area include enosiX who has a growing base of B2B customers who are using real-time integration to connect legacy ERP, on-premise systems to cloud apps and platforms, enabling faster operational performance as a result.



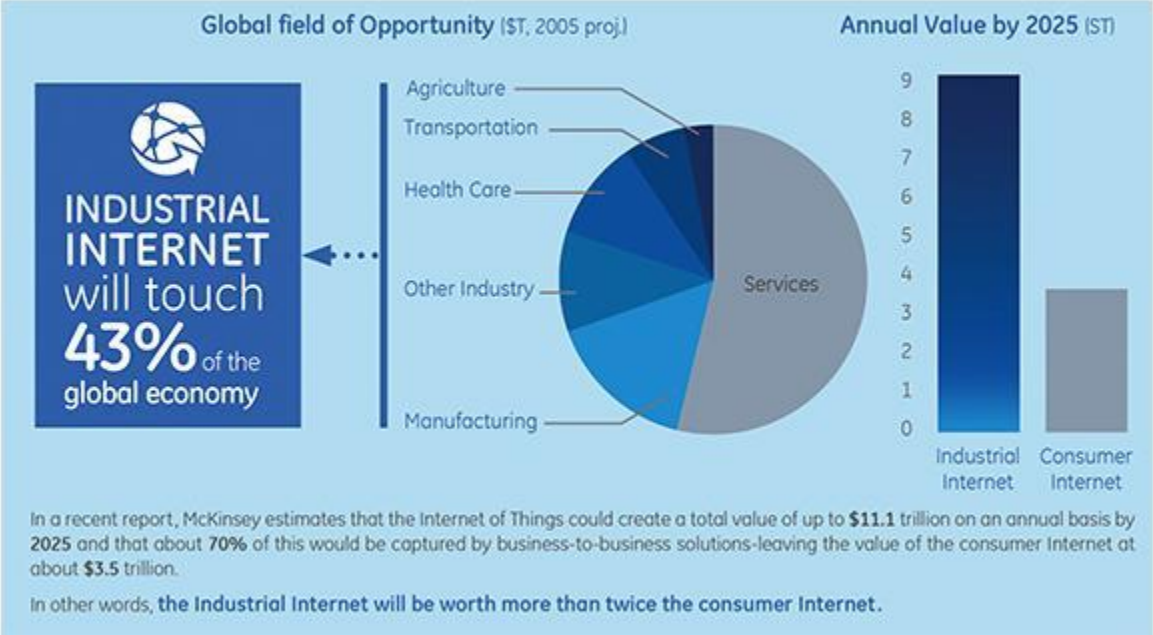
Source: Forbes

3.7.4 40% of today's IoT customers prefer to use traditional and well-established software companies for their IoT solutions. This represents a challenge for major industrial companies whose future depends on their ability to transition into IoT providers. General Electric's Predix platform is an end-to-end IoT industrial operating system designed to help GE customers' machines run more efficiently. GE has made it clear it plans to be a global leader in Industrial Internet of Things (IIoT) and be a leading IOT provider. Siemens is also pursuing a similar path with its MindSphere platform. Microsoft's Azure IoT Suite, SAP HANA Cloud Platform, IBM Watson IoT Platform, and Cisco IoT System are all examples of companies working to redefine their business models as IoT providers. Device makers including Intel and Bosch are offering hardware and complementary operating systems to provide customers with a more comprehensive IoT ecosystem as well.

Source: Forbes

3.8 GE Digital

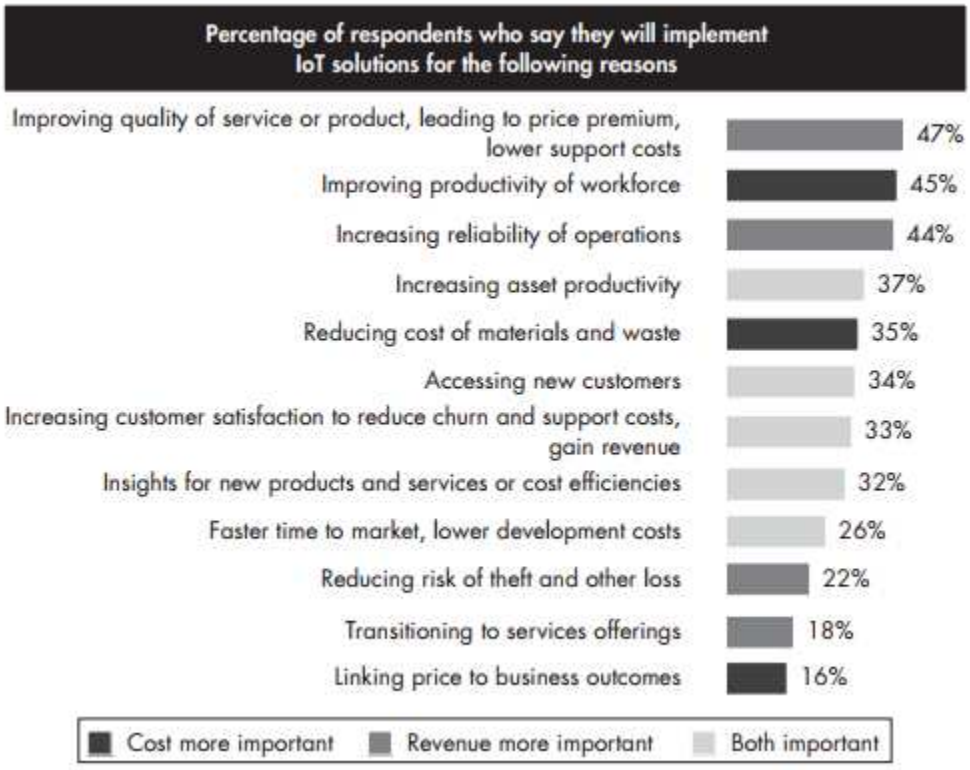
The Industrial Internet has the potential to deliver up to $11.1T on an annual basis by 2025. 70% of this would be captured by business-to-business solutions.



Source: GE

3.9 Bain IoT Survey 2016

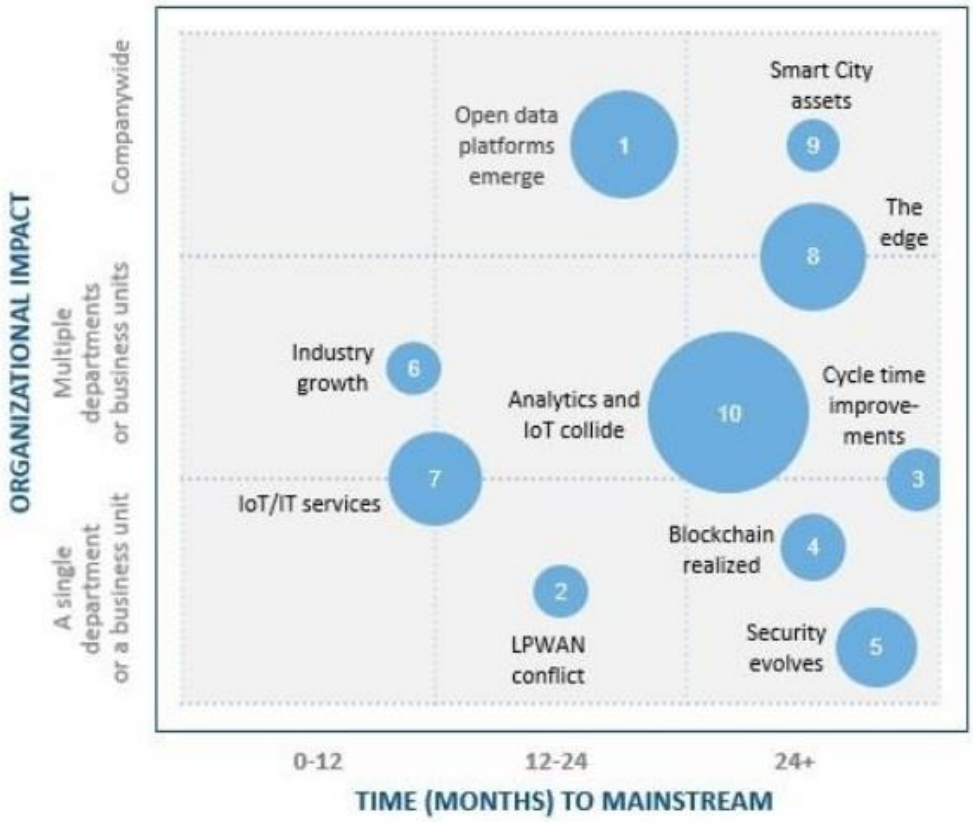
Bain surveyed more than 170 executives at IoT and analytics solutions vendors and more than 500 executives looking to deploy these solutions. They found that customers are optimistic about both the cost reduction and new revenue opportunities provided by the Internet of Things (see below figure). But it is still early days: About 90% of respondents remain in the planning and proof-of-concept stage, and only about 20%.



Source: Bain IoT customer survey, 2016 (n=533)

3.10 IDC FutureScape Worldwide IoT Predictions 2017

IHS forecasts that the IoT market will grow from an installed base of 15.4 billion devices in 2015 to 30.7 billion devices in 2020 and 75.4 billion in 2025.



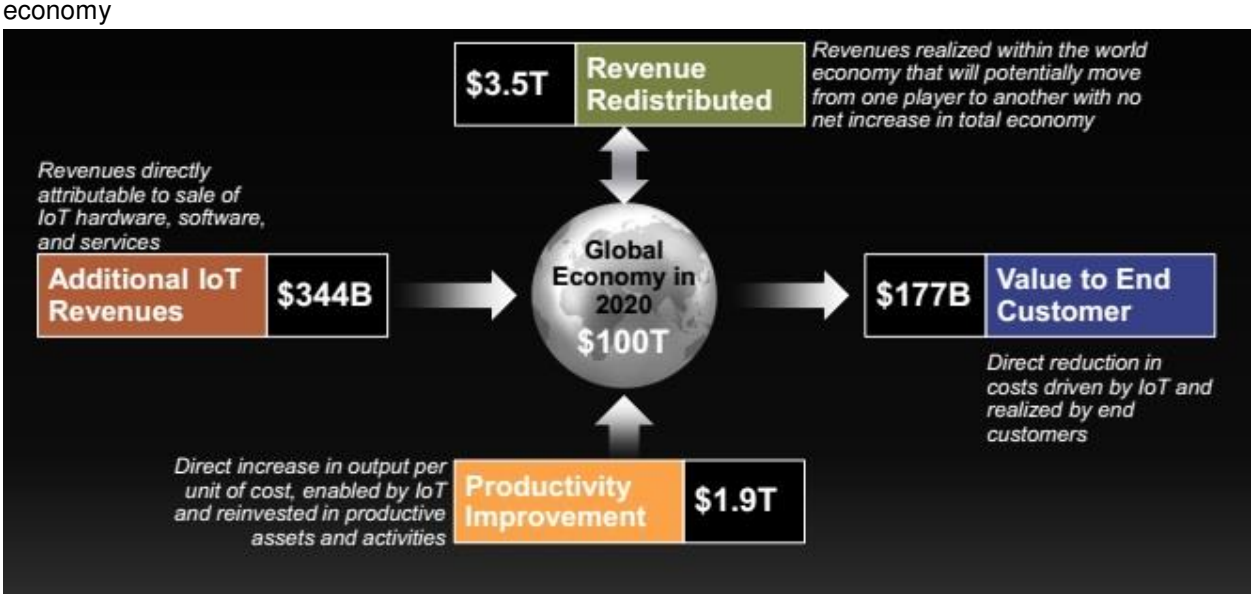
Source: [IDC FutureScape Worldwide IoT Predictions 2017]

1. By 2018, the "open data platform" will emerge as the next frontier in platform discussions, causing confusion for enterprises that already invested in IoT platform solutions.
2. Despite hype on the benefits of low power WAN, such as LoRa and Sigfox, its unlicensed spectrum and lack of QoS causes companies to focus it on non-critical applications – with 3% deploying by 2018.
3. By 2018, investments in operational sensing through IoT and situational awareness via analytics will deliver 30% improvements in critical process cycle times.
4. By 2019, as IoT adoption grows in major industry, government and consumer sectors, 20% of all IoT deployments will have basic levels of blockchain services enabled.
5. By 2019, more than 75% of IoT device manufacturers will improve their security and privacy capabilities, making them more trustworthy partners for technology buyers.

6. In 2017, connected vehicles, insurance telematics, personal wellness, and smart buildings will be four IoT use cases in the spotlight across all worldwide regions, accounting for $96B spending.
7. As adoption of IoT grows, 75% of IoT adopters will turn to outside firms for help in strategy, planning, development, implementation, and/or management of these initiatives.
8. By 2019, at least 40% of IoT-created data will be stored, processed, analyzed, and acted upon close to, or at the edge of, the network.
9. By 2019, 40% of local and regional governments will use IoT to turn infrastructure like roads, street lights, and traffic signals into assets instead of liabilities.
10. By 2019, all effective IoT efforts will merge streaming analytics with machine learning trained on data lakes, marts, and content stores, accelerated by discrete or integrated processors.

3.11 A.T.Kearney

As per A.T.Kearney Internet of Things 2020 survey, by 2020 IoT will impact close to 6% of the global economy



Source: A.T. Kearney IoT 2020 Survey

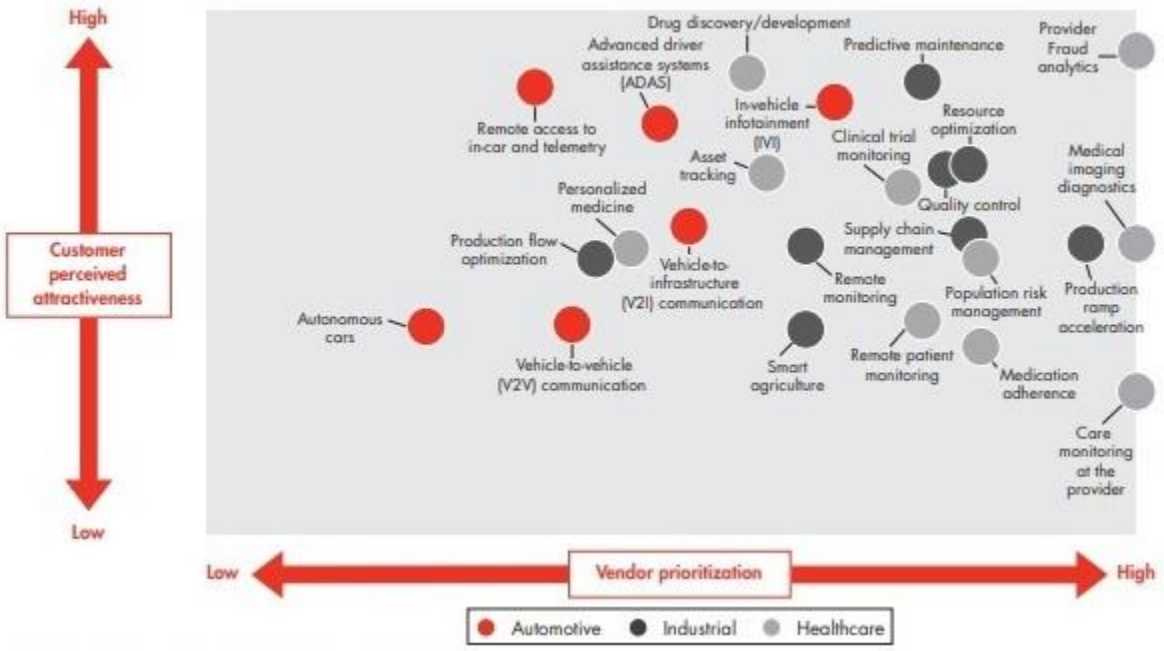
4. Selected Key Partnerships in IoT

There are several key partnerships taken place in IoT. We have selected key ones in this eBook.

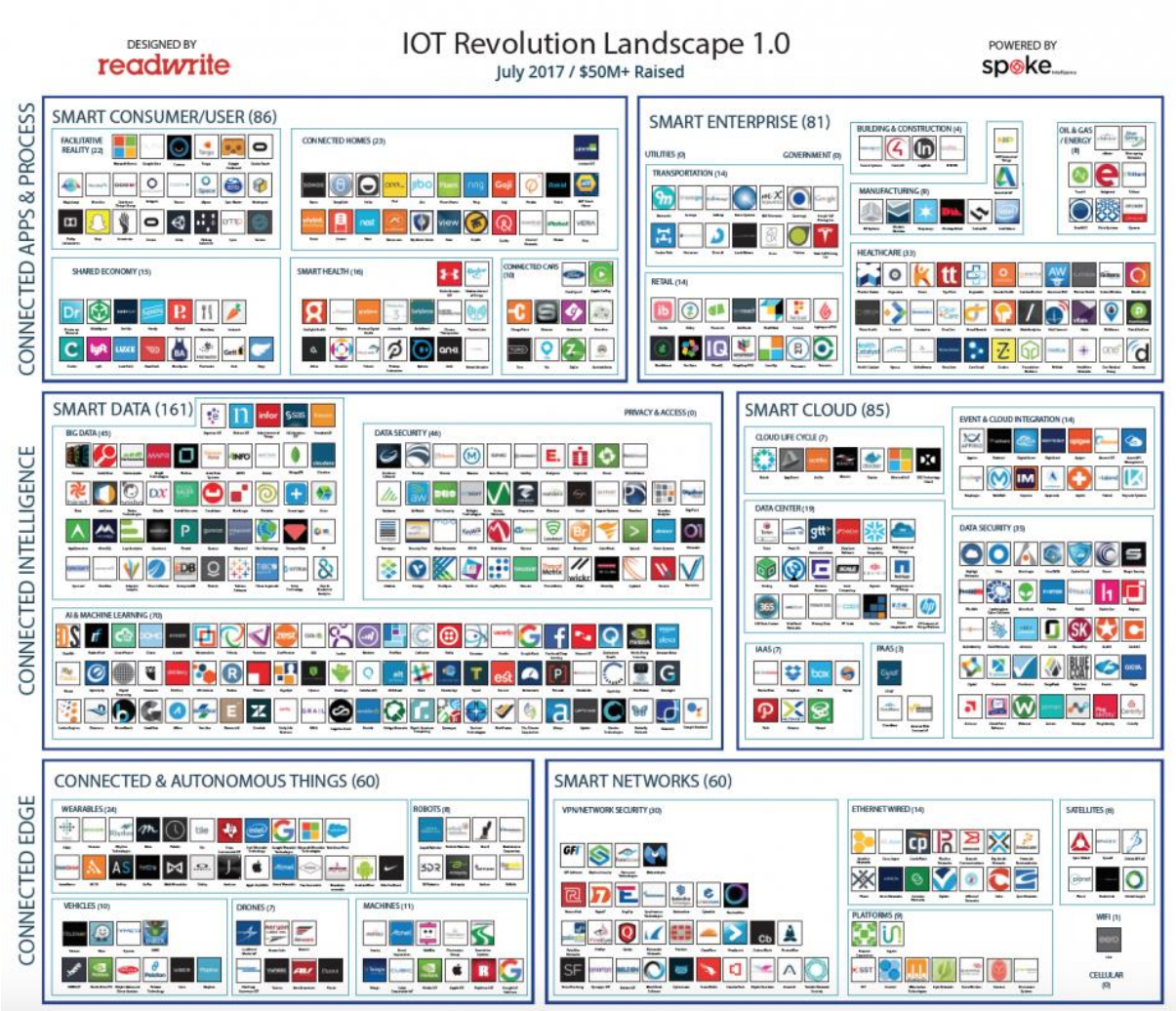
- GE and Apple partner on industrial Internet-of-Things platform Source
- InFluxData Teams With IBM And RedHat To Simplify Analyzing The IOT Data Deluge Source
- IBM, Fybr IoT Partnership Aims To Make Cities More Intelligent Source
- Microsoft Azure, United Technologies to partner on IoT, field and customer service, smart buildings Source
- Nokia partners with Bosch Connected Devices and Solutions for industrial IoT Source
- Microsoft and Cisco enable Azure IoT Suite to connect to Cisco Fog Deployments Source
- Nokia partners with AWS on cloud migration, 5G and IoT strategies Source
- Siemens and TCS join Forces for Industrial IoT on MindSphere Source
- Siemens Partners with SAP to Create MindSphere, an Open IOT Platform for Industrial Customers Source

5. IoT Investments

IoT In The USA: 3,000 Companies, $125B In Funding, $613B In Valuation, 342,000 Employees, 2,888 businesses building the Internet of Things employ 342,000 workers, have raised $125 billion in funding, and have created $613 billion in value. 95 of them are now unicorns: billion-dollar startups.



Source: Bain IoT customer survey 2016 (n=533)

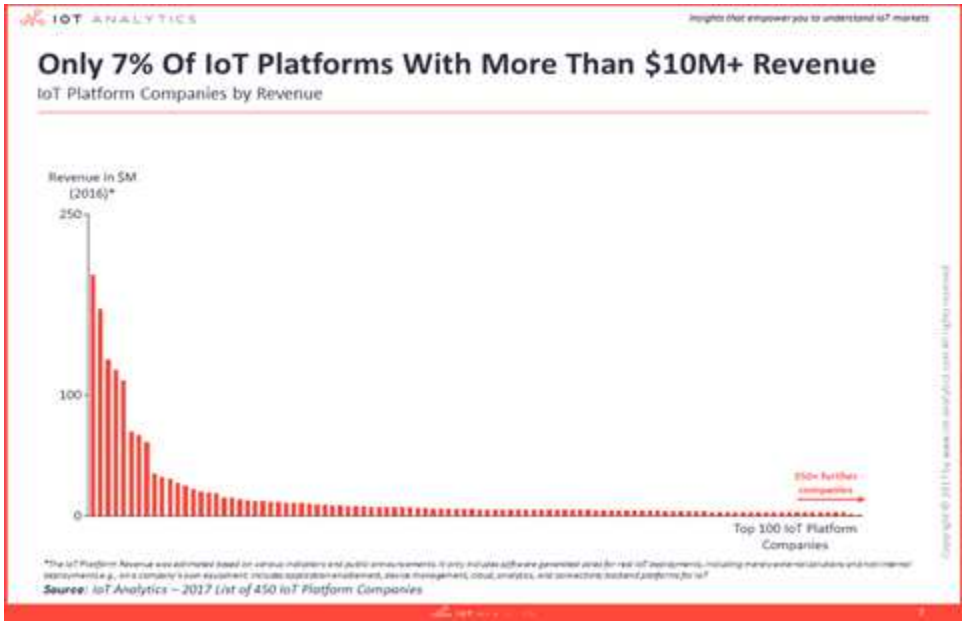


Source: The July 2017 IoT Revolution Landscape

6. Comparison of Vendors

Key insights of the IoT platform comparison are:

- **IoT Platform Comparison Insight 1: Market remains fragmented**

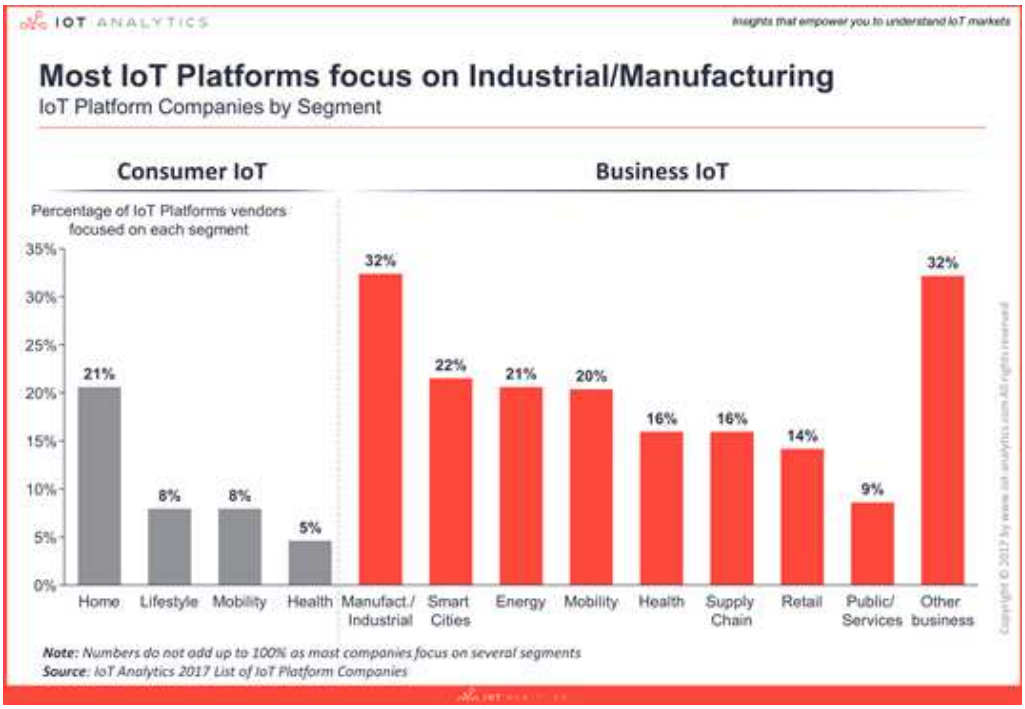


- **IoT Platform Comparison Insight 2: Leading providers are growing at 50%+**

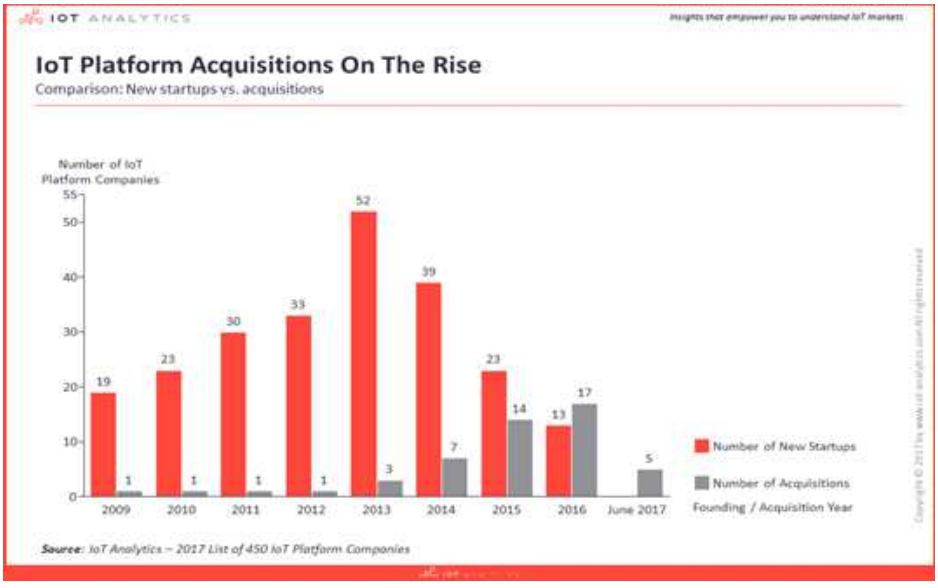
The consensus growth estimate for IoT markets, as provided by various analyst firms, lies between 25% and 40% annual growth for the next 5 years. Many of the IoT Platform Companies, however currently report numbers well above the forecast. A few smaller startups have stated that they are currently doubling revenue each year – but even leading providers recently reported growth rates above 50%. Three examples:

- C3 IoT, valued at $1.4BN in March 2017, recently announced a revenue increase of 65% year-over-year and bookings that have grown by 600%. The company also claims to have 100M Sensors and devices under management – so far, the highest number publicly announced
- Cisco Jasper's connectivity management platform "Control Center" has grown from 3,500 user companies in March 2016 to more than 9,000 in February 2017, thereby increasing the number of managed connected devices from 17M to 40M
- PTC increased its IoT revenue by 52% in 2016. Its core IoT offering is the application enablement Platform Thingworx, which it acquired in 2014

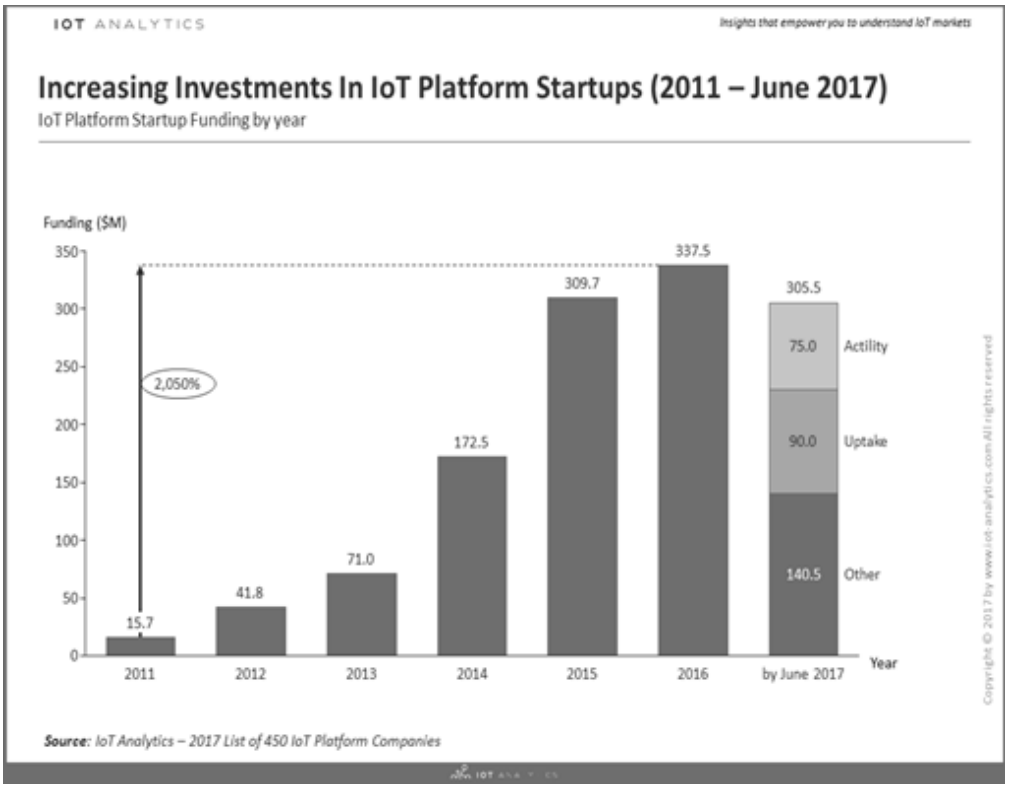
- **IoT Platform Comparison Insight 3: One third of platforms cater to the Industrial / manufacturing segment**



- **IoT Platform Comparison Insight 4: Increasing M&A activity – 17 deals last year**



- **IoT Platform Comparison Insight 5: Startup investment remains comparably insignificant**



Source: IoT Analytics

Comparison of Current IoT Software Platforms

IoT Software Platform	Device management?	Integration	Security	Protocols for data collection	Types of analytics	Support for visualizations?
2lemetry - IoT Analytics Platform	Yes	Salesforce, Heroku, ThingWorx APIs	Link Encryption (SSL), Standards (ISO 27001, SAS70 Type II audit)	MQTT, CoAP, STOMP,M3DA	Real-time analytics (Apache Storm)	No
Appcelerator	No	REST API	Link Encryption (SSL, IPsec, AES-256)	MQTT, HTTP	Real-time analytics (Titanium [1])	Yes (Titanium UI Dashboard)
AWS IoT platform	Yes	REST API	Link Encryption (TLS), Authentication (SigV4, X.509)	MQTT, HTTP1.1	Real-time analytics (Rules Engine, Amazon Kinesis, AWS Lambda)	Yes (AWS IoT Dashboard)
Bosch IoT Suite - MDM IoT Platform	Yes	REST API	*Unknown	MQTT, CoAP, AMQP,STOMP	*Unknown	Yes (User Interface Integrator)
Ericsson Device Connection Platform (DCP) - MDM IoT Platform	Yes	REST API	Link Encryption (SSL/TSL),Authentication (SIM based)	CoAP	*Unknown	No
EVRYTHNG - IoT Smart Products Platform	No	REST API	Link Encryption (SSL)	MQTT,CoAP, WebSockets	Real-time analytics (Rules Engine)	Yes (EVRYTHNG IoT Dashboard)

IoT Software Platform	Device management?	Integration	Security	Protocols for data collection	Types of analytics	Support for visualizations?
IBM IoT Foundation Device Cloud	Yes	REST and Real-time APIs	Link Encryption (TLS), Authentication (IBM Cloud SSO), Identity management (LDAP)	MQTT, HTTPS	Real-time analytics (IBM IoT Real-Time Insights)	Yes (Web portal)
ParStream - IoT Analytics Platform* **	No	R, UDX API	*Unknown	MQTT	Real-time analytics, Batch analytics (ParStream DB)	Yes (ParStream Management Console)
PLAT.ONE - end-to-end IoT and M2M application platform	Yes	REST API	Link Encryption (SSL), Identity Management (LDAP)	MQTT, SNMP	*Unknown	Yes (Management Console for application enablement, data management, and device management)
ThingWorx - MDM IoT Platform	Yes	REST API	Standards (ISO 27001), Identity Management (LDAP)	MQTT, AMQP, XMPP, CoAP, DDS, WebSockets	Predictive analytics(ThingWorx Machine Learning), Real-time analytics (ParStream DB)	Yes (ThingWorx SQUEAL)
Xively-PaaS enterprise IoT platform	No	REST API	Link Encryption (SSL/TSL)	HTTP, HTTPS, Sockets/ Websocket, MQTT	*Unknown	Yes (Management console)

* The cells marked with Unknown indicates that the relevant information could not be found from the available documentation.

** 2lemetry has been acquired by AWS IoT

***ParStream has been acquired by Cisco

Source: Comparing 11 IoT Development Platforms

7. IoT Trends by 2020

Highlights:

- Nearly four out of five (79%) companies surveyed have Internet of Things (IoT) initiatives in place today
- Almost half track (47%) customers through mobile apps, and 45% use IoT technologies to monitor production and distribution operations. However, only about one quarter track their products through embedded sensors or the customers who visit their premises
- The average company increased revenue 16% last year in the area of its business in which it had an IoT initiative. Nine percent of respondents attributed a revenue rise of more than 30% to their IoT efforts
- The higher the price of a company's products, the more heavily it will spend on IoT this year. Companies whose products' prices are more than $10 million will spend an average of $335 million, while those with product prices of $100 or less will spend an average of only $39 million

Regional Differences in Companies' Outlook

Sr. No.	Globally: 5 Biggest Impacts of IoT Initiatives by 2020
1	More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)
2	Greater insights for salespeople on key aspects of company products (for example, product features) that customers use the most
3	More tailored products and/or services
4	Reduction in cost of sales through automated reordering for customers
5	Better service because of more informed service reps (they can view data on how customers are using the products)

Sr. No.	North America: 5 Biggest Impacts of IoT Initiatives by 2020
1	Greater insights for salespeople on key aspects of company products (for example, product features) that customers use the most
2	More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)
3	Reduction in cost of sales through automated reordering for customers
4	More tailored products and/or services
5	Better service because of more informed service reps (they can view data on how customers are using the products)

Sr. No.	Europe: 5 Biggest Impacts of IoT Initiatives by 2020
1	More tailored products and/or services
2	More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)
3	Reduction in cost of sales through automated reordering for customers
4	Greater insights for salespeople on key aspects of company products (for example, product features) that customers use the most
5	Better service because of more informed service reps (they can view data on how customers are using the products)

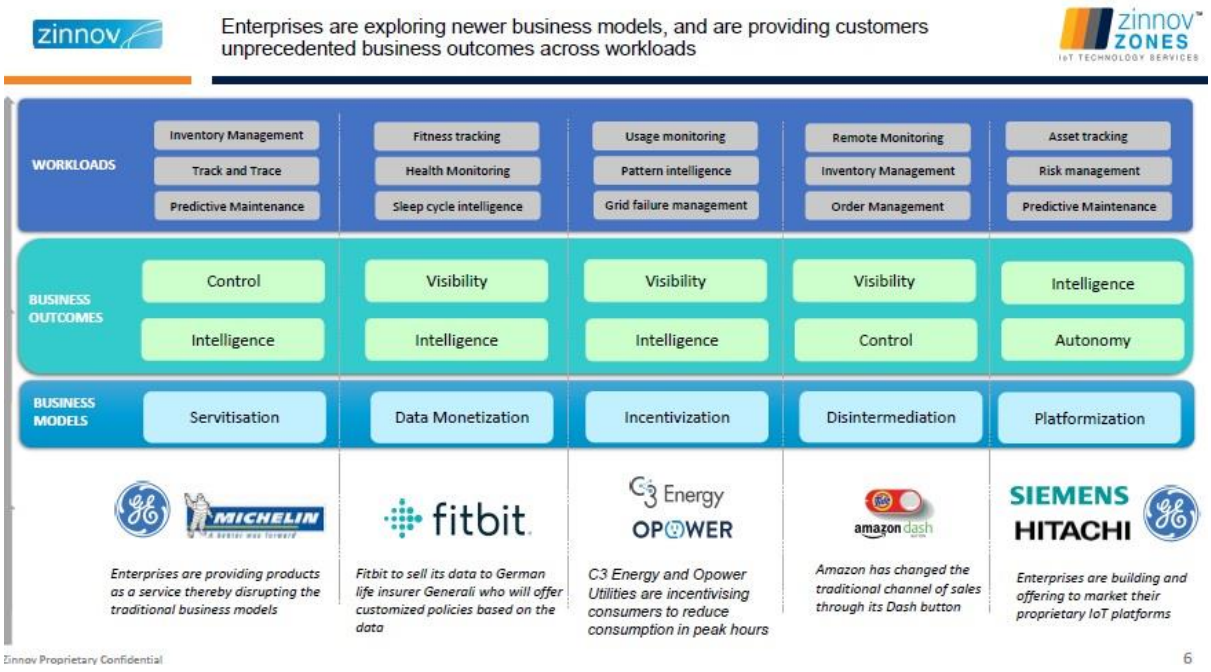
Sr.No.	Asia-Pacific: 5 Biggest Impacts of IoT Initiatives by 2020
1	Reduction in cost of sales through automated reordering for customer
2	More tailored products and/or services
3	Improved user experience by making near-obsolescence products more attractive to customers (for example, by monitoring such a product and preempting its breakdown before the customer realizes)
4	More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)
5	Greater insights for salespeople on key aspects of company products (for example, product features that customers use the most)

Sr. No.	Latin America: 5 Biggest Impacts of IoT Initiatives by 2020
1	Greater insights for salespeople on key aspects of company products (for example, product features that customers use the most)
2	More tailored and/or precise customer segmentation (for example, based on how customers use products and/or services)
3	More tailored products and/or services
4	Reduction in cost of sales through automated reordering for customers
5	a. Improved user experience by making near-obsolescence products more attractive to customers (for example, by monitoring such a product and preempting its breakdown before the customer realizes) b.Better service because of more informed service reps (they can view data on how customers are using products)

Source: TCS

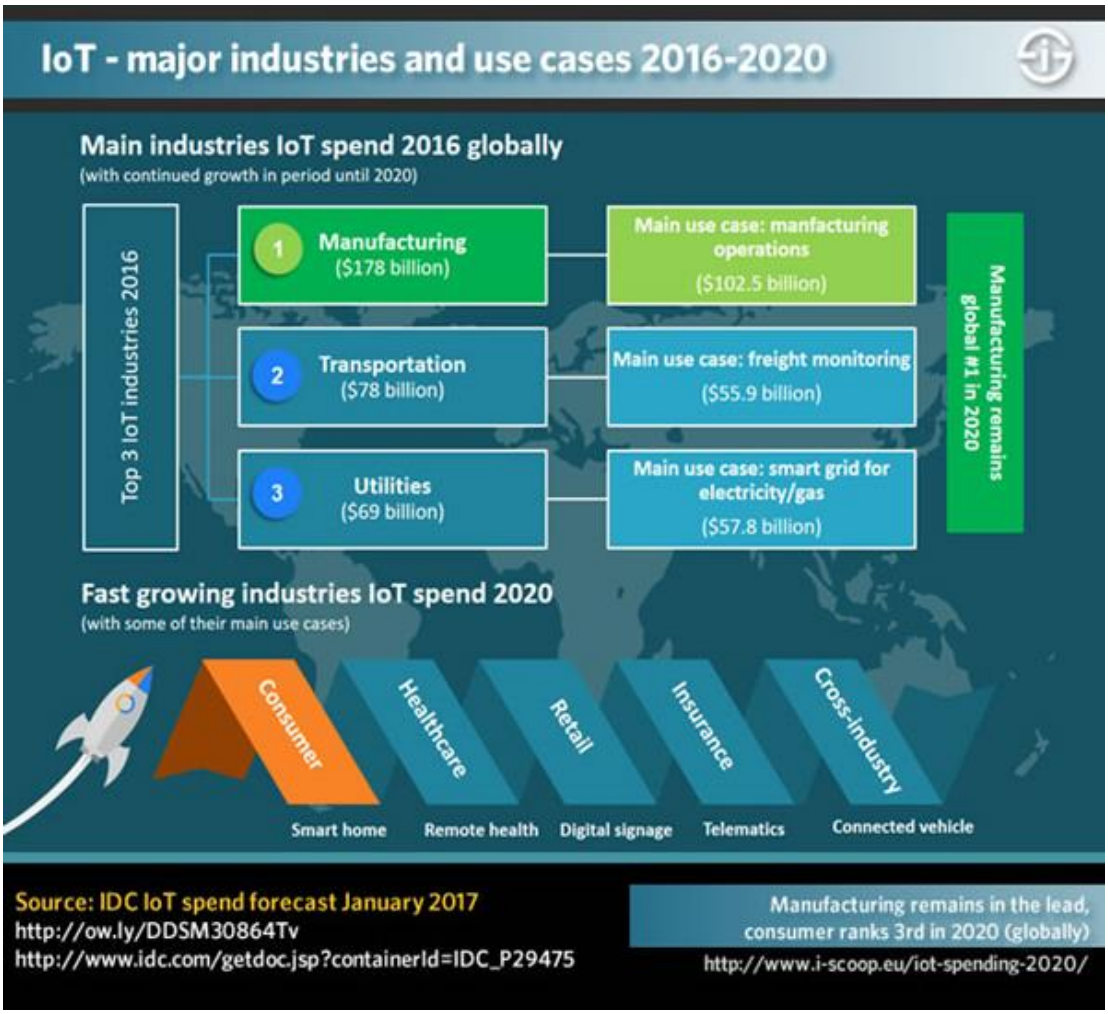
8. IoT Use Cases

The key IoT use cases from an actual investment perspective are



Source: Zinnov Slideshare

Whereas the overall ranking of segments where most IoT spending happens remains relatively similar and some industries outperform others from a CAGR viewpoint, a lot is happening if we take a deeper dive at IoT spending in various use cases within specific industries. A few examples.



Source: I-Scoop IoT-Spending-2020

9. About Calsoft Inc.

CALSOFT IS A LEADER IN PRODUCT ENGINEERING AND CONSULTING SERVICES

Calsoft is a leading software product engineering services company in Storage, Networking, Virtualization and Cloud domains; and new age areas like Big data, IoT, analytics and ML. Calsoft provides End-to-End Product Development, Quality Assurance Sustenance, Solution Engineering and Professional Services expertise to assist customers in achieving their product development and business goals. Our deep domain knowledge of Storage, Virtualization, Networking and Cloud verticals helps in delivering high quality products and services at the right time and cost. Our customer focused engagement models and innovative Accelerator IPs speed up time-to-market and accelerate revenue growth for our customers.

10. Calsoft's IoT Offerings

10.1 Gateways

- Building various gateways ranging from Dell Edge Gateways to RaspberryPI
- Integrating IoT data aggregators like VMware Liota platform to custom building edge analytics pipelines.
- Integrating various IoT communication protocols like XMPP/MQTT
- Integrating devices with the edge platforms

10.2 Data Storage and Analytics

- Implementing Big Data solutions to store and analyze the IoT data streams (Hadoop HDFS, OpenTSDB and real time analytics with Apache Spark etc.)
- Design and development of intelligent predictive analysis using latest Machine learning techniques
- Implementing machine learning using open source ML/analytics tools like Apache Mahout, numPy, R, TensorFlow, IBM Watson
- Using various cloud platforms for rapid IoT solution development like AWS IoT, Azure IoT, Google Weave

10.3 End User Applications

- Design and develop IoT dashboards
- Developing custom application front ends (UI/UX) using modern web technologies like AngularJS and D3 libraries etc.
- Integrating with various commercial or open source dashboards like Graphite, Graffana

11. References

- https://iot-analytics.com/iot-platform-comparison-how-providers-stack-up/
- http://sites.tcs.com/internet-of-things/wp-content/uploads/Internet-of-Things-The-Complete-Reimaginative-Force.pdf
- https://dzone.com/articles/iot-software-platform-comparison
- http://www.businessinsider.com/internet-of-things-devices-applications-examples-2016-8?IR=T
- http://www.ioti.com/strategy/11-innovative-iot-use-cases
- https://www.forbes.com/sites/louiscolumbus/2016/11/27/roundup-of-internet-of-things-forecasts-and-market-estimates-2016/#6c9f3df9292d
- https://www.i-scoop.eu/internet-of-things-guide/iot-spending-2020/
- http://www.crn.com/slide-shows/internet-of-things/300087866/5-hot-iot-solutions-launched-at-cisco-live.htm/pgno/0/1
- https://www.forbes.com/sites/johnkoetsier/2017/07/10/iot-in-the-usa-3000-companies-125b-in-funding-613b-in-valuation-342000-employees/#1c28693a3ef5
- https://blogs.cisco.com/cle/10-predictions-for-the-future-of-the-internet-of-things
- https://us.norton.com/internetsecurity-iot-5-predictions-for-the-future-of-iot.html
- http://www.digitalistmag.com/iot/2017/03/29/what-will-internet-of-things-look-like-in-2027-7-predictions-04998096
- https://readwrite.com/2016/12/29/8-predictions-for-the-future-of-iot-in-2017-il1/
- http://www.crn.com/slide-shows/internet-of-things/300083639/10-iot-predictions-for-2017.htm/pgno/0/6
- http://www.ioti.com/iot-trends-and-analysis/11-iot-predictions-2017