The Internet of Everything (IoE) is a $19 trillion global opportunity over the next decade. Private-sector firms can create as much as $14.4 trillion of value while cities, governments and other public-sector organizations can create $4.6 trillion.
FORWARD

Dr. Igor Ansoff is commonly referred to as the father of strategic management. The most important area of his research was in regard to environmental change and the pace of change. By the end of the ’70s, changes, especially in high turbulent environments (gaps), were underlying all of Ansoff’s work. He was fascinated by secular technological transitions showing the characteristics of discontinuity (with respect to the past) and surprise (like the transition of the transistor-based technology taking over valves at the beginning of the electronic industry).

Today, Ansoff would be absolutely amazed to see how dramatically transitional changes have evolved since the early days of his studies. Rapid change in high-turbulent environments is a true constant and each year both factors keep accelerating. Transitions that once took place over a decade are now happening in months.

First, we have experienced the biggest fundamental technological change in modern history since the beginning of the Internet as people, processes, data and things became increasingly connected. Now we are currently experiencing a dramatic Internet evolution, the so-called Internet of Everything.

Several major transitions in technology- each important in its own right- are combining to make the Internet of Everything possible. These include the emergence of cloud and mobile computing, the growth of big data and analytics, and the explosive development of the Internet of Everything (IoE). These transitions are dramatically changing the role of information technology (IT), with Internet protocol (IP) networks playing an increasingly central part by connecting disparate IT environments.

Innovation and technologies, which represent the foundation of IoE, have helped countries with advanced economies to buffer the recent economic downturn. Coincidentally, the more technology-based economies are the more productive and efficient work, and more capable and quick in recovering. At the same time, major technological transitions like IoE have helped in creating emerging economies who are leveraging favorable demographics with technology. As IoE continues to grow, we expect that it will drive massive gains in efficiency, business growth, and quality of life, helped along by thousands of new applications.

The future belongs to those who will truly understand the present scenario; understand and manage change; and innovate with a vision to create a new order.

We are confident that investors will find the following pages a pleasant reading, and at the end would be able to have a good idea about the size, the dynamics, the players and the beneficiaries of IoE.
INTRODUCTION

While the Internet is not a cure-all, it is the one technology that has the potential to rectify many of the challenges we face. Already, the Internet has benefited many individuals, businesses, and countries by improving education through the democratization of information, allowing for economic growth through electronic commerce, and improving business innovation by enabling greater collaboration.

Given a sizeable increase in Internet-enabled devices and a substantial reduction in the cost of technological infrastructure, we expect Internet of Everything (IoE) to dominate the canvas of the information technology industry in the next five years. With Cisco estimating IoE to create an overall economic value of approximately $19 trillion by 2023, we foresee trickle-down impact for all businesses, with major beneficiaries being the undercover small-cap technology firms. Hence, from an investment perspective, given the expected upside for the associated firms, IoE is likely to provide ample opportunities going forward.
Traditionally, the development of the Internet is classified into three stages. The first one is its evolution as a cyberspace with domination by fixed Internet. The prime technology for this phase was DSL/Ethernet that provided basic connectivity for fixed devices like personal computers and notebooks. The second stage is marked by development of mobile Internet mainly due to the success of smart phones. The dynamism of mobile Internet was backed by the introduction of 3G/4G technology. The third stage is use of Internet connectivity to manage *everything* through connected devices and specialized software. Although mobile Internet will be handy for the connectivity, this phase is likely to be dominated by Wi-Fi communication. An important component of this connectivity is IPv6 that allows data transformation at a very high pace.
The first two waves of connectivity have created enormous economic value for the U.S. economy. Internet-related activities recently contributed approximately 4.7% toward GDP.

Internet users have been increasing exponentially around the globe with almost 85 users per 100 inhabitants in United States at the end of 2013, which has almost doubled from 43 users per 100 in 2000. A similar trend is witnessed in almost all countries as can be seen from graph below.¹

Given this trend, the International Telecommunication Union (ITU) expects 75% of the world population to have Internet access by 2015.² If this connectivity density is achieved along with a large number of connected devices, IoE is definitely the next best thing in technology, offering enormous economic benefits.
WHAT IS INTERNET OF EVERYTHING??

The Age Of Internet Ubiquity Has Arrived.
Today there are more things connected to the Internet than there are people in the world. In the very near future, pretty much everything you can imagine will wake up. We are leading the next step in the evolution of the Internet and helping change the way we work, live, play and learn.

The Internet of Everything (IoE) is about use of devices to connect everything from consumer objects like wearables, personal vehicles and homes, to industrial processes like supply chain management, production, transport, etc. This connectivity will enable the management of these objects, through real-time information collection and data processing, resulting in increased efficiency.

The IoE will be comprised of networks of Internet-enabled applications based on technologies like IPv6, web services, RFID and 4G that will be pivotal in adapting the concept for everyday life.

*Applications* are the objects that will be controlled through IoE. For example, a connected home heating system will have operational gadgets, thermostats and maintenance sensors which will be remotely functioned in an IoE system. *Building Blocks* will be comprised of means that will communicate with the applications. These may include software; mobile devices; network and communicational technologies; and protocols. In the home heating system example, building blocks will include a mobile device (if it is controlled by a mobile); software used to trigger the communication; network protocols used to deliver this signal to the heating system; and any device installed on the application to *receive* the signal.

The combination of *building blocks* will create a *system* that enables communication between applications and remote devices. In the example, the system will consist of *triggering* the signal from the mobile device, *receiving* it on the heating application and ultimately *executing* it.
Will IoE Be Proprietary Technology?

As IoE verticals will be largely dependent on third-party applications and systems, a possible caveat in its mass adaptability is the proprietary nature of the technology. This would make using IoE verticals costly and platform specific. At present the IoE solutions are using proprietary protocols for connectivity that only allow those devices that are certified by a particular manufacturer. Similarly, some applications are platform-sensitive (for example, Android vs. IOS) that do not allow interoperability, restricting free connectivity. However, we believe that by shifting toward Wi-Fi, IP and more standardized protocols, the proprietary barrier is getting lowered. Further, with projects like IoT-A (a European commission) that is involved in development of a common connectivity protocol, we believe that going forward, IoE will be more like a low-cost open source technology.

Why Is IoE Pacing Up?

Key Drivers For The Adaptability

The technology industry is evolving rapidly and some of the changes have paced up the emergence of IoE.

Reducing Costs of Semiconductors

The price erosion in semiconductor markets, notably sensors, is the prime reason for acceleration of IoE. The cost of sensors has gone down by almost 50% in the last decade with an average price of $0.54 in 2014.³ Although a price decline of this magnitude is not expected going forward, competition and innovation in product design is likely to push manufacturers for price competition which would result in a further decline, albeit modest, in the price of sensors. The estimates for the demand for sensors are high and manufacturers are banking on quantity demand for increase in their expected revenues. It is expected that the demand for sensors will be approximately $9.6 billion by 2017, registering a growth of almost 47% from $6.5 billion in 2014.⁴ This is likely to fuel the adaptability of IoE, as sensors are the backbone for connectivity and higher demand in units will mean more connectivity.

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Source: IC Insights

R² = 0.9818

IFS Securities. Important disclosures appear at the end of this report.
Deflating Prices of Wholesale Bandwidth and Processing
The wholesale prices of bandwidth have deflated enormously, reducing the cost of Internet traffic. Prices have swooned by more than 85% in network hubs like Hong Kong and New York from approximately $49.5 and $10 respectively in 2007 to $6 and $1.64 in 2014. Another network giant, London, also witnessed a similar trend in prices, reducing from $10.5 in 2007 to $1.36 in 2014.5 Going forward, the prices are likely to reduce at a gradual rate, (~YoY decline of 10%) making data traffic more cost-efficient, resulting in higher connectivity. Similarly, the processing costs have significantly reduced (industry estimates of ~50x in last decade), making devices more effective in gathering, analyzing and processing the collected data. The low cost effective processing and transmission of data is adding spine to the IoE.

Increase in Smartphone Users and Connected Objects
Another important driver that has paced up IoE is an exponential increase in the number of Smartphone users and other connected objects. The number of Smartphone users in the U.S. has increased by 1.54x from 62.6 million in 2010 to 158.9 million in 2014, resulting in an increased penetration from 36% to 63% for the same period.6 These smart handsets are building blocks of IoE, as they act as a remote hub for connected objects, and with an exponential increase in their number of users, the connectivity is pacing up.
The overall number of connected objects in the world has also increased by a hefty 65% from 8.7 billion in 2012 to 14.4 billion in 2014. With IoE gearing up, more objects are expected to be connected, and by 2020 it is estimated that approximately 50.1 billion objects will be present within the connected eco system of IoE.\(^7\)
Wi-Fi Connectivity, Big Data and Internet Protocol Version 6 (IPv6)

Wireless connectivity is catching up at a very nominal cost, as compared to 3G/4G technology that required the use of spectrum and, therefore, subscription with a carrier. As more and more Wi-Fi coverage becomes available, the connectivity is expected to be enhanced. Furthermore, IoE is likely to deal in enormous structured and unstructured data at unprecedented speed, which could not have been managed using traditional data-handling mechanisms. Fortunately, we have big data analytics available that can deal with complexities of velocity, varieties and humongous size of data to be processed. Lastly, availability of IPv6 is likely to provide ample space for IP addresses that is vital for connecting objects to the Internet. At present, IPv4 accounts for 96% of Internet data traffic providing 4.3 billion IP addresses. IPv6, that currently carries 4% of total traffic, has a capacity to host 7.9x10^28 times more addresses compared to IPv4, something that will be vital to connect 50 billion objects by 2020.

The Vertical Markets for IoE

IoE holds the potential to be extended to virtually any vertical in the public or private sector. The value created will emanate primarily from innovation in business models, resulting from diversified revenue streams, enhanced employee productivity, improved cost efficiency and asset utilization. Cisco predicts an overall value of $19 trillion ($14.4 trillion from private sector while $4.6 trillion from public sector) by 2023. This number is not surprising, given the potential of IoE to reform the ways businesses can function. From this exhaustive list, we believe smart parking, smart marketing, smart factories and smart healthcare will gain momentum relatively quickly.
**Smart Parking**
A major problem faced by highly populated cities is increasing traffic flows. With smart parking, free spaces can be identified and reserved conveniently by those driving. The prospect of having the convenience of driving in to a mall at peak hours and having a pre-reserved parking space awaiting you is remarkable. Since parking data will be automated, variable parking rates can also be implemented by identifying peak and off-peak hours more systematically. Lastly, tracking non-compliance use will be much easier. Through smart parking, bottom line will be enhanced by increasing compliance; lower fuel consumption by avoiding traffic bottle necks; and dynamic pricing. The smart parking will require some level of connected cars which have already been initiated by AT&T through AT&T Drive Studio using 4G LTE networks.

**Example of Smart Parking**

![Smart Parking Example](image)

**Smart Marketing and Advertising**
IoE is making smart marketing and advertising a reality. In Japan, billboards are installed that assess passing consumers and adapt the display based on their assessment of attributes. Through smart marketing and advertising, companies will be able to understand the complete consumer dynamics and buying behaviors and can have targeted promotional campaigns that can help in tapping previously unidentified sales opportunities. Furthermore, observing the buying behavior in retailing can help companies to adapt better market segmentation and pricing that match purchasing power of their customers. Tesco has taken a lead in this and is among the early adapters of IoE.
Examples of Smart Marketing and Advertising

A man walks past a digital advertising display at a Tokyo station. Digital advertising billboards being trialed in Japan are fitted with cameras that read the gender and age group of people looking at them to tailor their commercial messages.

Big Digital-Out-Of-Home Advertising screen, run through cloud computing remotely, where ads and timing can be monitored through internet.

Smart Factories
IoE has tremendous potential to offer in production facilities. The benefits may emanate from a combination of revenue growth, cost reduction and work place environment. These will include predictive maintenance, lowering the production breaks and minimizing downtime, loss prevention, supply chain tracking of materials, devices’ optimization and energy efficiencies, etc. The demand forecasting can be more meaningful, boosting the bottom line through smart capacity utilization. Lastly, superior product quality will be maintained using the sensor-based quality controls.

Smart Factories Software

Smart Factoree is one of the software programs which manages manufacturing processes effectively by diminishing equipment downtime and manufacturing costs.
Smart Healthcare
Another important sector that would benefit from IoE earlier than other verticals is healthcare. With proactive management and monitoring of the human body through sensors and connected wearables, healthcare can be administered from the convenience of your home. This would result in a reduction of doctor visits. Furthermore, IoE will enable post-treatment monitoring through connected objects that will decrease the hospitalization time.

Examples of Smart Healthcare Wearables

**Jawbone UP24, Fitbit Flex & Nike+Fuelband: A Comparative Snapshot**

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<th>Fitbit Flex</th>
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<td>Both</td>
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Healthcare firms, including startups, are aggressively investing in IoE. Some examples include:

**Infant Monitors by “Mimo”**

The monitor uses a sensor shaped like a turtle that you attach to the included onesie to send live audio, breathing pattern, skin temperature, body position and sleep activity data straight to your Smartphone. One can also use the Mimo to track diaper changes and feedings and to ensure consistent care across different caretakers.
Smart Insulin Injection Tracker by Vigilant

The injection tracker records and transmits a diabetic patient’s insulin data to the Smartphone application. The company, Vigilant, unveiled a smart IOT innovation for diabetic patients called Bee+, the world’s first Bluetooth Smart Injection Tracker connecting insulin pens to Smartphones. Injection data can be easily accessed and shared with healthcare providers, friends and family. Bee+ App is a great companion for anyone wanting to remotely monitor the log book of their diabetic child or elderly family member.

Ingestible Sensors by Proteus Digital Health

The ingestible sensor is swallowed as part of prescription pills and tracks progress, with data being constantly shared with physicians.

This patch and smartpill system is in use by several NBA franchises. An oval-shaped patch is applied to a player’s skin, where it tracks sleep habits, skin temperature, body position and heart rate. The wearable also collects data sent to it wirelessly from within the player by the smartpill. The FDA-approved pill’s ingestible sensor and transmitter is powered entirely by stomach acid, and stays in the body roughly one week. These data help coaching staff accurately adjust practice intensity, especially on the road when the variables increase.
A notable point about these companies is that they are in their early stages of lifecycle and are picking up growth through the use of IoE. Lastly, with constant tracking of health conditions and availability of data, the entire health insurance industry can be revolutionized by linking insurance premiums directly to the gathered information.

**Summary of Potential Verticals with Estimated Value at Stake**

- **Under Public Sector (US$ Billions) (Figure 7)**
  - Connected Militarized Defense: $1,500
  - Connected Learning: $258
  - Chronic Disease Management: $146
  - Telework: $125
  - Gas Monitoring: $69
  - Smart Parking: $41
  - Water Management: $39
  - Road Pricing: $18

- **Under Private Sector (US$ Billions) (Figure 8)**
  - Smart Factories: $1,950
  - Connected Marketing and Advertising: $1,950
  - Smart Grid: $757
  - Connected Gaming and Entertainment: $635
  - Smart Building: $349
  - Connected Commercial Vehicles: $347
  - Connected Healthcare: $106
  - Connected Private Sector Education: $78

IFS Securities. Important disclosures appear at the end of this report.
IOE IS CHANGING THE FINANCIAL PARADIGM
Like previous waves of technology, IoE is also expected to evolve new business winners and losers. It has triggered a new wave of strategic acquisitions with major players positioning themselves by aggressive buyouts of firms that have products related to IoE. Although there will be impact on all verticals, major beneficiaries will largely emerge from technology stocks. Large firms like Cisco (CSCO), Apple (AAPL), Microsoft Corporation (MSFT), Hewlett Packard (HPQ), Oracle (ORCL) and Google (GOOG) are flushing with excess liquidity. Some of these firms are holding cash and liquid investments in a range of 49% - 53% of total assets. This gives them ample flexibility for any acquisition that may have strategic value with respect to IoE. It must be noted that these firms have been active in the technological-related buyouts historically, but the impact on their top and bottom line was not significant relative to the size of these giants. However, going forward, given the immense potential of IoE, we expect new acquisitions by these firms to add substantial incremental value to fundamentals.

The technology-related IoE drivers can be classified into three categories namely Hardware, Networking and Data Storage firms. We identify and present valuation snapshots of some small to medium cap firms in each category that offer excellent investment potential due to their expected participation in IoE. These growth firms have a low dividend yield of 0.6% - 2.9% and are currently trading at a P/E ratio between 8.8x – 84.8x, with a price to book range of 1.1x – 10.3x.
**VALUATION SNAPSHOT FOR IoE COMPANIES**

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<td>6.80</td>
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<td>Teradata</td>
<td>TDC</td>
<td>6.35</td>
<td>18.25</td>
<td>1.75</td>
<td>2.33</td>
<td>3.44</td>
<td>8.89</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Forward P/E reported (Dec 31, 2015)

Source: Yahoo Finance

Funding for startups and early growth companies has been on the rise, with seed and subsequent series (A, B and C) venture capital financing amounting to $67.8 million for 10 firms in the first nine months of 2014. Investors should watch these firms because as IoE beneficiaries, we expect them to pick up very quickly, with their further funding recourse coming from capital markets through public offerings.
In 2013 and 2014, the market for acquisitions has been active with companies like Jawbone and PTC gearing up to tap their share of IoE verticals. Jawbone is a privately-held firm that is producing connected wearables. With the increased usage of Smartphones, demand for such wearables is on the rise, resulting in unprecedented growth. Therefore, investors should not miss out on these early but massive growth companies like Jawbone, Fitbit and Sensoria Inc, etc., for possible ventures or public financing.

## IoE-RELATED ACQUISITION ACTIVITIES FOR 2013 - 2014

<table>
<thead>
<tr>
<th>Target</th>
<th>Price (Mln)</th>
<th>Acquirer</th>
</tr>
</thead>
<tbody>
<tr>
<td>BodyMedia</td>
<td>100</td>
<td>JawBone</td>
</tr>
<tr>
<td>ILS Technology</td>
<td>8.5</td>
<td>Telit Wireless Solutions</td>
</tr>
<tr>
<td>ThingWorx</td>
<td>112</td>
<td>PTC</td>
</tr>
<tr>
<td>Nest</td>
<td>3200</td>
<td>Google</td>
</tr>
<tr>
<td>Kovio</td>
<td>3.7</td>
<td>ThinFilm</td>
</tr>
<tr>
<td>Basis</td>
<td>100 - 150</td>
<td>Intel</td>
</tr>
<tr>
<td>Dropcam</td>
<td>555</td>
<td>Nest</td>
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<tr>
<td>NMI</td>
<td>140</td>
<td>Atmel</td>
</tr>
<tr>
<td>Axeda</td>
<td>170</td>
<td>PTC</td>
</tr>
</tbody>
</table>

*Source: postscapes.com*
SWOT ANALYSIS OF IoE
Internet of Everything

STRENGTH

- Cost Efficiency and Creation of a Diversified Revenue Stream
- Increasing Connected Objects
- Increasing Public & Private Sector Investment

WEAKNESS

- Early Stages Awareness Issues
- Compatibility between Objects
- Some Solutions can be Expensive

OPPORTUNITY

- Application to any Vertical
- Potential of Subsector Product Markets
- Efficient Management of Processes

THREAT

- Fear of Technology
- Security Issues
- Privacy Concerns

IFS Securities. Important disclosures appear at the end of this report.
Footnotes

1 World Development Indicators, Based on ICT Development Report and World Bank Estimates. Extracted from the website of The World Bank.


3 IC Market Drivers 2015, IC Market Insights.

4 The McClean Report 2014, IC Insights.


7 Connections Counter: The Internet of Everything in Motion, Cisco.

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**Underperform (MU4)** Expected to underperform the S&P 500 or its sector over the next six to 12 months and should be sold.

**Suspended (S)** The rating and price target have been suspended temporarily. This action may be due to market events that made coverage

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<table>
<thead>
<tr>
<th>Rating Distributions</th>
<th>Coverage Universe Rating Distribution</th>
<th>Investment Banking Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong Buy and Outperform (Buy)</td>
<td>IFS 100%</td>
<td>IFS 100%</td>
</tr>
<tr>
<td>Market Perform (Hold)</td>
<td>IFS 0%</td>
<td>IFS 0%</td>
</tr>
<tr>
<td>Underperform (Sell)</td>
<td>IFS 0%</td>
<td>IFS 0%</td>
</tr>
</tbody>
</table>

**Suitability Categories (SR)**

**Total Return (TR)** Lower risk equities possessing dividend yields above that of the S&P 500 and greater stability of principal.

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Valuation Methodology: For Internet of Everything (IoE), our valuation methodology utilizes Discounted Cash Flow methodology, and takes into account growth potential, earnings quality and visibility, and risk profile.

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