

# Embracing the Internet of Everything To Capture Your Share of \$14.4 Trillion

Joseph Bradley  
Joel Barbier  
Doug Handler

More Relevant, Valuable Connections Will Improve  
Innovation, Productivity, Efficiency & Customer Experience



To get the most value from IoE, business leaders should begin transforming their organizations based on key learnings from use cases that make up the majority of IoE's Value at Stake.

## Executive Summary

- The Internet of Everything (IoE) creates \$14.4 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.
- The five main factors that fuel IoE Value at Stake are: 1) asset utilization (reduced costs) of \$2.5 trillion; 2) employee productivity (greater labor efficiencies) of \$2.5 trillion; 3) supply chain and logistics (eliminating waste) of \$2.7 trillion; 4) customer experience (addition of more customers) of \$3.7 trillion; and 5) innovation (reducing time to market) of \$3.0 trillion.
- Technology trends (including cloud and mobile computing, Big Data, increased processing power, and many others) and business economics (such as Metcalfe's law) are driving the IoE economy.
- These technology and business trends are ushering in the age of IoE, creating an unprecedented opportunity to connect the unconnected: people, process, data, and things. Currently, 99.4 percent of physical objects that may one day be part of the Internet of Everything are still unconnected.
- To get the most value from IoE, business leaders should begin transforming their organizations based on key learnings from use cases that make up the majority of IoE's Value at Stake. These use cases include smart grid, smart buildings, connected healthcare and patient monitoring, smart factories, connected private education, connected commercial (ground) vehicles, connected marketing and advertising, and connected gaming and entertainment, among others.
- Robust security capabilities (both logical and physical) and privacy policies are critical enablers of the Internet of Everything Economy. The IoE Value at Stake projections are based on increasingly broad adoption of IoE by private-sector companies over the next decade. This growth could be inhibited if technology-driven security capabilities are not combined with policies and processes designed to protect the privacy of both company and customer information.

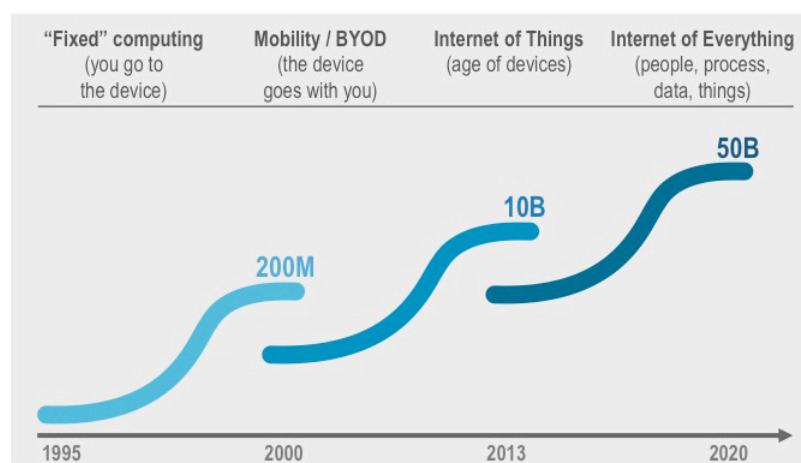
The next wave of dramatic Internet growth will come through the confluence of people, process, data, and things – the Internet of Everything.

## The Internet of Everything Is Happening Now

Cisco estimates that 99.4 percent of physical objects are still unconnected.<sup>1</sup> Conversely, this means that only about 10 billion of the 1.5 trillion things globally are connected.<sup>2</sup> At a more personal level, there are approximately 200 connectable things per person in the world today.<sup>3</sup> These facts highlight the vast potential of connecting the unconnected.

Even so, the growth of the Internet has been unprecedented (see Figure 1). Cisco estimates that there were about 200 million things connected to the Internet in the year 2000. Driven by advances in mobile technology and the “bring your own device” (BYOD) trend, among others, this number has increased to approximately 10 billion today, putting us squarely in the age of the Internet of Things (IoT). The next wave of dramatic Internet growth will come through the confluence of people, process, data, and things – the Internet of Everything (IoE).<sup>4</sup>

**Figure 1.** Rapid Growth of the Number of Things Connected to the Internet.



Source: Cisco IBSG, 2013

IoE is further being driven by several factors. First, powerful technology trends – including the dramatic increase in processing power, storage, and bandwidth at ever-lower costs (Moore’s law still at work); the rapid growth of cloud, social media, and mobile computing; the ability to analyze Big Data and turn it into actionable information; and an improved ability to combine technologies (both hardware and software) in more powerful ways – make it possible to realize more value from connectedness.

Second, barriers to connectedness continue to drop. For example, IPv6 overcomes the IPv4 limit by allowing for 340,282,366,920,938,463,374,607,431,768,211,456 more people, processes, data, and things to be connected to the Internet. Amazingly, IPv6 creates enough address capacity for every star in the known universe to have 4.8 trillion addresses.

Value at Stake . . . is the potential bottom-line value (higher revenues and lower costs) that can be created or will migrate among companies and industries based on their ability to harness IoE.

Third, form factors continue to shrink. Today, a computer the size of a grain of salt (1x1x1 mm) includes a solar cell, thin-film battery, memory, pressure sensor, and wireless radio and antenna. Cameras the size of a grain of salt (1x1x1 mm) now have 250x250-pixel resolution. And, sensors the size of a speck of dust (0.05x0.005 mm) detect and communicate temperature, pressure, and movement. These developments are important because, in the future, things connected to the Internet may be hard for the human eye to even see.

Finally, IoE reflects the reality that business value creation has shifted to the power of connections and, more specifically, to the ability to create intelligence from those connections. Companies can no longer rely solely on internal core competencies and the knowledge of their employees; instead, they need to capture intelligence faster, from many external sources. This will occur through connections enabled by the Internet of Everything.

## IoE Creates \$14.4 Trillion of Value at Stake for Companies and Industries

Value at Stake, according to Cisco, is the potential bottom-line value (higher revenues and lower costs) that can be created or will migrate among companies and industries based on their ability to harness IoE. Cisco predicts that the IoE Value at Stake will be \$14.4 trillion for companies and industries worldwide in the next decade (see Figure 2).<sup>5</sup> More specifically, over the next 10 years, the Value at Stake represents an opportunity to increase global corporate profits by about 21 percent.<sup>6</sup>

In other words, between 2013 and 2022, \$14.4 trillion of value (net profit) will be “up for grabs” for enterprises globally – driven by IoE. IoE will both create new value and redistribute (migrate) value among winners and laggards, based on how well companies take advantage of the opportunities presented by IoE. Those that harness IoE best will reap this value in either of two ways (see “Use Case” section for specific examples):

- By capturing new value created from technology innovation
- By gaining competitive advantage and grabbing market share against other companies less able to transform and capitalize on the IoE market transition<sup>7</sup>

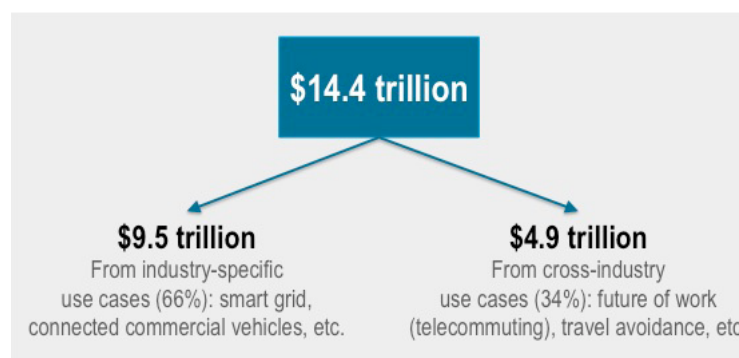
Cisco’s analysis shows that most of the potential Value at Stake (66 percent, or \$9.5 trillion) comes from transformation based on industry-specific use cases such as smart grid and smart buildings. The other 34 percent, or \$4.9 trillion, is produced by cross-industry use cases such as the future of work (telecommuting) and travel avoidance. It is important to note that Cisco is focusing on the amount of private sector Value at Stake to make the findings and insights relevant and actionable for businesses and industries. While a significant number on its own, the \$14.4 trillion does not include potential Value at Stake from the consumer or public sectors, or from societal benefits that are beyond the scope of this analysis.

Cisco calculated the Value at Stake by taking a bottom-up approach considering the value created by more than 50 use cases in the private sector only – both industry-specific and cross-industry – and consolidating them into the 21 most material and

There are five main drivers of the \$14.4 trillion of IoE Value at Stake. These findings allow business leadership to begin planning how they can benefit from IoE.

value-generating examples. Top-down analysis was also performed as a cross-check to validate the completeness and order of magnitude of the more thorough bottom-up approach. Finally, care was taken not to double-count value across use cases.<sup>8</sup>

**Figure 2.** How Much Value Is at Stake in the IoE Economy?



Source: Cisco IBSG, 2013

## 5 Drivers Fuel IoE Value at Stake

There are five main drivers of the \$14.4 trillion IoE Value at Stake. These findings allow business leaders to begin planning how they can benefit from IoE. The amount of Value at Stake is somewhat evenly distributed across each of the five drivers.

- **Asset utilization (\$2.5 trillion)** – IoE reduces selling, general, and administrative (SG&A) expenses and cost of goods sold (CoGS) by improving business process execution and capital efficiency.
- **Employee productivity (\$2.5 trillion)** – IoE creates labor efficiencies that result in fewer or more productive man-hours.
- **Supply chain and logistics (\$2.7 trillion)** – IoE eliminates waste and improves process efficiencies.
- **Customer experience (\$3.7 trillion)** – IoE increases customer lifetime value and grows market share by adding more customers.
- **Innovation, including reducing time to market (\$3.0 trillion)** – IoE increases the return on R&D investments, reduces time to market, and creates additional revenue streams from new business models and opportunities.

The fact that each of these areas has roughly the same amount of Value at Stake suggests that firms must examine how IoE can impact every aspect of their business processes – including both cost-cutting and revenue-raising activities.

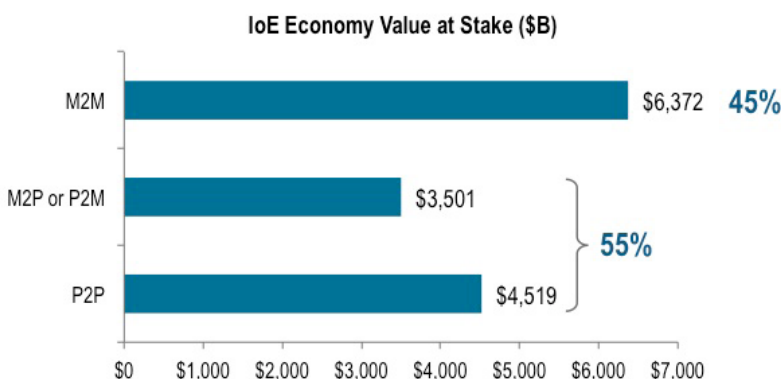
In addition, to benefit from IoE, firms must combine technology-enabled security capabilities (both logical and physical) with policies and processes designed to protect the privacy of company and customer information. IoE's growth potential in the private sector over the next decade will rely heavily upon the success of companies' security and privacy efforts.<sup>9</sup>

The bottom line is that the IoE Economy is about enabling people to be more productive and effective, make better decisions, and enjoy a better quality of life.

## Which Connections Matter Most?

By definition, IoE includes three types of connections – machine-to-machine (M2M), person-to-machine (P2M), and person-to-person (P2P). Combined, P2M and P2P connections will constitute 55 percent of the total IoE Value at Stake by 2022 while M2M connections make up the remaining 45 percent (see Figure 3). It is important to note that while M2M connections are fast becoming a sizable source of value, the end result of these connections is ultimately to benefit people. The bottom line is that the IoE Economy is about enabling people to be more productive and effective, make better decisions, and enjoy a better quality of life.

**Figure 3.** P2M and P2P Still Make Up the Majority of Internet Connections.



Source: Cisco IBSG, 2013

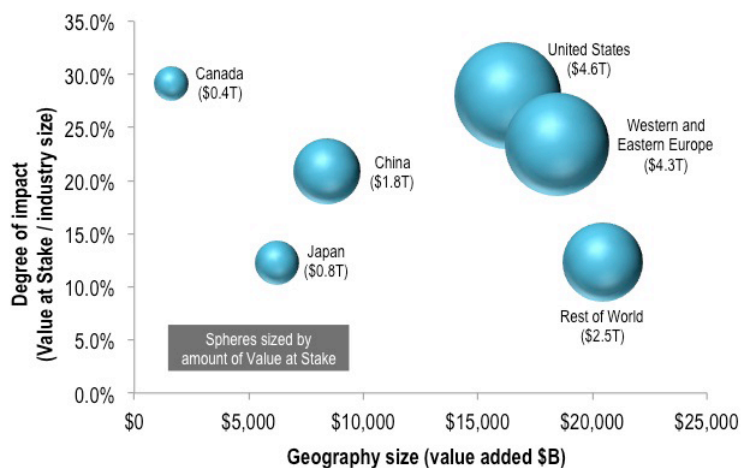
Connected healthcare and patient monitoring provide a great example (more details in the use-case section below). By enriching the connections between medical devices and both patients and doctors (M2P), and among patients and doctors themselves (P2P), better hospital-level care can be provided at patients' homes. This improves quality of life, increases positive medical outcomes, and reduces costs for both providers and patients.

## Value at Stake by Geography and Industry

It is also interesting to look at Value at Stake by geography and industry. By geography, the amount of Value at Stake is well distributed across the major geographies (see Figure 4). Figure 4 also shows the degree of beneficial impact for each geographic region, as determined by dividing the Value at Stake by the size of each region's output. The geographic and industry distributions of Value at Stake are very heavily driven by each region's relative economic growth rate and by the relative size of each industry sector in each region. For example, China's Value at Stake is very heavily derived from its relatively rapid economic growth and its large share of this growth in the manufacturing sector. In the United States and Europe, Value at Stake opportunities are more prevalent in the services areas.

From an industry perspective, four out of 18 industries make up more than half the total Value at Stake.

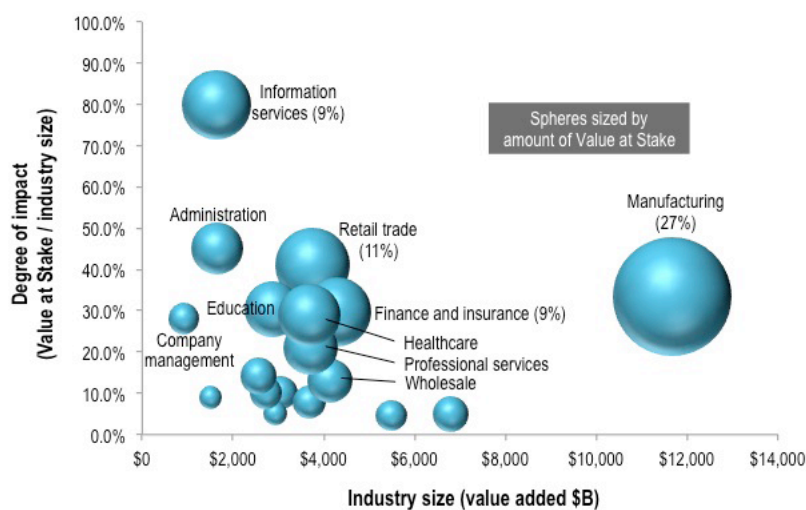
**Figure 4.** Value at Stake Is Well Distributed Across Geographies, Yet Impacts Regions Differently.



Source: Cisco IBSG, 2013

From an industry perspective, four out of 18 industries make up more than half the total Value at Stake (see Figure 5).<sup>10</sup> The amount includes manufacturing at 27 percent, retail trade at 11 percent, information services at 9 percent, and finance and insurance, also at 9 percent. The remaining 14 industries range between 7 percent and 1 percent.

**Figure 5.** The Top Four Industries Make Up More than Half of the Total Value at Stake.



Source: Cisco IBSG, 2013



To receive the most value from IoE, business leaders should begin transforming their organizations based on key learnings from use cases that show how IoE works in the real world.

The industry distribution of Value at Stake is very heavily driven by specific use cases. For example, much of the Value at Stake for manufacturers comes from greater agility and flexibility in factories, and from the ability to make the most of workers' skills. Additionally, a large amount of the Value at Stake for retailers comes from connected marketing and advertising. The top five industries in terms of potential IoE impact represent 63 percent of the total Value at Stake.

## Real-World Use Cases Show the Impact and Potential of IoE

To receive the most value from IoE, business leaders should begin transforming their organizations based on key learnings from use cases that show how IoE works in the real world. The eight use cases featured in this paper, which represent \$6.17 trillion of the \$14.4 trillion total Value at Stake, were selected for their usefulness in helping business leaders determine how to move forward with regard to their companies.<sup>11</sup>

Each of these use cases includes a general description, the amount of contribution to the total Value at Stake, and a comparison of the key use-case attributes in both 2013 and 2022 to highlight the impact of IoE. In addition, each use case describes the value of connections, top IoE drivers, types of connections, IoE technology enablers, and whether value is created or migrated.

### 1. Smart factories: \$1.95 trillion of total Value at Stake

Adding connectivity to manufacturing processes and applications increases factory productivity, reduces inventories with real-time inventory supplies, and cuts average production and supply-chain costs.

Smart factories represent one of the two largest use cases in terms of Value at Stake. The value is largely derived from more intelligent machines that incorporate better sensors, improved connectivity to other machines, and more intuitive interfaces with people. These new capabilities allow machines to be programmed more easily and make them more adaptable to their conditions so they can be more efficient at doing their work. In addition, back-end connections to the cloud for analytics enable more effective integration of labor, capital, and technology.

2013 Current state (without IoE)	2022 Potential with IoE
Automated assembly machines are expensive and complicated to create and install	Reduced costs as automated tools become less expensive to manufacture and implement
Often inflexible and costly product-line changes	Revenues increase with ability to produce multiple products with variations in inputs. Allows for greater customization of products and smaller product-line runs.
Quality controls rely on human perception and dexterity	Sensors help workers improve product quality
Reliance on low-cost manufacturing countries. Employees with IT and data interpretation skills are costly, scarce.	Socialization of knowledge flattens the skills curve; IoE maximizes access to human talent pools at lower cost
Inefficient use of key inputs for production. Lack of flexibility among assembly locations.	Reduced waste (materials, energy). Greater freedom and agility to reallocate production and optimize inputs.

Value in smart factories is obtained from cost-cutting, revenue growth, and better workforce collaboration.

- **IoE value created:** More intelligent design of machines; greater control of instrumentation and production conditions
- **Main IoE driver(s):** Asset utilization, supply chain and logistics
- **Type of IoE connection(s):** Machine-to-machine
- **IoE technology enabler(s):** Machine design tools, production sensors, employee training
- **Value created or migrated:** Migrated from inefficient producers and countries

Value in smart factories is obtained from cost-cutting, revenue growth, and better workforce collaboration. With this in mind, manufacturing leaders should accelerate adoption of IoE technologies and consider initiatives that focus on improved collaboration among workers to make employees more efficient.

## 2. Connected marketing and advertising: \$1.95 trillion of total Value at Stake

Broad IT and social applications for marketing and advertising transform the way companies engage with customers, analyze their behavior, and optimize the impact of their interactions. Examples include location-based services, viral marketing, and mobile advertising.

Today, it is very difficult to create and implement cohesive marketing and advertising strategies across numerous and disparate channels (TV, radio, Internet, point of sale). IoE will enable companies to have a complete view of their customers (behaviors, preferences, demographic profile) and deliver individually targeted messages and offers to them on any device at the time and location where they will have the most beneficial impact. Within this new paradigm, companies can react more quickly by assessing and reacting to their markets in real time; increase profits by offering pricing based on customers' situation and ability to pay; and grow revenues by bundling their offerings with other products and services based on a holistic assessment of customers' wants and needs.

2013 Current state (without IoE)	2022 Potential with IoE
Missed or unidentified sales opportunities	Increased sales from real-time market assessments and reactions
Inefficient geographical selling	Increased sales from location-based selling
Inflexible product lines	Increased sales from better use of Internet-driven "freemium" market segmentations
Lost sales due to shifting competitive pressures and poor timing	Increased sales by directly tying pricing to current selling situation and customers' ability to pay
Little holistic assessment of customers' wants and needs	Increased sales from improved coordination with other products and services (two-sided markets)



Data-driven business agility is at the core of achieving the Value at Stake from connected marketing and advertising.

- **IoE value created:** Assimilation and analysis of customer demographic and purchase histories from multiple sources
- **Main IoE driver(s):** Customer experience, innovation
- **Types of IoE connection(s):** Machine-to-machine, person-to-machine, and person-to-person
- **IoE technology enabler(s):** Cloud computing, Big Data, real-time decision tools, security
- **Value created or migrated:** Both

Data-driven business agility is at the core of achieving the Value at Stake from connected marketing and advertising. Leaders should focus on IoE initiatives that use Big Data and cloud computing to improve decision making across the company. To succeed, every customer-facing department, including marketing, sales, service, and support, must be able to adapt more quickly to rapidly changing customer demands in the IoE Economy.

### 3. Smart grid: \$757 billion of total Value at Stake

An effective smart grid uses network connections – from production to customers – to better understand user behavior and improve the reliability, economics, and sustainability of the production and distribution of electricity.

Utility companies today typically operate on a “best effort” infrastructure: they generate and place energy on the electrical grid without taking full advantage of their assets. This makes the grid vulnerable to faults and allows only for a one-way flow of electricity – from producers to consumers. In addition, the system is inefficient because power generation cannot be easily adapted to fast-changing energy usage cycles. IoE will improve the electric grid by automatically detecting and repairing problems, controlling electrical flows based on real-time demand, improving generator utilization, and enabling more sustainable energy sources such as wind and solar power.

2013 Current state (without IoE)	2022 Potential with IoE
Vulnerable to breakdowns and security threats	Automated detection and self-healing improves reliability of the electricity network
One-way electricity flow	Ability to shape the flow of electricity enables more flexibility and distributed power generation capabilities
Production calibrated only for peak demand, requiring reserves and causing inefficiencies	Demand-side management improves generator utilization and grid efficiencies
Variability in renewable energy sources prevents widespread adoption	Enables more sustainable energy sources such as wind and solar to contribute to the power grid

Value at Stake from the smart grid will come mostly from improved efficiencies and increased reliability of the electrical delivery system.

- **IoE value created:** Connects sensing, measurement, and controls in real time to improve supply and demand alignment, increase reliability, and reduce costs
- **Main IoE driver(s):** Supply chain and logistics
- **Type of connection(s):** Primarily machine-to-machine
- **IoE technology enabler(s):** Integrated network architecture, smart sensors and meters, private cloud computing, security
- **Value created or migrated:** Net reduction in energy costs for all private sector stakeholders

Value at Stake from the smart grid will come mostly from improved efficiencies and increased reliability of the electrical delivery system. For this to happen, however, significant regulatory changes are required. Assuming these changes take place, utility company leaders must be ready to implement initiatives that allow for more flexibility, improved demand-side management, and the enablement of more sustainable energy sources.

#### 4. Connected gaming and entertainment: \$635 billion of total Value at Stake

This use case includes service provider (SP) and software vendor revenues and cash flows from all applications of online gaming and entertainment; it does not include non-revenue-generating gaming activities (such as subsidized advertising).

Connected gaming and entertainment encompasses a wide spectrum of products and services, including games such as FarmVille from Zynga, streaming video from Netflix, and gambling from bwin.party in the United Kingdom. IoE will provide a whole new way for consumers to entertain themselves by allowing them to play with others remotely, select what they want to use on demand, and choose the device they want to use (any device, anytime, any location).

2013 Current state (without IoE)	2022 Potential with IoE
Asset-heavy, dedicated hardware	Asset-light, any Internet-enabled device
Pay for ownership	Pay for access or free
Offline or dedicated networks (cable and TV)	On-demand streaming
Considerable space requirements (casinos)	Digital
Alone or co-located	Together: collaborative, remote, and social

- **IoE value created:** Enhance gaming and entertainment experience with remote collaboration, rich media, and on-demand programs
- **Main IoE driver(s):** Innovation – increased revenue from new business models
- **Types of IoE connection(s):** Person-to-machine and person-to-person
- **IoE technology enabler(s):** Next-generation network, including intelligence, video, collaboration, BYOD, security

For leaders in the gaming and entertainment industries, this use case highlights the importance of focusing on the delivery of content to any device, anywhere.

- **Value created or migrated:** Mix of new value and value migration from traditional providers

For leaders in the gaming and entertainment industries, this use case highlights the importance of focusing on the delivery of content to any device, anywhere. It also shows that close partnerships with SPs are critical to delivering the seamless, high-quality experience customers will expect, and even demand, in the IoE Economy.

## 5. Smart buildings: \$349 billion of total Value at Stake

Smart buildings comprise an intelligent and converged IP network of electronic devices that monitor and control facilities services, including mechanical, electronics, HVAC, and lighting systems in a building, to achieve greater energy efficiencies and cost savings, along with an improved experience for occupants.

IoE allows buildings to create value by bringing together operations that are currently siloed into a single IP-based platform. IoE reduces waste (energy) by greatly increasing the efficiency of building management (HVAC, lighting, safety). Smart buildings also make more efficient use of available space by maximizing occupancy. For example, Cisco estimates that IoE can reduce space requirements for the same number of employees by 40 percent.

2013 Current state (without IoE)	2022 Potential with IoE
Inefficient use of energy leads to high amount of waste and increased costs; energy use not based on true demand or building occupancy	Reduces energy costs by using sensors and energy-efficient systems
Physical monitoring of building systems	Labor savings and increased staff productivity from remote monitoring
No scaling of building management infrastructure across facilities	Costs savings by utilizing shared infrastructure and open protocols
Inconvenience to tenants due to frequent breakdowns and repairs	Improved equipment life from continuous, proactive monitoring and timely maintenance
"One size fits all" occupant experience	Building automation delivers a personalized experience for each occupant

- **IoE value created:** Lower energy costs, lower management and maintenance costs, lower capital expenses
- **Main IoE driver(s):** Asset productivity
- **Type of IoE connection(s):** Machine-to-machine
- **IoE technology enabler(s):** Sensors, cloud computing, video, physical security
- **Value created or migrated:** Value created from next-generation networked systems; value migrated from stand-alone systems and lower staffing requirements

This use case will have a tremendous influence on the commercial real estate and construction markets in the next 10 years. As Smart Building initiatives come to

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fruition, lower operating costs should lead to reduced rents, providing benefits for both building owners and tenants. The IoE Economy should lead to more building renovation and new construction, which will also lead to faster building obsolescence. Commercial real estate and construction leaders will need to begin preparing for these significant shifts in their respective industries.

## 6. Connected commercial ground vehicles: \$347 billion of total Value at Stake

This use case is based on commercial fleet (ground) vehicles that use an integrated platform of control systems to automate tasks such as navigation, path optimization, and logistics improvements.

As vehicles become more connected with their environment (road, signals, toll booths, other vehicles, air quality reports, inventory systems), efficiencies and safety greatly increase. For example, the driver of a vending-machine truck will be able to look at a panel on the dashboard to see exactly which locations need to be replenished. This scenario saves time and reduces costs.

2013 Current state (without IoE)	2022 Potential with IoE
Lost time, money, and fuel due to traffic congestion	Reduced congestion from traffic management and optimization of transportation infrastructure
Reduced fuel efficiency due to sudden acceleration and braking	Improved fuel efficiencies from vehicles intelligently adjusting driving speeds
High accident rate due to human error	Lower accident rates due to vehicle-to-vehicle and vehicle-to-infrastructure communication
High vehicle insurance costs	Insurance premiums based on actual driving patterns
Ad-hoc routing of vehicles	Lower fuel and maintenance costs due to optimized delivery routes

- **IoE value created:** Reduced time lost in congestion, lower accident rates, lower fuel and repair costs
- **Main IoE driver(s):** Supply chain and logistics, asset utilization
- **Type of IoE connection(s):** Machine-to-machine
- **IoE technology enabler(s):** Telematics, sensors, cloud computing, security
- **Value created or migrated:** Both

While the main benefits from connected commercial ground vehicles come from improved logistics, there is also an opportunity for business leaders to improve service quality and consistency, and to realize environmental benefits through lower energy consumption and carbon emissions.

Connected healthcare and patient monitoring involve a fundamental shift in how healthcare providers deliver their services. Billing and insurance processes will also have to change for this Value at Stake to come to fruition.

## 7. Connected healthcare and patient monitoring: \$106 billion of total Value at Stake

IoE will enable better-connected devices and data-driven patient management, resulting in improved healthcare effectiveness and efficiencies.

Many of the inefficiencies in healthcare today are the result of siloed sources of knowledge and information – it is difficult to access all of the relevant knowledge available at the point of care. In addition, many measurements and tests are administered manually. The greater number of sensors and connections in IoE will allow for shorter hospital stays due to smarter home monitoring systems and improved care from standardized treatments that conform to all known best practices.

2013 Current state (without IoE)	2022 Potential with IoE
Long hospital stays to ensure patients can thrive at home after discharge	Reduced costs and improved quality of life from shorter hospital stays, with home monitoring systems that ensure health
Limited number of health conditions with home monitoring capabilities	Wider number of health conditions with home monitoring capabilities
Uncoordinated and manual collection of patient test records	Improved decision making from single electronic collection of patient records
Ad-hoc interpretation of medical test results and conditions	Improved patient care from standardized treatments that conform to best practices
Multiple doctors offer care in an uncoordinated manner	Improved patient care and health outcomes from consolidated, patient-centric views of all treatment aspects

- **IoE value created:** Continuous monitoring of health conditions in a less-expensive home setting; all care aspects consolidated and coordinated
- **Main IoE driver(s):** Asset utilization, supply chain and logistics, and customer experience
- **Types of IoE connection(s):** Machine-to-machine and machine-to-people
- **IoE technology enabler(s):** Medical devices, home IT connections, security
- **Value created or migrated:** Both

Connected healthcare and patient monitoring involve a fundamental shift in how healthcare providers deliver their services. Billing and insurance processes will also have to change for this Value at Stake to come to fruition. Given these changes, business leaders will need to focus on both new technology-driven initiatives and change management, while addressing patients' privacy concerns.

The IoE Economy will give private educational institutions the ability to scale instruction and provide it at a significantly lower cost than not-for-profit institutions . . . .

## 8. Connected private college education: \$78 billion of total Value at Stake

Better application of technologies helps scale teachers, faculty, and educational content; increases new ways of learning; and transforms the educational model – giving students curriculum flexibility to learn at their own pace, anywhere, anytime, using any device.

Today, education is mostly a “physical” experience where professors teach students in classrooms using books. IoE will allow private companies to challenge this traditional model. Even now, early adopters are breaking down physical barriers to make education available to people who previously didn’t have access. IoE will enable new business models, extend professors’ reach, and reduce textbook costs.

2013 Current state (without IoE)	2022 Potential with IoE
Physical classroom environment	Improved access to education by scaling professors and highest-quality content to any device, anywhere
One-time instruction in a single location	Greater accessibility from scaling content and providing recordable and replicable instruction anytime, at any venue
Static, linear content with limited control	Improved quality of education by learning at your own pace, focusing only on relevant content, and viewing richer, interactive material
Accessible only during university and library hours	Improved education from greater availability of professors and content
Search for content (pull vs. push); costly textbooks; designed for one-size-fits-all	Improved education from proactive content (push vs. pull), free materials, and ability to customize curriculum

- **IoE value created:** Extend professors’ reach and scale; enable new business models: scale globally without physical venue constraints; reduce textbook costs
- **Main IoE driver(s):** Customer experience, asset utilization
- **Types of IoE connection(s):** Person-to-person and machine-to-machine
- **IoE technology enabler(s):** Video, mobility, BYOD, collaboration tools, security
- **Value created or migrated:** Increased penetration of the online education model (migration)

The IoE Economy will give private educational institutions the ability to scale instruction and provide it at a significantly lower cost than not-for-profit institutions, which will give for-profit organizations a significant competitive advantage over not-for-profit establishments. And while video and online media are not new to education, in the IoE Economy, they will offer remarkable new capabilities both to improve academic outcomes and extend the reach of quality education to people who have not had access to it. This will have a significant economic impact, for example, by helping address the more technical skills that will be required in the IoE Economy.



“You can’t win if you don’t play. As technology and connectedness accelerate the pace of determining the winners and losers, preparing for IoE is not a question of if, but of when.”

Joseph Bradley,  
General Manager and Senior Director,  
Cisco IBSG Global Research &  
Economics, Communications, and  
Planning Practices

## How To Get Started

While the scope of IoE may seem daunting, there are actually some very simple steps you can take to begin capturing your share of the IoE Value at Stake:

- **Determine where your business is today with regard to IoE.** With the huge number of connections that need to be made among people, data, and things, companies must assess their strengths and weaknesses in the areas of technology skills, business process management, data analytics, connectedness, and security.
- **Understand the role of IT in enabling your company to benefit from IoE.** Using IT to reduce costs has diminishing returns; investing in IT to strengthen and grow the customer base has greater upside potential.
- **Take steps now to maximize your firm’s capabilities in the areas of security and privacy:** As mentioned previously, security and privacy are essential enablers – and potential inhibitors – of IoE’s Value at Stake. IoE security will be addressed through network-powered technology: devices connecting to the network will take advantage of the inherent security that the network provides (rather than trying to ensure security at the device level). Privacy, on the other hand, will require that companies combine technology with effective processes and policies. To benefit from IoE, firms will need to identify new privacy models that meet company and customer expectations.

Most important, firms will need to consider their own internal cultural changes that are necessary to embrace IoE. The value of any IT investment will be determined by the capabilities it enables outside the IT department. The IoE Value at Stake emanates from the marketing, HR, finance, production, sales, and other corporate departments. Therefore, a company’s IT decisions must consider the requirements of these departments. Corporate policies on employment, input-sourcing, and in customer-facing areas may need adjustment to embrace these IoE-driven best practices.

## The Game Is on . . .

Challenges abound for today’s business leaders. The rapid pace of change creates confusion and misinformation, which often leads to poor decision making or, worse, inaction. When combined with price transparency and global supply chains, many of the same technology trends that are ushering in the IoE era are also enabling new entrants to become viable threats in just weeks and months rather than years.

In this environment, winners and losers are determined faster than ever before. With \$14.4 trillion Value at Stake, IoE presents an important opportunity to increase market share, gain competitive advantage, strengthen and grow your customer base, and increase profitability. And because the stakes are high – over 10 years, companies stand to lose more than a year of profits if they do not embrace IoE – the time to act is now.

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## Endnotes

1. Source: Cisco IBSG, 2013.
2. Ibid.
3. Ibid.
4. Cisco defines the Internet of Everything as bringing together people, process, data, and things to make networked connections more relevant and valuable than ever before – turning information into actions that create new capabilities, richer experiences, and unprecedented economic opportunity for businesses, individuals, and countries.
5. Value at Stake differs from Internet Market Size, or total addressable market (TAM). Value at Stake is a forecast of the potential bottom-line value that can be created or that will migrate among companies and industries globally based on their ability to harness the Internet of Everything over the next decade (10-year net present value). Cisco estimates this value at \$14.4 trillion over the next 10 years. By contrast, the Internet Market Size, or TAM, is projected to reach \$4.1 trillion in annual revenue for all participating vendors by 2016. Beyond relevant information and communications technologies (ICT), it includes e-commerce and advertising. Cisco will address \$258 billion (6 percent) of this Internet market (source: Cisco SMO, 2012). Value at Stake includes shifts of benefits among competing firms in an industry; shifts of benefits among different industries; new-to-the-world revenue growth from innovation; cost savings from more efficient processes; and allowances for implementation costs. Value at Stake *does not* include extent of losses at firms that don't transform; consumer or government benefits; social benefits; and value estimates for reduced risk of operations.
6. We selected a period of 10 years because it is a reasonable amount of time for companies to identify, design, and implement changes to capture their share of the IoE Value at Stake. The \$14.4 trillion number is the net Value at Stake. The gross Value at Stake is \$18.7 trillion. In other words, an investment of \$4.3 trillion is required to achieve the net Value at Stake of \$14.4 trillion over 10 years. In addition, Cisco estimates that the \$14.4 trillion in Value at Stake represents an increase in aggregate corporate profit of about 21 percent over 10 years.
7. Cisco estimates that 59 percent of Value at Stake will be new value resulting from technology innovation, while 41 percent will be generated by companies capturing market share from the competition.

8. To illustrate how Value at Stake was calculated, we'll use the example of the "Connected Commercial Ground Vehicles" use case. Cisco's analysis considered two factors: 1) lower costs for fleet owners and 2) the potential revenue increase for service providers. We also projected the penetration of commercial ground vehicles as a percentage of the total global commercial fleet – from lower penetration today (6.3 percent) to estimated penetration of 24.5 percent by 2022. Using research, we then estimated the IoE benefits per commercial vehicle (including fuel efficiency and driver productivity) at \$970 annually. From these benefits, we deducted one-time and recurring costs. We also considered SP revenue opportunities. Based on the same penetration numbers, the analysis also considered new revenue opportunities for SPs, including connectivity and value-added services. To estimate the Value at Stake for SPs, we assumed a conservative average margin of \$12-\$15 monthly. The overall Value at Stake number – \$347 billion – reflects the combined net present value of the benefits for fleet owners and service providers. We believe Cisco is the only company to take this kind of use-case-driven, bottom-up approach to evaluate the opportunity offered by the Internet of Everything.
9. The critical need for security and privacy in IoE is underlined by U.S. President Barack Obama's executive order on cybersecurity, signed on February 12, 2013, which encourages all network operators, companies, and consumers to be cybersmart and cybersecure (<http://www.whitehouse.gov/cybersecurity>).
10. Sources: Global Insight, American Productivity and Quality Center, U.S. Bureau of Economic Analysis, U.S. Bureau of Labor Statistics (all 2012), and Cisco IBSG, 2013. The 18 industries measured for the amount of Value at Stake, in order of size, include: 1) manufacturing; 2) retail trade; 3) information services; 4) finance and insurance; 5) healthcare; 6) educational services; 7) professional, scientific, and technical services; 8) administrative and waste management services; 9) wholesale trade; 10) arts, entertainment, and recreation; 11) other services except government; 12) agriculture, forestry, fishing, and hunting; 13) construction; 14) transportation and warehousing; 15) management of companies and enterprises; 16) real estate, rental, and leasing; 17) mining; and 18) utilities.
11. The \$14.4 trillion in Value at Stake comprises the following use cases and values: 1) smart factories, \$1.95 trillion; 2) connected marketing and advertising, \$1.95 trillion; 3) smart grid, \$757 billion; 4) connected gaming and entertainment, \$634 billion; 5) smart buildings, \$349 billion; 6) connected commercial ground vehicles, \$347 billion; 7) connected healthcare/patient monitoring, \$106 billion; 8) connected private college education, \$78 billion; 9) innovative payments, \$855 billion; 10) wealth management, \$451 billion; 11) improved time to market, \$1.03 trillion; 12) business process outsourcing, \$742 billion; 13) virtual attendants, \$163 billion; 14) supply chain cost savings, \$697 billion; 15) smart farming, \$189 billion; 16) digital signage, \$38 billion; 17) next-generation workers (BYOD, mobile collaboration, telecommuting, VDI), \$2.16 trillion; 18) travel avoidance, \$980 billion; 19) physical and logical security, \$1.09 trillion; 20) next-generation retail bank branches, \$20 billion; 21) next-generation vending machines (digital malls), \$49 billion.




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San Jose, CA

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