Britt Technology Impact Series

THE INTERNET OF YOU:
BETTER LIVING THROUGH CONNECTIVITY

AN OVERVIEW
2013–14

TUCK SCHOOL OF BUSINESS AT DARTMOUTH
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The Britt Technology Impact Series is made possible by a generous donation from Tuck and Dartmouth alumnus Glenn Britt, former CEO and Chairman of Time Warner Cable. With great sadness, respect and gratitude, we honor Glenn Britt — our BTIS founder, a cable industry pioneer and our friend — who passed away in June. Glenn will be greatly missed by all of us at the center and by everyone who knew him.

In giving the gift, Glenn stated: "The role of business people is to understand the possibilities created by new technologies, recognize unmet consumer or business needs they could fulfill, and determine if the new technology and the customer needs can be put together in a business model that makes sense." The Center for Digital Strategies structures the Britt Series so it highlights relevant aspects of a set of technologies, examines business models, and illustrates how consumer and corporate needs are being met.

The 2013–14 Britt Technology Impact Series examined how the physical world is becoming fully embedded with technology in a series titled, "The Internet of You: Better Living through Connectivity." This summary highlights the unique perspectives offered by Britt Series speakers who are leaders in developing and deploying the Internet of Things.

THE INTERNET OF THINGS:
THE FUTURE ARRIVES

The Internet of Things (IoT) has long been a promise of the modern age and with the significant reduction of costs associated with sensor, networking, and data storage, it is finally reaching a tipping point and becoming widespread. The idea of putting connected sensors in everyday objects and controlling those devices or "things" via direct or machine-to-machine methodologies is now a reality, and has widespread implications for individuals, enterprises, and entire industries.

"The Internet of Things is the instrumentation of the physical world."

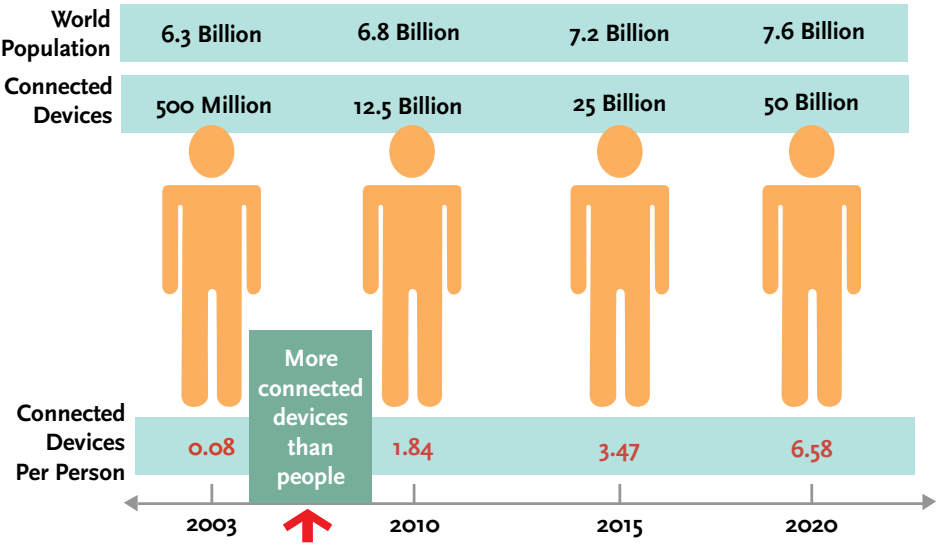
- Chris Rezendes, Founder and President, INEX Advisors

But what exactly is the Internet of Things? Chris Rezendes is the founder and CEO of IoT advisory firm INEX Advisors and works with public and private sector enterprises and entities to develop IoT strategies and capabilities. He explains that the mobile web is merging with embedded technology, which is creating a new world of connected devices. He further clarifies this concept by defining the Internet of Things as "the instrumentation of the physical world."

Just how big is the IoT now and how big will it get? IoT will be really big by almost every account. In a report release in December of 2013, Gartner Research Director Peter Middleton explained that the growth in IoT will far exceed that of other connected devices. By 2020, the number of smartphones tablets and PCs in use will reach about 7.3 billion units. In contrast, the IoT will have expanded at a much faster rate, resulting in a population of about 26 billion units at that time.

INEX Advisors Founder and President Chris Rezendes defines the Internet of Things as "The instrumentation of the physical world" at a Britt Series event in May.

The Internet of Things Was "Born" Between 2008 and 2009



Source: The Internet of Things: How the Next Evolution of the Internet Is Changing Everything, Cisco Internet Business Solutions Group (IBSG), April 2011

Source: Forecast: The Internet of Things, Worldwide, 2013,
http://www.gartner.com/newsroom/id/2636073

Cisco looks at the total number of connected devices to demonstrate the size of the opportunity, arguing that by 2020 we can expect about 50 billion connected devices making up the Internet of Things.

And what is the market worth? Cisco places a $14.4 trillion valuation on the IoT by 2022, coming in the form of both higher revenues and lower costs. With so much value at stake it's no wonder IoT is the big trend dominating the tech landscape.

Rezendes explained the importance of the IoT to the digital and physical worlds, "Everything we think we know about IT, social and mobile, about data privacy, and about business models and the economies of data is about to change."

With so much value and disruption on the table, the IoT is certainly a topic worth understanding.

CONNECTING EVERYTHING (IOT LANDSCAPE)

Talk about the IoT is everywhere, but what exactly does the IoT landscape look like? The diversity of applications and use cases is one of the reasons IoT is set to surpass human-to-human connections and interactions. Chris Briggs, vice president of marketing and development at Buxton, explained that we're reaching a tipping point where tech-generated (machine-to-machine) data is going to outstrip the amount of data humans generate directly.

Looking at the IoT landscape, it is easy to see why. Britt Series speakers from across several industries all discussed the importance of the IoT and explosion of connected devices. The following chart lays out the various sectors, applications and devices that makeup the IoT:

M2M World off Connected Services "The Internet of Things"

Source link: Beecham Research

The diagram above clearly shows that a large portion of the applications and devices that make up the IoT are not consumer products that often dominate headlines, such as Fitbit devices or connected toasters. Instead, the IoT is dominated by industrial, logistical, and other commercial applications.

THE UNSEXY DRIVERS OF IOT GROWTH

The IoT and connected devices have been discussed in some form or another since the Jetsons cartoons of the 1960s, so why are these technologies finally being realized now?

Britt Series speakers gave several reasons for the arrival of the IoT, including:

- Price and availability of the technology components (sensors and connectivity)
- Price of storage
- Compliance requirements
- Emergence of several high-ROI use cases
- The ubiquity of smartphones

Stuart Cornew, T'84 and co-founder of data analytics firm AnswerMine, pointed to the drop in storage and rise of the smartphone as a leading contributor to growth in IoT and big data coming out of IoT applications and services. According to Stuart, "The consumption of PCs is going down like a stone and [smartphones] are what's going to drive the world very fast."

EnergyHub founder and President Seth Frader-Thompson went a step further stating, "It's worth considering that your cellphone is your first wearable and for the foreseeable future will be the most popular wearable."

Christopher Mines, senior vice president of business technology futures at Forrester Research, points out that the increasing software control of the physical world improves business outcomes in three ways:

1. Helps optimize utilization of physical assets and financial assets
2. Differentiates their products and services by incorporating software control into them
3. Helps change the nature of their customer engagement and transforms their customer engagement, in many instances, from a one-time transaction to an ongoing relationship of engagement with customers

Rezendes agrees with Mines, highlighting his four areas for "Awesome ROI" with respect to IoT:

1. Optimize the utilization of an asset
2. Reduce risk
3. Compliance
4. Improving experience of existing customers with existing products and services

Rezendes points out that the reasons for IoT adoption and growth aren't as high profile or sexy as new products and consumer products, but they do generate a significant amount of value for enterprises.

> **"The ripest opportunities for the connected world are ones that are largely out of the spotlight."**
>
> - Christopher Mines, SVP of Business Technology Futures, Forrester Research

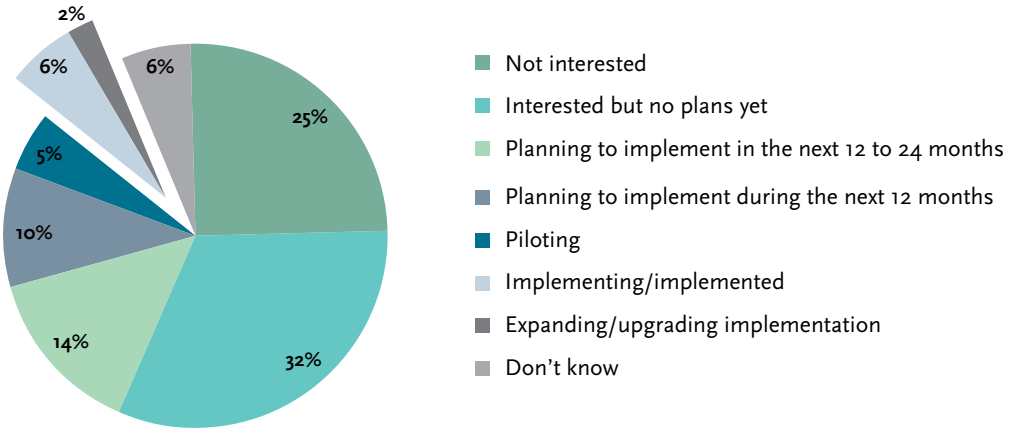
Mines couldn't agree more, stating, "The ripest opportunities for the connected world are ones that are largely out of the spotlight. And what I mean by that is that they're in the guts of industrial and commercial operations. They're in logistics. They're in transportation. They're in warehouses. They're in shipping containers. They are not the highly publicized smart car, smart home, wearable computing. Those are going to get, and do get, a lot of attention, a lot of buzz, a lot of press, a lot of hype from their suppliers. It's these more, dare I say, boring opportunities that are riper, that are nearer term and that represent bigger opportunities for both the suppliers and the buyers of these connected world systems."

Tuck students engage with Christopher Mines of Forrester Research on the topic of the Internet of Things.

WHAT ARE THE ROADBLOCKS?

According to Forrester Research, many firms are just not there yet with respect to the IoT. Adoption of IoT solutions remains limited, as Mines explained in his Britt Series talk. Forrester found that only about eight percent of firms have adopted a true M2M or IoT solution.

What are your firm's plans to adopt M2M/"Internet of Things" solutions or applications?



Source: Forrsights Networks and Telecommunications Survey, Q1 2013

Christopher Mines, SVP of Business Technology Futures at Forrester Research walked Tuck students through the roadblocks to full realization of the Internet of Things at a Britt Series talk in September.

With adoption rates so low, it's important to understand what roadblocks pose the biggest obstacles to widespread adoption. There are several key roadblocks Britt Series speakers identified this year, including:

- Interoperability challenges
- Privacy and security concerns
- Digital rights management / data ownership disputes
- Data usability and cleanliness

Mines shared data on the major concerns Forrester sees, and the concerns outlined by his fellow Britt Series speakers supports Forrester's findings.

What are your firm's concerns, if any, with deploying M2M/"Internet of Things" technologies?

Source: Forrsights Networks and Telecommunications Survey, Q1 2013

Tom Chmielewski of iControl Networks talks wireless standards and protocols for the Internet of Things at Tech@Tuck in February.

ROADBLOCK #1:
INTEROPERABILITY CHALLENGES

Interoperability is a main stumbling block for consumers and end users. A fractured device and platform market prevents the typical IoT consumer from linking various devices and services together in a seamless fashion. Driving the fragmentation is the wide range of standards and protocols used to connect the market.

Several organizations are trying to solve the fragmentation problem, each with a different approach. For some, the solution is a hub or platform for linking devices. Companies like SmartThings, iControl Networks, and Revolv aim to connect home IoT devices, but each works with a specific standard.

Other companies aim to remain hardware agnostic and use open APIs to link services together. IFTTT lets users create or leverage existing 'recipes' based on logical statements (the company gets its name from the 'If This, Then That' logical structure of recipes) that link devices, social media, and even email and web applications. But not every device or platform enables users' access to APIs, meaning workarounds are often created. Those workarounds can open the user up to security risks.

COMMON WIRELESS TECHNOLOGIES

- Wi-Fi
- Bluetooth
- Cellular
- Radio Frequencey Identification (RFID)
- ZigBee
- Z-Wave
- Near Field Communication (NFC)

Most individual consumers aren't savvy or patient enough to navigate the alphabet soup of standards and protocols used to make the IoT work without support, leaving them dissatisfied or disinterested in growing their personal interest in IoT.

With so many options to choose from, a fair question is, "who will be the winners?" Well, it turns out that question has about as many different answers. Some, such as Tom Chmielewski of iControl Networks, believes there won't be a need for a winner because cloud-to-cloud integration will solve the problem for us. Chmielewski points out that each standard has its own advantages and sweet spots, which means there won't be a winner. In the end it's about user experience and seamless functionality.

Rezendes agrees that no one standard will win but disagrees with a cloud-based answer, stating, "The idea that everything is going to be cloud-based is a fallacy." He points to the beginnings of the web as evidence that standards matter, but they tend to coalesce and unify over time. He points to the evolution of the Internet from ARPANET to the World Wide Web to the current mobile world as evidence that the IoT will continue to evolve as the applications and use cases expand and technology advances.

ROADBLOCK #2:
PRIVACY AND SECURITY CONCERNS

When we connect our homes, automobiles, health, financial information, and every other part of our lives, obvious privacy and security concerns come to the surface. Britt Series speakers universally agreed that privacy and security were major concerns, but differentiated between corporate users and individual users when it comes to the acceptance of risk associated with the IoT.

Adam Mayer of Time Warner Cable discusses security and privacy concerns specific to the Internet of Things and Connected Home at Tech@Tuck in February.

Adam Mayer explained how Time Warner Cable placed a huge emphasis on privacy and security, but admitted that, "Privacy is a contradictory topic, because everyone says they don't want to give up their privacy, but we all do it." Discussing the acquisition of Nest by Google, Mayer went on to add, "There is some concern around Google getting into your privacy in your home."

EnergyHub President Seth Frader-Thompson redirected the security debate to national security. His company places constant focus on security because of the risk to the power grid stating, "If you hack into a control system you can spike demand of power on grid and bring the grid down."

Rezendes fears in the race to connect, security and privacy are often secondary concerns lacking the depth necessary for truly creating a secure system, product, or service:

> *"What keeps me awake at night is this idea that we will not go deep enough in understanding that there are many commercial challenges to creating a secure Internet of Things. And one of them is having a level of transparency and persistent penetration to understand exactly where your components are coming from, what their embedded capabilities are, and what the intentions are of the suppliers. That people will just race and connect and do it with a single concept in mind, and then want to pivot three years later and have an architecture that is just completely inappropriate for that pivot."*

Despite the varying views on risk tolerance among consumers, there was universal agreement that most established enterprises are cautious when it comes to security and privacy concerns.

ROADBLOCK #3:
DIGITAL RIGHTS MANAGEMENT / DATA OWNERSHIP DISPUTES

A major challenge emerging from the growth of the Internet of Things is the concept of digital rights management. In other words, who owns the data generated by the IoT? In the industrial setting, Original Equipment Manufacturers (OEMs) were a hot topic in the Britt Series this year.

Currently, OEMs create and retain data ownership because they build the intelligent data gathering technology into their products. This allows OEMs to further introduce revenue generation strategies, such as advertisements, through their products and services.

Rezendes pointed to data ownership disputes as a major roadblock to widespread IoT deployment:

> *"One of the reasons we haven't had this massive deployment of IoT is because he or she that owns that asset and lives in the physical world doesn't own the digital capital. That's one of the reasons why certain enterprises and classes of enterprises haven't deployed this more broadly. It's a digital rights issue."*

Rezendes shared INEX Advisors' approach that they believe offers a future model that allows the asset owner to also own digital capital without sacrificing functionality and opportunities. The model enables the asset owner to make decisions about data access, including the ability to sell partial or complete access to asset data, as advantageous. The Digital Rights Model includes the following four principles:

1. The old paradigms of buyer-seller, customer acquisition, and customer service are under pressure
2. There are multiple parties with specific interests in location, status, performance and potential of these connected assets
3. New privacy and data control policies are enabled by the for-fee, not freemium, business models, where ad revenue is not critical
4. Technologies exist to separate metadata from payload, fixed and variable identities, persistent or transaction-based access, and more

INEX Advisors: Digital Rights Management Model

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Rezendes pointed to the monumental importance of data ownership in an IoT world stating, "He or she who owns the digital capital is going to be the primary disruptor of every domain of human endeavor on planet Earth. Can we find a way to distribute that capital so we have more ideas?"

> **"Who owns the personal data?"**
>
> - Chris Briggs, Vice President of Marketing and Business Development, Buxton

Buxton's Chris Briggs agreed with Rezendes that ownership of data is a big deal and will be a central question that needs to be settled in the near future. Briggs asked the question, "Who owns our personal data?" He believes that there will be an exchange of value-for-value and consumers will be paid for the value they add. He argues that, in some cases, this concept is already working by providing consumers compensation via discounts and monetary incentives.

ROADBLOCK #4:
DATA USABILITY AND CLEANLINESS

Too much data is a common concern for enterprises looking to cash in on the IoT. The volume of data is a real concern.

With so much data being generated and managed by the IoT, data usability and cleanliness is a significant concern. United Healthcare chief product, marketing & innovation officer Yasmine Winkler doesn't feel all industries are ready for primetime with respect to data usability, pointing out that most healthcare companies are not currently ready. "We talk about data, how much we have, but who cares? Because if it doesn't actually turn into information that is utilitarian to anyone, what difference does it make that you have this much data?" said Winkler. She added, "Data integration is going to unlock a whole lot of incredible information for us, but I don't think we're there yet."

Stuart Cornew also pointed to the lack of usability of medical data stating, "The big dataset that is huge, that's a total mess right now is health data...and that's where the big future is."

AnswerMine co-founder Stuart Cornew T'84, discusses the state of data usability and cleanliness at a Britt Series event in April.

Cornew went on to discuss the difficulty in using medical data is its usability and cleanliness. "It's incredibly disorganized. It's filthy and the filth factor is what is going to keep us from extracting value from it for a while."

Cornew cautioned that cleaning up the data is only one part of the equation. Cornew advocates for combining new data sources with existing sources that are well-grounded and understood. One such source is credit data. Cornew explained, "Data alone is not enough to create value. You have to bring in other data sources – be able to build the backdrop. Credit data turns out to be a wonderful backdrop because it's clean, it's very accurate, the rules are very, very well understood about how to use it, and you append your performance data to it. Build your model in that universe."

Rezendes took a different approach, explaining that enabling others to create value from data you collect is a viable option. Rezendes proclaimed, "It's not about what you would do with the data; it's about what others would do with the data to enable you to do something different with your time."

WHAT DOES THE FUTURE HOLD?

The value at stake and wide range of use cases mean the future is bright for the IoT. Because the IoT is still in its infancy, the Google acquisition of Nest Labs was a key point of emphasis across the year. Adam Mayer of Time Warner Cable referenced the entry of Google by stating, "It's a real space. [The IoT] has crossed the chasm from...just techie people to really everyone now trying to figure it out."
Seth Frader-Thompson couldn't agree more, stating, "The legitimacy point cannot be over-stated."

> **"The Internet of Things has crossed the chasm."**
>
> - Adam Mayer, Vice President of IntelligentHome, Time Warner Cable

Several speakers built on the Google entry into the IoT market and offered their take on what is required to fully realize mainstream adoption of IoT. A common theme was ease of use. Adam Mayer of Time Warner Cable summed it up best when he said, "What's really going to take it to the next level is...really making sure it's easy to use for the mass market."

Tom Chmielewski added that "To be the hub of the Internet of Things you have to have the most things." And added that it will be that user experience and consolidation of point solutions in the marketplace.

EnergyHub founder and President Seth Frader-Thompson discusses the Internet of Things during Tech@Tuck in February.

Seth Frader-Thompson adding some much needed perspective on adoption, commenting, "Until the last year, a lot of these things just didn't perform well." He attributed shortcomings to design flaws, specifically explaining that, "The mistake they made was people mixed the network layer and application layer."

Frader-Thompson went on to echo previous speakers by outlining what will take adoption to the next level. He explained his two drivers as, "85–90% convenience and control, number

Buxton's Vice President of Marketing and Business Development Chris Briggs explained the state of retail adoption of IoT technologies at a Britt Series event in October.

one and number two, a split between saving money and saving energy/climate." Beyond the specific drivers, he added, "It's hard to tell what is going to be really big beyond, say, two to three years from now, but the value proposition is just so good."

Stuart Cornew T'84 added his perspective by saying, "What I'm seeing is a much more intelligent network than what we've got today and [mesh networks] will be a part of that. I think that we've got too much cool technology coming down, all with the goal of moving data and making the use of tech a more pleasant experience." He qualified his prognostication by focusing on smart phones, stating, "Software design and interface will...continue to be very important, but it's going to be on these things [smart phones]."

> **"What I'm seeing is a much more intelligent network than what we've got today."**
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> - Stuart Cornew T'84, Co-Founder, AnswerMine

Despite optimism for the future of the IoT, a few speakers provided a reality check. Chris Briggs of Buxton cautioned audience members about the hype in retail by explaining, "Retailers really aren't as far along or advanced as the perception might be."

Finally, Mines of Forrester warned audience members that, "The technology maturity in the connected world is far ahead of the operational and processed maturity of the companies who are putting these systems in place. So this is a complex technology landscape, but it's even harder to change the way your business operates."

The Center for Digital Strategies at the Tuck School of Business at Dartmouth promotes the development and implementation of digital strategies — the use of technology-enabled processes to harness an organization's unique competencies and support its overall business strategies.

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The CDS MBA Fellows contributed project research and conducted exclusive interviews with many of the executives which informed this report. To access the interviews or learn more about the Center for Digital Strategies please visit:
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