

Cloud, IoT, and Smart Homes
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Executive Summary

The last month we were busy attending multiple, often overlapping-theme, events—[CONNECTIONS 2015](#), [IoT Developers Conference](#), and [TiEcon 2015](#)—on Cloud, IoT/T, and Smart Homes. Cloud and IoT/T are showing robust growth, despite the associated privacy and security concerns. Smart Homes, on the other hand, and despite vendors' claims, is still in its infancy, affordable only by the rich. Just having a Nest on your wall, a fitness device on your wrist, or a smartphone in your pocket doesn't make your home Smart; it's half Dumb or half Smart, depending on your point of view. Unless the vendors offer compelling values and products within the reach of the middle class, Smart Homes, often peddled by the Cable Guys (we all know their reputation for Service!) in conjunction with device manufactures, will be a Pipe Dream in the near future.

Smart Homes

By 2020, there are expected to be a multitude of appliances in your home—smart TVs, smart fridges, smart dishwashers, smart laundry washers and dryers, and smart wearables—with a smart handheld device letting you control everything remotely (can you say a fatter Couch Potato?), the fridge nagging you about running out of milk, organic kale, or frozen quinoa, the dishwasher telling you it needs more dishwashing liquid, and the washer/dryer fighting for supremacy. But how guilty would you feel if your fridge starts sending spam or acting as a member of the Botnet Patrol? Last year security firm Proofpoint said it found evidence that IP-connected fridges, toasters, and smart TVs were among more than 100,000 devices used in a massive spam email malware attack!

We don't mean to be all depressing or cynical about it. On the bright side, Smart Homes **DO** have a role to play in improving the quality of our lives: Elderly folks with healthcare wearables needing help in case of emergencies; disabled people being reminded of not taking their prescriptions or running low on consumables so they can seek help; homes equipped with smart-interactive security devices; and pets (and children?) with tags so they can be tracked. But these will take time and infrastructure investments and **are all hackers' potential targets**. Soon after Java technology was introduced by Sun Microsystems in 1995, then-CEO Scott McNealy predicted pretty soon every light bulb would have an IP address; that your appliances will all be on the Web, and one day the lonely Maytag Repairman would show up on your front door offering to replace the bearings in your dryer motor because the dryer prompted him the previous day. Twenty years later, we are still living with inferior-quality, Chinese-made, American brand-name appliances with pathetic Customer Support outsourced to India or the Philippines! This is Globalization!! To paraphrase the late, great Arthur C. Clarke, we overestimate the short-term impact and underestimate the long-term impact of new technologies.

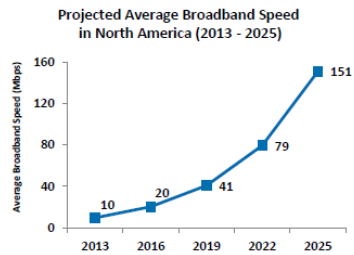


The Future of the Connected Home

[Tom Kerber](#) had some very interesting predictions at CONNECTIONS 2015 on what we can expect in the future.

What to Expect

- Top end U.S. broadband speed of 20 Gbps (2025)
- Average U.S. broadband speed of 150 Mbps (2025)



Impact

- Greater unicast / on-demand use
- Services / features driven from the cloud
- Video-centric world
- Competition and messaging changes for broadband providers

Advanced Authentication

- Biometrics – voice, facial ID
- Smartphone
- Mobility of content and services
- Increased automation of authentication



TiEcon 2015

Keynote: Jack and Suzy Welch

Jack had lot of views on how corporations should be run today.

Don't always look at cost-cutting (nice advice from Neutron Jack!). How can you tell an employee who has been there for 30 years "You are being laid off?" How come they were not given any feedback on their performance earlier? Managers need to communicate with them constantly. If a Manager is not happy with her employee, tell him she'll help him find another spot in the company where he is a better fit. A recent Gallup Poll showed 65% of workers in America would switch jobs if they got an opportunity. In other words, company loyalty is disappearing.

Globalization and jobs moving overseas are irreversible, but don't ship jobs foverseas for purely cost reasons. Find quality employees. "When I was head of GE, we went to India for low labor [costs], but we found high brains," Jack said. Many of the new and innovative products, e. g., an ECG/EKG machine, were developed by GE-India and are now being marketing worldwide.

Keynote: Johan Lodenius, CMO Mediatek

One driving force for IoT is the rapid increase in the middle class of more than 6.4 billion people in emerging countries, which is far more than the 1 billion+ people in developed countries, who want to be connected to the Internet no matter where they are. Instead of being limited by Internet Cafes with desktops to access the internet for goods, services, entertainment, education, and search, they want and expect a seamless Internet access experience via their handheld devices and wearables.

Most surfaces would become touch screens offering ubiquitous cloud interaction with unconstrained bandwidth in envisioning the future.

Mediatek offers a “Cross Mount” platform through which one can control, read, and display any device that one has authorized access to. The significance of such a platform and adoption provides for unification of various devices via seamless access vis-à-vis having disparate devices with their own unique access and the resulting duplication of functions and devices.

Another driver for IoT is the rapid development cycle for products that is offered today and into the future where a designer can develop in four months to bring their ideas to fruition and to the market for a limited initial set of devices enabled by access to the worlds of other designers, on-demand R&D, and manufacturers with 3D printing capabilities, etc. with four additional months for volume production versus 12 months prototype plus 12 months production cycle of the recent past. The shorter development cycle to work with different vendors enabled via the cloud, social media, and the Internet provide for rapid growth in customized IoT applications for consumers and industry for various markets of the world.

Wireless technologies with attractive cost, power, and performance characteristics, along with hardware and software solutions, are big enablers of IoT in wearables, smart home, connected cars, and mobile workplaces with ‘frictionless’ development and adoption across many local and global IoT value chains and markets.

Keynote: Navigating the IoT landscape, Tom Kerber on Director of Research, Parks Associates

Tom’s presentation was centered on the creation of value in the IoT landscape. Actionable data creates ongoing value, and services offered around that will mean that this value can be monetized. Sensors can make a home ‘smart’ and, when coupled with a connected HVAC system, can lead to many energy-monitoring and saving services, including performance monitoring, diagnostics, preventive maintenance, extended warranties, and repair services, all of which can be offered at various price points to the consumer, based on the data collected and analyzed.

The speaker elaborated on the importance of unstructured data in cognitive computing whereby processes such as marketing are enhanced via video and audio analytics for facial and emotional state recognition, activity monitoring, and object recognition. Data mashups further enhance value and lead to value-added services, for instance, by the coupling of general data such as weather and location.

Keynote: Banny Banerjee, Associate Professor and Director, Stanford Change Labs.

Banny’s talk was of a broader vision of IoT which he said required a change of paradigm and a change of the frame of reference of IoT. The broader vision is one of the Internet of Planetary Elements (IoPE). The IoPE is more than just IoT in that it organizes information, and it is a processing system that analyzes processes and behaviors.

IoPE = Identity + Sensing + Connectivity + Data + Interpretation + Control

IoPE is a large ecosystem of possibilities that enables and provides new experiences, new markets, new choices, new behaviors, and new classes of possibilities.

One example of such possibilities is that of a lady heading out from her home to the airport and this ecosystem has the possibility that the door tells her that she is forgetting her passport. A second example would be a person knowing exactly where to poke the needles in their body and do self-acupuncture.

Things are much worse than we think in our planet today and they will worsen further over time if they remained unaddressed and unsolved and grow in complexity. The world’s exponential/non-linear problems

require exponential/non-linear solutions and the IoPE provides these with the necessary scale and speed. Behavior change can be brought about faster than information, e, g., in carbon emissions, water usage, or other

wasteful activities that humankind individually and collectively engages in. The IoPE ecosystem provides behavior change technology. Humans can be thought of as the demand side of the equation and infrastructure as the supply side. The dimension/facet of behavior involves data sensing, context awareness, control systems, ambient interference and interactions, transactions, business models, choices, and architectures. The IoPE is the mechanism for scaled transformation of our world.

Keynote: Nir Eyal, author of *Hooked: How to Build Habit-Forming Products*

Nir presented a fresh perspective on IoT and the devices in IoT. We know that products can change behavior. But what makes products habit-forming? What makes products very successful at changing behavior? A customer is hooked to the use of a product purely out of habit, but we must design products so as to use habit for good purposes. The more the user uses a well-designed product that capitalizes on habit of a person, the more the product solves and meets the user's problems and needs. This frequency of use builds on the habit of use, boosts utility, and value into/of the product. The internal triggers are often negative emotions such as loneliness (Facebook, Instagram, and Tinder), indecision (Google Search) powerlessness, tension, disgust, confusion, fatigue, depression, envy/jealousy or sometimes even genuine curiosity.

$$\text{Behavior} = \text{Motivation} + \text{Ability} + \text{Trigger}$$

Motivation is energy for action. There are six factors that increase motivation:

1. Seeking pleasure
2. Avoiding pain
3. Seeking hope
4. Avoiding failure/loss
5. Seeking acceptance
6. Avoid rejection

Time, money, physical ability, brain cycle, and social status/influence can enable ability. The areas of the brain that influence triggers have been studied by Olds and Milner. Behavior can be reward-seeking and can be looked as the itch we seek to scratch. A stimulus creates this itch or the stress that needs to be satisfied. Uncertainty, longer pause, and some form of variability of rewards create a need that needs to be satisfied. Variable rewards can involve one or more of these three characteristics: tribe, hunt, and self. This can create empathetic, cooperative behavior or competitive behavior. Gambling, for instance, is a hunt for variable material rewards. Twitter offers variable rewards of the tribe. Online games are a way to fulfill search for self-achievement and mastery and competency can lead us to seek the next level of achievement. Addressing our email inbox or to-do list gives us the satisfaction that comes from being consistent, thorough, completing and taking control over tasks. The takeaway is to build variable rewards into the activities that products provide us.

Keynote: Jay Vijayan, CIO, Tesla

Jay's talk was squarely focused on Tesla as a company and its founder's vision and passion to bring an electric car to the mainstream...accelerating the market's transition to sustainable transportation. Product excellence, customer experience, and the right infrastructure are necessary for any company's success. Tesla's Model S holds the enviable record of being the most liked car in *Consumer Reports* beating out all other cars in this category. Tesla's products fit into the IoT space of a connected car and increasingly incorporating sensors and other electronics so as to attain as much of an autonomous, self-driving car as possible.

Tesla's founder Elon Musk is often quoted as saying, "We don't build cars, we build computers on wheels. Detroit recalls cars, we send software patches and upgrades." Tesla's vision currently includes plans for 500,000 cars/year, employing 6,500 people, and also a massive battery plant in Nevada capable of producing 50

GWh annual battery production by 2020. Jay's own vision of IoT includes machines that can think for themselves with safety and security built in even as we advance in artificial intelligence.

Panel – IoT and Big Data/Cloud: Geetha Dabir, VP IoT Intel; Jinesh Varia, Technology Evangelist Amazon Web Services; and John Mathon, WS02

Some data requires storage, retrieval, and analysis in the cloud such as those that are higher up the value chain or stack. One can build them on top of services such as AWS. Airbnb is an example of a business that has been built with cloud providing much of the backbone via data storage, retrieval, and analytics, front-ended with user engagement. Of course, bandwidth and usage of cloud services mean paying entities such as AT&T and Amazon.

There are many business applications where local analytics in the 'fog' is much more appropriate and relevant, for instance, in the HVAC industry for energy-usage monitoring and control. Regardless of whether there is extensive usage of cloud or only local analytics is required, there is value in every layer of the IoT landscape. Customization, personalization, and integration with social media can add value to an application. How well IoT devices are integrated within or without users' ecosystem often determines their value. Customers want to pay for enhanced experiences.

The IoT applications marketplace has tremendous potential. There are 1.4 million applications in the Apple App Store; however, only a few are monetized as customers often do not find a compelling utility in them. So, the lesson to be learned is to provide enhanced value in IoT applications so as to make them much more amenable to adoption and continued use. Cooperation among vendors for standards and interface development and adoption will rapidly proliferate the IoT applications marketplace.

Keynote: Anand Oswal, VP Engineering, Cisco

Very large industries such as Aviation, Oil & Gas, Power Utilities, and Railroads can be transformed and made much more efficient. The numbers are significant in terms of potential revenue for IoT from achieving just 15% improvement in operating efficiency. Analysis by Cisco Consulting Services shows that by implementing a range of IoE-empowered solutions, Oil and Gas companies can capture their share of \$600 billion of value at stake between 2016 and 2025. For a \$50 billion firm, this translates into an 11% bottom line improvement. Digital transformation of these industries can be brought about by key technologies in analytics, data, sensors, wireless and mesh networks, and through solutions developed with key partners. For example, in the Oil and Gas industry Cisco enhances:

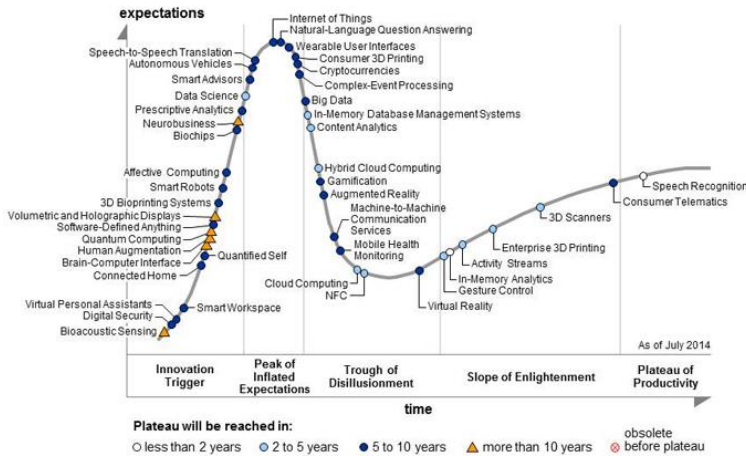
- Remote Operations: Developed with GE, Connected Oilfield solutions increase personnel safety and improve asset integrity with predictive maintenance; real-time analytics at the edge, and virtual expert support to enable faster and better decisions.
- Pipeline Automation: In partnership with Schneider Electric, Cisco's Connected Pipeline solution uses analytics at the edge to improve security and environmental protection with predictive detection of pipeline intrusion, leakage, and deformation.
- Wireless Operations: Developed in partnership with Emerson and Honeywell, the Connected Processing Plant solution improves personnel safety and process efficiency with wireless real-time tracking, video analytics, and automated incident response.
- Secure Operations: Industrial cybersecurity solutions improve security and risk management to combat new and evolving cybersecurity threats, specifically in the process control domain. A good example is a project for Royal Dutch Shell that provides remote proactive monitoring and SLA-driven management of security, applications, and infrastructure.

More data is now generated in one year than what was generated in the last 5,000 years. The world is now people, processes, data, and devices interacting with each other, and it is all about enhancing the experiences of customers. A very basic application can be of self-monitoring of medicine bottles that sense usage and accordingly order refills. Real-time analysis from sensors can improve safety in rails and other transportation

systems. Planting and harvesting can be improved by monitoring atmospheric temperature, soil conditions and properties, and microclimate. Staffing can be improved in retail stores by monitoring customer traffic and optimized placement of store sales associates. Manufacturing can achieve and maintain regulatory compliance through IoT. Smart Cities are possible with the connectivity of IoT sensors and devices.

Conclusions

The three events provided various views of Cloud, IoT, and Smart Homes, albeit there were many overlapping views and themes. As Gartner reported last year, IoT is expected to reach its peak of inflated expectations in 5 to 10 years. In the meantime, vendors will put stakes in the ground and scramble for leadership beachhead.



Source: [Gartner](http://www.gartner.com)