Before the
FEDERAL TRADE COMMISSION
Washington, DC 20580

In the Matter of	)
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Privacy and Security Implications of the Internet of Things	)
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COMMENTS OF
THE CONSUMER ELECTRONICS ASSOCIATION

Gary Shapiro
President & CEO

Laura Knapp Chadwick
Senior Manager, Government Affairs

CONSUMER ELECTRONICS ASSOCIATION
1919 South Eads Street
Arlington, VA 22202
(703) 907-5224

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EXECUTIVE SUMMARY

The Consumer Electronics Association ("CEA") is the principal trade association for the consumer electronics industry with more than 2,000 members, including manufacturers, technology developers, distributors, and retailers. CEA also produces the International CES ("CES"), the world's largest and most important consumer technology trade show. With this unique and critical perspective, CEA welcomes the opportunity to provide input to the Federal Trade Commission ("FTC" or "Commission") staff in preparation for the Commission's November 21 workshop on the "Internet of Things."

Until recently, people used the Internet principally to obtain information, conduct transactions, and communicate and connect with one other. Now, we are beginning to connect physical objects to the Internet and to each other through small, embedded sensors and wired and wireless technologies, creating an ecosystem of ubiquitous computing where "smart" devices securely collect and transmit data to other devices automatically and in real time. The vision of the Internet of Things is jaw-dropping in its expanse and in its potential to improve quality of life across many metrics. If, in the early stages of the Internet of Things, consumers already can use connected wireless technology to remember to take medicine, keep their plants healthy, secure their homes, and save on their electric bills, the examples that the innovators of tomorrow will create range from the life-changing to the unimaginable. Consumers and public officials can use the connected world to improve energy conservation, efficiency, productivity, public safety, health, education, and more. It will enable more smart homes, smart cars, smart appliances, and even new and yet to be invented smart devices. The connected devices and applications that consumers choose to adopt will make their lives easier, safer, healthier, less expensive, and more productive. Today's world already is connected in numerous ways; the evolution of the Internet of Things will build on this foundation and also will serve as a driver for jobs and economic growth.

The Internet of Things depends on the collection and sharing of information among devices, and thus is premised on consumer trust, utility, specific needs, and data. Trust, in turn, relies on confidence in the technology, transparency and the real and perceived consumer benefit. Just as consumers choose how, where, and for what purpose to use connected devices, they will choose how, where, and for what purpose they will share their personal information through such devices. The manufacturers and service providers that are poised to deliver this bright future to consumers understand and take seriously the need for consumer trust, and they are committed to ensuring that consumer privacy is adequately protected in the connected world of tomorrow.

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I. INTRODUCTION

CES is the most popular technology trade show in the world and arguably the most important annual innovation event worldwide.[2] It is the ultimate marketplace, and it is here, each year, that we see the world of tomorrow today. From around the globe, more than 3,000 companies display an awe-inspiring vision of the future. The hallmark of CES is innovation, the lifeblood of technological evolution. Our members and exhibitors are risk-takers; they think outside the box and strategize solutions to problems we did not even know we had. Just as the

[1] *See* FTC News Release, *FTC Seeks Input on Privacy and Security Implications of the Internet of Things* (Apr. 17, 2013), http://www ftc.gov/opa/2013/04/internetthings.shtm.

[2] *See generally* GARY SHAPIRO, NINJA INNOVATION: THE TEN KILLER STRATEGIES OF THE WORLD'S MOST SUCCESSFUL BUSINESSES (2013).

world we live in today is unrecognizable to that of just 20 years ago, we cannot imagine how the world will work 20 years from now.

In particular, the technological progress demonstrated at the 2013 CES has the potential to change the world. Walking the show floor, visitors saw a vision of a connected world—an "Internet of Things"—that soon will be here. In the Central Hall of the sprawling Las Vegas Convention Center, traditional consumer electronics manufacturers showcased connected refrigerators, washers, dryers, thermostats, and other appliances, as well as mobile devices. In the North Hall next door, visitors saw connected cars with open app development platforms, voice controlled interfaces, automatic crash response, 4G LTE connectivity for streaming audio and social media, concierge services, and even a "driverless," automated functionality. The South Hall featured sensors and more sensors, each tinier than the last, connecting devices of all kinds to the network and each other—sensors for gardening, air quality, navigation, traffic monitoring, safety, and more. Two miles away at the Venetian Las Vegas Hotel, 150 start-up entrepreneurs, exhibiting in the "Eureka Park" section of the show, showcased new technologies and services at the forefront of innovation, many of which may grow and develop into the next breakthrough in the Internet of Things. The 2013 CES also featured multiple "tech zones," focused on areas such as digital health ("one of the fast growing markets where health, wellness, and technology converge [with] solutions for diagnosing, monitoring, and treating a variety of illnesses … games that reinforce healthy behaviors and sensors that let people take more responsibility for their own health …."), fitness tech ("hundreds of ways to use technology to make your workouts and outdoor activities more fun, safer, and more effective …focus[ed] on the newest innovations and tools for the sports enthusiast and spotlight[ing] key trends …."), higher ed ("a collaborative, connected, and very dynamic environment depending on experiential

learning, online courses, and cloud based tools … a 21st century campus involves everything from eliminating printed text to being able to take the best classes from the best minds in the world, wherever they be … [v]irtual simulations, new enhanced whiteboard experiences, social networking, and Just in Time course materials revitalizing education ….”), and other areas.[3]

This is the next phase in the development of the Internet and the World Wide Web. Until recently, people used the Internet principally to obtain information, conduct transactions, and communicate and connect with one other. Now, we are beginning to connect physical objects to the Internet and to each other through small, embedded sensors and wired and wireless technologies, creating an ecosystem of ubiquitous computing where “smart” devices securely collect and transmit data to other devices automatically and in real time.

The vision of the Internet of Things is jaw-dropping in its expanse and potential: multitudes of devices communicating with each other to improve quality of life across many metrics. It is a chance to make a difference in people’s lives. And if, in the early stages of the Internet of Things, consumers already can use connected wireless technology to remember to take medicine, keep their plants healthy, secure their homes, and save money on their electric bills, the examples that the innovators of tomorrow will create simply are unimaginable. As one such innovator, zero2one founder Monisha Perkash, has observed, “we are at a unique moment in time where we can combine emerging technologies, data and intelligent algorithms to empower each of us to do the little things in life that can dramatically improve our lives.”[4]

It is CEA members and other CES exhibitors that manufacture the products and provide the services that comprise the backbone of the Internet of Things. At CES, these innovators

[3] *See* CES TechZones, International CES, http://www.cesweb.org/Show-Floor/CES-TechZones.aspx#4jump (last visited June 10, 2013).

[4] *See* Regina Sinsky, *Demo: LUMOback has a mobile solution for perfect posture*, VentureBeat, Sept. 14, 2011, http://venturebeat.com/2011/09/14/demo-lumoback-has-a-mobile-solution-for-perfect-posture/.

displayed "smart" devices and software of every kind – ranging from audio-visual equipment and gaming platforms to home appliances, mHealth devices, educational content, and interactive automotive software. Nearly 1,000 exhibitors—a third of all exhibitors—self-identified in the category of "Connected Home." Another 283 identified as "Digital Health and Fitness," and still another 307 identified as "Embedded Technology – Wireless and Wireless Devices."[5]

The most important personalized, customizable, accessible, user-friendly components of the Internet of Things are smartphones and tablets, which serve as a platform for consumer control. Smart phones and tablets have, in fact, acclimated consumers to smart, connected devices and thus have accelerated the deployment of the Internet of Things.[6] For example, between 2008 and 2009, less than a year after Apple introduced the iPhone, the number of "things" or "objects" connected to the Internet had even surpassed the number of people using the Internet.[7]

This trend will continue–by some estimates, there will be as many as 25 billion connected devices worldwide by 2015 and as many as 50 billion connected devices worldwide by 2020.[8] Beyond smart phones and tablets, over the next decade, as the cost of inexpensive, small sensors

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[5] Exhibitor Directory, International CES, http://ces13.mapyourshow.com/5_0/search.cfm (last visited June 4, 2013).

[6] Stacey Higginbotham, *Enjoying the Internet of Things? Thank Your Smartphone*, GigaOm, Nov. 16, 2012, http://gigaom.com/2012/11/26/enjoying-the-internet-of-things-thank-your-smartphone/.

[7] Cisco Internet Business Solutions Group, *The Internet of Things: How the Next Evolution of the Internet is Changing Everything*, at 3 (Apr. 2011) [hereinafter Next Evolution of the Internet White Paper]; *see also* Melanie Swan, *Sensor Mania! The Internet of Things, Wearable Computing, Objective Metrics, and the Quantified Self 2.0*, 1 JOURNAL OF SENSOR AND ACTUATOR NETWORKS 217, at 217 (2012). In January 2013, comScore reported that over 129.4 million Americans owned smartphones, representing a 55 percent market penetration. Press Release, comScore, *comScore Reports January 2013 U.S. Smartphone Subscriber Market Share*, Mar. 6, 2013, http://www.comscore.com/Insights/Press_Releases/2013/3/comScore_Reports_January_2013_U.S._Smartphone_Subscriber_Market_Share. And the app economy, which did not exist before the mass consumer adoption of smartphones, is now a $25 billion industry. John Koetsler, *Apple will take 65% of the global $25 billion app economy in 2013, analyst says*, VentureBeat, Mar. 12, 2013, http://venturebeat.com/2013/03/12/apple-will-take-65-of-the-global-25-billion-app-economy-in-2013-analyst-says/.

[8] Next Evolution of the Internet White Paper, *supra* n. 7 at 3; *see also* Organization for Economic Cooperation and Development, *Machine-to-Machine Communications: Connecting Billions of Devices*, OECD Digital Economy Papers, No. 192, at 7, 8 (Jan. 2012), http://dx.doi.org/10.1787/5k9gsh2gp043-en. CEA estimates that over 111 million smartphones and 80.1 million tablets shipped in the U.S. in 2012, up from 87.4 million smartphones and 31.9 million tablets that were shipped the year before. 2013 will bring even more.

continues to decline and more Internet Protocol ("IP") addresses become available to connect devices to the Internet, the number of connected devices will explode.[9] These sensors and actuators will continue to connect "things" that are fixed and mobile, large and small, animate and inanimate,[10] including home appliances, industrial and agricultural equipment, livestock, automobiles, parking meters, bike rental stations, roads, highway signs, traffic lights, retail merchandise, heart monitors, and ingestible health monitoring devices.

This connected world, the Internet of Things, will change lives in tens of thousands of different ways, driven by consumers' choices and preferences. And just as consumers choose how, where, and for what purpose to use connected devices, they will choose how, where, and for what purpose they will share their personal information through such devices. Different individuals will choose to adopt different applications of these new forms of connectivity, some of which will rely on the transfer of information between and among devices. As discussed in more detail below, the increased connectivity of the Internet of Things will transform consumers' lives and drive economic growth, premised on consumers' trust in the benefits of such services and the information necessary to facilitate them. The manufacturers and service providers that are poised to deliver this bright future to consumers understand and take seriously the need for consumer trust. They are committed to ensuring that consumer privacy is adequately protected in the connected world of tomorrow in part because of their inherent interest in protecting their brand—a company's most valuable asset—and the goodwill associated with it. But there is an even greater reason: the Internet of Things is the new world order and a new opportunity to

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[9] Elaine Pittman, *Why the Internet of Things Needs IPv6*, Government Technology, Apr. 18, 2013, http://www.govtech.com/policy-management/Why-the-Internet-of-Things-Needs-IPv6.html; *see also* Joseph Bradley et al., *Embracing the Internet of Everything to Capture Your Share of $14.4 Trillion*, Cisco Systems, Inc., at 2 (2013) [hereinafter Embracing the Internet of Everything].

[10] Hakima Chaouchi, ed., *The Internet of Things: Connecting Objects to the Web*, John Wiley & Sons, Inc., at xii (2010).

grow and expand. As such, protecting consumer privacy makes good business sense. If some companies exceed the limits of what consumers expect in terms of privacy, then market mechanisms, including penalties such as customer abandonment or rewards in terms of growth, will align companies' practices with consumers' expectations. Moreover, existing approaches to privacy, including self-regulatory efforts and the Commission's Section 5 authority to protect against unfair and deceptive practices, will be sufficient to address privacy concerns that develop. In this evolving area, the Commission's primary goal should be to avoid taking any action that would prevent the flourishing future demonstrated at CES and beyond.

II. INCREASED CONNECTIVITY WILL TRANSFORM CONSUMERS' LIVES

The vision displayed at CES was clear: the connected world has enormous potential to transform consumers' lives. Its seamless connectivity, made possible by increased processing power and tiny sensors, will enable machines and devices to respond to conditions and situations pursuant to parameters dictated by a consumer—for example, increasing power to the freezer at a time of day when energy costs are low. Consumers and public officials can use the connected world to improve energy conservation, efficiency, productivity, public safety, health, education, and more. It will enable more smart homes, smart cars, smart appliances, and even smart devices we cannot imagine today. The connected devices and applications that consumers choose to adopt will make their lives easier, safer, healthier, less expensive, and more productive. As discussed below, today's world already is connected in numerous ways. The evolution of the Internet of Things will build on this foundation.

A. EXAMPLES OF TODAY'S CONNECTED WORLD

Consumers already have embraced connected devices and applications, and they are experiencing all the benefits of today's connectivity, such as home automation services, energy management and conservation, enhanced medical care, and others.

1. THE SMART HOME

When HGTV creates a sweepstakes contest for its "smart home" of the year, we know the connected home is here to stay.[11] Over the last few years, manufacturers and service providers have grasped the opportunity to meet consumer demand in the most personal of spaces, the home. They have begun to offer new, innovative connected appliances and home automation services that control door locks, lighting, security cameras, window treatments, pools, and entertainment components. Even cooktops, toilets, faucets, bathtubs, showers, and mattresses can be programmed with customized, connected options. All of this can be based on an individual's or household's lifestyle and routine.

For example, connected thermostats, such as those offered by CEA member Honeywell, allow consumers to control the temperature of their homes from a smartphone app, whether they are at home or away.[12] Connected thermostats also can automatically notify homeowners via smart phone if the humidity at home is too high or too low, allowing consumers to adjust the settings remotely to conserve energy and save on costs.[13] Another company exhibiting at CES, Koubachi, offers a Wi-Fi sensor that monitors indoor climates to optimize plant care. This sensor detects the temperature and humidity around plants and alerts the user if the plants need water, mist, sun, or shade.[14] Consumers also can purchase appliances that record their energy

[11] *See HGTV Smart Home 2013 Giveaway*, HGTV, http://www.hgtv.com/hgtv-smart-home-2013-giveaway/package/index html (last visited June 4, 2013).

[12] *See* Total Connect Comfort Services, Honeywell, http://yourhome.honeywell.com/home/Products/Accessories/Total+Connect+Comfort+Services/Total+Connect+Comfort+Services htm (last visited June 10, 2013); *see also* Natt Garun, *Kuhl Air Conditioners Will Soon Be Controlled by Your Smartphone*, Digital Trends, June 5, 2012, http://www.digitaltrends.com/lifestyle/kuhl-air-conditioners-will-soon-be-controlled-by-your-smartphone/; Wi-Fi 7-Day Programmable Touchscreen Thermostat, Honeywell, http://yourhome.honeywell.com/home/Products/Thermostats/7-Day-Programmable/RTH8580WF.htm (last visited June 10, 2013).

[13] *See id.*

[14] *See* Koubachi, http://www koubachi.com/features/sensor?locale=en (last visited June 10, 2013).

consumption,[15] refrigerators that can count and display the number of times the door is opened and alert home owners via a smart phone app when the door is ajar,[16] and washers and dryers that allow consumers to start a cycle on the way home from work.[17] These connected appliances offer consumers convenience, richer information to help reduce energy use and costs, and additional control over the appliances in their homes.

Connected devices also are enhancing consumers' safety. Connected alarm systems allow homeowners to arm a security system after leaving the house and receive alerts when they forget to turn on the system or if motion is detected within.[18] Home automation services also allow homeowners to turn on lights when coming home late, check in on their pets and children via security camera, unlock the front door for a house sitter, and ensure that the garage door is closed after leaving the house.[19]

2. SMART METERS

A fully deployed smart electrical grid will conserve energy and save consumers money by monitoring power consumption throughout the day and recommending usage of certain home appliances when power is least expensive. Smart meters are a central component of the smart grid, an electrical power distribution network that includes two-way digital communications between energy producers and consumers. According to the Institute of Electric Efficiency, one-

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[15] *See* Thomas Ricker, *LG Thinq linqs your smart appliances with WiFi and smartphones*, engadget, Jan. 4, 2011, http://www.engadget.com/2011/01/04/lg-thinq-linqs-your-smart-appliances-with-wifi-and-smartphone-ap/.

[16] *See id.*

[17] *See, e.g.*, Natt Garun, *Demoing the App-Controlled Samsung Washer and Dryer*, Digital Trends, Aug. 3, 2012, http://www.digitaltrends.com/mobile/demoing-the-app-controlled-samsung-smart-washer-and-dryer/; Darrell Etherington, *LG's Smart Home Gets A Lot Smarter In 2013, The Company Reveals Its Vision at CES*, TechCrunch, Jan. 7, 2013, http://techcrunch.com/2013/01/07/lgs-smart-home-gets-a-lot-smarter-in-2013-the-company-reveals-its-vision-at-ces/.

[18] *See, e.g.*, Press Release, AT&T, *AT&T Digital Life Launches in First 15 U.S. Markets*, Apr. 26, 2013, http://www.att.com/gen/press-room?pid=24112&cdvn=news&newsarticleid=36356; Home Monitoring and Control, Verizon, https://shop.verizon.com/buy/Monitoring-Energy-Saving/Home-Control/Verizon-Home-Monitoring-and-Control/cat30006 (last visited June 10, 2013).

[19] *See id.*

in-three households had a smart meter as of May 2012.[20] The Institute estimates that approximately 65 million smart meters will be deployed by 2015.[21]

Connected smart meters also have provided consumers with unprecedented access to their household energy usage data, which consumers can use to better manage their energy usage, set spending and usage goals, and receive notifications when their energy usage exceeds set limits. The energy industry launched the Green Button initiative in January 2012, which allows customers to securely download their own energy usage information in an accessible manner. (Utilities have committed to providing the "Green Button" to 27 million households.[22]) Not only have smart meters provided consumers greater control over, and information regarding, energy usage than ever before, but they also have enabled utilities to offer rewards programs that lower energy costs if consumers reduce energy use at specific times.[23]

In addition to providing benefits directly to individual consumers, smart meters transmit data regarding power outages to utilities, thus enabling utilities to expedite power restoration efforts and manage power outages, ultimately reducing the time consumers are without power.[24]

3. CONNECTED HEALTH

For many years, individuals suffering from illness or injury have looked to technology to improve their lives. Connected devices represent a breakthrough for those with chronic diseases, as well as for individuals seeking to maintain good health and athletes focused on monitoring and improving their performance. For example, Abiogenix offers the u box, a connected

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[20] *See Utility-Scale Smart Meter Deployments, Plans & Proposals*, Institute of Electric Efficiency, at 1, May 2012, http://www.edisonfoundation.net/iee/Documents/IEE_SmartMeterRollouts_0512.pdf.

[21] *Id.*

[22] *See* About, Green Button, http://www.greenbuttondata.org/greenabout html (last visited June 10, 2013).

[23] *See, e.g.*, BGE Smart Energy Rewards, BGE, http://www.bge.com/smartenergy/smart-energy-rewards/pages/default.aspx (last visited June 10, 2013).

[24] Press Release, Institute of Energy Efficiency, *IEE Report Finds Growing Smart Meter Installations, Benefits*, May 16, 2012, http://www.edisonfoundation.net/iee/newsevents/Pages/2012-05-16.aspx.

medicine storage device that tracks when a user takes his medication, sends reminders when he does not, and, at the user's option, can send alerts to caregivers or relatives if a dose is missed.[25] Verizon Telematics produces LifeComm, a wearable cellular device that monitors the user's activity for falls and other situations requiring emergency response. In addition, iHealth sells the Pulse Oximeter, which clips onto a person's finger and measures blood oxygen levels and pulse rate. The device can be used by people with breathing difficulties and by athletes who engage in altitude sports, enabling them to monitor their condition.

Manufacturers of connected devices are making other products that help consumers improve their health and fitness. For example, zero2one has developed a sensor and software that encourages good posture.[26] The product, LUMOback, uses a wireless sensor to track a user's body position. It vibrates to alert the consumer when he slouches and tracks the posture over time so he can measure his improvement.[27] Another company, Basis Science, sells a wrist watch with an activity monitor that tracks heart rate, motion, perspiration, and skin temperature. Finally, Fitbit offers a wearable band that tracks calories burned, steps taken, and sleep patterns. The device can collect data about how long and well a user sleeps and can wake the user up with a silent alarm.

B. EXAMPLES OF TOMORROW'S CONNECTED WORLD

It is well understood that a technology company or even an entire sector must "innovate or die." To stay alive in an era of round-the-clock technological evolution, the companies exhibiting at CES and many others have devoted significant time and resources to producing the

[25] *See* Scott Jung, *Abiogenix's uBox Reminds You to Take Your Medication On Time*, MedGadget, Jan. 25, 2013, http://www.medgadget.com/2013/01/abiogenixs-ubox-reminds-you-to-take-your-medication-on-time.html.
[26] *See* How LUMOback Works, LUMO, http://lumoback.com/product/ (last visited June 10, 2013).
[27] *See id.*

connected world of tomorrow. More is yet to come, as innovation flourishes to take advantage of improvements in technology, and as consumer demand grows for "the next big thing."

1. THE EVEN SMARTER HOME

While home automation services available today provide consumers with increased control of their homes, convenience, and safety, in the very near future smart homes will entirely transform the way we live. The smart refrigerator will be able to catalog its contents using RFID tags or image recognition technology and will alert the owner via smart phone app when a given item is past its best-by date or is running low. In addition, the owner may be able to use a smart phone app to communicate directly with the refrigerator and receive a grocery list, automatically generated based on past purchases and the current items in the refrigerator. A refrigerator that catalogs past purchases and current stored products could provide, at the owner's request, information regarding sales or coupons. Based on refrigerator contents, it could deliver recipes to the owner's tablet. The refrigerator also may communicate directly with the smart electric meter, responding to a set user preference to increase power in the freezer when real-time energy prices are at their lowest, lowering the consumer's costs dramatically.

A smarter home also may identify smart phones present in the house to determine which individuals are at home and adjust temperatures accordingly, based on those individuals' preferences. The smart home could automatically turn off certain pre-programmed lights when all individuals leave, or, by collecting and analyzing light usage patterns, offer this same capability without requiring the homeowner to program the system. A security camera outside could identify, for example, a delivered package, an incorrectly parked car, visitors at the door, or suspicious activity at night. The automated system could then notify the homeowner via the homeowner's preferred method (*e.g.*, smart phone app, e-mail, or text message) and, in the case of suspicious activity, offer to notify the police immediately. Finally, another CES exhibitor,

iSmart Alarm, is developing a security system with motion sensors, contact sensors, and remote tags that can be used to monitor children and possibly pets. Individuals will control the system through an app on a smart phone or tablet. Most importantly, the smart home of the future will bring parents the knowledge that their children are safe and sound in bed.

2. SMART CARS

Connected cars can improve an individual's driving experience, including navigation and entertainment, and also make the roads safer for everyone. They also are projected to provide $600 billion in value by 2020.[28] Today, connected cars offer real-time vehicle diagnostics to drivers and service facilities; Internet radio; navigation, weather, and traffic information; automatic alerts to first responders when airbags are deployed; and smartphone control of the starter and other aspects of the car.[29] In the future, particularly as they are increasingly able to connect with each other, connected cars will offer even more.

If broadly adopted, connected cars could collect precise traffic data regarding their location and speed and share it with nearby cars to avoid collisions. In addition, connected cars may automatically search for and reserve available parking spots and, eventually, may park in a spot on their own after depositing the driver at her location. Communication between cars and city infrastructure may enable traffic light synchronization and optimization, which would, for example, ensure that drivers do not idle unnecessarily at traffic lights when there is no cross traffic. Further, consumers may choose to disclose data regarding their driving patterns to insurance companies in order to lower insurance costs through pay-as-you-go plans. Under such

[28] *See* Press Release, GSMA, *Mobile Connectivity in Cars Will Be the Top Connected Application in 2020*, Feb. 27, 2012, http://www.gsma.com/newsroom/gsma-announces-the-business-impact-of-connected-devices-could-be-worth-us4-5-trillion-in-2020/.

[29] *See, e.g.*, AT&T, *The Connected Car* (2012), http://www.att.com/Common/about_us/pdf/att_connected_car.pdf.

plans, infrequent drivers would be charged based only on the amount of driving they actually do, offering significant savings.

Car manufacturers also have experimented with facial recognition technology to increase consumer convenience and safety. For example, developers are working on applications of facial recognition technology that would allow a consumer to control his radio merely by blinking at the radio, reducing the need for the consumer to take his hands of the wheel and eyes off the road.[30] Software developers are also hoping to use facial recognition technology in life-saving automotive applications that would detect drowsy drivers before they fall asleep at the wheel.[31] In tomorrow's smart car, consumers may be able to choose facial recognition as a tool to unlock the car and verify the driver's identity, creating a strong theft deterrent that would also eliminate the need to carry keys.[32]

In the future, smart cars also may communicate with smart homes. Through machine-to-machine communication, consumers could enjoy a service that would automatically open garage doors, turn on lights in the home, and turn up the air conditioning when they pulled in the driveway. A smart hybrid electric car could combine time and geolocation information, including historical information, to determine when the driver is heading home for the night and thus use electricity, rather than gas, knowing that the car would soon be close to a power source at home. When home, this car, like smart appliances, could communicate with the home's smart meter and select to recharge at times that energy usage is cheapest, providing consumers' with significant cost-savings.

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[30] *See, e.g.*, Ben Mack, *Toshiba Brings Facial Recognition to Cars*, Wired, June 1, 2009, http://www.wired.com/autopia/2009/06/facial-recognition/.

[31] *See id.*

[32] Google offers a similar feature to unlock smartphones with Android 4.0. *See* Android, *Introducing Android 4.0*, http://www.android.com/about/ice-cream-sandwich/.

3. MOBILE PAYMENTS

The Internet of Things may ultimately enable the purchase of grocery items, time on a parking meter, or even charitable contributions through seamless mobile payments. Mobile payments, which use a smartphone to conduct point-of-sale transactions,[33] are estimated to reach $90 billion in 2017, up from just $12.8 billion in 2012.[34] Initially, mobile payments may serve as a consumer's substitute for physical credit and loyalty cards. As mobile payment systems are further deployed, however, companies may use consumers' transaction data, with consumer consent, to offer innovative benefits, such as valuable loyalty and rewards programs. By giving consumers the option to share their transaction information, merchants can use mobile payment information to provide an enhanced shopping experience similar to that in the online world, where merchants can provide advertisements and discounts for products that would be of interest to the consumer.

In the future, mobile payments technology may one day serve as an effortless and automatic payment mechanism. For example, after a smart car identifies and reserves an available parking spot, the driver could pay for the spot simply by pressing "accept charge" on her mobile phone. Retail outlets that have incorporated RFID tags into their inventory could offer a rapid self-checkout lane, where consumers who have an accepted mobile payment platform can simply exit the premises with the merchandise, without having to wait in line.

4. CONNECTED HEALTH

Connected devices also will have increasingly dramatic effects on heath and public safety. Later this year, iHealth will offer a wireless smart glucose monitoring system which

[33] As the FTC is aware, the online payment industry is experimenting with many technologies, business models, and partnerships. *See* FTC Staff Report, *Paper, Plastic…or Mobile? An FTC Workshop on Mobile Payments*, at 17 (Mar. 2013).

[34] *See* Denée Carrington, Forrester, *U.S. Mobile Payments Forecast 2013-2017: Mobile Payments to Reach $90B by 2017*, Jan. 16, 2013, http://blogs forrester.com/denee_carrington/13-01-16-us_mobile_payments_forecast_2013_2017_mobile_payments_to_reach_90b_by_2017.

measures the user's glucose levels and sends the results via Bluetooth to the user's iPhone.[35] The user can monitor trends in glucose levels and through his smartphone app set reminders to follow a testing schedule.[36] This type of development, which may be a convenience for a patient in an urban environment, may represent life-saving technology for a patient in a rural area without proximate medical care.

In the future, increased connectivity will improve the lives of diabetic patients even more. Diabetics could use sensors to monitor and report glucose levels to their smartphone apps and, at their option, directly to their doctors. Analyzing current and historical trends and patterns, the app could predict – and help prevent – diabetic attacks, providing daily recommendations and warnings before an attack so that the user can take preventive measures. To the extent the user has a significant attack, the wireless sensor could immediately contact first responders and/or loved ones and provide them with his location and symptoms.

Connected sensors offer the ability to monitor behavior and symptoms in real-time, without a substantial cost, providing unprecedented benefits to individuals and to society as a whole. With respect to individuals, the connected monitoring devices can improve quality of life and safety by providing a richer source of data to the patient's doctor for diagnosis and treatment. With respect to society as a whole, connected monitoring devices can improve disease prevention, making the healthcare system more efficient and driving costs down. They also can provide an incredible wealth of data, revolutionizing medical research and allowing the medical community to better treat, and ultimately eradicate, diseases.

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[35] *20 Gadgets From CES 2013 To Help You Stay Fit And Healthy*, CoolThings.com, Jan. 15, 2013, http://www.coolthings.com/health-and-fitness-gadgets/.

[36] *See id.*

III. THE INTERNET OF THINGS IS A DRIVER FOR JOBS AND ECONOMIC GROWTH

The technology industry drives the nation's job creation and economic growth, and the Internet of Things will be no exception. The convergence of connected devices, cloud computing services, and powerful data analytics will drive tremendous economic growth over the next decade.[37] GSMA, a global trade association for the mobile industry, and Machina Research predict the Internet of Things will produce $4.5 trillion in global revenue by 2020.[38] Cisco estimates the global business impact will reach $14.4 trillion by 2022, $635 billion of which will be attributable to connected gaming and entertainment.[39] Gartner has determined that the data-driven analytics the Internet of Things makes possible will generate $34 billion of information technology ("IT") spending in 2013 and create 4.4 million IT jobs globally (1.9 million in the U.S.) by 2015.[40] According to Gartner, each of these IT jobs will generate three additional jobs outside the IT sector, for a total of 6 million jobs added to the U.S. economy.[41]

IV. THE CONNECTED WORLD RELIES ON INFORMATION AND CONSUMER TRUST

Privacy concerns arise anytime a new technology is introduced that involves the collection of any consumer data. In CEA's experience, consumers generally recognize the need to make tradeoffs regarding the information they choose to share in order to obtain the benefits offered by new products and services. One person might decide it is worth it to share personal

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[37] Elgar Fleisch, *What is the Internet of Things? An Economic Perspective*, Auto-ID Labs White Paper WP-Bizapp-053, at 2 (Jan. 2010), http://www.autoidlabs.org/uploads/media/AUTOIDLABS-WP-BIZAPP-53.pdf.

[38] GSMA and Machina Research, *The Connected Life: A USD4.5 Trillion Global Impact in 2020*(Feb. 2012), http://connectedlife.gsma.com/wp-content/uploads/2012/02/Global_Impact_2012.pdf.

[39] Embracing the Internet of Everything, *supra* n. 9, at 10-11.

[40] Software and Information Industry Association, *Data-Driven Innovation*, at 12 (2013), https://www.siia net/index.php?option=com_docman&task=doc_download&gid=4279&Itemid=318.

[41] *Id*.

body measurements in order to obtain custom clothes; another might be willing to share medical information in order to access greater monitoring, diagnosis, and treatment.[42]

With the Internet of Things, consumers will recognize that the sweeping benefits of the connected world are not possible without the collection of information and the sharing of information among devices. Just as they have learned to do with computers and, more recently, smart phones, consumers will become increasingly familiar with and capable in managing the risks of other connected devices. The manufacturers and service providers that are poised to deliver this bright future to consumers understand and take seriously the need for consumer trust, and they will continually assess, reassure, evolve, rework and innovate to ensure that consumer privacy is adequately protected in the connected world of tomorrow. The technology market is fiercely competitive, and consumers will not purchase products if they do not trust a manufacturer's or provider's handling of data.

The privacy and security concerns of the Internet of Things parallel the same privacy concerns we face today. Self-regulatory regimes have worked well to ensure consumer privacy and foster innovation, and industry has a strong track record of developing and implementing best practices to protect information security. For instance, some CEA members are also members of industry groups that have developed cybersecurity resources for consumers and best practices for home security.[43] Other types of self-regulation, including publication of and compliance with privacy policies, should be encouraged and embraced. In addition, the FTC can use its Section 5 enforcement authority, when appropriate, and develop consumer education

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[42] *See, e.g.*, Andrew Couts, *CES Kingpin Gary Shapiro Talks Privacy, Patent Trolls and the Future of the Largest Tech Show in America*, Digital Trends, Jan. 6, 2013, http://www.digitaltrends.com/ces/ces-leader-gary-shapiro-we-are-just-part-of-the-ecosystem/.

[43] For example, the National Cyber Security Alliance and the WiFi Alliance, both of which share some members with CEA, have developed the following resources: http://www.StaySafeOnline.org and http://www.wi-fi.org/discover-and-learn/security.

materials and initiatives to help consumers as they embrace new connected devices and technologies. For instance, the FTC can play a pivotal role in informing consumers of the risk of unsecured connected devices and encourage them to limit vulnerabilities by, for example, changing default passwords on network equipment, password-protecting home Wi-Fi networks with strong passwords, and/or utilizing a virtual private network.

The primary goal of government should be to enhance individuals' continued use of and trust in technology and technology products, without hindering innovation. Government must resist temptations to regulate, particularly before we fully understand the privacy and security risks associated with the data that connected devices will collect and use. Premature regulation can choke innovation, and we are just beginning to benefit from the Internet of Things.

V. CONCLUSION

The connected world of tomorrow will improve people's lives. CEA is proud to represent the companies whose products and services largely comprise the Internet of Things, and CEA would be pleased to serve as a resource for the Commission staff as it develops plans for the future.

Respectfully submitted,

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Gary Shapiro
President & CEO

Laura Knapp Chadwick
Senior Manager, Government Affairs

CONSUMER ELECTRONICS ASSOCIATION
1919 South Eads Street
Arlington, VA 22202
(703) 907-5224

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