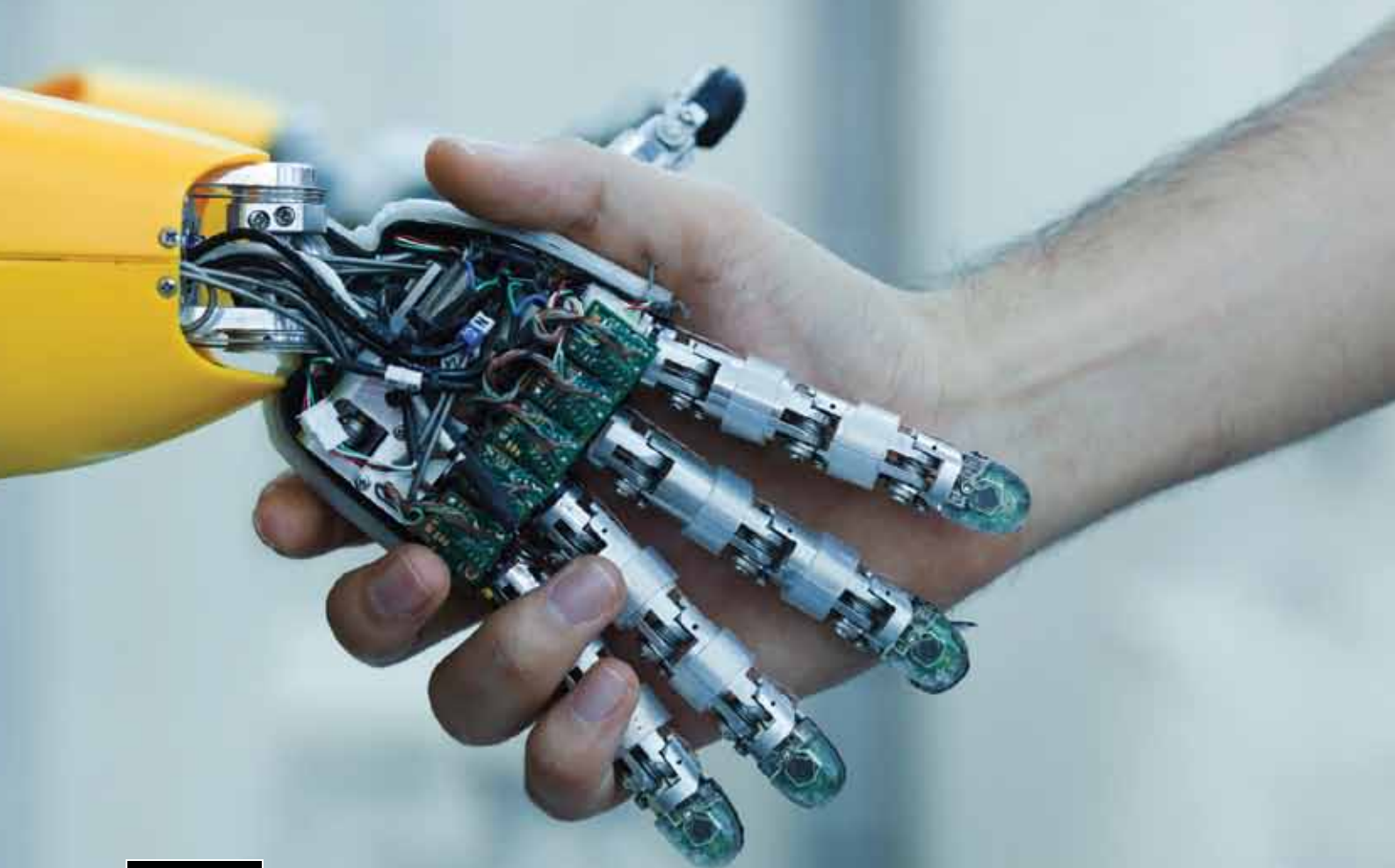


GSMA: The Impact of the Internet of Things

The Connected Home





FOREWORD

The Internet of Things (IoT) may sound like a futuristic term, but it is already here and improving our lives. Multiple machines, devices and appliances connected to the Internet through multiple networks are providing consumers and businesses with innovative new services. Moving beyond smartphones, tablets and other consumer electronics, wireless connectivity is now being added to a wide range of machines, including vehicles, household appliances, monitors and sensors.

The impact of the IoT is already evident in consumers' homes. Connected home security systems, energy meters, games consoles and other appliances are enriching the lives of consumers in many markets around the world. Connectivity gives consumers remote control of their home, enabling them to save money, access new services and enjoy greater peace of mind. The results of the consumer surveys outlined in this report show that there is already strong and growing demand for connected home devices, services and solutions.

To maximise the potential of the connected home, all these different devices and services need to be able to interact with each other seamlessly - collaboration and interoperability between companies from different sectors is, therefore, crucial.

Mobile connectivity is playing a pivotal role in the development of the smart home, enabling both the human-to-machine and machine-to-machine (M2M) connectivity that underpins the IoT. Mobile networks are often used to connect a home hub or as an aggregation device to the Internet, while providing wide-area connectivity for vehicles and consumer electronics, such as cameras and tablets. Within the home, short-range wireless technologies, such as Bluetooth, Wi-Fi and ZigBee, are often used to connect individual appliances to a home hub.

Supported by the GSMA, mobile network operators are forming partnerships and alliances to enable device-to-device communication, standardise platforms and simplify business processes, such as billing and subscription management, to lower operational costs and optimise performance.

At the GSMA, the primary goal of our Connected Living programme is to accelerate the delivery of new connected devices and services, and thereby enable a world in which consumers and businesses enjoy rich new services, connected by an intelligent and secure mobile network.



Anne Bouverot

Anne Bouverot
Director General
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Executive Summary

The connected home is fast becoming a reality. As Mobile Broadband networks spread, the cost of hardware falls, new business models emerge and smartphones become commonplace, consumers are using wireless connectivity to enhance security systems, energy meters, household appliances, wearable devices, healthcare monitors and the in-car experience. These connected devices are the building blocks of the Internet of Things (IoT).

New online quantitative research among 2,000 technology enthusiasts in Germany, Japan, the UK and the US highlights how the IoT is already enhancing home and family life. Within the home, security and energy-focused applications are leading the way, enabling householders to save money and increase peace of mind. Surveys by KRC Research in the four countries found that smart meters are the most widely adopted connected device after computers, games consoles, smartphones and tablets. Some 28% of the total respondents said they already own a connected utility meter.

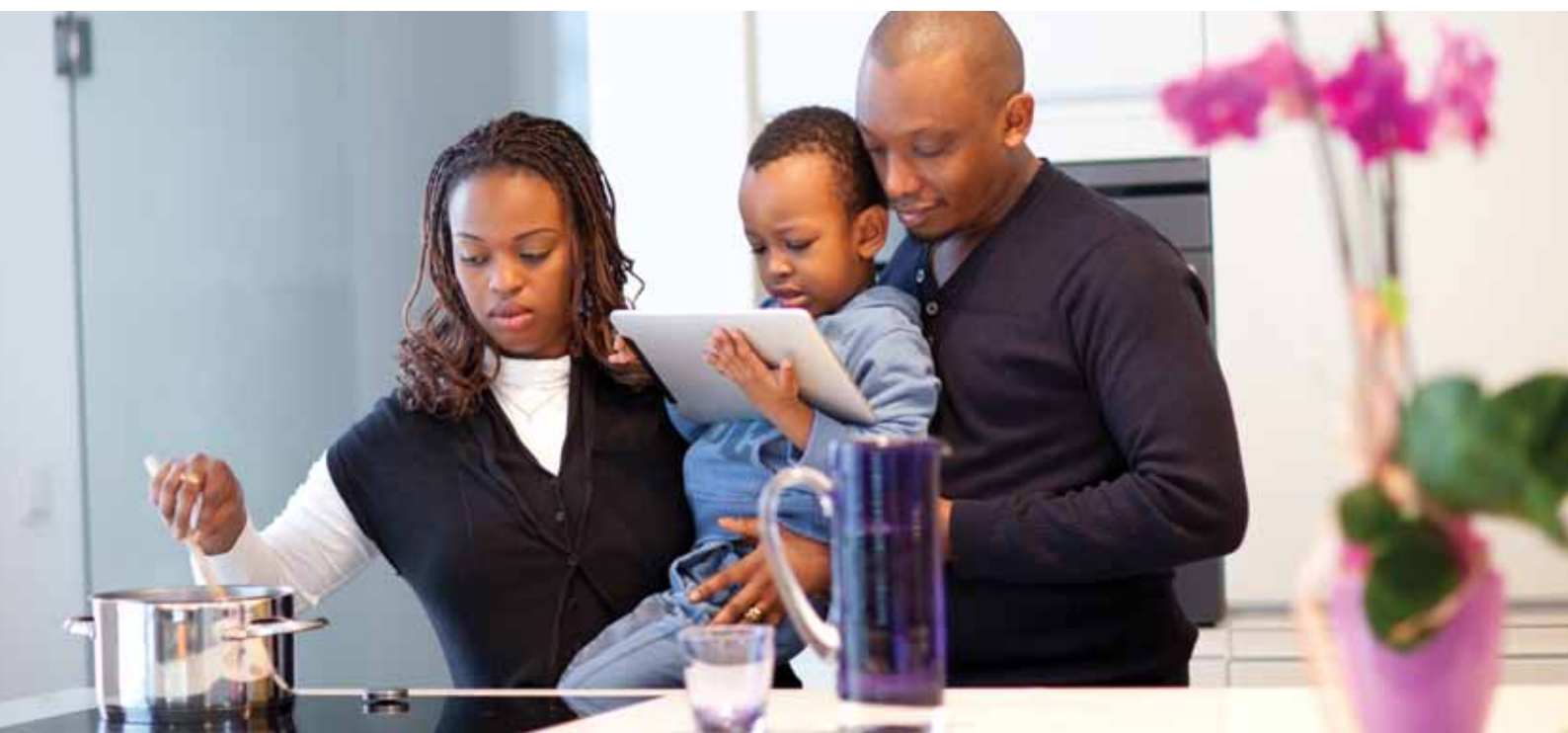
Today, the early adopter family has about 6.8 connected devices in their household, led by US and UK families, who own about 7. Of the surveyed countries, Japanese households own the fewest devices at about 6.4 on average.

But adoption of other connected devices and solutions is not far behind. Almost one in four (23%) technology enthusiasts said they own a connected security system. And a similar percentage own connected lighting (23%), a connected washing machine (24%), a connected thermostat (24%), and a connected health monitor (23%). Beyond the home, the KRC research also found strong uptake of wearables and in-vehicle connectivity. In the surveys, 24% of the technology enthusiasts said they own an activity tracker, while 19% have a smart watch. Connected cars which includes in-vehicle Satellite Navigation are even more widespread – 43% of the respondents say they have a connected car.

Connected Devices – A Global Perspective

Between the US, UK, Germany and Japan

- UK households are most likely to have a connected utility meter installed (37%)
- Smart lighting systems are most prevalent in Japan and Germany (31%, 29%)
- US early adopters monitor their daily activity the most with connected fitness trackers (33%)
- Germans are keeping time with smart watches more than any other surveyed (24%)



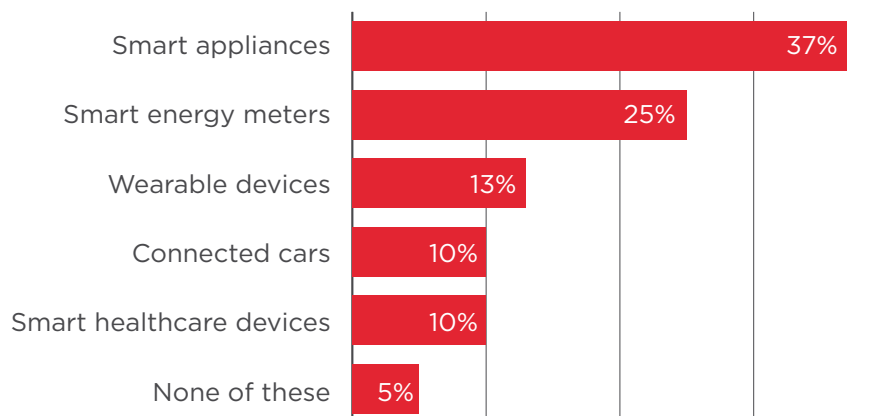
Moreover, uptake of connected devices is set to grow rapidly over the next few years. A high proportion of the respondents in the survey are interested in owning connected security systems (80% of respondents), connected thermostats (79%), smart meters (78%), connected lighting (78%) and connected cars (78%). The research also suggests there is strong interest in connected health monitors (68%), connected washing machines (66%), smart watches (65%), activity trackers (63%) connected ovens (62%), connected fridges (62%) and elderly monitors (61%).

A mixture of factors is driving this interest. When asked to identify the biggest potential benefit of having their devices connected to the Internet, 25% of the respondents in the KRC surveys chose money savings, while 19% chose convenience and 16% security.

The vast majority of technology enthusiasts are also interested in connecting devices to each other so that they exchange relevant information. For example, a connected car could detect that its owner and their family are travelling, and automatically turn off the home heating system. In the KRC Research, 89% of respondents said they are interested “in having all their household devices communicate constantly and seamlessly with one another to form a completely connected home or lifestyle.”

There is a clear need to establish standards and interoperability between different connected products or services. As such the GSMA Connected Living programme is facilitating interoperability between solutions from different vendors and service providers, enabling industry collaboration, encouraging appropriate regulation and helping mobile operators to optimise their networks. The programme is also developing key enablers, such as the GSMA Embedded SIM Specification, which enables the remote provisioning of secure connectivity.

Which connected device are you most likely to use in the next five years?



Source: KRC Survey, n=2000



Introduction

THE RISE OF CONNECTED LIVING

This report explores the emergence of the “connected home”, which refers to the growing use of wireless and fixed connectivity in security systems, energy meters, household appliances, wearable devices, consumer healthcare devices and connected cars. This includes all short range connectivity such as Bluetooth, Wi-Fi and ZigBee.

Commissioned by the GSMA's Connected Living Programme and GSMA Intelligence, the report draws on surveys of technology enthusiasts in Germany, Japan, the UK and the US by the public opinion research consultancy, KRC Research. KRC surveyed 500 technology enthusiasts in each country. They were selected on the basis of their answers to questions about their interest in new technologies. If a potential respondent strongly agreed or somewhat agreed with at least three of the following statements, they were asked to participate in the survey:

- My friends describe me as “into the latest technology”
- I often purchase new technology before my friends
- I often influence what my friends buy
- I consider myself pretty technologically sophisticated

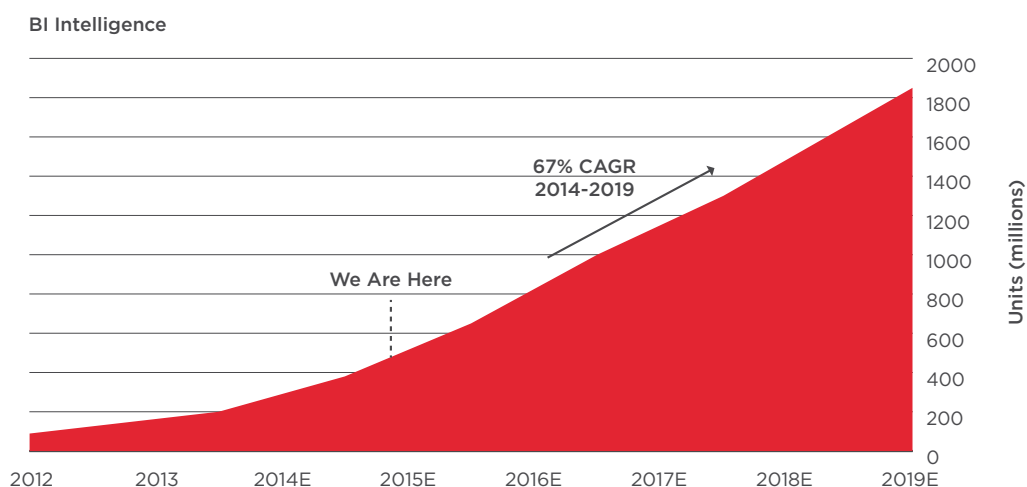
As well as exploring the positive impact of the Internet of Things (IoT) on the home and family life, the report considers how the IoT will continue to evolve and further benefit consumers over the next few years.

Manufacturers have been working on adding more intelligence and connectivity into household objects and appliances for more than a decade – Electrolux, for example, mooted the idea of an Internet-connected fridge in 2000. These early innovators envisaged a world in which consumers would have remote control over their homes and all their appliances, enabling them to easily see if they have enough milk, turn off the central heating, unlock the front door and check on elderly relatives from just about anywhere. Now, the falling cost of wireless hardware, the expansion of mobile networks, the development of new business models and the spread of smartphones, is enabling that vision to become a reality.

The connected home is already one of the largest segments of the Internet of Things, accounting for about 25% of that broader market in 2014, according to Business Insider Intelligence.

As demand grows and prices fall, the research firm anticipates that connected home device shipments will quadruple over the next five years, to hit 1.8 billion units shipped in 2019. Business Insider's definition of connected home devices includes all smart appliances (washers, dryers, refrigerators, etc.), safety and security systems (internet-connected sensors, monitors, cameras, and alarm systems), and energy equipment, such as smart thermostats and smart lighting.

Global Connected Home Device Annual Shipments



Source: Business Insider

Other analysts agree that the connected home represents one of the largest growth opportunities for the IoT ecosystem. "The installed base of smart homes is expected to grow fivefold from 2014 to 2018 with associated service revenues growing at a similar pace," says Pete Cooney, Principal Analyst, Smart Home, IHS. "We expect the connected home to be the biggest sector in M2M/IoT," adds Matt Hatton, CEO of Machina Research.

The growing demand for in-home connectivity has turned the heads of many of the largest players in information and communications technology (ICT).

VENDORS' STRATEGIES

In 2014, Samsung Electronics acquired Smart Things, which is developing a smart home platform. The consumer electronics giant has also announced that by 2020, all of its products, from smartphones to refrigerators, will be Internet connected.

In the past few years, Google has purchased gesture-recognition software developer Flutter, smart meter developer Nest Labs and robotics specialist Boston Dynamics, while Apple has released the HomeKit developer framework for creating iOS apps that can communicate with and control connected accessories in a user's home.

Leading wireless semiconductor maker Qualcomm has said it will act as an "enabler" for the connected home, not only supplying the hardware, but also driving standards and providing an entire, interoperable umbrella platform from base-level connections to sophisticated processing and big data gathering, right up to the applications layer.

OPERATOR-LED DEPLOYMENTS

AT&T's Digital Life service - a security and home automation offering managed through a smartphone app - is now available across the U.S. AT&T said Digital Life had 140,000 subscribers at the end of the third quarter of 2014, with more than half representing additions in the most recent two quarters. Telefónica, which has licensed the Digital Life platform, began a trial service in late 2014 in Europe. In France, Orange has launched its Homelive service, which allows users to manage a range of connected devices.

Some operators, including AT&T, are now offering new tariff plans that enable consumers to share their data traffic allowance across multiple devices. Bill Morelli, Director, IoT and M2M, IHS says: "The growth of the connected car market is expected to accelerate this trend even further." AT&T said it added 800,000 new connected car subscriptions in the fourth quarter of 2014.

GSMA Intelligence noted in a recent report that AT&T is particularly keen to make it easier for customers to add connected cars and cellular enabled devices to their shared data plans. As such existing AT&T customers can add a 4G LTE-equipped General Motors Vehicle to a mobile share value plan for US\$10 per month - the same cost as a connected tablet. Customers can also add cellular smart watches to their shared data accounts, such as the Timex IronMan One GPS+ smart watch, or communication and location devices such as Amber Alert GPS and FiLIP, both of which have two-way calling.

Other operators also see strong demand for cars with built-in connectivity that enables drivers and passengers to access infotainment and telematics services, such as vehicle diagnostics, and make automated emergency calls in the event of an accident. In October 2014, China Mobile and Deutsche Telekom signed an agreement to establish a joint venture to address the Chinese automotive market.



CONSUMER ELECTRONICS SHOW 2015

The connected home and connected car were major themes at the Consumer Electronics Show in January 2015. Google announced an expansion of its 'Work with Nest' developer programme with 15 new partners. At its pre-event Developer Summit, AT&T announced that it would open up the Digital Life platform for third party developers, such as Qualcomm Life and Samsung.

Rising Consumer Demand and Adoption

Consumers are becoming increasingly aware of, and receptive to, connected home and connected car solutions. New research commissioned by the GSMA suggests that smart meters, connected security systems and connected lighting systems, in particular, are on the cusp of becoming mainstream in developed countries.

CONSUMERS PRIORITISE ENERGY AND SECURITY

After computers, games consoles, smartphones and tablets, smart meters appear to be the most widely adopted connected device, according to the survey by KRC Research commissioned by the GSMA. Some 28% of the respondents in the KRC surveys of 2,000 technology enthusiasts in Germany, Japan, the UK and the US said they already own a connected utility meter. Almost one in four (23%) said they own a connected security system. And a similar percentage said they own a connected lighting system (23%), a connected washing machine (24%), a connected thermostat (24%) and a connected health monitor (23%).

Research by other analysts has also detected particularly strong demand for connected home security systems, which alert the householder if something abnormal happens, and connected heating and ventilation systems that can save the consumer money on energy bills. "Security will be the main Trojan horse that gets the connected home adopted and HVAC (heating, ventilation and air conditioning) will be the other major application by virtue of the potential cost savings associated with implementing a connected solution," says Matt Hatton of Machina Research. "Security is the one application that it has been proven people will pay for." Home security monitoring services typically start at about \$30 a month for a basic service.

In 2014 security devices and connected lighting together accounted for 50% of total smart home device shipments, according to Pete Cooney of IHS. However, he notes "strong growth is forecast across all aspects of the smart home device market. Smart thermostats (including the ubiquitous Nest) and smart appliances (e.g. washing machines) have captured the imagination of consumers and seen increasing adoption," he says. "Simple devices such as smart plugs are also seeing rapid shipment growth."

Looking beyond the home, the KRC research also found strong uptake of wearables and in-vehicle connectivity. In the surveys, 24% of the technology enthusiasts said they own an activity tracker, while 19% have a smart watch. Connected cars - that includes in-car satellite navigation - are even more widespread - 43% of the respondents in the KRC research have a connected car.

"Security is the one application that it has been proven people will pay for," - Matt Hatton, Machina Research

SIGNS OF STRONG GROWTH AHEAD

Uptake of connected devices look set to grow rapidly over the next few years. The survey found that most technology enthusiasts are interested in connected security systems (80% of respondents), connected thermostats (79%), smart meters (78%), connected lighting (78%) and connected cars (78%). The research also suggests there is strong interest in connected health monitors (68%), connected washing machines (66%), smart watches (65%), activity trackers (63%) connected vacuum cleaners/lawn mowers (63%), connected ovens (62%), connected fridges (62%) and elderly monitors (61%).

A mixture of factors is driving this interest. When asked to identify the biggest potential benefit of having their devices connected to the Internet, 25% of the respondents in the KRC surveys chose money savings, while 19% chose convenience and 16% security.

The vast majority of technology enthusiasts are also interested in connecting devices to each other so that they can exchange relevant information. For example, a connected car could detect that its owner and their family are travelling via a mobile connected network and automatically turn off the home heating to save the household money, and monitor the home security system to let the owner know if there is a problem while they are away. In the KRC Research, 44% of respondents said they are very interested and 45% somewhat interested "in having all their household devices communicate constantly and seamlessly with one another to form a completely connected home or lifestyle." The advantage of the connected car, in this example, is to communicate, via the mobile network, with the connected house and adjust any connected devices in the home remotely. The mobile network, in this context, plays a significant role in reliably and securely transferring relevant data from the car to the house.

KRC's findings reinforce the results of a 2014 survey of 4,000 consumers' attitudes to the IoT by Affinova, a Nielsen company. That survey found that being able to access or control objects remotely is the most desired functionality for smart products. "For many people, the ability to check on appliances or complete household tasks remotely is a way to quell anxiety—by verifying that doors are locked, curling irons and ovens are off, the garage door is closed and so on, once away from home. Peace of mind ranks highly on most consumers' lists," Affinova concluded.

The Affinova survey found the most desired items are refrigerators, light bulbs and sprinkler systems, among others. "Regular people want smart technology to solve age-old challenges such as saving money and the need to be in two places at once," the research firm said.

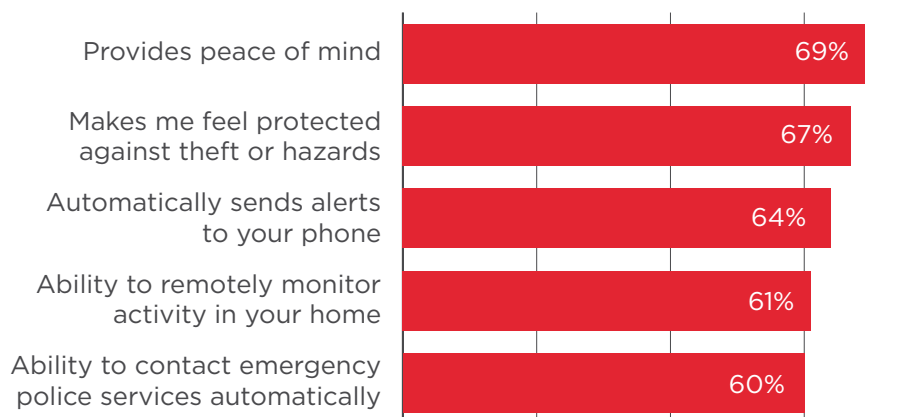
CONNECTED SECURITY - PEACE OF MIND

Connected security systems typically make use of sensors to monitor when doors or windows are opened and when there is movement within the property. There are also home automation systems which enable elements of the home to be remotely controlled, so householders can lock and unlock doors, for example, using their smartphone. If consumers want their home to appear occupied, they can automatically switch lights on in the evening and turn the radio on once in a while. The mobile network plays a crucial role as an effective communication medium between the home's security system and the user's smartphone.

Connected security systems can typically be configured to send a message to the consumer's smartphone via the mobile network remotely if the user is in a different location to the house e.g. at work if certain criteria are met. For example, a parent might want the system to send them a message when the front door is opened, signalling that the kids have returned from school. Some connected security systems also incorporate video cameras that can be remotely monitored and controlled, enabling the householder to check on individual rooms or outside areas.

The KRC research found that 26% of technology enthusiasts in Germany, 24% in the US, 23% in the UK and 21% in Japan already own a connected security system. Of the respondents who own a connected security system, 57% said it has "significantly increased their sense of security", while a further 42% said it had "somewhat increased their sense of security".

Ranking Connected Security System Benefits



source: KRC Research Note: Top two box ratings on a four point scale

In Germany, the US and Japan, 81% of the respondents in the KRC surveys are interested in a connected security system, as are 77% of the respondents in the UK. Peace of mind was identified as the most important benefit (69% of owners said this is very important and 49% of non-owners).





CONNECTED ENERGY - CUTTING WASTE, SAVING MONEY

Today, too many homes waste energy. Central heating, air conditioning and hot water systems are programmed to come on at certain times each day, regardless of whether the property is occupied or not. Moreover, some households could save energy by only heating or cooling those rooms that are actually being used.

With connected thermostats and/or smart meters, householders can control their energy use from their smartphones, enabling them to turn off lights from the office, for example. In some cases, connected heating and lighting systems can be configured to switch off automatically when the occupants' smartphones leave the building.

Conversely, smart meters can also relay consumption information to an energy or water supplier, removing the need to send out meter readers, while giving the utility greater insight into the household's consumption patterns and how they vary with time. The utility can also offer customers discounts if they configure certain appliances, such as washing machines or dish washers, to only come on during quiet periods, such as the middle of the night, when overall demand is low.

The KRC research found that 49% of technology enthusiasts in the UK, 46% in Germany, 42% in the US and 40% in Japan already own a connected energy solution, such as a smart meter, a thermostat or lighting system. Of the respondents who own a connected energy solution, 72% said they are saving money on their utility bills. The average (mean) monthly estimated saving in the US was \$80, in the UK \$77 (£50), in Japan \$31 (¥3786) and in Germany, \$95 (€80).

How much would a connected energy system reduce your monthly utility bill?



In Germany, 92% of the respondents to the KRC survey said they are interested in a connected energy solution, as are 90% of the respondents in the UK, 89% in the US and 88% in Japan. The respondents identified cost savings on utility bills as the most important benefit (71% of owners of connected energy systems and 69% of non-owners said this is very important). In the current marketplace, connected energy producers assert that their consumers can save from 20% per month or up to £250 per year. And, these claims may not be unfounded—72% of those who already own a smart energy system say it has saved them money on their utility costs since installing the system in their home. This reality is very enticing for prospective owners—over 90% of early adopters in each country surveyed would be likely to purchase such a system for their home if it could save them the equivalent of £250 per year.

MAJOR SUPPLIERS OF CONNECTED THERMOSTATS

Research firm CCS Insight says Google Nest is the dominant player in this area, despite having a somewhat limited product - a single thermostat for the whole house. CCS Insight notes that other companies have started to use Nest as the basis for their systems — Big Ass Fans, for example, has demonstrated a connected fan that linked to Nest. Honeywell has established an alternative in its evohome distributed thermostatic valve system, while Ecobee's new ecobee3 thermostat works with sensors in individual rooms that monitor temperature and occupancy. Ecovent offers a system for blown-air heating and cooling systems (popular in the US) that opens and closes battery-powered adjustable vents, depending on which rooms are in use. British Gas has also introduced its smart heating system, Hive, which already has 100,000 users in the UK. British Gas has also deployed over 1 million smart meters and over 500,000 are using a smart online monitoring solution to track how much energy they are using per month.

CONNECTED APPLIANCES - CONVENIENT AND RELIABLE

It is now cost-effective to add connectivity to a growing range of household appliances, providing benefits for both consumers and manufacturers. Connected washing machines and dishwashers, for example, could inform the householder when a cycle is complete remotely. Connected sprinkler systems and pet feeders can be remote controlled by householders while they are away from home. Using their smartphone, consumers could configure connected appliances to perform certain tasks at certain times. For example, a consumer with an early start could set their radio, kettle and oven to come on at 6am.

Built-in connectivity can also help manufacturers determine the likelihood of a defect or breakdown. Where appropriate, the connection can be used to provide diagnostic information to service engineers so they arrive at the home with the right parts to fix the specific fault. In some cases, the consumer might buy a service instead of an appliance. For example, the manufacturer might charge the consumer a monthly fee for ensuring they always have a working washing machine, dishwasher or boiler. More broadly, the manufacturer could use the usage and diagnostic information collected via the connectivity to improve future products.

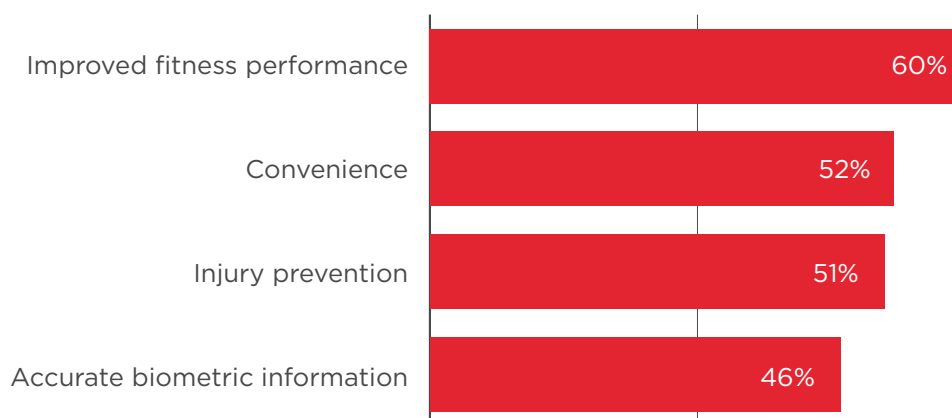
Ownership of connected ovens and smart fridges is lower, averaging 14% and 12% respectively across the four countries. In Germany, 71% of the respondents to the KRC survey said they are interested in a connected washing machine/dryer, as are 67% of respondents in Japan, 65% in the US and 63% in the UK.



WEARABLES – SMART WATCHES COME OF AGE

Among fitness enthusiasts, connected activity monitors, which measure steps taken and motion, are already commonplace. The KRC research found that 33% of respondents in the US, 27% in the UK, 26% in Germany and 10% in Japan already own an activity tracker. Asked about the features and benefits of such devices, 60% of the current owners said improved fitness performance is very important, while 46% said accurate biometric information is very important. Among the non-owners, 69% said they are likely to consider purchasing a connected fitness device in the next year, if the device would increase the number of calories they burn each month by 10%.

Ranking of Wearable Device Benefits



Source: KRC Research Note: Top two box ratings on a four point scale

Some consumers are also now adopting smart watches that provide richer functionality, including messaging and Internet access, as well as activity tracking. In some cases, these watches can, for example, be configured to provide consumers with timely alerts, such as the availability of a nearby parking space or the time of the next train. Smart watches can also be used to enable mobile payments and as authentication devices, allowing the owner to unlock doors or access specific services. In some cases, the watch may use biometrics to enable the authentication process.

Although some smart watches will rely on a short range wireless connection to a smartphone to access the Internet, others, such as the Samsung Gear S, have their own SIM card, enabling them to access the Internet independently, reducing the demands on the smartphone battery and enabling the watch to be used as a substitute handset as required.

The KRC surveys found that 24% of technology enthusiasts in Germany, 19% in the UK, 18% in the US and 14% in Japan have a smart watch. In Japan, 69% of the respondents to the KRC survey said they are interested in a smart watch, as are 64% of the respondents in the US and Germany and 62% in the UK.

Berg Insight estimates that shipments of connected wearables reached 19 million units in 2014 – 90% of these devices were activity trackers. It expects the market to grow at a compound annual rate of 55% to reach shipments of 168 million in 2019. Analysys Mason believes the smart wearables market will be worth USD 22.9 billion worldwide by 2020.

Berg anticipates so-called smart bands will be superseded by smart watches with greater functionality, and new devices designed to serve specific niche use-cases. CCS Insight expects further partnerships between fashion brands and technology companies to develop stylish wearable devices.

Sales of so-called smart glasses, which enable consumers to view information on a small screen embedded into a pair of spectacles, have been held back by limited availability, high prices and privacy concerns. However, Berg anticipates that promising use cases in professional markets, as well as in niche consumer segments, will enable smart glasses to become the third largest category of connected wearables, with annual shipments climbing to 11 million devices in 2019, up from only 30,000 units in 2014.

Beecham Research also anticipates that enterprises will adopt wearables to help employees carry out specific tasks. “At present wearable tech is seen largely as an accessory – for example, an extension to smartphone use – but that will change,” the research firm says. “The true potential of wearables are as standalone devices in their own right providing access to a wide range of connected services.”

CONNECTED HEALTHCARE - IN-HOME MONITORING

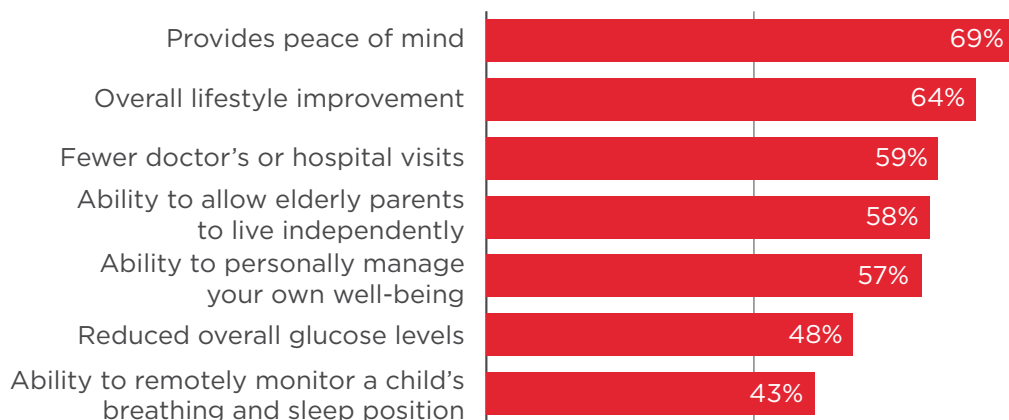
Wireless technologies can make it easier for both patients and their clinicians to monitor chronic diseases, such as diabetes and heart disease. A person living with diabetes, for example, can use a connected blood glucose monitor to capture regular readings and help them manage their intake of sugar and insulin.

Similarly, connectivity can help to provide care for babies and for the elderly. A connected vest could monitor a baby's sleeping position and breathing, while a connected wristband, could detect when an elderly person has suffered a fall and then send a message to a relative. In the case of people suffering with Alzheimer's disease, or dementia, connected devices could track if the patient leaves a certain pre-defined geographic area.

Connected health monitors, which track heart rate, blood pressure and other vital signs, can also be used for prevention, reducing the need for patients to see clinicians for face-to-face check-ups or spend time in medical facilities having tests.

Uptake in the health sector will depend on the establishment of a positive regulatory environment as well as effective MNO business models set up to address health and wellness related issues says GSMA Intelligence. Globally the population aged 60 years or over is expected to more than double from 841 million people in 2013 to more than 2 billion in 2050 according to the United Nations, while health expenditure accounted for 10.2% of GDP worldwide in 2012 (according to the World Bank). Most operators see the health vertical as a valuable medium to long-term opportunity.

Ranking of Smart Healthcare Device Benefits



Source: KRC Research Note: Top two box ratings on a four point scale

The KRC research found that 27% of technology enthusiasts in Germany, 24% in the US and UK, and 16% in Japan already own a connected health monitor. Asked about the features and benefits of connected healthcare devices, 69% of the current owners said peace of mind is very important, while 64% said overall life improvement is very important. Of the current owners, 83% reported their connected healthcare device has improved their sense of well-being.

In Japan, 73% of the respondents to the KRC survey said they are interested in a connected health monitor, as are 68% of the respondents in Germany, 67% in the UK and 62% in the US. Among the non-owners, 86% said they would be interested in a connected healthcare device that monitors when a family member with a chronic illness has, or has not, taken their medicine and would send them alerts. Moreover, 80% said they would be interested in an article of connected clothing that could monitor their vital signs and alert them before a potential health problem became serious.

However, some analysts believe it will take time for connected healthcare to realise its full potential. "This market has developed very slowly due to a variety of factors including a complex regulatory process, liability concerns, and insufficient levels of physician reimbursement," says Josh Builta, Associate Director, M2M, at IHS. "In the long term (10 years and beyond) I believe the healthcare market presents a strong growth opportunity for IoT. There is a growing need for the industry to evolve and develop more affordable and efficient models of healthcare delivery."

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Josh Builta, Associate Director, M2M, at IHS

CONNECTED CARS – SAFER, MORE ENJOYABLE AND MORE SECURE

Sales of connected cars are rising fast. For consumers, in-vehicle connectivity enables a raft of valuable services, such as navigation, real-time information about local traffic and nearby amenities, entertainment, automated emergency calls and vehicle diagnostics. In some markets, such as the EU, regulators are mandating that cars have a built-in cellular connection to enable automated “e-calls” in the event of an accident.

Drivers of connected cars may also be able to secure lower insurance premiums. Insurance companies are increasingly offering pay-as-you-drive tariffs in which the premium reflects the number of miles driven and the driving-style (safer drivers pay less for insurance).

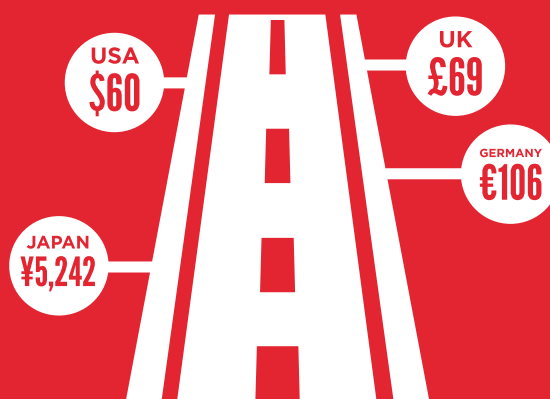
The advent of in-vehicle connectivity also enables automakers to maintain an ongoing relationship with their customers. For example, they can use mobile network connectivity to notify drivers that their vehicles are due a service, which local dealers have availability and when. They could even enable the driver to book the service simply by pressing a button on the dashboard. An automaker can also use in-vehicle connections to monitor the performance of the car and design future models. Moreover, as cars become increasingly computerised, an embedded cellular connection can be used deliver software updates to the vehicle “over the air.”

The expansion of in-car connectivity will also support the automotive industry’s moves to develop increasingly autonomous cars that are able to drive themselves in certain controlled environments, such as on motorways.

The KRC research (which includes Sat-Nav technology in its definition of the connected car) found that 47% of technology enthusiasts in Germany, 44% in the US and 41% in the UK and Japan already own a connected car. Asked about the features and benefits of connected cars, 66% of the current owners said cost savings on fuel is very important, while 61% said cost savings on insurance is very important. Of the current owners, 60% also said increased safety and peace of mind is very important.

Of the respondents who own a connected car, 71% said they are saving money on insurance costs. The average (mean) estimated monthly saving in the US was \$60, in the UK \$106 (£69), in Japan \$43 (¥5242) and in Germany, \$120 (€106). Moreover, the respondents with a connected car reported on average that they saved four hours a month by using real-time traffic updates to avoid congestion. And, 86% of prospective owners would be likely to consider purchasing a connected car for their next vehicle if it would save them 30% on their monthly insurance costs.

How much would a usage-based smart insurance device reduce your monthly insurance bill?



In Germany, 81% of the respondents to the KRC survey said they are interested in a connected car, as are 79% of the respondents in Japan and the US, and 74% in the UK.

Research firm Gartner has forecast that one in five cars will be connected by 2020, leading to more than 250 million networked vehicles on the roads worldwide. Josh Builta, of IHS, adds: “In the short term I believe the automotive market presents the greatest growth opportunity for IoT.” IHS expects the EU’s eCall initiative to increase the number of M2M automotive connections in Europe from under four million in 2012 to more than 30 million in 2018.

The smartphone operating system (OS) vendors – Apple and Google – could play a major role in the fast evolving connected car market, according to some analysts. “2015 will be the year that one of the major OS players makes a disruptive intervention in the connected car market through an innovative after-market device and platform play,” Machina Research predicts. “There are a number of interesting start-ups in this area with onboard diagnostics-based propositions that are sound, but sub-scale. Several look ripe for acquisition or emulation by the big boys.”



THE NEXT STEPS FOR THE CONNECTED HOME

There are several steps the mobile industry and policy makers can take to ensure connectivity can realise its full potential in enhancing people's daily lives. Although demand for connected homes and connected cars is growing quickly, there is still a need to increase consumer awareness, increase regulatory clarity, particularly in the healthcare and connected car sectors, and alleviate concerns about privacy and security. The industry also needs to reduce technological fragmentation, which can make it difficult for vendors to achieve economies of scale and for consumers to get connected devices from different suppliers to work together.

Earlier in January 2015, Samsung's Chief Executive, BK Yoon, highlighted that the opportunities and benefits of the IoT are huge, but so are the challenges. This, in turn, points to the need, BK Yoon underscored, for an open system, which sees collaboration among many entities across industries, not just within technology.

"Of course many of these barriers have always existed and are, in many cases, gradually being overcome," says Matt Hatton of Machina Research. "Nevertheless they tend to slow down the market."

Sylvia Kechiche, Senior Analyst, GSMA intelligence says "a key requirement to secure operators' ambitions and ensure rapid growth in consumer IoT devices is the enhancement of the connectivity layer that connects intelligent devices to each other and the cloud. This development is also required in order to enable rich data and services ecosystems and remove the cost and complexity for mass market adoption."

The GSMA's Connected Living programme is working with mobile operators and vendors to address these issues. The programme is accelerating the delivery of new connected devices and services in the M2M market through industry collaboration, encouraging appropriate regulation and helping operators to optimise their networks. The programme has also developed key enablers, such as the GSMA Embedded SIM Specification, which enables the remote provisioning of secure connectivity.

There is a potential opportunity for operators to play an even more active role in the connected home space by participating in initiatives of major M2M alliances (e.g. AllSeen, AllJoyn). These alliances are working towards enabling interoperability among connected products says Sylvia Kechiche, Senior Analyst at GSMA Intelligence.

To drive adoption of new services in other sectors, the GSMA has also set up special interest groups for automotive, health, education, utilities and transportation. These groups allow manufacturers and mobile operators to meet and share information, enabling industry cooperation with the goal of resolving barriers to deployments and to accelerate the adoption of services.



ASSUAGING PRIVACY AND SECURITY CONCERNS

Many consumers say they're more worried about privacy and security issues than any other potential downsides of the Internet of Things, with 53% of respondents in the Affinnova survey expressing concern that their data might be shared without their knowledge or approval, and 51% expressing concern that their data could be hacked by other users.

The GSMA Mobile Privacy Initiative is helping to establish universal guidelines and approaches that address consumer concerns and foster confidence and trust for mobile users. The GSMA's Connected Living programme is also establishing device security requirements and an accompanying accreditation process for operators to demonstrate that solutions utilising their networks are secure.

"The complexity of IoT solutions will require a fresh way of thinking about security," notes Matt Hatton at Machina Research. "Requirements will vary massively depending on the application, while the number of moving parts in any solution mean that there are a lot of potential weak links. Security will need to be considered on an end-to-end basis. Furthermore M2M and, particularly, IoT involve the widespread sharing of data. Understanding the dynamic and implications of all of that data sharing will be critical."

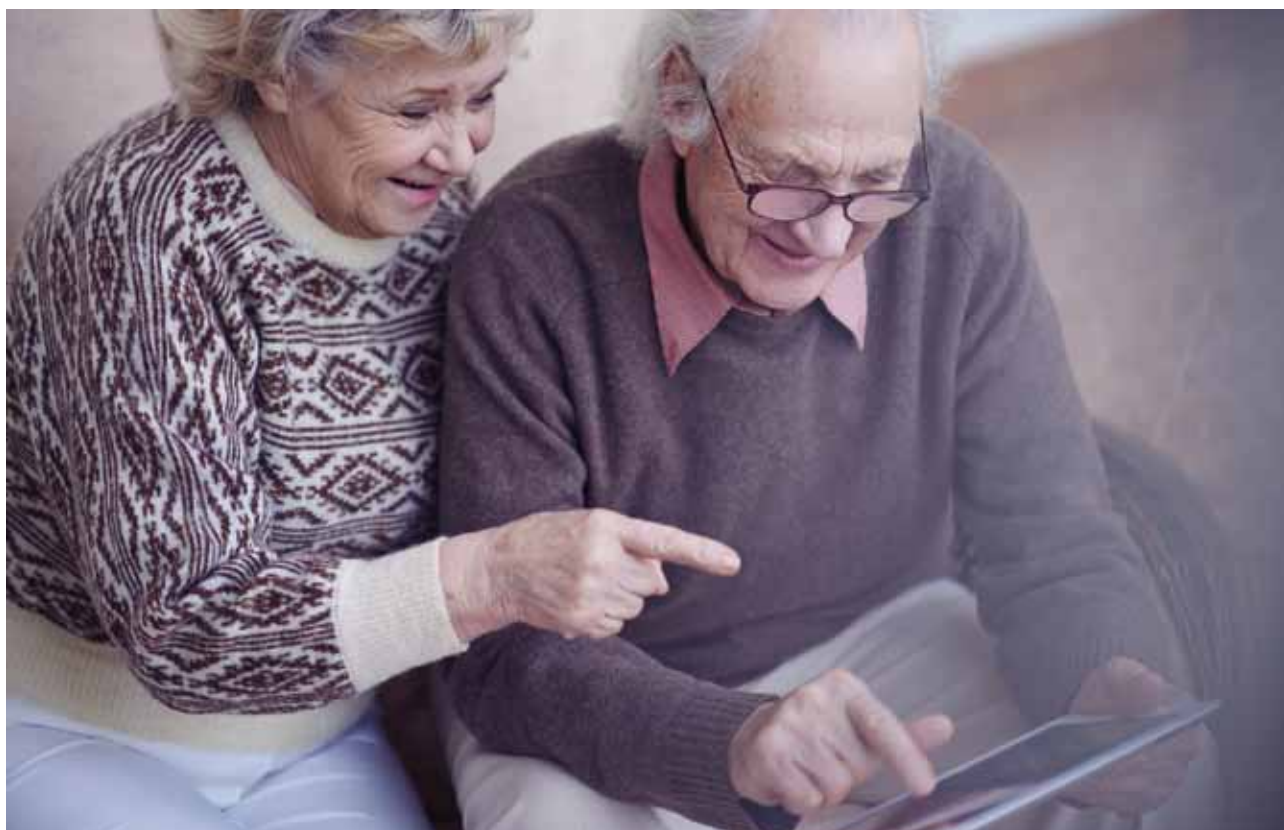
In a magazine article¹, Jon Carter, UK Head of Business Development – Connected Home at Deutsche Telekom, predicted that companies that play 'fast and loose' with customers' privacy will increasingly suffer as a result. "Security features such as secure SSL encryption and Trusted Platform Module (TPM) integration will become more important," he added.

INCREASING REGULATORY CLARITY

Across the world, the GSMA is in a continuous dialogue with policy makers to raise awareness of the socio-economic benefits connectivity can bring to consumers and accelerate the development of appropriate regulation. In some regions and some sectors, notably connected cars, energy and healthcare, regulatory uncertainty can make it difficult for companies to develop future-proof solutions. However, once regulation is in place, in most cases, it should give the IoT further impetus. Analysts say proposed regulation in the EU, Russia and Brazil is set to mandate the inclusion of cellular connectivity in new vehicles, paving the way for drivers to benefit from a range of in-car services.

Similarly, government initiatives to improve energy efficiency should have a positive impact on the smart meter market. Josh Builta, of IHS, explains: "As a result of the European Union's 20/20/20 initiative (which aims to reduce greenhouse gases, fossil-fuel dependency, and energy consumption) many countries in the region have committed to nationwide rollouts of connected smart utility meters. Among these projects is the Smart Meter Implementation Program in the United Kingdom, which aims to have 53 million smart meters installed in homes and small businesses throughout the UK by 2020. However, it should be noted that this program is already facing delays and appears unlikely to meet this deadline."

A previous survey, conducted by both GSMA intelligence and the Connected Living programme in 2014, among operators and non-operators on the key drivers of M2M/IoT connection and revenue growth over the next few years, highlighted the importance of implementing government/regulatory policies in a timely manner. Also, Government



¹ <http://m2mworldnews.com/2014/12/30/84575-deutsche-telekom-connected-home-predictions-for-2015/#sthash.ougVcHGO.dpuf>

policies that are implemented in one country/region that can potentially “spill over” into another region/country also significantly helps to move towards widespread global adoption of such initiatives

Builta also highlights the impact of government initiatives on the energy and utilities market in China. He anticipates the Chinese government’s efforts to upgrade the country’s utility services infrastructure will lead to a large rollout of communicating electricity meters by the two state-run utility enterprises, the State Grid Corporation of China and China Southern Grid.

TACKLING TECHNOLOGICAL FRAGMENTATION AND A LACK OF STANDARDS

Given the scale of the opportunity, the connected home market has attracted large numbers of players from different industries offering a wide range of solutions. In some sectors, there is a lack of standards or a number of competing standards. This kind of fragmentation can make it difficult for suppliers to achieve economies of scale and interoperability. For consumers, fragmentation can mean confusion, potentially curbing adoption.

The GSMA Connected Living programme is creating full interoperability specifications for remote SIM provisioning of M2M devices and evaluating convergence between M2M and smartphone/tablet solutions. The programme is also exploring the viability of existing networks to meet the low power, low data rate and low mobility use cases, and the viability of alternative complementary networks, while considering the potential for integration with the macro network and related spectrum/policy issues.

“Today the market is fragmented with a wide range of vendors operating across numerous verticals including (but not restricted to) security, smart energy and home automation with various routes to market,” notes Pete Cooney at IHS. “Multiple connectivity standards also compete for position, with the number increasing (rather than decreasing) in the shorter term. All of this volatility lends itself to those in the wider IoT market that are able to bring clarity to the smart home through, for example, all-encompassing platforms.”

CCS Insight agrees that the connected home market needs more coherence and will likely coalesce around several major platforms: “Standards remain a messy aspect of the connected home market, making it difficult for consumers and developers to invest with confidence,” the research firm says. “Apple’s HomeKit and Google’s Works with Nest will help to concentrate efforts from the second half of 2015, enabling more rapid adoption.”

Both the GSMA and individual mobile operators regard interoperability between different solutions to be of fundamental importance. “Only platforms which both handle established standards and are able to learn new protocols will hold their ground in the market in 2015,” says Jon Carter, UK Head of Business Development – Connected Home at Deutsche Telekom, in a magazine article². “Customers don’t want to be limited in their product choices or care about compatibility issues. Integrating any device into a connected home setup needs to be smooth and simple.”



“Today the market is fragmented with a wide range of vendors operating across numerous verticals including security, smart energy and home automation with various routes to market”

Pete Cooney, Principle Analyst, IHS.

² <http://m2mworldnews.com/2014/12/30/84575-deutsche-telekom-connected-home-predictions-for-2015/#sthash.ougVchGO.dpuf>

The Future of the Connected Home

As the connected home market gains momentum, solutions will become increasingly sophisticated, creating more value for consumers and for suppliers. Today, it is dominated by discrete solutions that share data with consumers and, sometimes, manufacturers, but typically don't share data with each other. Realising the full socio-economic potential of the IoT will depend on enabling many different solutions to share information in real-time, so they can respond automatically to changes in circumstances.

To take a straightforward example, a utility company could notify a smart meter that there has been a surge in demand and that the householder will receive a discount on their bill, if they keep their energy usage below a certain threshold for the next four hours. The smart meter could then pause the washing machine and dishwasher. Or a smart watch could interact with individual room sensors so that they are aware who is in a particular room and adjust the lighting and entertainment systems accordingly. "Wearable tech is huge right now but, towards the end of 2015, we will be seeing the first real examples of wearables interconnecting with smart home devices, to enable users to personalise their home – so music follows them into every room they enter or lights turn on based on the homeowner's preferences," says Jon Carter of Deutsche Telekom.

Analysts say the ultimate goal should be to deploy machine learning, in which devices and appliances can detect patterns and then adjust their own actions accordingly. "Many of the connected devices presently available are unintelligent point solutions," notes CCS Insight. "Many of the providers believe they are addressing the limitations by opening application programming interfaces (APIs) to their system. This is an important first step, but is not the whole answer, instead encouraging a sprawling mass of systems (all with open APIs) and making it difficult for a developer to choose a focus. There is movement toward greater intelligence with increasing programmability, systems that learn and treating multiple things in the home as a whole system."

In the long-term, both homes and cars may become heavily automated, freeing up their owners to engage in other more productive and enjoyable activities. In the KRC surveys, 61% of respondents forecast that robots will be cooking dinner and washing up the dishes within 20 years.

Technological advances will be accompanied by new business models. In time, consumers that agree to share data on activity in their homes may be able to buy usage-based insurance policies, for example. If connected sensors can show a home is occupied the majority of the time, it may cost less to insure. In a similar vein, houses that have a connected smoke alarm on each floor may also attract lower insurance premiums.

As the cost of connectivity continues to fall and the socio-economic benefits become increasingly apparent, the connected home market is likely to continue to grow rapidly over the next five years. Whereas a typical family of four in a developed country had 10 devices connected in 2012, they are likely to have 25 in 2017, and up to 50 in 2022, according to a study by international body the OECD (see chart).



Device Ownership of a Typical Family of Four, 2012, 2017, 2022

2012	2017	2022
2 smartphones	4 smartphones	4 smartphones
2 laptops/computers	2 laptops	2 laptops
1 tablet	2 tablets	2 tablets
1 DSL/Cable/Fibre/Wifi Modem	1 connected television	3 connected television
1 printer/scanner	2 connected set-top boxes	3 connected set-top boxes
1 game console	1 network attached storage	2 eReaders
	2 eReaders	1 printer/scanner
	1 printer/scanner	1 smart metre
	1 game console	3 connected stereo systems
	1 smart metre	1 digital camera
	2 connected stereo systems	1 energy consumption display
	1 energy consumption display	2 connected cars
	1 Internet connected car	7 smart light bulbs
	1 pair of connected sport shoes	3 connected sport devices
	1 pay as you drive device	5 internet connected power sockets
	1 network attached storage	1 weight scale
		1 eHealth device
		2 pay as you drive devices
		1 intelligent thermostat
		1 network attached storage
		4 home automation sensors
Devices that are likely but not in general use		
Ereaders	weight scale	alarm system
sportsgear	smart light bulb	in house cameras
network attached storage	ehealth monitor	connected locks
connected navigation device	digital camera	
set top box		
smart metre		

Source: OECD

Of course, societal factors and public policy will result in regional variations in market uptake. Matt Hatton of Machina Research, believes fast-urbanising China will place a lot of emphasis on smart city deployments, in which local governments play a major role in connecting homes and offices to municipal services, while Europe's ageing population will drive strong demand for healthcare and wellness solutions. EU regulation will mandate the use of connected cars and encourage uptake of smart meters, boosting these markets.

While the degree of government intervention will vary around the world, the consumer surveys by KRC and other researchers suggests the demand for connected homes and connected cars is universal. As the substantial socio-economic benefits of connectivity become increasingly apparent, global sales of connected devices and vehicles are set to grow rapidly. Ultimately, wireless connectivity is likely to become as fundamental and ubiquitous as electricity in both the home and the car.

The IoT is already here and it is changing and improving our lives for the better. Wireless connectivity is giving consumers remote access to their home security systems, energy meters and other appliances enriching their lives and enabling them to save money and enjoy greater peace of mind. Of course we are just at the beginning and the IoT will have a wider impact across society beyond just the connected home. It will expand and evolve over the coming years and it is imperative that the industry collaborates on interoperability to avoid fragmentation as well as to maximise its potential and ensure that numerous different devices and services are able to interact with each other seamlessly.

The GSMA Connected Living programme

Our vision: To enable the IoT, a world in which consumers and businesses enjoy rich new services, connected by an intelligent and secure mobile network.

Our aim: The GSMA Connected Living programme is an initiative to help operators add value and accelerate the delivery of new connected devices and services in the M2M market. This is to be achieved by industry collaboration, appropriate regulation, optimising networks as well as developing key enablers to support the growth of M2M in the immediate future and the IoT in the longer term.

Our Programme:

1. **IoT Connection Efficiency:** The GSMA works with its ecosystem partners to establish guidelines for how machines should communicate via the mobile network in the most intelligent and efficient way.
2. **Future IoT Networks:** The GSMA is working to establish common capabilities among mobile operators to enable a network that supports value creation for all stakeholders.
3. **Remote SIM Provisioning for M2M:** The GSMA's vision is to unite all stakeholders behind a single, common and global specification to help accelerate the growing machine-to-machine (M2M) market.
4. **IoT Business Enablers:** The GSMA is working to create a sustainable M2M environment that enables operators to unlock the consumer and business benefits of the IoT.

For further information please go to www.gsma.com/connectedliving

About the GSMA



The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with more than 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai and the Mobile 360 Series conferences.

For more information, please visit the GSMA corporate website at www.gsma.com. Follow the GSMA on Twitter: @GSMA.