IHS Markit™

INTERACTIVE VERSION

TECHNOLOGY

IoT trend watch 2017

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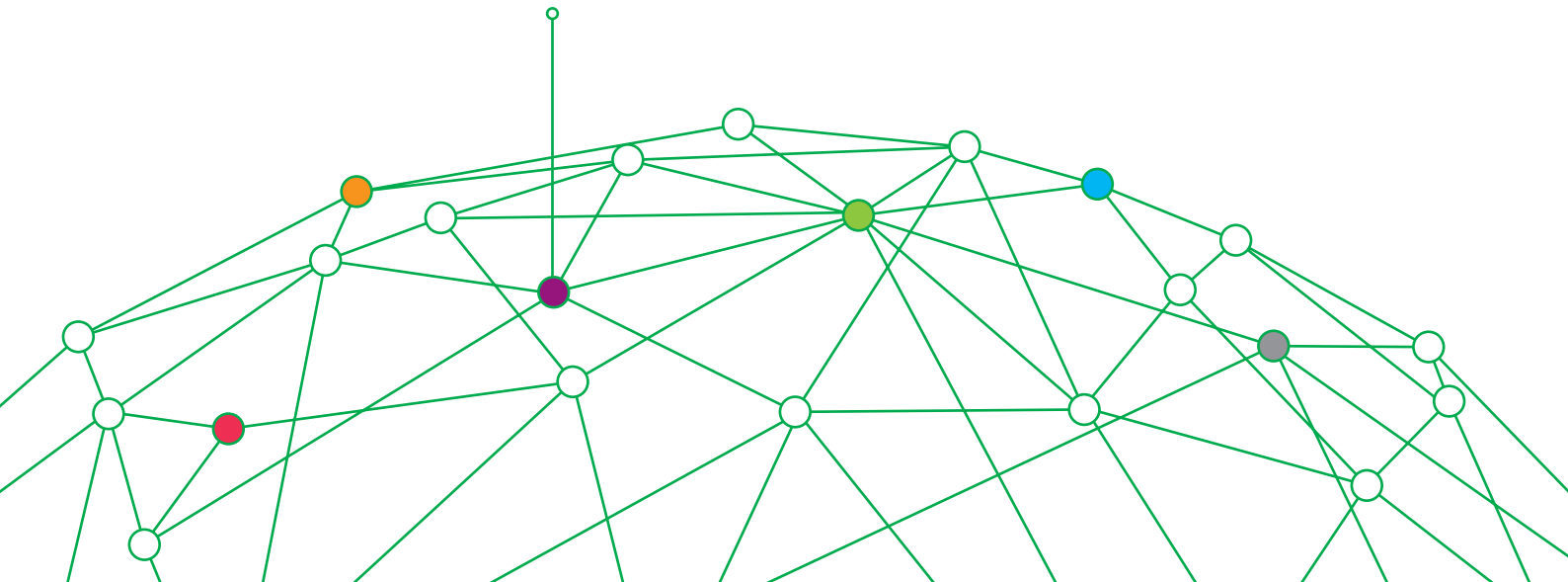
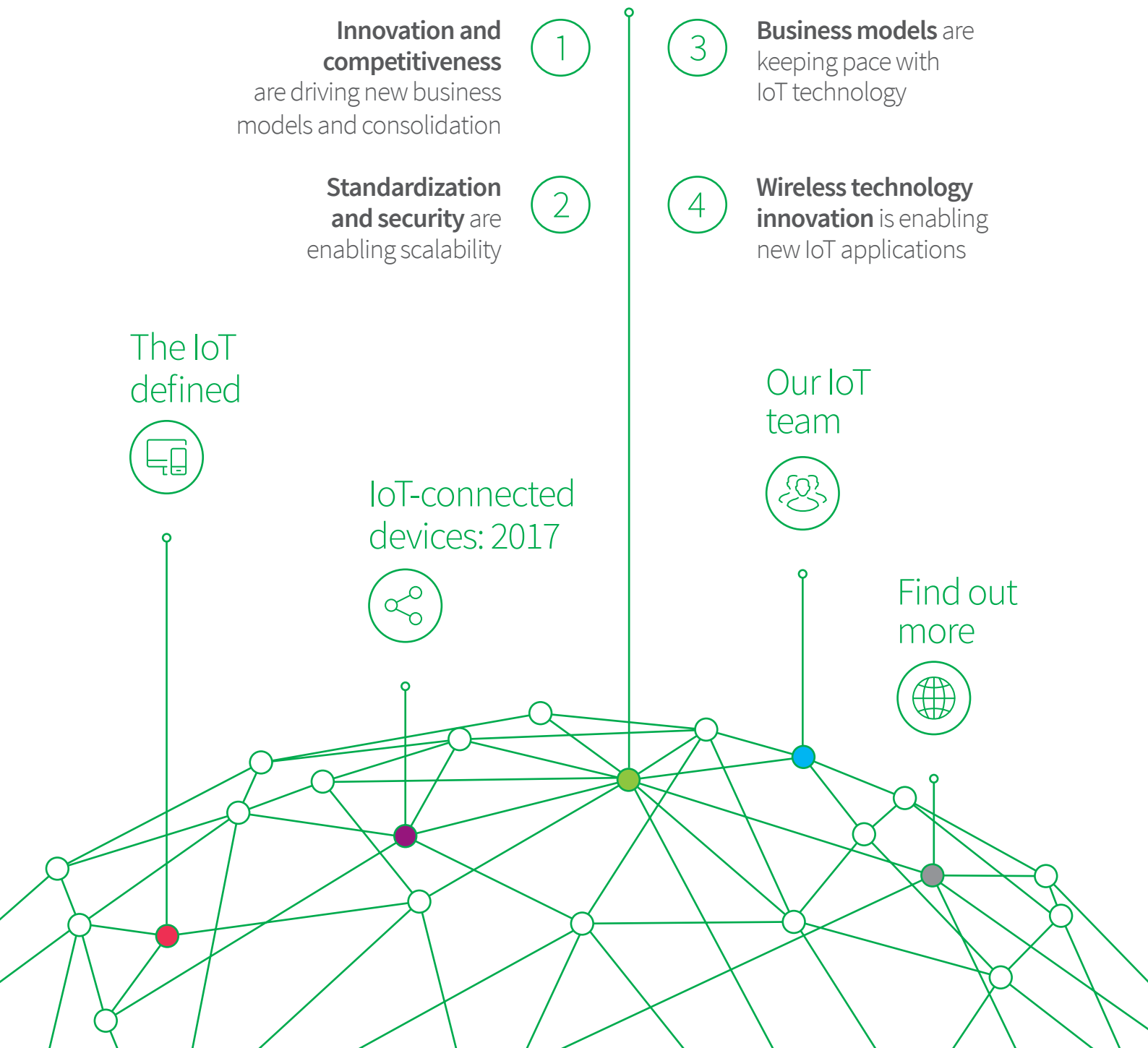


What's inside

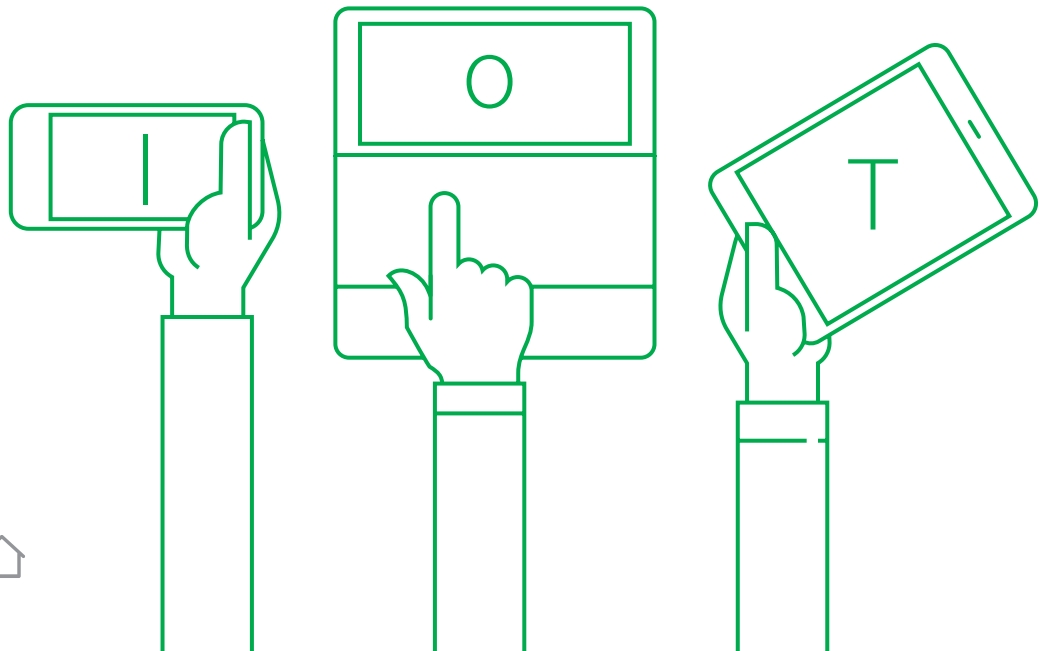


What exactly is the IoT?

The Internet of Things, or "IoT," is not a specific device or technology. Rather, it's a conceptual framework, driven by the idea of embedding connectivity and intelligence in a wide range of devices.

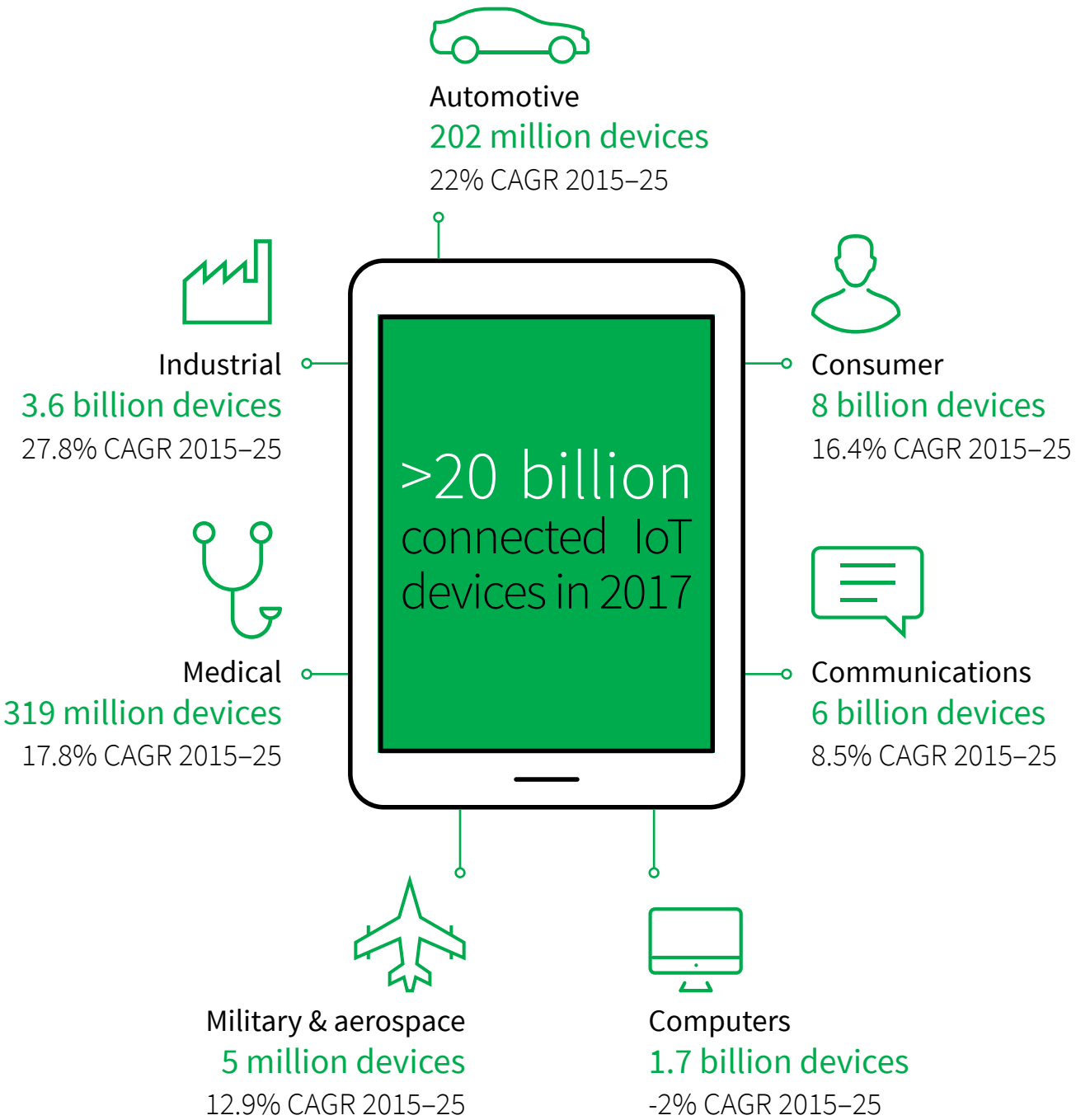
IHS Markit defines an IoT device as a device that has some form of embedded connectivity that allows it to directly connect to the internet or an IP-addressable device. This connectivity can be wired or wireless. These devices can include a range of sensors as well as some type of user interface, but neither sensors nor a user interface is required.

The ability to collect vast amounts of data in near-real time from this broad range of intelligent connected devices is the foundation of the IoT. This data can then be accessed directly, or via the cloud, and unique value propositions can be created through the application of complex analytics and big data techniques. In this way, the IoT can, and will, be used to provide unique value propositions and create complex information systems that are greater than the sum of their individual components.



How many IoT devices will be connected globally in 2017?

The industrial sector, driven by building automation, industrial automation and lighting, will account for nearly 1/3 of new connected devices between 2015 and 2025.



Innovation and competitiveness are driving new business models and consolidation

Key trend 1

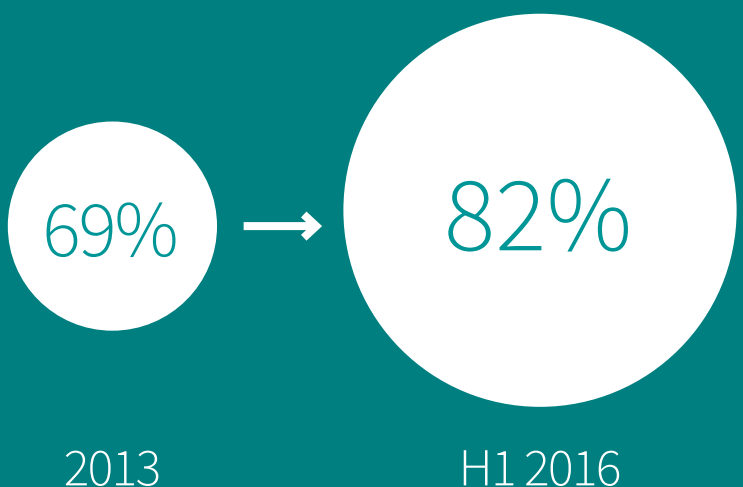
To date, much of the focus on IoT monetization has rightly revolved around the way in which suppliers are earning revenue selling components, software and/or services to IoT application developers. Essentially, how are the "folks selling shovels to the miners" making money?

Increasingly, however, the focus is shifting to the IoT developers themselves and how THEY'LL monetize the new streams of data delivered by their IoT deployments.

There is a wide diversity of monetization models being tested, reflecting the fragmented nature of the IoT market across numerous vertical industries. Successful models will revolve around "servitization" and closer, on-going relationships with end customers.

Over the last several years, the IoT connectivity space has undergone consolidation as larger vendors have built out their portfolios.

M2M modules – market revenue, top five vendors



Can companies derive ROI from the IoT and adjust to shifting demands?

On-going advancements and optimization in IoT technologies are enabling a growing collection of IoT solutions that achieve a positive business case by lowering costs, increasing efficiencies and expanding opportunities for innovation.

The IoT will help a diverse array of industries address fundamental structural challenges:

Telcos

Need to embrace the IoT to enhance customer experience in their legacy voice and data business and drive new vertical revenue opportunities

Industrial

Fluctuating prices and external demand require greater efficiencies and flexibility in oil and gas production

Automotive

Car manufacturers must address the challenge of a declining pool of drivers and the opportunity presented by the demand for more connected, intelligent cars

Will M&A in the IoT space reduce fragmentation and improve scalability?

Merger and acquisition drivers for the IoT				
Company type	Slowing core business	Restrictions on intra-sector M&A	Fragmented competitive landscape	Gaps in IoT porfolio
Telecoms operators	●	●		●
Semiconductor vendors	●		●	●
IoT platform vendors			●	●

A slowdown in their core businesses will drive telecoms operators and semiconductor vendors to diversify further into the IoT through vertical and horizontal acquisitions. Automotive, energy and healthcare represent key vertical opportunities.

IoT platform vendors will seek acquisitions to enhance their existing horizontal capabilities—in areas such as connectivity, device, data and security management—and create new vertical opportunities.

M&A—and partnerships—will lead to reduced fragmentation in the supply chain for IoT solutions and will enable telecoms operators, semiconductor vendors and IoT platform providers and their customers to build scalable IoT products.

How are semiconductor vendors optimizing their IoT portfolios?

A successful IoT strategy must consider the diverse "long tail" of thousands of low-volume applications. Not only is the long tail expected to account for the bulk of IoT volume, it is also the incubator for killer apps. However, it is not an easy segment of the market to address. It's characterized by thousands of customers buying in relatively low volume, but requiring extensive support due to their often limited development capabilities. To make this work, semiconductor vendors must remake their entire organizations:

Product: a complete solution is required, including software and services. A broad IP portfolio of connectivity, processors and sensors is a big plus. Qualcomm's acquisition of CSR and NXP was a shift to address the product requirements of the IoT.

Resources: a world-class website should enable self-serve support, including data sheets, app notes, development tools, reference designs and user forums. Texas Instruments does this well.

Distribution: multiple distributors focused on the mass market are critical. Online retail availability is important for enabling the maker community.

Culture: perhaps the biggest obstacle, a vendor's culture must embrace the mass market. This was an issue at Broadcom, resulting in the sale of its IoT assets to Cypress.

Community: if all of the above points are executed well, a self-sustaining user community may develop. The Arduino community, which is based on Atmel AVR microcontrollers, is a great example.

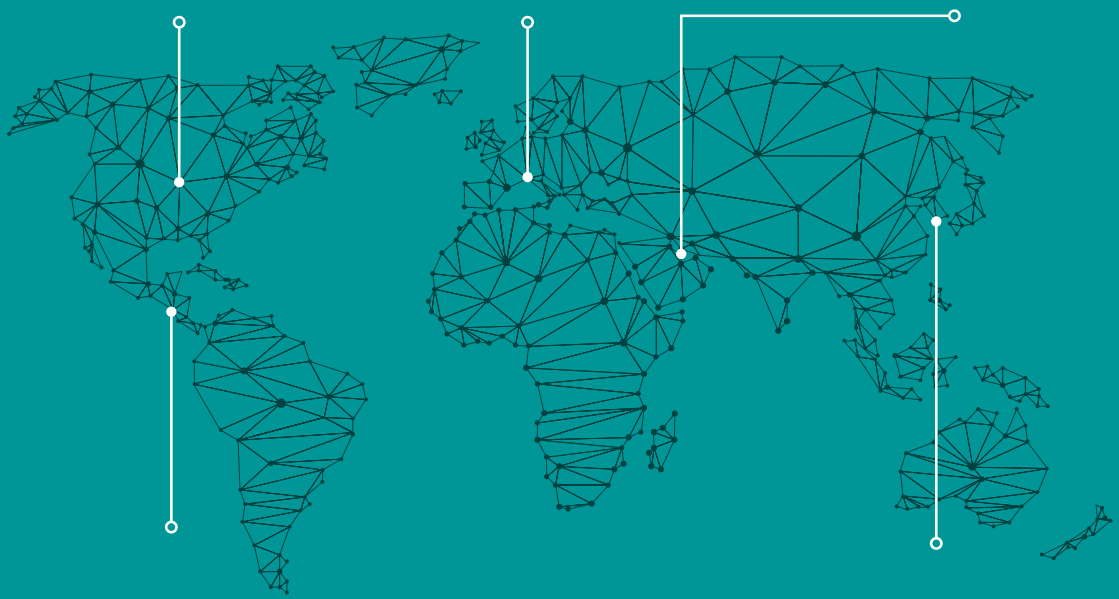
Mastering these IoT-ninja skills has benefits. The mass market is stable, allows better pricing control and gives vendors visibility into the killer app laboratory that is the long tail of the IoT.

Which governments are using smart city investments to drive economic development?

U.S.: in September 2016 the White House announced **$80 million** in funding to support the Smart Cities Initiative. The following month the DOT announced a further **$65 million** to support mobility and transport projects.

Europe: within the Horizon 2020 program, the new lighthouse cities project will provide **€69.5 million** in funding, while the sustainable cities through nature-based solutions will provide **€44 million** in funding.

UAE: the Smart Dubai Initiative launched in 2014 and aims to transform Dubai into the smartest city by 2017. Now entering its last year, significant new initiatives and likely a new plan are expected.



Mexico: the Asociación Mexicana de Ciudades Inteligentes (AMECI) announced that it intends to formulate a **MXN500 million** budget to drive smart city transformation.

South Korea: the nationwide IoT network based on LoRaWAN technology that's currently deployed by Samsung and SK Telekom will drive the expansion of smart city solutions.

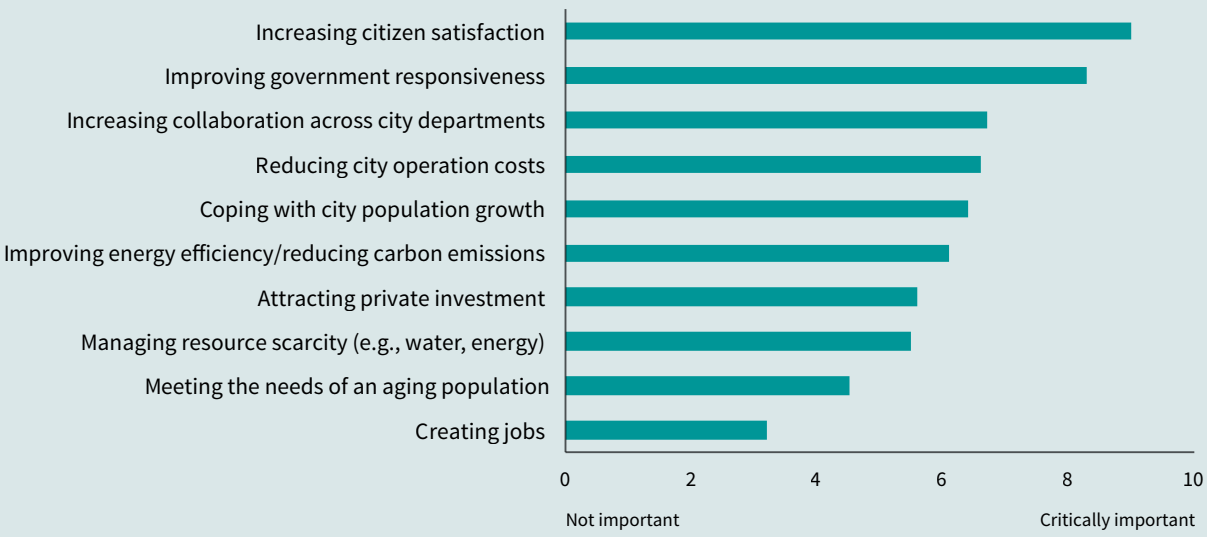
Are cities using IoT as a competitive advantage?

The top priority for smart city planners is improving citizen satisfaction through various types of projects that drive economic growth.

From a sample of U.S. cities in 2016:

- 86 projects were implemented in **governance** in 2015; 90 projects are planned up to 2017
- 74 projects were implemented in **mobility** and **transport** in 2015; 104 projects are planned up to 2017
- 59 projects were implemented in **physical infrastructure** in 2015; 90 projects are planned up to 2017

Average priority level by project objective



Source: IHS Markit

Standardization and security are enabling scalability

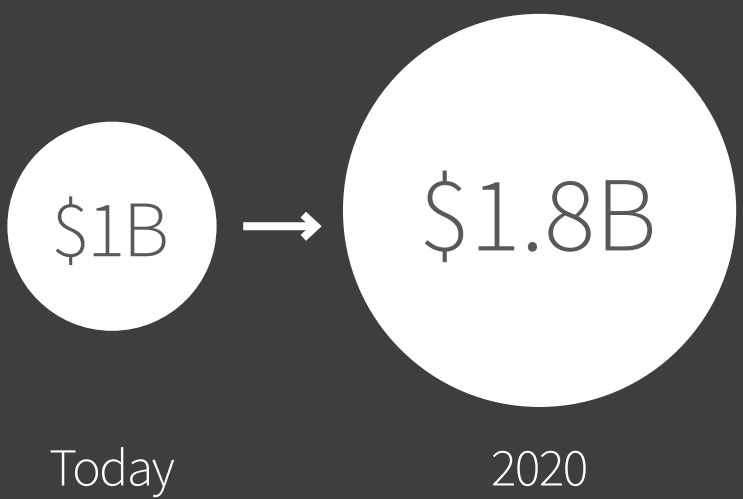
Key trend 2

With the high growth in IoT deployments and the hype surrounding the promise of the IoT marketplace, it's evident that scaling the IoT is highly dependent on not just the pace at which devices are connected, but also the ability to manage a large number of devices.

Currently, diverse standards and technologies make it difficult to evaluate the multitude of available technology options. Alongside managing this complexity, stakeholders must take a holistic, end-to-end view of securing systems comprehensively and move beyond focusing solely on device security.

By 2020, the global market for industrial cybersecurity hardware, software and services is expected to surpass $1.8 billion as corporations deal with new IoT devices on business networks as well as a new wave of mobile devices connected to corporate networks.

Global market for industrial cybersecurity hardware

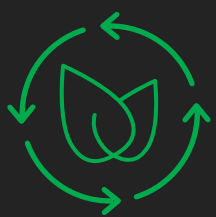


How will technology fragmentation in the IoT be solved?

Several mobile operators will fortify relationships with tier-two module makers in order to sharply lower module costs and standardize module form factors.

OneM2M—a key telco industry IoT service layer standardization effort—will finally gain traction as it solves its developer complexity challenges and as IoT developers start to use the standard.

There will be further alignment of industrial IoT standards groups and industry organizations, as many of these groups share key members and there is a widespread realization that such efforts need to be coordinated and consolidated.



Key consumer tech and enterprise IT companies will continue to build broad ecosystems around their own IoT platforms.

How much will be spent on network and device security in 2017?

Network security

In 2017, over **$750 million** will be spent by companies across the globe on distributed firewalls that protect supervisory control and data acquisition (SCADA), industrial control systems and IoT environments.

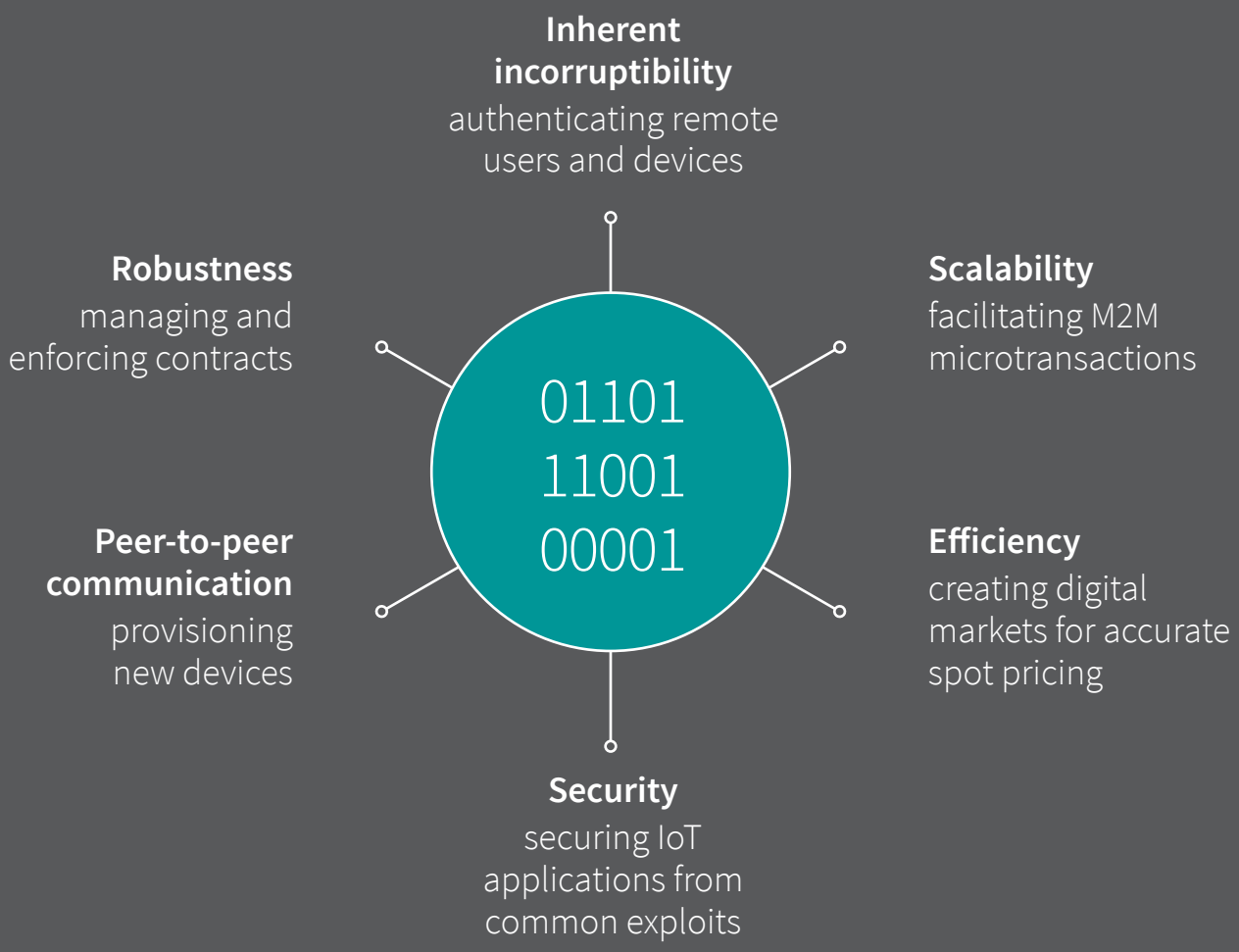
Device security

Chipset vendors will earn over **$740 million** on the sale of secure co-processors for non-smart card applications in 2017, although secure co-processors will only be used in a tiny minority of IoT solutions due to cost and complexity issues.

Can blockchain technology enable microtransactions to take the IoT to scale?

By eliminating the middleman—for example, credit card processors—blockchain technology can enable financial transactions of fractions of a cent, which haven't been practical previously due to "friction" in the system.

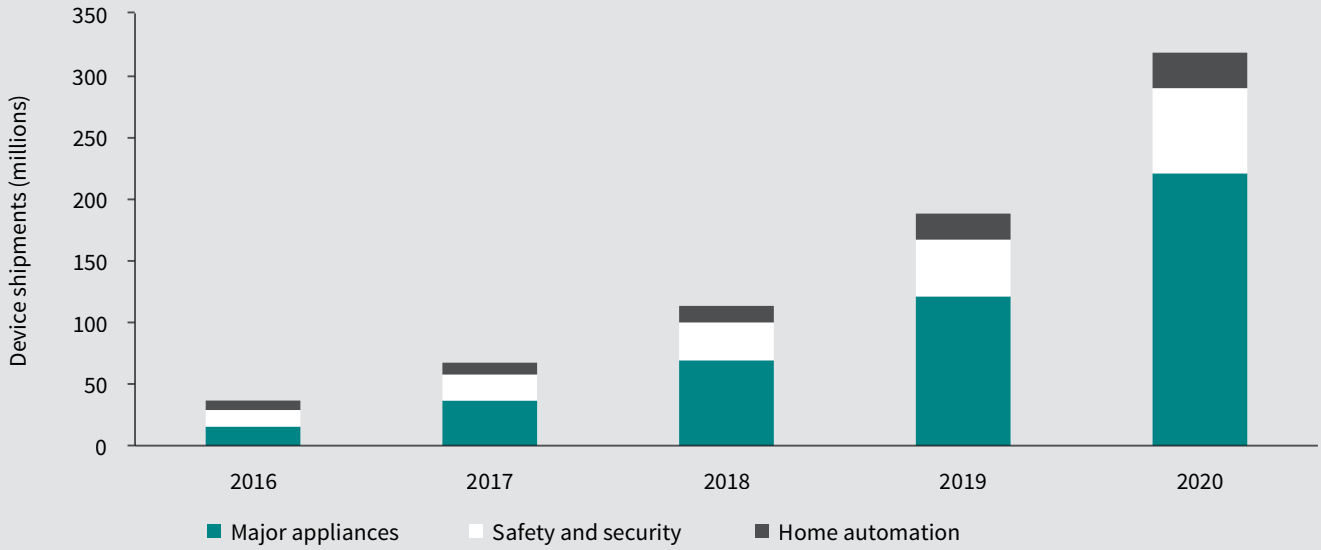
Blockchain's inherent attributes can move the IoT beyond today, which is a collection of client/server applications subject to scalability issues, single-point vulnerabilities and dependence on a trusted entity.



How is the standardized use of Wi-Fi in smart home devices driving growth?

The proliferation of the smart home platform is supported by having smart home devices adopt Wi-Fi as a standard connectivity option to enable interoperability, ultimately driving **319 million** devices shipped worldwide in 2020. Wi-Fi-enabled major home appliance global shipments will grow from 37 million in 2017 to 221 million in 2020—a compound annual growth rate (CAGR) of 82%.

Global shipments of Wi-Fi enabled smart home devices



Source: IHS Markit

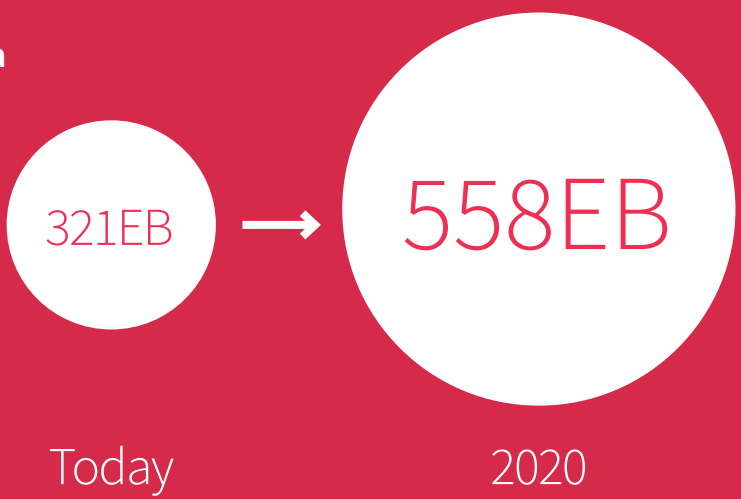
Business models are keeping pace with IoT technology

Key trend 3

The methods used to monetize the IoT are almost as diverse as the IoT itself. Many pioneers of the IoT sold products to build the IoT. That's still happening, of course, but now there is a shift to reaping the benefits of the data that's been created.

An overabundance of business models are being tested to determine which models work and for which applications. Advertising, services, retail and big data are just a few of the areas that have spawned many innovative experiments in monetization. In the coming years, the pace of innovation will slow as successful business models are identified.

Non-media data transmitted



Will the industry finally solve the data monetization business model issues?

To drive IoT growth, business models that promote the use of data gathered by IoT devices need to be developed. This is a separate issue from the revenue that is generated through content data monetization and, therefore, requires different models.

GE is leading efforts within industrial IoT and continues to drive its way to becoming the "Digital Company." GE built the leading IoT platform, Predix, by **clustering fleet data** that is generated directly from sensors installed on GE medical equipment and jet engines.

App developer MapMyFitness has created a revenue stream of aggregated user data generated through IoT devices by **selling to insurance** companies. Connecting wearables and scales to the app allows MapMyFitness access to data generated by IoT devices.

Hitachi Insights has launched a new program, City Data Exchange, which is a **platform that brokers city data**. The platform allows any entity in a city to post aggregated data on a common platform, providing an open marketplace for city-generated data—whether telecoms vendors, police departments or utility providers.

Looking to expand beyond smart thermostats, Nest is creating a **service model as a secondary revenue stream**. The IoT device maker is leveraging a mobile app to connect consumers and generate data that is then provided as a service to utility vendors, providing a recurring and more lucrative revenue stream.

How will revenue business models unlock the potential of smart city?

Well-defined business models will dictate the long-term existence of smart city projects.

Advertising-based models offer one of the most obvious business cases, and smart advertising is anticipated to play a growing role in smart cities.

Smart advertising can be delivered around Wi-Fi hotspots—as the hotspots can harness user data. This model is expected to be replicated in other projects, especially those where smart advertising will fit into existing structures or habits.

Besides advertising, the app-centred freemium business model, on the back of data-rich platforms, is expected to expand its role into the smart cities market. The wide availability of freemium-based applications will facilitate the expansion of this model in the smart cities world.

Funding projects is the key challenge

Source: IHS Markit

Will companies other than Amazon use smart home as a retail channel and not just a retail market?

Amazon pioneered the home automation retail channel business model with its Dash buttons and Echo voice assistant. It remains the sole company driving a virtuous cycle around a smart home ecosystem.

That said, companies like Samsung and Google do offer smart home devices that enable the capture of consumer spending at the moment of demand realization. The extent to which Google Home will become a cornerstone in a similar ecosystem driving its primary business of advertising is undetermined.

Amazon is the only provider that's addressing the majority of product consumption models

	2015	2016	2017
On-demand preset product ordering		Amazon Dash Button	
On-demand custom product/service ordering	Amazon Echo	Samsung Smart Fridge	Google Home
Incentivized ordering		Amazon Echo – voice assistant upgrade	
Automatic ordering services	Amazon DRS		

Which IoT devices will be used to expand retail business models?

Drones for autonomous/semi-autonomous delivery:

companies are conducting field tests on the delivery of products and goods via drone to end users and throughout the supply chain.

- 100k **retail drones** were sold worldwide in 2017, growing to 310k by 2020

Beacons and connected shoppers:

the use of beacons and smartphones for enhancing the "brick-and-mortar" shopping experience is being explored. 5G would potentially enable not just retailers—but also brands and products—to interact with consumers in a more dynamic fashion.

- **Smart tag** global shipments will grow from 21M in 2017 to 125M in 2020

Enhanced **digital signage**:

touchscreen-enabled digital signage has already become somewhat commonplace in retail environments, and augmented reality (AR)/virtual reality (VR)–enhanced digital signage would be a logical extension of this.

- **Cellular-connected digital signage** global shipments will increase from 494k in 2017 to 1.07M in 2020

Wireless technology innovation is enabling new IoT applications

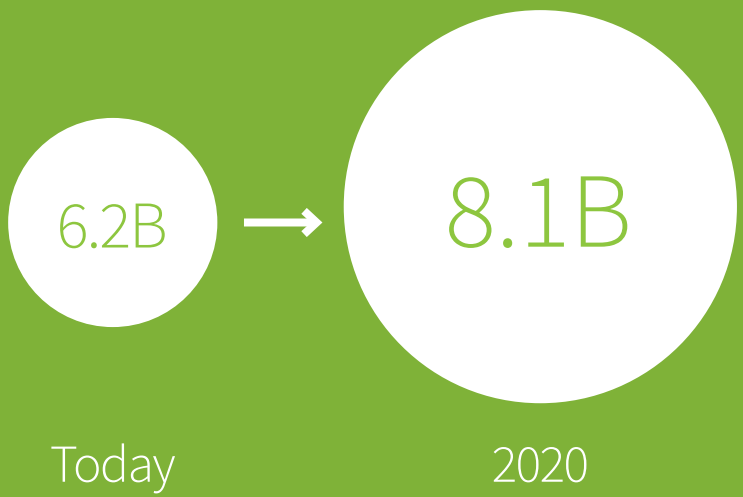
Key trend 4

Getting value out of the IoT inherently means moving beyond connectivity. However, at the core, connectivity availability remains key to our world—connecting applications that could not be linked previously.

Advances in wireless technologies will continue to extend the IoT at both the low and high ends. At the low end, low-power wide-area network (LPWAN) promises low cost, low power and long range, connecting millions of devices that previously could not be united in a practical way. At the high end, 802.11ad makes it possible to wirelessly connect very-high-performance applications such as 4K video. Beyond 2020, 5G has the potential to address new mission-critical use cases, particularly where mobility is essential.

By 2020, around 2 billion devices with cellular connectivity, 2.7 billion devices with low power wireless connectivity and 3.3 billion devices with wireless LAN (WLAN) connectivity will be shipped.

Global device shipments with wireless connectivity

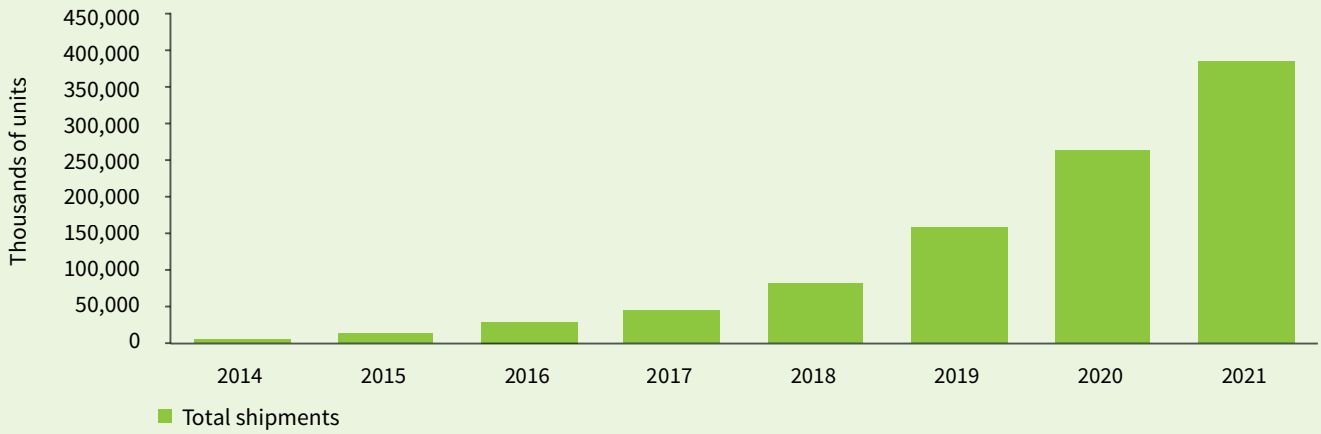


Will LPWAN expand the reach and lower the cost of connectivity in industrial applications?

For low-bitrate applications, LPWAN technologies will emerge as a competitive threat to short range wireless (SRW) standards such as Wi-Fi, Bluetooth, ZigBee and Thread. Deploying LPWAN technology in campus environments and commercial facilities can be less expensive and simpler than implementing SRW.

Smart metering, smart building, precision agriculture and environmental sensors will increase connectivity rates beginning in 2017 due to cost-optimized devices.

LPWA module global shipment forecast, 2014-2021



Source: IHS Markit

Which mission-critical IoT use cases will be in pre-5G trials in 2017 and beyond?

Smart agriculture: the use of connected sensor technologies in farming and agriculture has increased significantly over the past few years, driven in part by the growing availability and attractive price point of LPWAN networks. Uses can range from basic tank monitoring to specialized sensors that can monitor the moisture levels and chemical composition of soil. Agriculture is one of the largest projected markets for drones.

Advanced driver assistance systems (ADAS) and self-driving cars: more data bandwidth would allow video and data to be streamed to and from the car, even in highly populated areas. The resulting benefits could include enhanced HD mapping and vehicle, pedestrian and object localization; the gathering of continuous leaning patterns for artificial intelligence (AI)–based vehicles; an improved driver experience with real-time AR input to the human-machine interface (HMI); and pure entertainment or video applications in the case of level 4 autonomous cars.

AR: given the ubiquitous nature of smartphones, the large size of some venues and the complexity of many sporting events, augmented reality could be used to significantly enhance the viewing experience in much the same way that it's used to enhance the home viewing experience today. This use case, however, would rely on enhanced coverage, as most large venues struggle to manage a high volume of smartphones in use at one time.

Public safety: potential uses of drones by governments could include police reconnaissance, anti-terrorism, riot control, patrolling, search and rescue, tracking, public safety, traffic regulation, exploration surveys and weather monitoring. Security, surveillance and proactive monitoring of areas, crowds or even vehicles in a government-related task will also be sectors where drones could be adopted because they would make those activities more cost-efficient, effective and convenient.

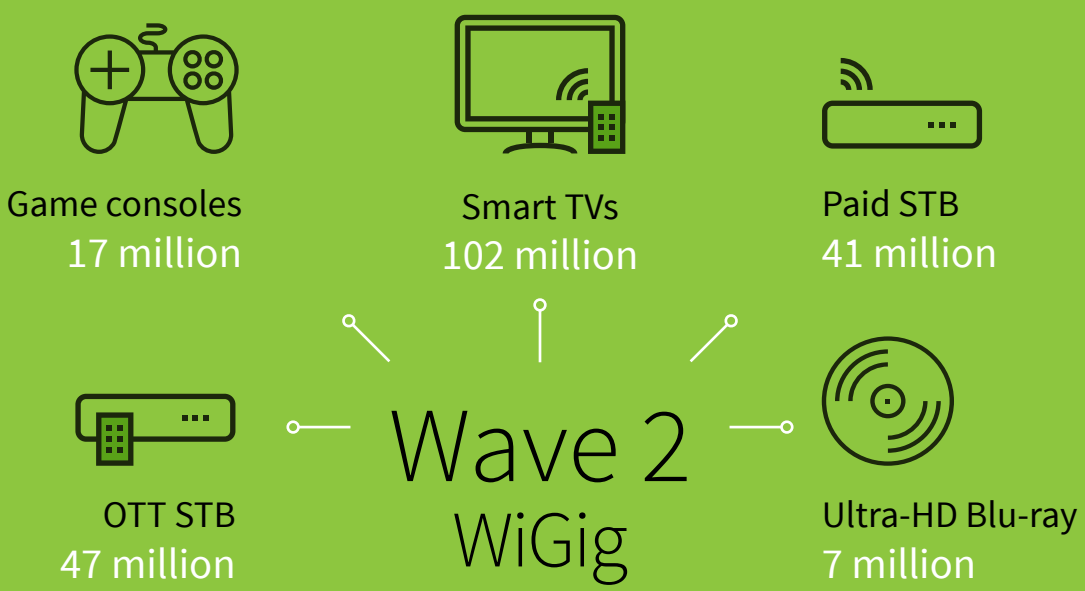
Can Wi-Fi bandwidth developments keep pace with consumer demand?

Given the availability of 802.11ac and WiGig, around 214 million 4K/UHD video devices are projected to ship worldwide in 2020.

The 802.11ac Wi-Fi standard, including Wave 2 and 802.11ad (WiGig), provides transmission speeds of 433 Mbps or higher as well as access to the less congested frequency channels, supporting high consumer demand for improved video resolution.

In 2017, the number of Wi-Fi devices using 802.11ac will surpass those of 802.11n, as the majority of smartphones in developed countries now have 802.11ac connectivity. In 2020, devices with 802.11ac will total nearly 2.1 billion—but even more interesting are the 347 million WiGig devices expected to ship the same year, propelled by VR demand.

Global consumer 4K/UHD video product shipments - 2020



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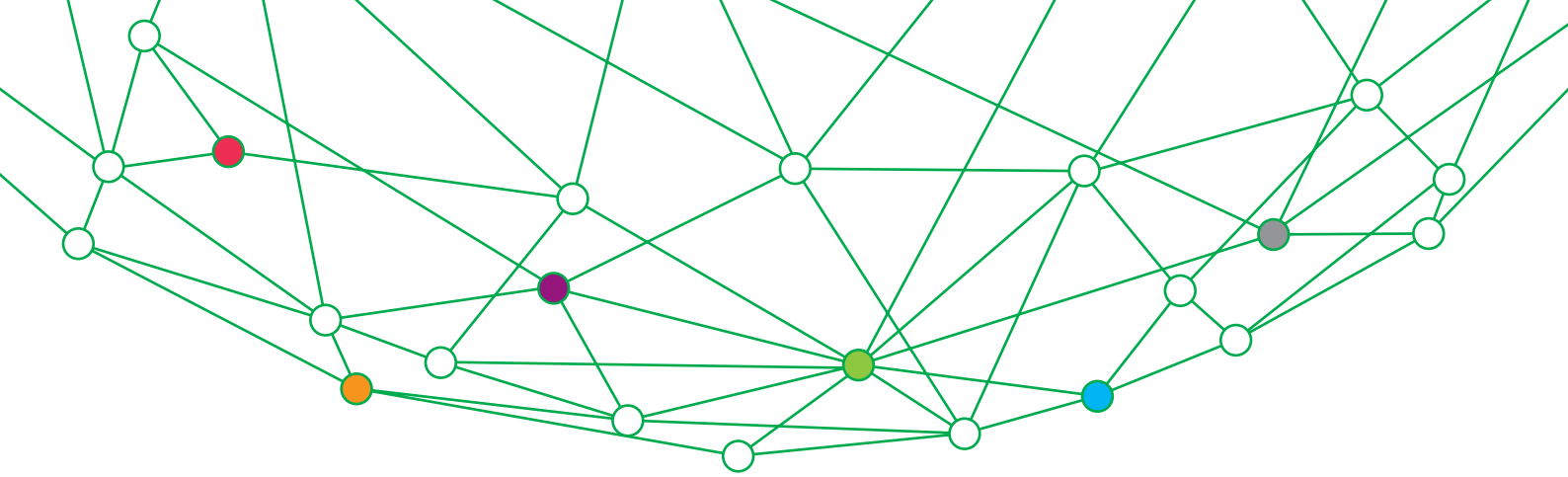

Find out more

IHS Markit provides timely insight and analysis for more than 25 connectivity technologies in 34 application segments used for the Internet of Things.

For more information on wired and wireless connectivity technologies and the opportunities offered by the IoT, please visit

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