



MARKET ANALYSIS

Worldwide and Regional Internet of Things (IoT) 2014-2020 Forecast: A Virtuous Circle of Proven Value and Demand

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IDC OPINION

The reality of the Internet of Things (IoT) market around the world is undoubtedly underway. Vendors are evolving their solutions in a supply-driven market on the edge of becoming a demand-driven market. Businesses are expanding their understanding of the efficiencies, business process transformations, and revenue implications that IoT solutions can generate. Consumers are witnessing connected home, car, and other innovative concepts coming to life, changing the way they understand their daily activities and the world around them. IDC provides the following highlights from our analysis:

- The revenue forecast encompasses the full breadth of the IoT ecosystem including intelligent and embedded systems shipments, connectivity services, infrastructure, purpose-built IoT platforms, applications, security, analytics, and professional services. IDC expects the worldwide market for IoT solutions to grow at a 20% CAGR from \$1.9 trillion in 2013 to \$7.1 trillion in 2020.
- IDC defines the Internet of Things as a network of networks of uniquely identifiable endpoints (or "things") that communicate without human interaction using IP connectivity – be it "locally" or globally. The IoT brings meaning to the concept of ubiquitous connectivity for businesses, governments, and consumers with its innate management, monitoring, and analytics.
- IoT market revenue is largely incremental to worldwide information and communications technology (ICT) revenue in *Worldwide Black Book Query Tool, Version 3.1, 2013* (IDC #244842, December 2013).
- Developed regions garner the majority of the IoT market, representing approximately 90% of installed units. Pervasive broadband and a culture of governmental support and innovation are major drivers.

IN THIS STUDY

This IDC study analyzes the Internet of Things market at a worldwide level and by region. It provides an update to the worldwide IoT market outlook published in *Worldwide Internet of Things (IoT) 2013-2020 Forecast: Billions of Things, Trillions of Dollars* (IDC #243661, October 2013). It updates worldwide IoT units installed and revenue and provides a regional perspective on IoT potential globally. The study discusses the key themes contributing to and characterizing the worldwide and regional growth of the IoT.

Methodology

Since IDC published *Worldwide Internet of Things (IoT) 2013-2020 Forecast: Billions of Things, Trillions of Dollars* (IDC #243661, October 2013), it has continued its research into and discussions with ecosystem players regarding IoT solution implementations. Without a doubt, all IoT solutions require intelligent systems. Devices or things in the IoT are managed by these intelligent systems, defined as securely managed electronic systems that run a high-level operating system (HLOS) and autonomously connect to the Internet, execute native or cloud-based applications, and facilitate data analysis. Research indicates that traditional embedded systems are also being enhanced to function like intelligent systems in IoT solutions in some cases. IDC's current definition of the Internet of Things has evolved to underscore the requirement that the IoT system is the foundational unit in the forecast and is defined precisely as an intelligent system or enhanced traditional embedded system and must have IP connectivity. The forecast revision in this study further reflects our evolved point of view on the rate of intelligent and embedded systems connectivity and replacement rates.

The Internet of Things forecast and analysis in this study are based on a collaborative effort across several of IDC's research groups at the regional level. The forecast methodology involved the creation of an installed base forecast to which revenue was associated, all of which was grounded in the ecosystem research discussions over the past six months. The current forecast is an update to the forecast published in *Worldwide Internet of Things (IoT) 2013-2020 Forecast: Billions of Things, Trillions of Dollars* (IDC #243661, October 2013).

To create the worldwide IoT units installed forecast, IDC considered intelligent and embedded system shipments as well as ensuing retirement rates across several industry implementations. The forecast also builds in assumptions for white good adoption. The following are not counted as installed IoT units in this forecast: standalone sensors, "dumb" devices, smartphones, tablets, PCs, and the majority of wearables.

To create the worldwide IoT revenue forecast, IDC considered two major revenue categories – IoT system shipment revenue (recognized in the year the unit was first connected) and the IoT stack revenue per installed device, inclusive of connectivity services, infrastructure, purpose-built IoT platforms, applications, security, analytics, and professional services. Four IoT use case types were considered in the creation of the worldwide IoT revenue forecast. Per installed IoT unit stack charges are typical in a number of IoT vertical uses (i.e., transportation, healthcare). IDC research indicates this type of business model will become increasingly typical in other vertical use cases. IDC's forecast incorporated the following use cases as part of its IoT revenue forecast:

- **High-end case.** IoT use case that incorporates smart monitoring and analytics

- **Mid-high case.** IoT use case that incorporates rich "track and trace" with exception-based reporting and some predictive data
- **Mid-low case.** IoT use case that incorporates rich "track and trace" with exception-based reporting
- **Low-end case.** IoT use case that incorporates basic "track and trace" updates

To create the regional IoT installed units and revenue forecast, the IoT team worked in conjunction with IDC's regional IoT teams to gain regional guidance specific to IoT that was applied to the relative regional positions regarding information and communications technology investments. Each region's share was forecast relative to the other regions' shares based on ICT spend trends, how IoT solution adoption varies from its ICT spend adoption rates, and the differences between developed and emerging market climates.

The quantitative approach to the current forecast update was further augmented by analyst briefings with device manufacturers, software vendors, service providers, systems integrators, and other key players participating in the Internet of Things market. Finally, feedback from end users – both consumer and enterprise – provided valuable insight into their awareness and willingness to invest in IoT solutions.

Note: All numbers in this document may not be exact due to rounding.

Definition

IDC defines the Internet of Things as the following:

- IoT is a network of networks of uniquely identifiable endpoints (or "things") that communicate without human interaction using IP connectivity – whether locally or globally.
- The IoT brings meaning to the concept of ubiquitous connectivity for businesses, governments, and consumers with its innate management, monitoring, and analytics.
- With uniquely identifiable endpoints integrated throughout networks, operational and location data, as well as other such data, is managed and monitored by the intelligent or traditional embedded system that has been enhanced and made part of IoT solutions and applications for businesses, governments, and consumers.
- IoT is composed of technology-based connected solutions that allow businesses and governments to gain insights that help transform how they engage with customers, deliver products/services, and run operations.

For additional definitions, see the Definitions in the Learn More section.

IDC's IoT taxonomy provides the classifications and definitions for the major components that make up the IoT market (see Figure 1). These components include:

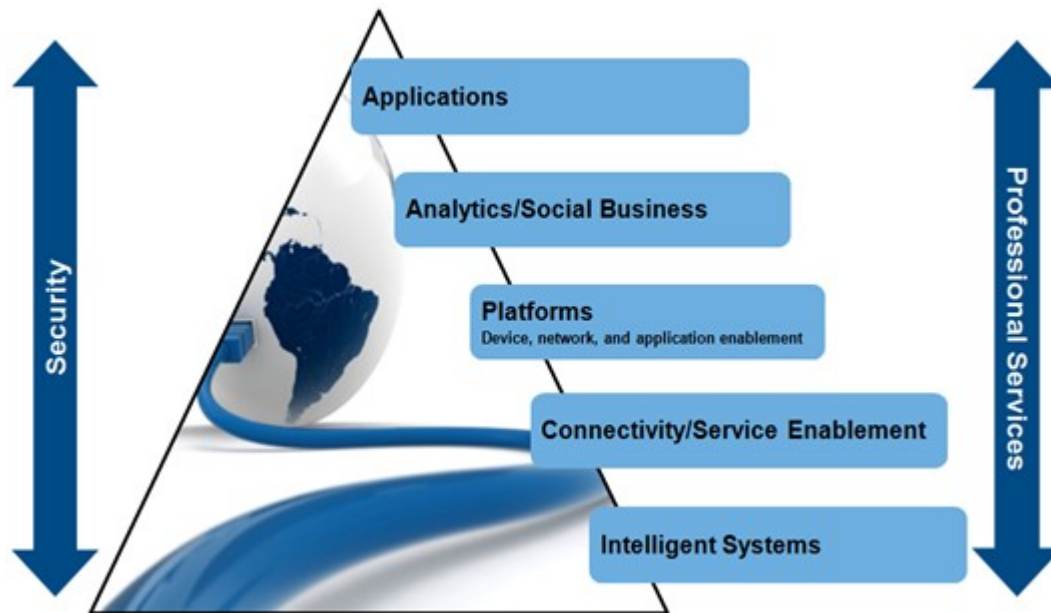
- Intelligent, or enhanced traditional embedded, systems
- Connectivity/service enablement

- Platforms: device, network, and application enablement
- Analytics and social business
- Applications
- Security
- Professional services

Details of this taxonomy are found in *IDC's Worldwide Internet of Things (IoT) Taxonomy, 2013* (IDC #243397, October 2013).

FIGURE 1

IoT: A New Construct and Ecosystem



Source: IDC, 2014

SITUATION OVERVIEW

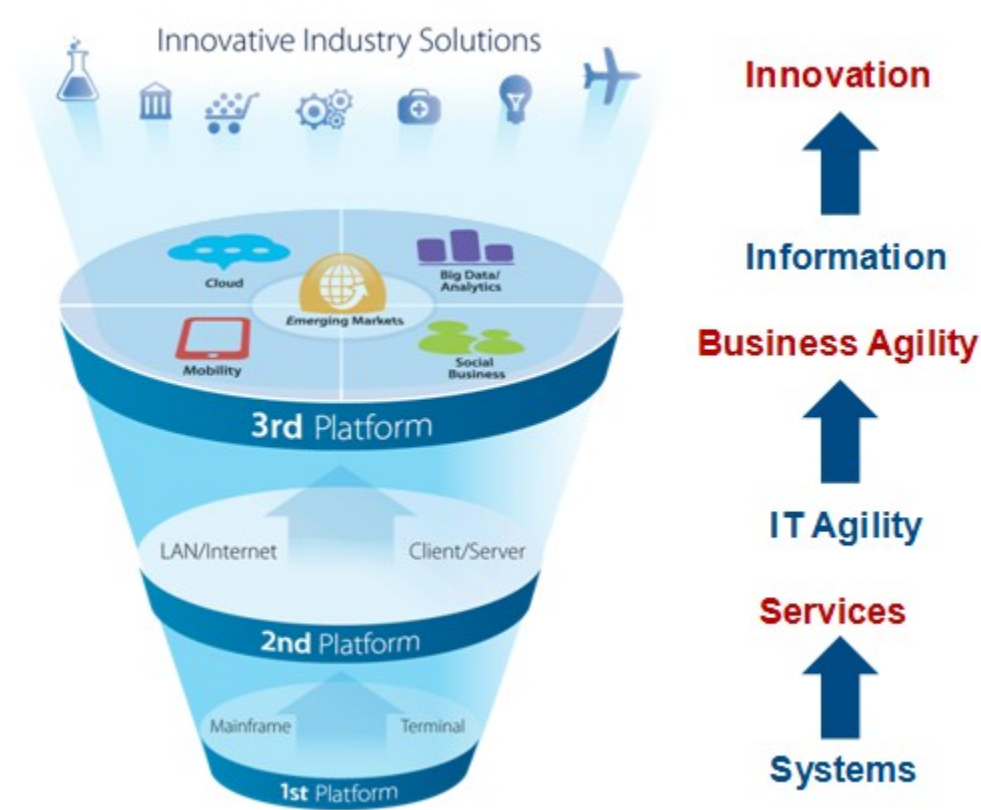
Despite the Internet of Things being a relatively new construct around the world for businesses and consumers alike, IDC research confirms the awareness of the value of IoT solutions is increasingly being recognized as transformative to businesses, governments, and consumers and the way each party experiences, operates, and innovates in the world. IDC research into the regional macrolevel economic and social indicators for IoT adoption reveals a backdrop that is rich with broadband pervasiveness and government support in developed regions and eco-consciousness in developed

and developing regions. These are favorable macrolevel indicators for an ultimate high-growth worldwide IoT market.

IoT solutions are at the heart of IDC's view of the 3rd Platform. IDC indicates that the future of IT will be driven by four pillars – mobility, social business, big data/analytics, and cloud – resulting in millions of applications available to billions of users. Internet connectivity underpins the 3rd Platform. Over the past year, IoT solution introductions have been brought to market that leverage these pillars in different ways. These solutions fulfill efficiently and innovatively the vision of value creation throughout the 3rd Platform. Figure 2 depicts IDC's view of the 3rd Platform.

FIGURE 2

IoT: Driving Value Throughout the 3rd Platform



Source: IDC, 2014

Key Market Enablers

To date, the IoT market has been supply driven. Vendors that have played in the more traditional ICT markets are looking to IoT for new revenue to complement existing product and service portfolios. New

and innovative players have entered the ecosystem. Almost any enterprise-focused systems integrator, software vendor, professional services firm, or mobile operator has a story around what IoT can do to help businesses become more productive, efficient, customer friendly, and agile.

IDC research from January 2014 across United States-based business and IT decision makers indicates that nearly two-thirds of this group are familiar with IoT. As the market of potential buyers continues to become familiar with the value of the solutions, and the macro-indicator backdrop at the country and regional levels evolves toward a backdrop that is increasingly favorable for adoption of autonomous, IP-connected "things," the IoT market will become demand driven. IDC expects when this point is reached, product offerings will begin to be more intently differentiated and competition will generally intensify, particularly around holistic solution offers that incorporate smart analytics and applications.

Other enablers to the rise of IoT include:

- **Ongoing development of smart cities/cars/houses.** There is development happening in many industries to find a way to diversify products and services. For smart cities, municipalities are looking for ways to become more efficient, and IoT solutions provide several options to save money, improve productivity, and better serve their constituents.
- **Enhanced connectivity infrastructure.** With the recent wave of network enhancements (e.g., ongoing LTE deployments, small cell networks) and the repurposing of legacy networks, connectivity is becoming increasingly ubiquitous – whether using personal area networks such as ZigBee or Bluetooth, local area networks such as WiFi, or wide area networks such as cellular, in addition to fixed connectivity (i.e., Ethernet). This anyway, anytime ability to connect anything is helping make the Internet of Things a reality.
- **Connected culture.** Globally, individuals are developing a high affinity for full-time connectivity, which makes consumer IoT a compelling proposition.
- **Visible trials and early implementations creating a virtuous circle.** Proven benefits and adoption interest and the start of numerous use case implementations create a virtuous circle. From smart meters and operational and cost efficiencies to smart buildings and smart home systems, end users are able to see and feel the tangible benefits of IoT. This will spur increased demand for IoT solutions around the world.

Key Market Challenges

One of the most significant challenges that the IoT ecosystem faces in achieving the growth expected is its ability for the autonomously connected "things" to speak a compatible language between each other and to the cloud. Without standards, growth in the forecast adoption of IoT solutions will be constrained. Smart analytics and ever-expanding networks of networks will be limited without standard protocols facilitating the communication ease and flow of data. It is true that technology markets improve on their prior evolution. The IoT looks to be shaping up as a market that will more rapidly shift to common standards as well as overcome a variety of other supply and demand-side challenges. Key market supply-side challenges include:

- **Lack of standards.** Service providers are being looked to as in a position to help drive large parts of the market toward an acceptable IoT communications protocol. While some

preliminary protocols are becoming visible to the market, formally available protocols remain to be seen.

- **Global scalability.** Large-scale adoption will likely be seen in enterprises that have a global presence. It is crucial that cross-border connectivity ease and costs are addressed satisfactorily. For example, a large transportation company that ships assets globally will need to have ubiquitous access to its goods and thus will require a robust connectivity solution that includes not only global cellular connectivity but satellite access for areas not covered by cellular networks (e.g., trans-Atlantic or trans-Pacific shipments).
- **Nascent ecosystem for application development.** The Internet of Things is challenging application developers, vendors, and business decision makers to transform existing business processes or technologies. However, the application ecosystem is still extremely nascent as the IoT really opens up endless opportunities to create solutions to connect "things" and change business processes or consumer behavior.
- **Competing priorities in developing regions.** While IoT solutions bring the promise of cost savings, and this may help business profitability in emerging markets, basic transportation and healthcare infrastructure and broadband establishment goals would stand to delay IoT implementations in developing countries.
- **Privacy and security concerns.** So much has *not* been raised and resolved formally around privacy within an increasingly IoT-connected world. According to a recent IDC survey of U.S. technology decision makers, the top hindrances they see to IoT growth are security and privacy concerns. IDC sees the ecosystem embracing the need for connectivity standards, but not close to raising and embracing the issue of privacy. With the amount of data and contextual input expected from sensors and other parts of the IoT solution, this is a challenge that will have to be overcome over the forecast period.

FUTURE OUTLOOK

Forecast and Assumptions

Assumptions

IDC has developed a number of key assumptions related to economic conditions, technology trends, and regulatory policy. These assumptions are central to the qualitative and quantitative sections of this forecast. Although this list is not exhaustive, it includes many of the key factors IDC believes will be core to the Internet of Things evolution over the forecast period. Table 1 provides the top 3 assumptions and Table 2 provides the full set of key forecast assumptions for the Internet of Things market for the 2014-2020 forecast period.

TABLE 1

Top 3 Assumptions for the Worldwide and Regional Internet of Things Market, 2014-2020

Market Force	IDC Assumption	Significance	Changes to This Assumption That Could Affect Current Forecast	Comments
Economy	<p>The global economy was sluggish in 2013, with volatility in emerging markets and weaker growth in mature economies. The U.S. government shutdown dragged on GDP in the fourth quarter, and the recoveries in Europe and Japan appeared to lose some steam. China recorded its slowest rate of growth in 14 years. This year will see stronger growth in mature economies including the United States, but emerging markets are vulnerable to capital flight and will be volatile again.</p>	<p>Because of the breadth and depth of installed connected "things" in both developed and even emerging economies worldwide, there is a strong correlation of the health of this market to worldwide economic health. A down economy affects business and consumer confidence, the availability of credit and private investment, and internal funding. A global recession would cause businesses to delay Internet of Things (IoT) implementations along with other IT and business-driven projects; a rising economy does the opposite. A crisis (perhaps triggered by more volatility in emerging markets) could create a chain of events that would drive tech spending much lower in the near term. Business and consumer demand in developed regions as a whole will remain critical to watch over the long run.</p>	<p>Increasing growth of the Internet of Things will be driven by enterprise and consumer demand. If the economic situation in emerging markets turns favorable and becomes less volatile, the growth of these regions could accelerate faster than predicted here.</p>	<p>Concerns to watch for include global demand for intelligent systems, the austerity versus growth policies in Europe, and a slowdown in China.</p>

TABLE 1

Top 3 Assumptions for the Worldwide and Regional Internet of Things Market, 2014-2020

Market Force	IDC Assumption	Significance	Changes to This Assumption That Could Affect Current Forecast	Comments
Embedded computing, Internet of Things	This term refers to the proliferation of client devices and end-user or end-use devices at the network edge. These other devices range from smartphones and networked entertainment devices to automobiles, building automation systems, smart meters and thermostats, medical electronics, and industrial controllers, not to mention RFID tags and sensors. Communicating client devices will proliferate at 5–10 times the rate of PCs installed. Devices will both converge (smartphones with more functionality) and diverge (single-use devices, such as RFID readers and industry-specific devices).	The addition of billions of devices to the network edge will drive the need for more enterprise systems to deploy, manage, and make use of these devices and the data they generate. Establishing Interoperability and connectivity standards will become a priority. It will also shift the prevailing traffic from the center of the network outward to edge inward, which will affect computing and communications architectures.	Without supporting systems and infrastructure, sufficient functionality, standards, and services to manage and analyze the influx of IoT systems connecting without human interaction and the data they generate, growth will be slowed as enterprises stall deployments until these come about.	It will be important to watch network strategies by service providers to ensure networks are built to handle increased bandwidth demands and the transition to a "transactional" network and available network types are leveraged appropriately given the varying IoT use cases and connectivity needs specified. Equally important to watch is how connectivity service providers align with other ecosystem players in the IoT market to help IoT clients realize the value of the data and analysis enabled by interoperable "things" and networks of networks.
Internet users	Billions of Internet users will go online, using the Internet on mobile devices and intelligent systems to browse, social network, entertain, and conduct commerce.	This means that hardware (computing, networking, and storage technologies), software, and services must be able to scale. Broadband penetration is essential for the growth of the IoT at the country and regional levels.	Without sufficient network capabilities, hardware, software, and services, IoT growth will be stalled.	Transitioning vendors' perspective on serving "individuals" to "things" will require significant retooling of value positioning and servicing customers.

Source: IDC, 2014

TABLE 2

Key Forecast Assumptions for the Worldwide and Regional Internet of Things Market, 2014-2020

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Macroeconomics				
Economy	The global economy was sluggish in 2013, with volatility in emerging markets and weaker growth in mature economies. The U.S. government shutdown dragged on GDP in the fourth quarter, and the recoveries in Europe and Japan appeared to lose some steam. China recorded its slowest rate of growth in 14 years. This year will see stronger growth in mature economies including the United States, but emerging markets are vulnerable to capital flight and will be volatile again.	High. A down economy affects business and consumer confidence, the availability of credit and private investment, and internal funding. A global recession would cause businesses to delay IT upgrades and some new projects; a rising economy does the opposite. A crisis (perhaps triggered by more volatility in emerging markets) could create a chain of events that would drive tech spending much lower in the near term.	↔	★★★★☆
Fiscal stimulus packages	The U.S. Federal Reserve is likely to continue tapering down its QE monetary stimulus throughout 2014, as long as the U.S. economy remains stable. This will continue to create uncertainty in emerging markets as investors look to move capital back into safe havens and away from weakening currencies. Fiscal stimulus in Europe is unlikely, but the government in China may step in if growth shows any sign of dropping closer to or below 7%.	Moderate. The major stimulus spending packages that followed the financial crisis have given way to a different form of monetary stimulus. In the United States, QE helped drive growth in spite of government spending cuts. In Japan, monetary easing is helping drive away deflation. We believe the GDP forecasts have accounted for the most likely government actions, including any additional stimulus measures in emerging markets in 2014.	↔	★★★★☆

TABLE 2

Key Forecast Assumptions for the Worldwide and Regional Internet of Things Market, 2014-2020

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Crisis duration/ potential relapse	2013 was a bump in the road for the global economy, with growth weaker than forecast, but the long-term recovery remains on course and in line with expectations. There are still downside risks that could trigger a relapse: debt in Europe, a hard landing in China, and capital flight from emerging economies. The long-term period of "weaker growth" still appears to be the baseline scenario.	Moderate. The long duration of the global recession created pent-up demand for IT products and services, but the recession's severity created a persistent air of caution on the part of buyers. As businesses came to believe the risks were receding, they loosened their purse strings. However, this was dampened by a sense that the crisis has given way to a period of long-term weaker growth. A return of "crisis mode," perhaps triggered by events in emerging markets, could plunge the global economy back to square one. While the risk of relapse lingers, business confidence will remain inhibited to some degree.	↔	★★★★☆
Oil prices	Oil prices have been relatively stable by the standards of some years but remain vulnerable to external shocks and supply chain disruption. In 2013, it was the conflict in Syria that caused volatility. In 2014, the crisis in Ukraine may drive up prices if supplies are disrupted by conflict or trade sanctions against Russia.	Moderate. While lower oil prices help spur lagging consumer spending, higher prices signal that demand is rising. If prices rise too quickly and spur demands for wage increases and pass-through to end users, this can be disruptive for the overall economy.	↔	★★★★☆

TABLE 2

Key Forecast Assumptions for the Worldwide and Regional Internet of Things Market, 2014-2020

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Policy	The major policy move in recent months has been the decision of the U.S. Federal Reserve to begin tapering down its QE stimulus program, which has in turn created a period of uncertainty and currency speculation in emerging markets. As a result, most policy measures in 2014 will be reactive as governments seek to shore up currency valuations and prevent capital flight. The European Central Bank will attempt to "stay the course," while Japan may accelerate its policies targeted at achieving 2% inflation by the end of this year.	Low. Policy measures can drive IT spending where they stimulate economic growth or consumer spending, or they can have a direct impact on IT spending (e.g., healthcare investment). On the other hand, this can create political uncertainty (e.g., the recent shutdown in the United States), which is bad for business confidence.	↔	★★★★☆
Profits	Corporate profits have been stable if unspectacular in most countries and are likely to remain so in 2014. Businesses have come to terms with an economy that has settled into a long-term period of subdued growth, and they have positioned themselves accordingly. Profits are unlikely to surprise on the upside or the downside in 2014, and are thus unlikely to disrupt IT spending plans.	Moderate. If profits are more subdued than expected, this could delay new investments including project-based IT spending. In an upside scenario, if profits begin to accelerate again in 2014, this will drive businesses to tap into their cash reserves.	↔	★★★★☆

TABLE 2

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Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Inflation	Inflationary pressures are currently a moderate concern in developed economies but retain the potential to disrupt economic growth in emerging markets because of currency devaluation in countries such as India. In particular, any rise in energy prices could have a severe impact on vulnerable economies. Cost-of-living increases in many countries are still outpacing income growth. In Japan, the government is actively seeking to drive inflation by loosening monetary policies to force a solution to deflation.	Moderate. Low inflation keeps interest rates low and leads to more capital spending, including spending on ICT. High inflation can dampen investment and can also raise the cost of IT products and component imports. Currency devaluation raises import prices, pressurizing profit margins at a time when businesses can least afford to pass this inflationary effect on to pessimistic consumers.	↓	★★★★☆
Exchange rates	Currency devaluation in emerging markets including India is a significant threat to short-term stability. Capital flight from emerging markets, driven by the tapering down of QE in the United States and provoked further by the perception of increased short-term risk and volatility in emerging economies, is creating inflationary pressures. A spike in oil prices could create a chain of events that would derail emerging markets even further, although governments are proactively attempting to drive a stabilization of exchange rates.	Moderate. A stable or steadily falling currency makes it easier for vendors to manage supply lines and stabilizes the prices of imports and exports. A weaker domestic currency can boost international firms, which report a positive impact on foreign earnings. A weaker domestic currency can also, however, raise the cost of imports. If prices for essential imports (e.g., oil) go up, this can flip an economy into a negative spiral.	↓	★★★★☆

TABLE 2

Key Forecast Assumptions for the Worldwide and Regional Internet of Things Market, 2014-2020

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Vertical industries	The main drag on IT spending is from the public sector, with government spending cuts in the United States and austerity measures in most of Europe. Dynamic industries include healthcare, which continues its pace of modernization to deal with aging populations in mature economies, and the services sector. Manufacturing firms are investing to improve their global competitiveness, while telecom operators are engaged in customer retention efforts. Industry-specific solutions will be a major driver for IT spending.	High. A downturn in major contributors to IT revenue (e.g., the financial services sector) can have a major impact on IT spending. Momentum in vertical sectors (e.g., healthcare) can drive overall IT spending. Industry-specific solutions are increasingly a major contributor to growth.	↑	★★★★☆
Wild cards	We don't predict a future wild card (which by definition is an unpredictable event with the potential to disrupt our forecasts), but the stability of emerging markets represents a wild card that may have a significant impact on forecasts. Spillover effects of the crisis in Ukraine could also be disruptive.	Moderate. Wild card events such as a flight of capital from emerging markets or conflict in Ukraine have the potential to significantly impact global growth.	↔	★★★☆☆

TABLE 2

Key Forecast Assumptions for the Worldwide and Regional Internet of Things Market, 2014-2020

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Technology/ service developments				
Embedded computing, Internet of Things	This term refers to the proliferation of client devices and end-user or end-use devices at the network edge. These other devices range from smartphones and networked entertainment devices to automobiles, building automation systems, smart meters and thermostats, medical electronics, and industrial controllers, not to mention RFID tags and sensors. Communicating client devices will proliferate at 5–10 times the rate of PCs installed. Devices will both converge (smartphones with more functionality) and diverge (single-use devices, such as RFID readers and industry-specific devices).	High. The addition of billions of devices to the network edge will drive the need for more enterprise systems to deploy, manage, and make use of these devices and the data they generate. Establishing interoperability and connectivity standards will become a priority. It will also shift the prevailing traffic from the center of the network outward to edge inward, which will affect computing and communications architectures.	↑	★★★★☆

TABLE 2

Key Forecast Assumptions for the Worldwide and Regional Internet of Things Market, 2014-2020

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Green IT	<p>Green IT refers to a basket of technologies and practices designed to minimize power costs, carbon output, and hazardous waste. The major impact of green IT will be on technology choices based on low power, more attention to asset disposal, and some change in vendor selection. Depending on the country, voluntary adherence to green IT principles could become law. The search for sustainability in areas outside IT will lead to opportunity for IT vendors. However, the weak economy has shifted some attention away from green IT in the near term, in many cases because of vendors' inability to fund new projects.</p>	<p>High. The adoption of green IT products and practices should increase demand for new IT products and services, and it bolsters the case for many connected city, energy management, and industrial IoT use cases. However, initiating new projects with short-term costs for long-term gain is more difficult in a weak economy.</p>	<p>↑</p>	<p>★★★★☆</p>

TABLE 2

Key Forecast Assumptions for the Worldwide and Regional Internet of Things Market, 2014-2020

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Cloud	<p>Cloud is a new paradigm of computing that will shape IT spending over the next several decades — the logical evolution of what IDC called "dynamic IT" for years. It entails shared access to virtualized resources over the Internet. IDC estimates that cloud services spending will continue to grow at double-digit rates for the next few years, gradually accounting for a larger proportion of all IT spending. In the short term, this will have a negative impact on some IT vendors, pressuring profit margins and increasing competition while allowing some end users to lower their overall spending on certain solutions. In the long term, however, we believe that cloud will have a positive overall impact on industry growth as more users adopt more advanced computing solutions at a faster rate.</p>	<p>Moderate. The key advantage to cloud services should be the ability of IT organizations to shift IT resources from maintenance to new initiatives. This in turn could lead to new business revenue and competitiveness as well as create new opportunities for IT vendors in SMB and emerging markets. The benefits may be offset to some extent by cannibalization in the short term, resulting in shorter service engagements, price model disruption, and some hardware commoditization, but a strong economy would see most organizations shift resources to new IT development and adoption areas in the long term. We see cloud adoption as an IT spending driver overall, despite these cannibalization effects in the next two to three years.</p>	<p>↑</p>	<p>★★★★☆</p>

TABLE 2

Key Forecast Assumptions for the Worldwide and Regional Internet of Things Market, 2014-2020

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Regional IoT growth influencers				
Internet users	Billions of Internet users will go online, using the Internet on mobile devices and intelligent systems to browse, social network, entertain, and conduct commerce.	High. This means that hardware (computing, networking, and storage technologies), software, and services must be able to scale. Broadband penetration is essential for the growth of the IoT at the country and regional levels.	↑	★★★★★
Government support or mandates for efficient technologies and services	Monetary support and/or government-funded research is taking place in major developed countries around the world. This is being seen more often than not in countries with a longstanding culture of governmental involvement in requiring or inspiring efficient technologies for their communities and for driving RFPs and multiyear implementation initiatives to this end.	Moderate. Government interest in connected device, particularly IoT, solutions results in both trials and conceptualizations as well as RFPs and contracts being awarded.	↑	★★★★☆
Eco-consciousness and regulation	Some businesses, governments, and local and national organizations around the world have taken action on reducing waste produced by business or end-user consumption.	Low. While IoT use cases (smart metering, connected homes, etc.) can yield results that include energy cost savings, a culture of eco-consciousness indirectly impacts the growth of the Internet of Things. It appears that some eco-conscious efforts in communities are at a level removed from RFPs. The degree of impact expected from this favorable backdrop in countries around the world may evolve more favorably over time.	↑	★★★★☆

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Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Standardization efforts	Tangible progress from multi-corporation associations around IoT standards that promote and facilitate open and agnostic connectivity and data protocols is not quite seen around the world yet. Briefings indicate that preliminary standard protocols designed specifically for IoT are garnering interest. Multiple standards organizations are actively forming and marketing themselves to lead the ultimate IoT standard.	High. While it is not clear if it will be one or two IoT connectivity standards that will rule in the IoT market worldwide, it is clear that for the value-added layers of the IoT solution stack to result in the business and consumer benefits as envisioned, that networks of networks of things will have to talk to and understand each other.	↑	★★★★☆
Market characteristics				
Hardware	Capital spending on IT equipment was weak in 2013 but this has helped create a certain level of pent-up demand for infrastructure investment. The slowdown in emerging markets has also contributed to lower overall growth, and a rebound is likely if those economies continue to stabilize. We expect capital spending to accelerate in 2014 as businesses look to "fix the roof while the sun is shining."	High. Hardware spending, about 40% of total IT spending, also drives downstream spending in software and services.	↔	★★★★☆

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Key Forecast Assumptions for the Worldwide and Regional Internet of Things Market, 2014-2020

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Software	Software spending has rebounded strongly over the past two years and was ahead of expectations in 2013. There is some evidence that organizations are investing in software as a means of labor substitution. Businesses seem willing to continue with software investments, even while looking to cut back on other areas of their overall spending.	High. Software spending, about 20% of total IT spending, can drive spending in hardware and IT and in business services.	↔	★★★★☆
Services	Services markets have been steady but tepid by historical standards. Government austerity programs have included direct reductions in levels of IT services spending, and cannibalization from the cloud is still a drag on overall growth. On the upside, there will be some downstream spending from hardware and software, but less than in previous cycles.	High. IT services spending can affect the rate of overall solution adoption as well as the migration to cloud computing. IT services account for about 40% of IT spending.	↔	★★★★☆
Telecom	The telecom industry in its size and utility is somewhat insulated from sudden economic swings, or at least it has significant inertia. Service provider revenue has picked up in the past 24 months, driven by the adoption of smartphones and related mobile data charges. Mobile data revenue continued to drive growth in 2013, with overall telecom services revenue increasing by 4%.	High. The IT industry has already factored telecom industry spending into its internal forecasts; the key is the pace at which convergence takes place. Mobile services will continue to drive mobile devices and software, and vice versa.	↔	★★★★☆

TABLE 2

Key Forecast Assumptions for the Worldwide and Regional Internet of Things Market, 2014-2020

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Explosion of data	More users with more devices connecting to more systems that — being intelligent — can connect, share, process, store, and analyze data among each other will collectively realize the phenomenon that IDC identifies as big data.	High. Machine-enabled data analytics will become critical for society to function. Pervasive demand for data from consumers and enterprises will continue to exceed the capacity of networks over our forecast period, so there is a large opportunity that emerges to build intelligent, efficient, and flexible networks. This will drive demand for heterogeneous solutions across the entire network.	↑	★★★★☆

Legend: ★☆☆☆☆ very low, ★★☆☆☆ low, ★★★☆☆ moderate, ★★★★☆ high, ★★★★★ very high

Source: IDC, 2014

Worldwide Market Size and Forecast of the Internet of Things – Installed Units

IDC estimates that as of the end of 2013, there were 9.1 billion IoT units installed – with IP connectivity and communicating without human interaction. While the market for the Internet of Things is still a construct in its infancy, there is a long legacy of autonomously connected things from the machine-to-machine (M2M) communications era. IDC expects the installed base of IoT units to grow at a 17.5% CAGR over the forecast period to 28.1 billion in 2020. Enablers for the impressive growth rate over the forecast period include but are not limited to pervasiveness of wireless connectivity, ubiquitous access to the Internet regardless of location, IoT standard protocols, regional government support for efficient technologies and services, and consumer familiarity with conceptual and realities around connected cars and connected homes.

Table 3 presents IDC's forecast for the installed base of the Internet of Things.

TABLE 3**Worldwide Internet of Things Installed Base, 2013-2020 (B)**

	2013	2014	2015	2016	2017	2018	2019	2020	2013–2020 CAGR (%)
Internet of Things	9.1	11.4	13.7	16.3	19.2	22.2	25.2	28.1	17.5
Growth (%)	25.4	24.8	20.8	19.1	17.5	15.8	13.5	11.5	

Note: See Table 1 for top 3 assumptions and Table 2 for key forecast assumptions.

Source: IDC, 2014

Worldwide Market Size and Forecast of the Internet of Things – Revenue

IDC has looked at the totality of IoT solutions, including connectivity services, analytics, applications, platforms, security, infrastructure, and professional services, as well as the revenue associated with the intelligent or enhanced traditional embedded system shipment itself. We expect IoT technology and services revenue to grow to more than four times what it is estimated to be at year-end 2013. IDC estimates that revenue will grow from \$1.9 trillion in 2013 to \$7.1 trillion in 2020 at a 20% CAGR.

The revenue attached to the installed unit – from connectivity to platforms to analytics to applications – makes up the majority of the revenue estimate. The IoT embedded system shipment revenue makes up nearly one-third of revenue today. This share of total worldwide IoT revenue is expected to decline over the forecast period as the premium value of midlevel and high-end IoT use cases are proven and supported by the adoption of standard connectivity protocols and bolstered by acceptable security and privacy initiatives. At the present time, a sizable proportion of the revenue attached to the installed IoT units, and not shipment revenue, is not bundled together as an IoT solution, but discussions with players in the IoT ecosystem corroborate IDC's expectation that IoT solutions will be increasingly put forth with bundled pricing schemes that are applied on a per unit per month basis. Our assumptions for attached revenue are in bundles, ranging from lower-value to higher-value fees, as discussed in the Methodology section.

Table 4 presents IDC's forecast for the overall revenue potential of the Internet of Things.

TABLE 4**Worldwide Internet of Things Revenue, 2013-2020 (\$B)**

	2013	2014	2015	2016	2017	2018	2019	2020	2013–2020 CAGR (%)
Revenue	1,927.5	2,292.3	2,711.5	3,179.7	3,782.4	4,592.3	5,648.6	7,065.3	20.4
Growth (%)	25.7	18.9	18.3	17.3	19.0	21.4	23.0	25.1	

Note: See Table 1 for top 3 assumptions and Table 2 for key forecast assumptions.

Source: IDC, 2014

Regional Market Size and Forecast of the Internet of Things – Units and Revenue

IDC has assessed each of the major regions around the world and puts forth that while every region in the world has begun implementing IoT solutions, developed regions are leading and will continue to lead the way to the massive growth of IoT by 2020. Investment in traditional Information, communications, and technology is certainly one indicator of the relative proportions that we expect to see in the IoT market, but it is not the only driver of how the regions are expected to fare relative to each other. Key observations on the developed regions and their IoT installed unit and revenue trajectory include:

- The homogeneity of connectivity needs has allowed the North American market to sidestep border-driven IoT adoption challenges so far and set the groundwork early for IoT market growth.
- In both the Western European and Asia/Pacific (APAC) regions, government mandates are visibly going hand in hand with a more openly eco-consciousness culture supported by regulations than IDC observes in North America. These favorable trends coupled with the sheer volume possibilities in some APAC countries in particular and a noticeable IoT solution trial mentality are expected to drive both Western Europe and APAC higher than North America in terms of both installed units and revenue by 2020.
- With the exception of Central and Eastern Europe (CEE), which arguably is more similar to Western Europe than it is to Latin America (LATAM) and the Middle East and Africa (MEA), the regions are focused on sustainable economies and safety and security issues. Therefore, solutions that align well with these regional needs have seen some adoption in smaller pockets, namely transportation-connected solutions in Brazil and Mexico.

Table 5 and Table 6 present IDC's forecast for the unit and revenue, respectively, potential of the Internet of Things by region.

TABLE 5**Worldwide Internet of Things Installed Base by Region, 2013-2020 (B)**

	2013	2014	2015	2016	2017	2018	2019	2020	2013–2020 CAGR (%)
Asia/Pacific	2.8	3.6	4.4	5.4	6.4	7.6	8.9	10.1	20.1
Central and Eastern Europe	0.3	0.3	0.4	0.5	0.6	0.7	0.8	0.8	15.0
Latin America	0.2	0.2	0.3	0.2	0.4	0.4	0.5	0.6	17.0
Middle East/Africa	0.3	0.4	0.4	0.5	0.5	0.7	0.7	0.8	15.0
North America	3.1	3.8	4.5	5.2	5.9	6.5	7.0	7.5	13.5
Western Europe	2.4	3.1	3.7	4.5	5.4	6.3	7.3	8.3	19.4
Total	9.1	11.4	13.7	16.3	19.2	22.2	25.2	28.1	17.5

Note: See Table 1 for top 3 assumptions and Table 2 for key forecast assumptions.

Source: IDC, 2014

TABLE 6**Worldwide Internet of Things Revenue by Region, 2013-2020 (\$B)**

	2013	2014	2015	2016	2017	2018	2019	2020	2013–2020 CAGR (%)
Asia/Pacific	600.3	729.5	881.8	1,056.9	1,287.6	1,605.9	2,027.2	2,602.6	23.3
Central and Eastern Europe	57.9	69.0	81.9	96.4	115.0	140.0	172.9	217.1	20.8
Latin America	37.5	42.5	47.2	51.5	56.7	62.9	69.4	76.3	10.7
Middle East/Africa	56.2	63.7	70.8	77.2	85.1	94.4	104.1	114.4	10.7
North America	667.9	775.5	892.7	1,016.8	1,168.8	1,363.2	1,608.0	1,922.1	16.3
Western Europe	507.7	612.1	737.1	880.9	1,069.2	1,325.8	1,667.0	2,132.8	22.8
Total	1,927.5	2,292.3	2,711.5	3,179.7	3,782.4	4,592.2	5,648.6	7,065.3	20.4

Note: See Table 1 for top 3 assumptions and Table 2 for key forecast assumptions.

Source: IDC, 2014

Market Context

Multiple factors have come together in the IoT research that together explain the decrease in IDC's worldwide IoT installed base overall, and particularly in the early years of the forecast period. The definition revision that emphasizes IP connectivity in addition to no human interaction has resulted in refinement of current estimates of intelligent systems and enhanced embedded systems that are true to this definition today. The growth rate is impacted over the forecast period as the forecast builds to near what it was in the prior forecast. Additionally, recent research into the average life of an IoT system indicates that industrial systems are in place much longer than originally anticipated. Table 7 and Figure 3 provide a comparison of the current forecast with the forecast published in *Worldwide Internet of Things (IoT) 2013-2020 Forecast: Billions of Things, Trillions of Dollars* (IDC #243661, October 2013).

TABLE 7

Worldwide Internet of Things Installed Base, 2012-2020, Comparison of October 2013 and May 2014 Forecasts (B)

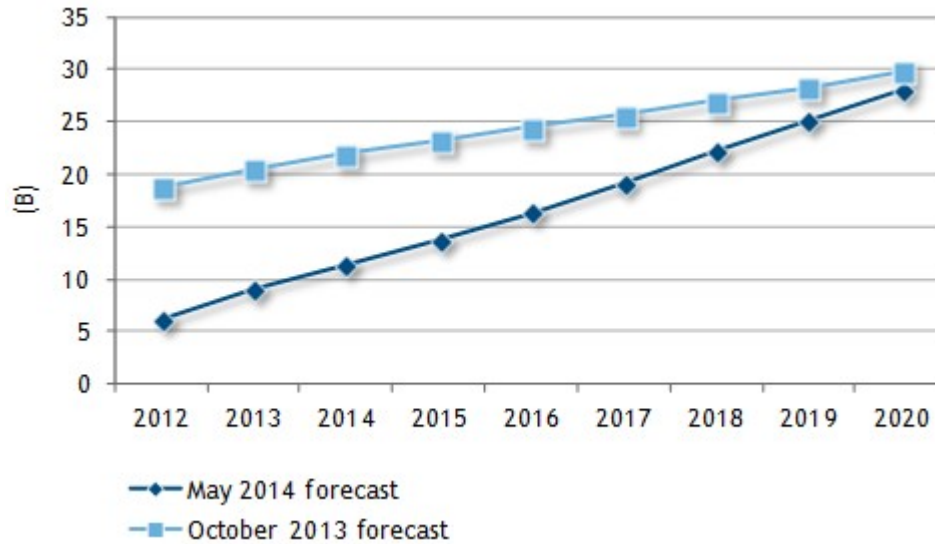
	2012	2013	2014	2015	2016	2017	2018	2019	2020
May 2014 forecast	6.1	9.1	11.4	13.7	16.3	19.2	22.2	25.2	28.1
Growth (%)	NA	49.1	24.8	20.8	19.1	17.5	15.8	13.5	11.5
October 2013 forecast	18.8	20.4	21.9	23.2	24.4	25.6	26.9	28.2	29.7
Growth (%)	NA	8.5	7.4	5.9	5.2	4.9	5.1	4.8	5.3
Change from October 2013 to May 2014 forecast	-12.7	-11.3	-10.5	-9.5	-8.1	-6.4	-4.7	-3.0	-1.6

Note: See *Worldwide Internet of Things (IoT) 2013-2020 Forecast: Billions of Things, Trillions of Dollars* (IDC #243661, October 2013) for prior forecast.

Source: IDC, 2014

FIGURE 3

Worldwide Internet of Things Installed Base, 2012-2020, Comparison of October 2013 and May 2014 Forecasts



Source: IDC, 2014

ESSENTIAL GUIDANCE

The entire ecosystem remains motivated to make the IoT a reality. The worldwide market is in the process of evolving from a supply-driven market to a demand-driven market. As standard connectivity protocols are formally introduced and accepted, privacy and security concerns that are currently an elephant in the room in most industry discussions on the IoT market are addressed, and the value of higher-end IoT solutions is proven through trials and business and consumer awareness and education campaigns, the Internet of Things market will become a reality.

IDC asserts that businesses, consumers, and the ecosystem of vendors in the IoT will experience a multitude of benefits from the IoT market's progress. IDC characterizes six major experiences the worldwide market and developed regions in particular will experience as the market takes shape heading into 2020:

- **New business models.** In an increasingly competitive market, vendors and enterprises alike are desperate to find new ways to do business and create new approaches to creating value for their end customers. For businesses that are playing in a business-to-business world or in a business-to-consumer world, the Internet of Things will allow automation of some business processes that can speed time to market, measure performance, and rapidly respond to customer needs. For some vendors, the Internet of Things market is a defining moment in their evolution away from license-based business models to recurring revenue streams associated

with installed units. For other vendors, the Internet of Things market is validating the horizontal value of their longtime enablement offers.

- **Mission critical processes and products.** The Internet of Things will allow businesses to capture more data about their processes and products. In some cases, the data collected will provide crucial and valuable corporate information that will allow these enterprises to transform their business or make real-time decisions. In other cases, the data will help first responders make better decisions about a patient's healthcare on the spot. And in still other cases, consumers will be fed improved offers that make or break the customer-business relationship and sale of a product or service.
- **Diversification of revenue stream.** For vendors and service providers especially, the Internet of Things provides a chance to innovate and offer a new product/service to existing customers, thus creating new revenue opportunities. For businesses, the Internet of Things can help monetize additional services on top of their existing products (e.g., a vending machine vendor can offer an inventory monitoring service to its consumer packaged goods customers).
- **Global player.** With the Internet of Things, enterprises will be able to have visibility to their business regardless of their location and be able to monitor, manage, and track activities of that endpoint or collect valuable information. For some enterprises, this will significantly impact their business in that they don't require a local presence to manage their assets or products.
- **Efficient intelligent operations.** The Internet of Things will have a profound effect on how businesses are able to make optimization, productivity, and real-time decisions. With instantaneous access to information on their autonomous endpoints – with corporate assets or customer products – and the ability to act on information captured immediately, businesses will benefit or change business processes over time to elicit longer-term productivity and efficiency gains.
- **Increased expectations.** As more and more consumers, businesses, governments, healthcare providers, and the like witness the enhancements to the quality and/or cost of life and business firsthand, expectations for vendor solutions will increase. Analytics will be an expected output of data generated from more basic IoT solutions. The virtuous circle of proven value and demand will expand. With this will come increased competition among vendors in the ecosystem, a theme that IDC will continue inspecting over the forecast period.

LEARN MORE

Related Research

- *Worldwide Internet of Things 2014 Top 10 Predictions: Nascent Market Shakes Up Vendor Strategies* (IDC #245578, January 2014)
- *IDC's Worldwide Internet of Things (IoT) Taxonomy, 2013* (IDC #243397, October 2013)
- *The G20 Through the Internet of Things Lens* (IDC #243705, October 2013)
- *Worldwide Internet of Things (IoT) 2013-2020 Forecast: Billions of Things, Trillions of Dollars* (IDC #243661, October 2013)
- *Worldwide Intelligent Systems 2013-2017 Forecast: The Rise of Intelligent Systems* (IDC #241359, July 2013)

Definitions

- **Intelligent systems** are securely managed electronic systems that run a high-level operating system and autonomously connect to the Internet, execute native or cloud-based applications, and analyze data collected. Some traditional embedded systems are enhanced to operate within an IoT construct similarly.
- **Machine-to-machine (M2M)** is an older, but still used, industry term that became popular to describe a network facilitating communications between – either wired or wireless – devices. Its origins can be placed somewhere around the time that computer networking automation took place. Early applications were in telemetry and industrial automation.

Synopsis

This IDC study analyzes the Internet of Things (IoT) market at a worldwide level and by region. It provides an update to the worldwide IoT market outlook published in *Worldwide Internet of Things (IoT) 2013-2020 Forecast: Billions of Things, Trillions of Dollars* (IDC #243661, October 2013). It updates the worldwide IoT units installed and revenue split by region. The full breadth of the IoT ecosystem revenue is put forth in the revenue forecast, encompassing revenue from the IoT system shipments themselves as well as revenue from connectivity services, infrastructure, purpose-built IoT platforms, applications, security, analytics, and professional services attributable to the base of installed IoT systems. The study discusses the key themes contributing to and characterizing the worldwide and regional growth of the IoT.

"Despite the Internet of Things being a relatively new construct around the world for businesses and consumers alike, IDC research confirms the awareness of the value of IoT solutions is increasingly being recognized as transformative to business, governments, and consumers and the way each party experiences, operates, and innovates in the world. Visible trials and early implementations create a virtuous circle," said Carrie MacGillivray, program vice president, Mobile Services, IoT, and Infrastructure. "From smart meters and operational and cost efficiencies to smart buildings and smart home systems, end users are able to see and feel the tangible benefits of IoT. This will spur increased demand for IoT solutions around the world."

About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

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