

# The Internet Of Things Heat Map, 2016

Where IoT Will Have The Biggest Impact On Digital Business

by Michele Pelino and Frank E. Gillett

January 14, 2016

## Why Read This Report

Internet of Things (IoT)-enabled applications are poised to revolutionize digital customer experience and enhance digital operational excellence — but where will they apply at your company? Some key IoT-enabled applications such as security and surveillance and building management apply across multiple industries, while others, including inventory management, supply chain, and asset management, provide higher value in specific industries. Infrastructure and operations executives must collaborate with their line-of-business partners to identify IoT application priorities and deployment momentum across their organization. This report helps you identify where the ripest opportunities lie.

This report provides a new version of the heat map of IoT use cases published in the “Mapping The Connected World” Forrester report.

## Key Takeaways

### **IoT Is A Business-Driven Tech Trend That I&O Will Support For Each Use Case**

A majority of global enterprises are using or planning to use IoT -- but that doesn't mean I&O leaders should rush to construct IoT infrastructure for the business. IoT tech is enormously varied and complex because it is designed to address a wide range of business applications that span many industries. I&O leaders must support business leaders as trusted advisors to support business-led use cases.

### **Prioritize Your Firm's IoT Applications And Use Cases**

Evaluate opportunities for your firm to deploy IoT-enabled applications and use cases based on three factors specific to your firm: IoT use case applicability and maturity, physical asset intensity, and information and communications technology (ICT) spending.

### **Evaluate The Impact Of IoT Application Deployment On Processes And Skills**

Implementing IoT requires I&O execs to reassess technology solutions to help deploy, manage, and secure their firm's connected devices and processes, and demands new employee skill sets to enable IoT applications and analyze data captured from these connected products and applications.

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Forrester interviewed Cisco, IBM, L&T Infotech, Microsoft, PTC Axeda, Schneider Electric, and Zebra Technologies and leveraged analyst expertise and inquiry discussions with end users and vendors for this research.

### Related Research Documents

[Brief: The Internet Of Things Will Transform Customer Engagement](#)

[Infrastructure Will Drive The Retail Store Experiences Of The Future](#)

[Internet-Of-Things Software Platforms Simplify Transformation Of Business Operations](#)

[Mapping The Connected World](#)

[An S&R Pro's Guide To IoT Security](#)

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## Companies Are Looking To IoT To Help Them Go Digital

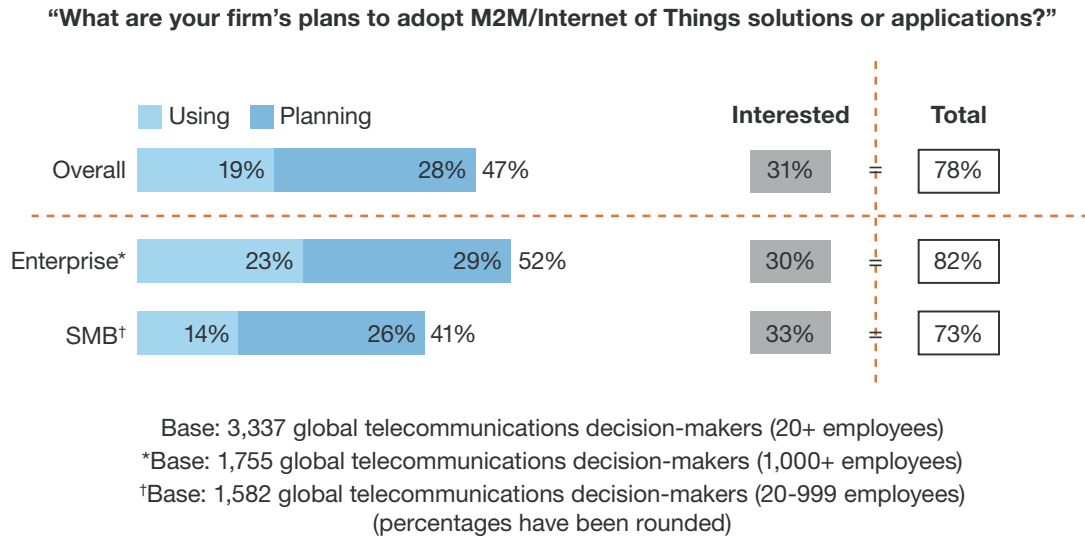
Relationships with customers are becoming increasingly digital, and so are companies' products and operations — and that has sparked companies in every industry to embrace digital business transformation.<sup>1</sup> Internet of Things (IoT) solutions help companies bridge the physical and digital worlds, ingesting information and context through sensors from the physical world into the digital and taking actions in the physical world via actuators based on digital insights.<sup>2</sup> Business leaders and product owners are increasingly making and operating connected products and business processes — and depending on the CIO's organization to connect, support, secure, and integrate these new business technologies. They do so to both help create new digital customer experiences (DCXes) and achieve digital operational excellence (DOX) in service of customers.<sup>3</sup> So how prevalent is the phenomena? We surveyed telecom decision-makers and learned that:<sup>4</sup>

- › **Global adoption is now one-fifth of all firms.** About 19% of respondents report IoT usage today, with 28% planning to adopt in the near future, across 10 established and emerging countries on five continents (see Figure 1). Developments in IoT software platform solutions are enabling grocers such as Kroger to help customers find relevant products, cut costs, and improve loss prevention by using sensors and employee mobile devices to get greater visibility into retail store inventory and operations.<sup>5</sup>
- › **Enterprises lead SMBs in IoT adoption and interest by more than 10 points.** As is common with new technologies, enterprises are more likely than smaller companies to use IoT. Twenty-three percent of global enterprise respondents use IoT, but only about 14% of small and medium-size business (SMB) respondents do. For example, Lufthansa Airlines is using real-time aircraft, airport, and weather sensor data to improve on time performance and optimize operations.<sup>6</sup> For SMBs, simple technology to get more data about operations can make a big difference. German dairy farmer Steffen Hake uses SCR Dairy necklace sensor tags on his cows to get early alerts on sick cows and to improve calving rates on breeding cows.<sup>7</sup>
- › **Emerging markets show the strongest interest in IoT, across global regions.** Respondents in North America and Australia/New Zealand report similar adoption rates; around 37% plan to or are already using IoT. European respondents are a little more likely to report IoT interest or use at 42%. But Latin American and Asian respondents really stand out, with 52% and 75% of firms reporting use of or plans for IoT, respectively (see Figure 2).

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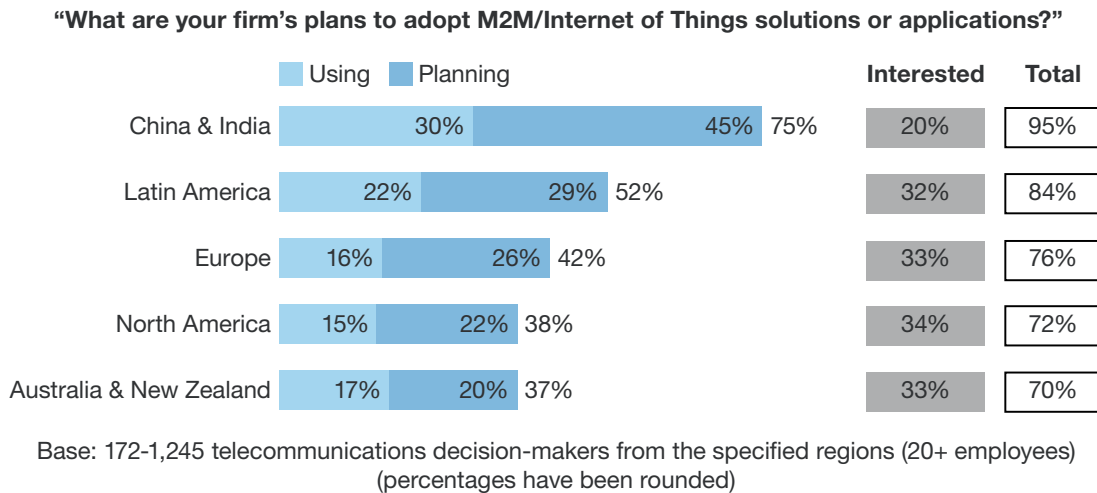
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**FIGURE 1** Internet Of Things Application Adoption Among Enterprises And SMBs



Source: Forrester’s Global Business Technographics® Networks And Telecommunications Survey, 2015

**FIGURE 2** Geographic Differences In IoT Application Deployment Are Evident



Source: Forrester’s Global Business Technographics® Networks And Telecommunications Survey, 2015

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**IoT Is Complex Technology That Defies Simple Approaches**

Enterprises have been using early forms of sensors since the first programmable logic controller (PLC) was invented for manufacturing decades ago. But only recently have sensor and automation vendors begun to take advantage of the tiny, cheap sensors and processors emerging from the silicon and smartphone revolution. The new digital and Internet-enabled technology enables IoT devices to exist both inside a company and in the wild with its customers. IoT use cases incorporate a variety of devices and contexts, from PLCs on manufacturing lines to satellite-connected sensors on long-haul trucks to Nest thermostats in customers' homes. IoT technologies and applications have:

Companies can use the improved data about products, processes, and customer behavior to achieve additional levels of IoT value: differentiation and transformation.

- › **Three very different business value propositions.** When businesspeople grasp the possibilities that flow from instrumenting physical assets, they often focus on optimization examples like “reduce the number of forklifts needed in a factory by 10%.” But companies can use the improved data about products, processes, and customer behavior to achieve other levels of IoT value: differentiation and transformation.

For example, the shipping company Maersk achieved differentiation by instrumenting its shipping containers so that customers know location, impact and vibration, and temperature status of their shipment. Kaeser Compressors used sensor-enabled air compressors to transform its business model into a product-as-a-service. It now offers compressed-air-as-a-service for customers that would rather pay for compressed air as they use it, rather than buying and maintaining compressed-air equipment.<sup>8</sup>

- › **Diverse sensor technologies that enable many different use cases or applications.** Sensors range from microscopic accelerometers etched directly into systems-on-a-chip to giant strain gauges to measure the weight of industrial silos. The variety of real-world use cases is nearly infinite — companies have an enormous appetite for more information about customer behavior and real-world status. ThyssenKrupp extended connectivity to thousands of sensors in its elevator and escalator systems to create a dashboard of critical events, a rich capability for detecting emerging problems, and the ability to schedule convenient preventive maintenance rather than endure unplanned downtime.
- › **Wildly varied communications and software technologies, protocols, and standards.** Because of the enormous range of sensors, customer scenarios, and business cases, the technologies for IoT sensor devices, radios, network protocols, software protocols, and data formats are very diverse. There is nothing like the market norms and industry standards of data center, PC, or

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mobile device technology. And it's not getting better soon: The need for a wide range of capabilities to suit a wide range of use cases means that the industry won't standardize any time soon on any universal IoT technologies beyond the existing web and Internet standards.

- › **Little integration with traditional I&O.** Technology for IoT was developed outside of the computer industry for product engineering and production management buyers. These buyers have little or no relationship with the CIO's organization — because they had no need to connect operational technology (OT) to IT networks or business applications. Now product and business leaders actually do want to connect their growing streams of IoT data to business applications, but they will continue to own and manage this technology, rather than turn it over to I&O. But they increasingly will need help from I&O and security teams to manage and secure IoT devices, and to integrate their data and applications into enterprise applications.<sup>9</sup>

## Focus On Business-Led IoT Use Cases, Not Vertical Or Tech Strategies

With all of that complexity and diversity of potential applications, I&O execs may be tempted to plan for generalized IoT infrastructure to try and be ready for anything, in the same way that they did for cloud and mobile. But because IoT technology is driven by specific business use cases, and there is no common IoT infrastructure, IoT solutions are being built from scratch for each use case. I&O execs should focus on supporting the business use of IoT. They can do this by focusing on specific business cases where they can:

- › **Help pick the right IoT software platforms.** Business execs in product and operations orgs will face choices about which IoT software platforms they should choose for integrating into products and into business processes. I&O execs, along with enterprise architects and app dev execs, should work with business leaders to pick among the IoT software platforms that meet business needs while offering the best road map for integration with business technology systems and other IoT use cases.<sup>10</sup>
- › **Collaborate with security peers on management and security of IoT.** IoT software platforms provide crucial and specialized capabilities for connecting, managing, and securing IoT edge devices and gateways. But these should not be isolated and invisible from I&O systems. I&O and business execs should work together with security teams to create an integrated view of the company's digital systems, with common visibility into status and security across business-operated IoT systems and IT infrastructure.
- › **Integrate IoT data and applications into enterprise apps and analytics.** The data from IoT devices only reaches its full potential when it's integrated with business, customer, and financial systems. And business owners of IoT can't drive this. So I&O execs must work with their app dev and enterprise architecture partners to integrate IoT data flows, direct IoT data into analytic systems, and link IoT data into business applications.

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**Business, Operational, And Regulatory Goals Shape IoT Use Cases**

Respondents to Forrester's Global Business Technographics® Networks And Telecommunications Survey, 2015 reveal that IoT applications and future plans vary based on industry sector (see Figure 3). A wide variety of product companies offer sensor-enabled connected products to enhance customer experience and engagement.<sup>11</sup> In addition, many firms are using IoT-enabled assets to improve company operations, both for customer impact and for operational efficiency. To sort out the most interesting IoT opportunities, each firm must identify and evaluate current and emerging IoT use cases based on business, operational, and regulatory requirements. IoT technologies help businesses address core business drivers by enabling them to:

- › **Drive revenue growth and enhance services.** Firms use IoT to improve DCX in ways that expand revenues and raise retention. For example, Disney rolled out MagicBand, a wearable device that guests use to navigate their theme park experience and speed access to rides, restaurants, and hotel rooms.<sup>12</sup> In the utilities sector, firms such as PG&E use smart grid technology to analyze power usage data, identify outages, and proactively resolve customer issues. They also work with consumers using smart thermostats to reward customers that reduce peak demand and help them manage overall energy costs.
- › **Optimize allocation of capital, assets, and personnel.** Many firms use IoT technologies to extend digital business deeply into their daily operations by getting detailed visibility into the physical world. For example, industrial manufacturers use sensor-enabled machinery to evaluate machine performance, detect issues, and inform field service personnel when they need to perform proactive maintenance to prevent industrial line service interruptions. An important driver of IoT solution deployment is the number and value of physical assets (e.g., cars, equipment, machinery) and physical structures within each industry sector. The success of asset-intensive manufacturing, government, utilities, telecom, and transportation organizations depends on how efficiently and extensively they leverage their extensive physical assets.
- › **Address regulatory requirements.** In some industries, such as transportation, energy, and healthcare, IoT solutions can help address specific regulatory requirements. For example, the European Parliament mandated that as of April 2018, auto manufacturers must equip all new cars with eCall technology.<sup>13</sup> The eCall system automatically dials Europe's single emergency number in the event of a serious accident, transfers accident location information to the nearest emergency service center, and improves emergency response time. In the US, the Rail Safety Improvement Act (RSIA) requires railroads transporting poisonous materials or passengers to implement positive train control (PTC) by December 31, 2015.<sup>14</sup> These IoT-enabled PTC solutions prevent train derailments and collisions by automatically warning a locomotive engineer to act, or by engaging brakes to stop a train if the engineer fails to act.
- › **Reduce risk by managing buildings, facilities, and security processes.** Firms across multiple industry sectors can use IoT-enabled building management and surveillance solutions. For example, Honeywell installed a security and building management system (BMS) in a

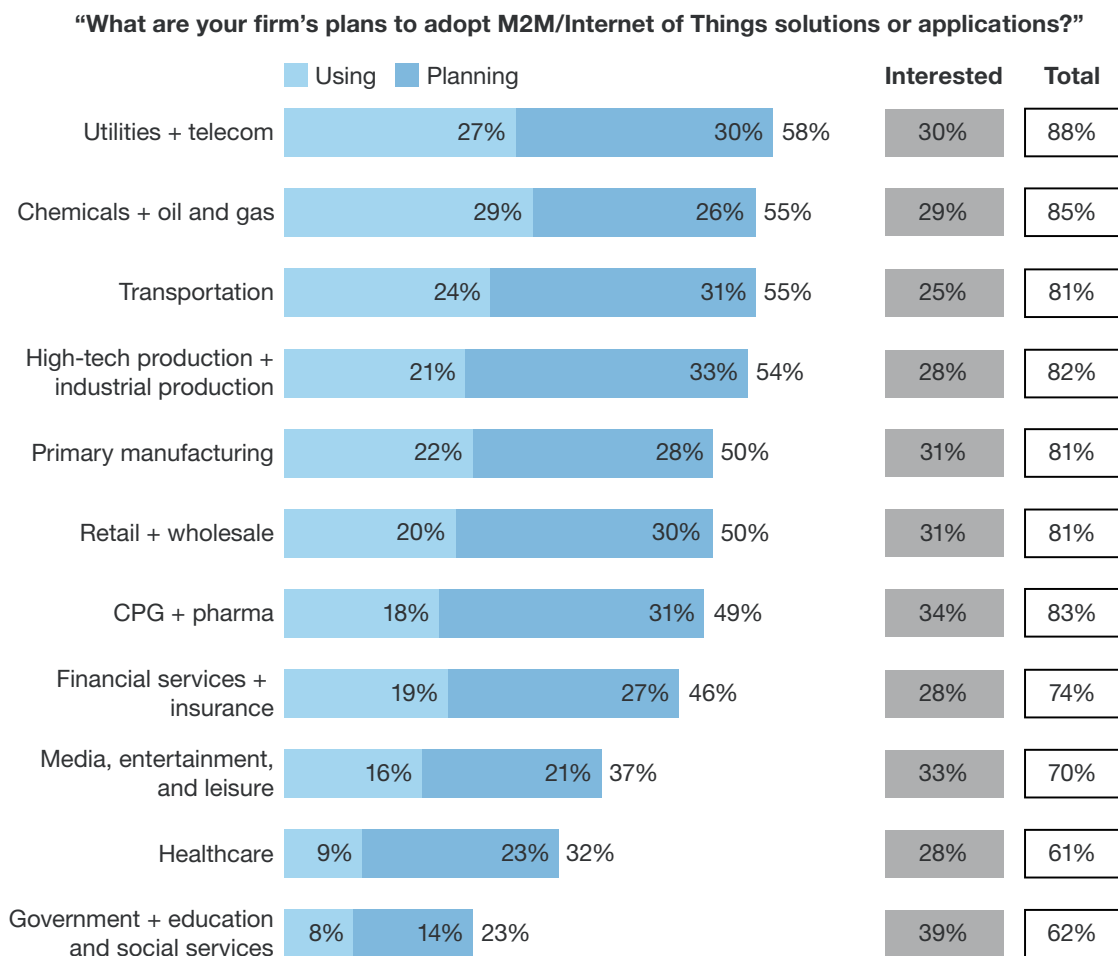


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12,000-square-meter office building in SmartCity Malta.<sup>15</sup> The BMS receives sensor-enabled input from multiple sources, including fire alarms, security systems, lighting systems, power generators, and water monitoring alarms to trigger alarms or actions like recording video. Schneider Electric is equipping a children’s hospital in Australia with an intelligent hospital infrastructure to integrate sensor-enabled hardware, software, power, building automation, facilities management, IT, security, and systems network solutions.<sup>16</sup>

**FIGURE 3** Industry IoT Deployment Momentum Varies Widely



Base: 99-423 global telecommunications decision-makers working in the specified industries (20+ employees) (percentages have been rounded)

Source: Forrester’s Global Business Technographics® Networks And Telecommunications Survey, 2015



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## Forrester's 2016 IoT Heat Map Highlights Use Cases By Industry

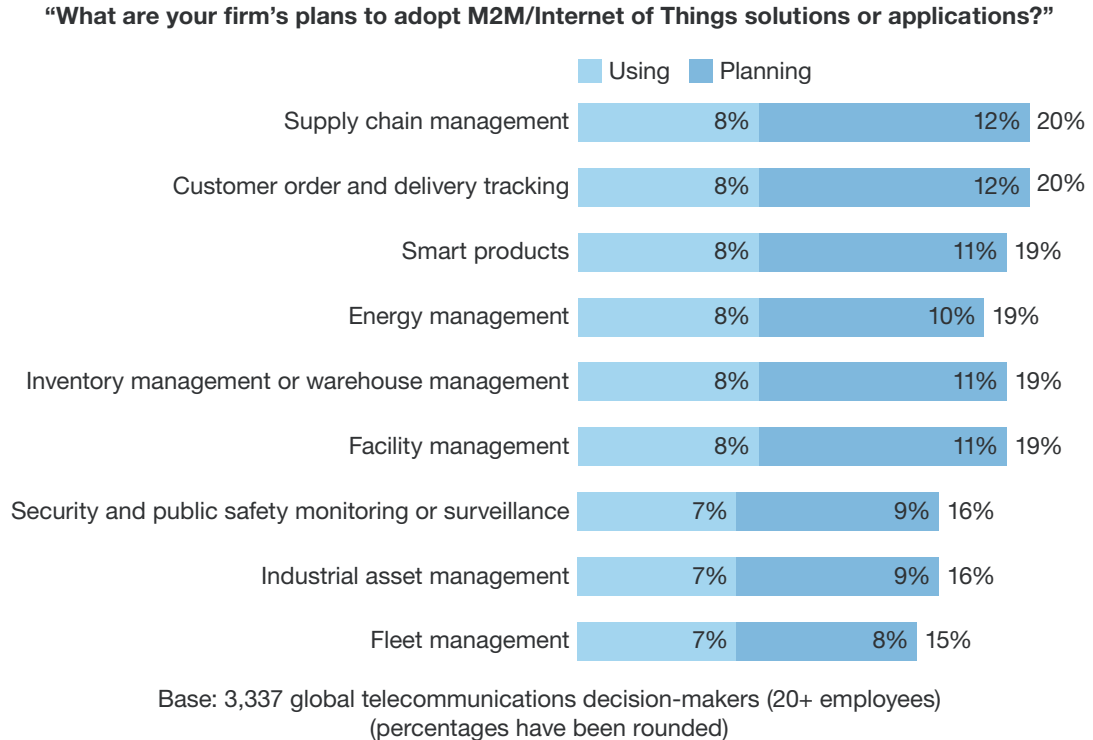
To truly understand momentum for IoT application and use case deployment, I&O execs should consider not just industry sector, but also specific use cases that are relevant to their firm's strategic goals and operations (see Figure 4). Across these nine representative IoT use cases, we found that adoption and planning levels ranged from 15% to 20% of firms (see Figure 5).

**FIGURE 4** Key IoT Application Descriptions

Application	Description
Security and surveillance	Monitoring of facilities and spaces for public safety and commercial security purposes
Supply chain management	Managing supply chain relationships including payment processing
Inventory and warehouse	Tracking inventory levels and managing warehouse operations
Customer order tracking/ delivery tracking	Enabling customer visibility into the status of orders and deliveries
Facility management	Monitoring the design, construction, and operation of structures and buildings, including lighting and HVAC systems
Industrial asset management	Monitoring and managing the location, condition, and usage of industrial equipment and machinery
Smart products	Incorporating connectivity and intelligence into products in industrial, commercial, and consumer markets
Energy management	Monitoring, managing, and reporting usage of water, electricity, and other energy sources
Fleet management	Monitoring and managing the condition, location, and usage of vehicle fleets (e.g., airplanes, taxis, buses, trucks)

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**FIGURE 5** Implementation And Deployment Plans Vary By Use Case

Note: Not all responses shown.

Source: Forrester’s Global Business Technographics® Networks And Telecommunications Survey, 2015


**The Hottest: No Single Use Case Or Industry Dominates IoT Opportunities**

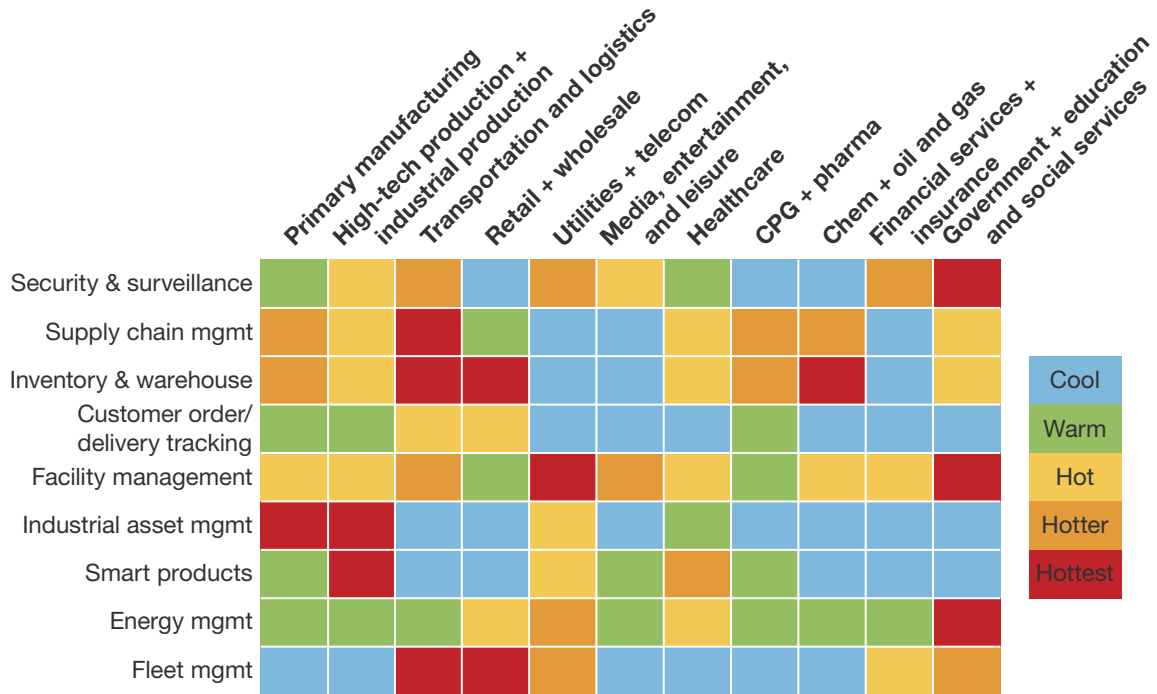
To help you determine where the ripest opportunities for IoT lie, Forrester has updated the heat map from our October 2013 report based on the latest Forrester survey data and on economic data on physical-asset intensity and information technology investments across key industry sectors.<sup>17</sup> Forrester’s IoT application heat map technique analyzes specific IoT applications that Forrester has asked about in surveys for several years to determine which ones are hot — meaning they have a combination of attractive industry conditions and strong adoption by customers in those industries (see Figure 6). For more information about this heat map technique, we include an explanation of our methodology in the supplementary material section for this report. Examples of key use case and industry sector combinations that create particular value are included below.

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**FIGURE 6** Heat Map Of Key IoT Opportunities Varies By Industry And Application

 The spreadsheet associated with this figure contains details about this methodology.



**Hottest: Established IoT Applications In Transportation, Government, And Retail**

Our analysis revealed examples of the hottest IoT application use cases in multiple vertical markets.

1. **Fleet management in transportation.** Fleet managers across industries can now use packaged solutions to manage vehicle fleets, rather than build custom solutions, which FedEx and UPS have been doing for many years. Land ‘N’ Sea, a wholesale distributor of marine products, uses Navman Wireless fleet tracking solutions to monitor over 40 delivery trucks and 11 warehouses. Dispatchers use GPS tracking to determine the location of every truck and can provide customers with up-to-date arrival times on their deliveries. GPS tracking identifies the most efficient delivery routes, and geofencing alerts the warehouse when a driver is five miles away to ensure that the driver’s manifest, invoices, and next delivery load are waiting. Land ‘N’ Sea achieved fuel savings of \$14,000 per month and overtime savings of \$2,000 per week using these solutions.<sup>18</sup>
2. **Security and surveillance applications in government.** City and local governments are deploying networked surveillance cameras and video analysis software to expand public safety capabilities. Cisco and City 24/7 are working with the City of New York to deploy smart screens and an interactive,

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sensor-enabled platform in the five boroughs, which provides emergency response personnel, police departments, and citizens with real-time information relevant to their immediate proximity.<sup>19</sup> New York installed City 24/7 Smart Screens at bus stops, train stations, shopping malls, and sports facilities, which incorporate touch, voice, and audio technology to deliver local (about two square city blocks) information and services in real time.

- 3. Inventory and warehouse management applications in retail.** Proactive retailers are implementing IoT solutions to improve the accuracy and efficiency of inventory management and supply chain processes. Lord and Taylor enhanced the accuracy and availability of thousands of shoe styles in its flagship Fifth Avenue New York store by working with Zebra Technologies to deploy ultra high frequency (UHF) RFID tags onto display shoes. The RFID tags on the shoe provide information including designer, color, sizes, and price. Sales associates use handheld RFID readers to identify the tagged items and upload inventory report data. This RFID solution enables Lord and Taylor to maintain daily shoe-store display accuracy of 95%, and it can complete the daily process of scanning the shoe display floor in about 1 hour.<sup>20</sup>
- 4. Industrial asset management in primary manufacturing.** Primary manufacturing firms must manage complex, industrial asset systems and production processes. One of the largest global aluminum manufacturers transformed the manual, time-consuming process of controlling and monitoring individual aluminum processing pots. The application allowed plant operators to identify a pot by scanning a barcode and performed scheduled operations including anode check, anode redressing, and supervisory functions such as beam raising and lowering in an intuitive way. It also implemented security measures such as geofencing, authentication, and authorization. L&T Infotech worked with the manufacturing firm to deploy a sensor-enabled system to connect, manage, and remotely monitor the materials, bath sampling, temperature, and operational status of each aluminum processing pot. It achieved the following benefits from this IoT solution: a 60% faster response time and operational efficiency due to notifications and intuitive workflow, a 50% decrease in time needed to measure individual pot status, and an 80% reduction in data capture errors.<sup>21</sup>

**Hotter: Emerging Use Case Opportunities In Healthcare, Utilities, And Pharma Sectors**

Other IoT use cases are emerging as particularly relevant in specific vertical markets. Leading examples include:

- 1. Smart products in healthcare.** Healthcare providers often use IoT-enabled solutions to maintain and manage the status and operational performance of medical equipment. Ventana Medical Systems, a medical instrument and diagnostic equipment manufacturer, worked with PTC Axeda to enhance customer service for its hematoxylin and eosin automated slide preparation system, Symphony.<sup>22</sup> This IoT-enabled solution automatically monitors field instruments on a 24x7 basis, enables remote issue diagnosis and repair processes, and enables automatic inventory replenishment of reagents; it reduces the time to recover from a system failure by over 27%, provides pre-emptive issue notifications to customers, and proactively resolves customer problems.

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2. **Energy management in the utilities sector.** Intelligently connecting power infrastructure and assets transforms the power grid into a platform for deploying new energy services. Smart meters enable power and energy utilities firms to deploy new services such as enhanced outage management services, improved distribution system monitoring capabilities, automated budget assistance, and energy use notifications. Smart meters also deliver operational savings to utilities firms, including reduced truck rolls and automated meter reading. At least 30 of the largest utilities in the US have fully deployed smart meters to their customers to achieve some of these benefits.<sup>23</sup>
3. **Supply chain management in pharmaceuticals.** Many pharmaceutical firms must track medication temperatures to ensure that the medication will work effectively for patients. Kuehne + Nagel worked with CartaSense to deploy an active RFID solution that manages, monitors, and tracks medications throughout the supply chain and shipping process.<sup>24</sup> U-Sensor RFID tags attached to shipments monitor temperature during air and ground transport, as well as in warehouses. Fixed readers located in warehouse facilities transmit medication temperature when shipments arrive onsite, and analytic software evaluates captured data to automatically generate alerts if an unacceptable temperature occurs. Kuehne + Nagel's care team monitors these alerts 24/7 and takes action to address temperature discrepancies before the medication is harmed.

**Recommendations**

## Use Cloud Lessons To Proactively Help Business Leaders With IoT

While taking on IoT initiatives might feel foreign and new, I&O execs can take advantage of some of the lessons learned from their journeys to deliver mature cloud solutions.<sup>25</sup> The similarities are numerous: there is not a standard IoT definition or strategy; business decision-makers (not IT execs) drive IoT application deployment just as developers outside of IT drove cloud; and successful solution implementation requires many different technology elements. I&O execs can take these lessons and apply them to new IoT use cases:

- › **Use your firm's specific business needs to filter IoT marketing hype.** There is not a standard definition of the technology elements, components, and applications included in the Internet of Things. Just as we saw with cloud computing, vendors will spin their solutions to make it sound like they can help you — but often they attempt to latch onto buzzwords to help drive interest in their solutions.<sup>26</sup> Large vendors such as Cisco, GE, IBM, Microsoft, SAP, and others have their own spin on the product and service frameworks necessary to deploy IoT solutions, which connect physical assets to the digital world. Having a clear understanding of your firm's IoT strategy and initiatives will help you focus and prioritize your specific needs, which vendors can help you with.
- › **Become a trusted advisor and enabler.** Business decision-makers (e.g., product development, field service, manufacturing operations, and marketing) have their own budgets and resources to pursue IoT applications, often without requesting input from tech management execs. I&O pros had a reputation for taking a defensive, "shut it down" approach to business-driven initiatives. This

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restrictive strategy encourages siloed, unregulated cloud initiatives within individual business units, and drives distrust between business and I&O staff. I&O pros have honed disciplines in areas like management and integration that help with the success of IoT initiatives. Replace “no” with “here’s how.” Proactively collaborate and build trust with business decision-makers to help you establish a governance framework to facilitate successful IoT solution implementations.

- › **Ensure your vendor management process includes emerging, specialized IoT vendors.** Just as with cloud, I&O execs must prepare to interact with a variety of conventional, well-known vendors and many new suppliers for technical components. For example, an emerging category of IoT platform vendors simplifies the IoT solution deployment process by connecting to networks, interfacing with APIs to develop IoT applications, enabling analytics, and incorporating management and monitoring tools.<sup>27</sup> A mix of conventional and new vendors including enterprise infrastructure and software vendors (e.g., Cisco, IBM, Microsoft, Oracle, SAP); network specialists (e.g., Jasper, Kore, Numerex); generalist IoT platform providers (e.g., Ayla Networks, PTC’s ThingWorx, Xively); and others are participating in the IoT platform space.
- › **Bring in peer specialists early.** Taking advantage of the cloud was difficult for organizations because it wasn’t clear how to organize around it. Take the shortcut for IoT. I&O execs must collaborate with their security colleagues to ensure that connected devices, applications, and captured data align with industry and geographic regulatory and compliance requirements. Networking and infrastructure professionals should develop a complete list of connected products and assets used in manufacturing, operations, or facilities processes.
- › **Reassess the skill set requirements of your team.** As with cloud, I&O pros may need new cross-functional skill sets. The fragmented IoT vendor landscape may require some team members to have some vendor management expertise to work with third-party technology providers. I&O pros must also be comfortable collaborating with and pushing back on irrational requests from line-of-business colleagues. It is also important to have some tech management employees with analytic skills to determine how connected assets are used by employees and customers to manage assets, optimize workforce scheduling, enhance business processes, and address compliance reporting requirements. Making this analytics shift also requires working with business employees who can provide input into the predictive analytic data models and the resulting insight.
- › **Address key stakeholder concerns to facilitate further adoption.** A key requirement for cloud solutions and IoT application deployment success is obtaining stakeholder buy-in. The top three IoT-related stakeholder concerns were security (34%), total cost of deployment (30%), and integration challenges (28%).<sup>28</sup> Extreme variance in IoT applications, data, connectivity, and ecosystem complexity requires firms to identify key factors that might expose them to security risks. Broad IoT solution adoption requires expanded security features such as security configuration management functions to handle orders of magnitude, more connected devices, and strong identity controls for privileged users and administrators to ensure IoT data security.<sup>29</sup>

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## Engage With An Analyst

Gain greater confidence in your decisions by working with Forrester thought leaders to apply our research to your specific business and technology initiatives.

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Learn more about inquiry, including tips for getting the most out of your discussion.

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Put research into practice with in-depth analysis of your specific business and technology challenges. Engagements include custom advisory calls, strategy days, workshops, speeches, and webinars.

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## Supplemental Material

### Online Resource

The underlying spreadsheet detailing the data in Figure 6 is available online.

### Survey Methodology

For Forrester's Global Business Technographics Networks And Telecommunications Survey, 2015, Forrester conducted an online survey fielded in January 2015 of 3,627 business and technology decision-makers located in Australia/New Zealand, Brazil, Canada, China, France, Germany, India, the UK, and US from companies with two or more employees.

Forrester's Business Technographics provides demand-side insight into the priorities, investments, and customer journeys of business and technology decision-makers and the workforce across the globe. Forrester collects data insights from qualified respondents in 10 countries spanning the Americas, Europe, and Asia. Business Technographics uses only superior data sources and advanced data-cleaning techniques to ensure the highest data quality.

We have illustrated only a portion of the survey results in this document. To inquire about receiving full data results for an additional fee, please contact [data@forrester.com](mailto:data@forrester.com) or your Forrester account manager.



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**Methodology Used To Create The Internet Of Things Heat Map**

To determine the industry taxonomy, Forrester typically uses seven broad categories of industries: manufacturing; retail and wholesale; business services; media, entertainment, and leisure; utilities and telecommunications; finance and insurance; and the public sector. These seven industry groups have subcategories, which in turn map into 20 specific industries using North American Industry Classification System (NAICS) In our heat map, we have broken apart and recombined several of the 20 industry categories as follows: high-tech production and industrial production; retail and wholesale; utilities and telecommunications; consumer products and pharmaceuticals and medical equipment; chemicals and oil and gas; financial services and insurance; government and education and social services. We left the following industries as their own categories: primary production; transportation; media, entertainment, and leisure; and healthcare.

Next, we determined the physical-asset intensity of our 11 industry categories by updating data from the September 22, 2012, “Which Verticals Are Most Attractive For ICT Vendors?” Forrester report. We took the average of structural intensity and equipment intensity for each of the original 20 industry categories, and indexed this average across these 20 industries. For grouped heat map industry categories, we averaged the indexes of the industries recombined from the original 20 industry categories.

After we determined the physical-asset intensity, we factored in ICT spend. Taken together, these two factors help us determine which are the best industry targets. For data on ICT spend, we used the US spending data for 2014 as a percentage of gross output for each of the original 20 industry categories from the October 22, 2014, “US Tech Spending By Industry, 2014 To 2015 — Which Industries Will Lead The BT Charge?” Forrester report. For grouped heat map industry categories, we took the average ICT spend as a percentage of gross output of that for each of the included industries recombined from the original 20 industry categories. We then indexed these ICT spend percentages across the 11 heat map industry categories.

To come up with a single rank for industry attractiveness, we averaged the physical-asset intensity index with the ICT spending index for each of the heat map industry categories, weighting each index equally.

Solution adoption is the average percentage of respondents from companies with 20-plus employees indicating “implemented” or “implemented and expanding” as their firm’s plans to adopt Internet of Things/machine-to-machine solutions from Forrester’s Global Business Technographics Global Networks And Telecommunications Survey, 2015. We indexed solution adoption, with the highest adoption equal to one and the remaining solution adoption indexes represented as a proportion of the specific solution’s adoption relative to the highest solution adoption.

Where industry attractiveness and solution adoption intersected, we took the average of the industry attractiveness and the solution adoption rank to determine the overall ripeness of the opportunity for that industry and use case.

We reviewed the combined score for ripeness for each industry and use case. In cases where the results did not match our views on the industry use case, we adjusted the heat map rating.

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**Companies Interviewed For This Report**

Cisco

PTC Axeda

IBM

Schneider Electric

L&amp;T Infotech

Zebra Technologies

Microsoft

**Endnotes**

- <sup>1</sup> Business leaders don't think of digital as central to their business because in the past, it hasn't been. But now your customers, your products, your business operations, and your competitors are fundamentally digital. See the "[The Digital Business Imperative](#)" Forrester report.
- <sup>2</sup> In the following report, we separate the hype from reality by mapping the landscape of the emerging connected world and analyzing the maturity of different industry sectors and applications. See the "[Mapping The Connected World](#)" Forrester report.
- <sup>3</sup> Business leaders don't think of digital as central to their business because in the past, it hasn't been. But now your customers, your products, your business operations, and your competitors are fundamentally digital. While 74% of business executives say their company has a digital strategy, only 15% believe that their company has the skills and capabilities to execute on that strategy. A piecemeal strategy of bolting on digital channels or methods is no longer sufficient. See the "[The Digital Business Imperative](#)" Forrester report.
- <sup>4</sup> Source: Forrester's Global Business Technographics Networks And Telecommunications Survey, 2015.
- <sup>5</sup> Source: Dan Berthiaume, "Kroger debuts Retail Site Intelligence, new enterprise IT architecture," Chain Store Age, April 2, 2014 (<http://www.chainstoreage.com/article/kroger-debuts-retail-site-intelligence-new-enterprise-it-architecture>).
- <sup>6</sup> Source: "Lufthansa enlists SAP to help crunch IoT data," Business Cloud News, July 23, 2015 (<http://www.businesscloudnews.com/2015/07/23/lufthansa-enlists-sap-to-help-crunch-iot-data/>).
- <sup>7</sup> Source: Lorence Heikell, "Connected cows help farms keep up with the herd," Microsoft, August 17, 2015 (<http://news.microsoft.com/features/connected-cows-help-farms-keep-up-with-the-herd/>).
- <sup>8</sup> Source: Craig Powers, "Using the Internet of Things to Provide 'Air-as-a-Service'," ASUG News, June 25, 2015 (<http://www.asugnews.com/article/internet-of-things-kaeser-example>).
- <sup>9</sup> Many Internet of Things (IoT) implementations are driven by business leaders and groups rather than the CIO's technology teams. Business leaders are driving two types of IoT systems: connected products and connected assets. They're motivated to implement new technologies, or update established industrial control systems, to respond to competition or new customer demand. But this report asserts that CIOs will end up operating the infrastructure of the connected world, just as they ended up owning PCs, websites, and smartphones, all of which started as do-it-yourself efforts by the business. As they integrate IoT into the business technology (BT) agenda, CIOs will face five categories of challenges spread across the three basic domains of IoT infrastructure. To prepare, CIOs need to coordinate the work of app dev, architecture, infrastructure and operations, and line-of-business teams. See the "[Brief: CIOs Will Architect And Operate The Internet Of Things](#)" Forrester report.
- <sup>10</sup> IoT software platforms simplify the processes of developing, connecting, controlling, and capturing insight from connected products and assets, allowing firms to sense and respond to changing customer needs. See the "[Internet-Of-Things Software Platforms Simplify Transformation Of Business Operations](#)" Forrester report.

**The Internet Of Things Heat Map, 2016**

Where IoT Will Have The Biggest Impact On Digital Business

- <sup>11</sup> For examples of the many ways firms are deploying IoT solutions to serve the needs of their customers, see the “[Brief: The Internet Of Things Will Transform Customer Engagement](#)” Forrester report.
- <sup>12</sup> For more information on the impact of Internet of Things applications in the retail vertical, see the “[Infrastructure Will Drive The Retail Store Experiences Of The Future](#)” Forrester report.
- <sup>13</sup> Source: European Commission (<http://ec.europa.eu/digital-agenda/en/ecall-time-saved-lives-saved>).
- <sup>14</sup> Source: “Detailed Report Shows Most Railroads Will Miss Positive Train Control Deadline,” U.S. Department of Transportation Federal Railroad Administration press release, August 7, 2015 (<https://www.fra.dot.gov/eLib/details/L16967>).
- <sup>15</sup> Source: “Integrating a Security and Building Management System Enables Energy Efficiencies for SmartCity Malta,” Honeywell Security Group ([https://www.security.honeywell.com/uk/documents/HIS-SMCTY-01-EN\(0512\)CS-E.pdf](https://www.security.honeywell.com/uk/documents/HIS-SMCTY-01-EN(0512)CS-E.pdf)).
- <sup>16</sup> Source: Forrester conversation with Schneider Electric.
- <sup>17</sup> Forrester’s analysis in the Internet of Things heat map relies on the insight and methodology of previously published research. For more information on asset intensity and ICT spend, see the “[US Tech Spending By Industry, 2014 To 2015 – Which Industries Will Lead The BT Charge?](#)” Forrester report. For the first heat map, see the “[Mapping The Connected World](#)” Forrester report.
- <sup>18</sup> Source: Navman Wireless (<https://www.navmanwireless.com/why-us/success-stories/case-studies/>).
- <sup>19</sup> Source: Shane Mitchell, Nicola Villa, Martin Stewart-Weeks, and Anne Lange, “The Internet of Everything for Cities,” Cisco (<http://www.cisco.com/web/strategy/docs/gov/everything-for-cities.pdf>).
- <sup>20</sup> Source: “Fully Stocked Shoe Displays Let Lord & Taylor Capture More Sales,” Zebra (<https://www.zebra.com/content/dam/zebra/success-stories/en-us/pdfs/lord-taylor-success-story-en-us.pdf>).
- <sup>21</sup> Source: Forrester conversation with L&T Infotech.
- <sup>22</sup> Source: “Improving Instrument Recovery Time and Reducing Downtime,” PTC (<http://www.iotsworldcongress.com/documents/4643185/6f979cb2-2a48-4893-adb0-1224516312d3>).
- <sup>23</sup> Source: “Utility-Scale Smart Meter Deployments: Building Block Of The Evolving Power Grid,” The Edison Foundation, September 2014 ([http://www.edisonfoundation.net/iei/Documents/IEI\\_SmartMeterUpdate\\_0914.pdf](http://www.edisonfoundation.net/iei/Documents/IEI_SmartMeterUpdate_0914.pdf)).
- <sup>24</sup> Source: Samuel Greengard, “Keuhne + Nagel Monitors Pharmaceuticals to Improve Customer Service,” RFID Journal, July 5, 2015 (<https://www.rfidjournal.com/purchase-access?type=Article&id=13231&r=%2Farticles%2Fview%3F13231>).
- <sup>25</sup> For insight into how technology management executives are redefining their roles to address the expectations of business executives who are deploying cloud solutions, see the “[Organize The Chaos Of Cloud With A Realistic And Effective Strategy](#)” Forrester report.
- <sup>26</sup> The cloud value proposition is so compelling, many who are doing things that are similar — such as virtualization, application outsourcing, and traditional hosting — are painting over their solutions with a cloud name. See the “[Make The Cloud Enterprise Ready](#)” Forrester report.
- <sup>27</sup> Internet of Things systems will enable companies to use networks of sensors and controls to better compete for customers and to offer new levels of customer engagement. But developing and deploying smart, connected products and retrofitting existing equipment is very challenging, requiring coordination of network connectivity, application protocols, data analytics, and system management. See the “[Internet-Of-Things Software Platforms Simplify Transformation Of Business Operations](#)” Forrester report.

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<sup>28</sup> Source: Forrester's Global Business Technographics Telecommunications And Mobility Workforce Survey, 2015.

<sup>29</sup> IoT-enabled solutions hold vast promise, with the potential to revolutionize customer experience, enhance safety, improve health, and tear away efficiency. However, the security implications of these devices and the data that lies within cannot be ignored. See the "[An S&R Pro's Guide To IoT Security](#)" Forrester report.

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