The Forrester Wave™: IoT Software Platforms, Q4 2016

The 11 Providers That Matter Most And How They Stack Up

by Michele Pelino and Andrew Hewitt

November 15, 2016

Why Read This Report

In our 25-criteria evaluation of internet of things (IoT) software platform providers, we identified the 11 most significant ones — Amazon Web Services (AWS), Ayla Networks, Cisco Jasper, Exosite, General Electric (GE), IBM, LogMeIn, Microsoft, PTC, SAP, and Zebra Technologies — and researched, analyzed, and scored them. This report shows how each provider measures up and helps infrastructure and operations (I&O) professionals make the right choice to support their IoT-enabled connected product and asset initiatives.

Key Takeaways

IBM, PTC, GE, And Microsoft Lead The Pack

Forrester's research uncovered a market in which IBM, PTC, GE, and Microsoft lead the pack. AWS, SAP, and Cisco Jasper offer competitive options. LogMeIn, Ayla Networks, Exosite, and Zebra Technologies lag behind.

IoT Software Platforms Simplify Enabling Connected Products And Processes

To deliver differentiated connected products or transform business processes, I&O leaders face a fragmented set of network technologies, hardware, protocols, software, applications, and analytics solutions. IoT software platforms help simplify deploying, managing, operating, and capturing insights from IoT-enabled connected devices.

Partner Ecosystems, Prebuilt Apps, And Advanced Analytics Are Key Differentiators

Vendors that allow customers to tap into a broad partner ecosystem to extend the functionality available through their platform solutions will position themselves to successfully deliver additional value to end user customers. Other key criteria to jump-start IoT solutions include application enablement functions, analytics features, and interfaces to generate actionable insights from connected products and prebuilt applications.

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by Michele Pelino and Andrew Hewitt
with Christopher Voce, Merritt Maxim, Frank E. Gillett, Jeffrey S. Hammond, Michael Caputo, and Diane Lynch

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Notes & Resources

Forrester conducted product evaluations in September 2016 and interviewed 11 vendor companies: Amazon Web Services (AWS), Ayla Networks, Cisco Jasper, Exosite, General Electric (GE), IBM, LogMeIn, Microsoft, PTC, SAP, and Zebra Technologies.

Related Research Documents

The Internet Of Things Heat Map, 2016

Internet-Of-Things Software Platforms Simplify Transformation Of Business Operations

TechRadar™: Internet Of Things, Q1 2016

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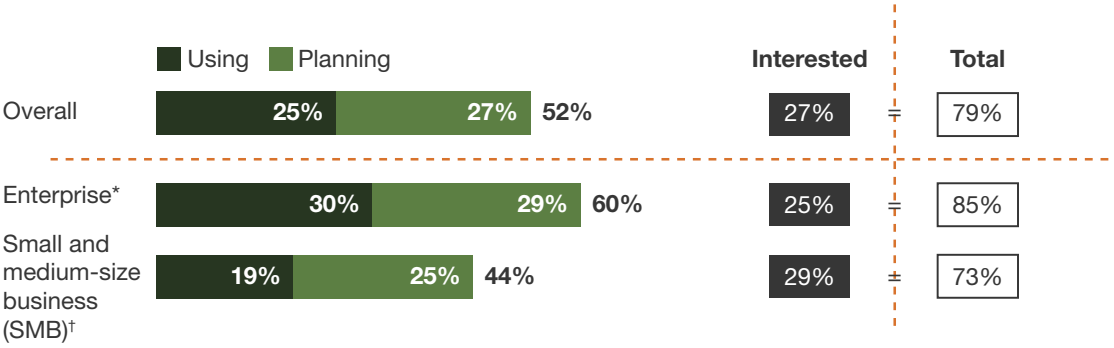
Forrester Research, Inc., 60 Acorn Park Drive, Cambridge, MA 02140 USA
+1 617-613-6000 | Fax: +1 617-613-5000 | forrester.com

Enterprises Are Embracing IoT To Support Digital Transformation

Global businesses and I&O professionals are embracing the vision of a connected world that bridges the physical and digital worlds. IoT solutions support this by helping ingest information and context through sensors from the physical world and taking actions in the physical world via actuators based on digital insights.[1] In fact, Forrester's survey results show that 60% of decision-makers at global enterprises are using or planning to use IoT-enabled applications over the next two years, compared with 52% across global firms of all sizes (see Figure 1).

FIGURE 1 Interest In Adoption Of IoT Applications Is Highest Among Enterprises

"What are your firm's plans to adopt machine-to-machine/IoT solutions or applications?"



Base: 3,289 global telecommunications decision-makers (20+ employees)
*Base: 1,665 global telecommunications decision-makers (1,000+ employees)
†Base: 1,624 global telecommunications decision-makers (20 to 999 employees)
(Percentages have been rounded.)
Source: Forrester's Global Business Technographics® Networks And Telecommunications Survey, 2016

Different IoT Opportunities Carry Unique Technology Challenges

As businesses pursue digital initiatives, I&O execs must assist their line-of-business colleagues with addressing software, security, data, and business analytics integration complexity associated with deploying these IoT solutions. Digital opportunities to use IoT include:

› **Building connected products.** Product manufacturers are creating smart, connected products to differentiate their offerings and generate new revenue streams as well as ecosystems for other partners to participate in and create their own value. Freight Farms leverages LogMeIn's Xively platform to monitor environmental elements, including air temperature, humidity, carbon dioxide nutrient, and water levels in each hydroponic growing container. Users can access the Farmhand Connect mobile application to receive alerts highlighting changes in the container environment

and to track growing history. However, many product development teams lack experience with designing and incorporating internet-connected sensors, intelligence, manageability, security, and application enablement services into these new products.[2] These IoT-enabled products can have varying connectivity methods, product models, software versions, and operating systems.

› **Transforming operational processes.** Businesses across many vertical markets are using IoT-enabled use cases to transform supply chain processes, enhance inventory management and operational processes, and track and monitor asset performance.[3] Using Microsoft's Azure IoT platform, global elevator manufacturer thyssenkrupp can predict with 70% accuracy when one of its 200,000 connected elevators will break down in the next five days, allowing the company to carefully plan technician schedules and decrease downtime for customers. Initiatives like these require that I&O pros understand the technologies, infrastructure, software platforms, applications, and architectural frameworks necessary to successfully deploy IoT-enabled operational processes.[4]

IoT Software Platforms Simplify IoT Solution Deployment

In the report "Internet-Of-Things Software Platforms Simplify Transformation Of Business Operations," Forrester introduced its definition of an emerging solution to help simplify the process of developing, connecting, controlling, and capturing insight from IoT-enabled products and assets (see Figure 2).[5] Forrester defines IoT software platforms as:

Software solutions that connect to and manage smart devices and infrastructure to integrate operational data and control into business and customer processes.

IoT software platform vendors incorporate a diverse array of functionality into their platforms, natively or via partnerships, which we categorize into five core categories:

1. **Connect: create and manage the link from the device to the internet.** Local wireless connectivity choices supported by IoT software platforms include specialized radio technologies such as ZigBee, Z-Wave, and low-power wireless personal area networks to offer improved range, reliability, cost, battery usage, and compatibility over existing Wi-Fi and Bluetooth networks. For IoT devices requiring long-range carrier connectivity, IoT software platforms offer capabilities to manage multiple carrier relationships and enable over-the-air device management. Some support specialized network protocols, such as M-Bus for metering solutions, and may support specialized application and messaging protocols such as XMPP, CoAP, and MQTT that are more efficient than HTTP.
2. **Secure: protect IoT devices, data, and identity from intrusion.** Security pros are quick to cite numerous threats to their businesses due to the increased attack surface IoT creates.[6] IoT devices generate sensitive information about company operations and customers and transmit that data using specialized protocols to local gateways and then over the internet. In addition, the connected devices themselves are vulnerable to hacks that can leak information, damage equipment, or

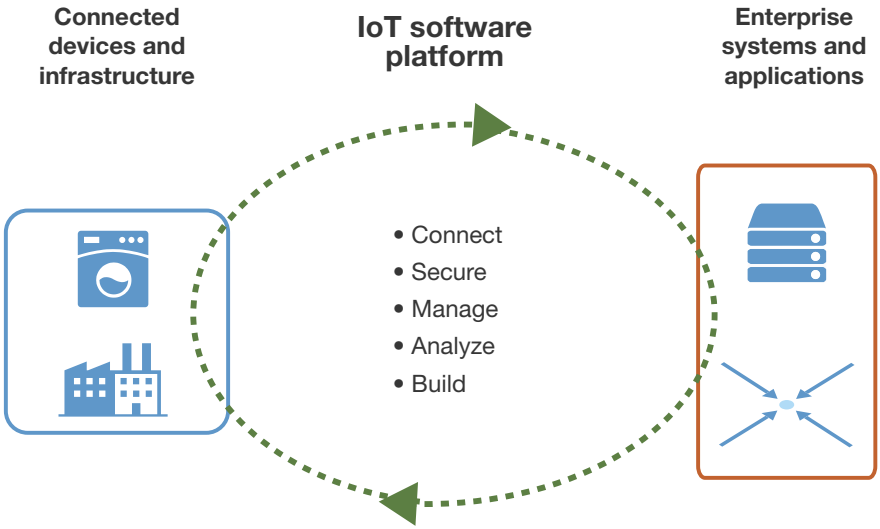
even cause personal injury. IoT software platforms incorporate security components to ensure device attestation, network connectivity, software upgrades, authentication, identity and access management, and data loss prevention. These capabilities are built into intrusion detection systems and access management features such as access control lists (ACLs) and a certificate authority.

3. **Manage: control the provisioning, maintenance, and operation of IoT devices.** IoT scenarios often involve thousands or tens of thousands of connected devices to measure state information like pressure, temperature, or vibration. IoT software platforms enable technology management personnel to simplify the process of configuring, provisioning, and initiating operation of connected assets and products. Once in production, IoT platforms offer a broad range of capabilities to support monitoring, testing, updating software, and troubleshooting connected devices. Operational logs and reports documenting the status of updates are also included in some platform solutions.

4. **Analyze: transform data into timely, relevant insight and action.** Many sensors capture and generate time-series data in a per-minute or real-time manner, while audio and video sensors deliver rich media insight. Most business analysts lack the tools to evaluate captured sensor data for actionable insights. IoT analytics functions are an emerging category of functionality, including data filtering and streaming analytics to monitor data in real time and advanced analytics to extract hidden patterns and insights from captured information.[7] Some platforms, such as IBM Watson IoT Platform and SAP HCP IoT Services, also offer predictive analytics, which can analyze vibration data from rotating machinery and predict pending failures with enough accuracy to enable preventive maintenance.[8]

5. **Build: create applications and integrate with enterprise systems.** The diverse array of IoT use cases requires software integration and APIs to support mainstream business processes and applications. IoT platforms enable developers to easily create code, business rules, and data management capabilities integrated with specific IoT connectivity, security, and manageability capabilities.[9] Development tools, scripting tools, API links, and API management tools interface with enterprise applications, including those from IBM, Microsoft, Oracle, and SAP. IoT platforms also help transform industry- or technology-specific data and data models into a usable format by providing developers with a range of APIs, software development kits (SDKs), and development tools.

FIGURE 2 IoT Software Platforms Integrate Edge Devices With Enterprise Systems



IoT Software Platforms Are Part Of A Complex, Diverse, Rapidly Changing Ecosystem

The complete IoT vendor landscape is crowded, with a wide variety of IoT specialist vendors, enterprise technology firms, public cloud vendors, global telecom providers, and systems integrators positioning their software solutions to help firms simplify the tasks of connecting, deploying, and operating IoT-enabled products. Companies like AT&T, Bosch, Hewlett Packard Enterprise, and Telefonica are developing their own platforms or engaging customers to help develop custom platform solutions. Customers can purchase IoT software platform solutions directly from the software makers, white label these solutions from vendors, or engage with service providers and system integrators that offer IoT platforms as part of their overall solution and integration services. For this evaluation, Forrester focused on the core IoT software platforms either purchased directly by customers or packaged, built upon, and resold by partners. We will further explore the IoT partner ecosystem in upcoming research.

IoT Software Platform Evaluation Overview

To assess the state of the IoT software platform market and see how the vendors stack up against each other, Forrester evaluated the strengths and weaknesses of key IoT software platform vendors. After examining past research, user need assessments, and vendor and expert interviews, we developed a comprehensive set of evaluation criteria. We evaluated vendors against 25 criteria, which we grouped into three high-level buckets:

- **Current offering.** We evaluated each vendor's current offering according to the functional categories of connect, manage, secure, and analyze. Specifically, we looked at the breadth of protocol support and cloud integration, the strength of the management console for managing virtual devices using a rules-based engine, support for developers through SDKs and prebuilt applications, and the platform's identity and access management functions. Additionally, we examined each platform's capacity for analytics, including advanced capabilities such as predictive analytics, augmented reality, and edge analytics.
- **Strategy.** Forrester assessed each vendor's strategic positioning as a factor of several evaluation criteria, including planned enhancements, geographic reach, and the robustness of its partner ecosystems.
- **Market presence.** This category indicates the relative ranking of the vendors in the areas of customer installation, geographic client distribution, and dedicated employee resources.

Evaluated Vendors And Inclusion Criteria

Forrester included 11 vendors in the assessment: Amazon Web Services, Ayla Networks, Cisco Jasper, Exosite, GE, IBM, LogMeIn, Microsoft, PTC, SAP, and Zebra Technologies. These vendors deliver their solutions through different delivery models and pricing structures (see Figure 3). Each of these vendors (see Figure 4):

- **Focuses on enabling industrial, commercial or enterprise class IoT devices.** The evaluated IoT software platform solutions enable deployment of third-party enterprise, industrial, or commercial IoT-enabled devices and assets. We did not include vendors that focus solely on consumer scenarios or vendors whose platforms currently support only their own products.
- **Demonstrates a mature approach with dedicated organizational resources.** Each of the vendors evaluated supports its IoT software platform solution with mature, clearly defined marketing, sales, engineering, and support personnel and corporate resources.
- **Provides a broad array of IoT software platform features and functions.** The IoT platform functions evaluated in this Forrester Wave extend beyond connectivity to include managing and securing IoT devices as well as providing application enablement and analytics interfaces to capture insight from connected products and assets.
- **Shows evidence of market viability.** Each of the evaluated IoT software platform solutions has been in the market for more than six months. Features or product releases evaluated were available as of September 7, 2016. Any feature or product releases after this date were not part of the evaluation process, but we did consider them in the strategy portion of the evaluation.
- **Interest from Forrester clients.** These offerings have mindshare among Forrester's enterprise customers, as evidenced by their appearance in client inquiries, shortlists, consulting projects, and case studies.

FIGURE 3 IoT Software Platform Pricing Models

	Pricing metric	Available pricing models
AWS	• Number of messages	• Pay as you go
Ayla Networks	• Feature set	• One-time upfront fee • Subscription
Cisco	• Cellular data	• Pay as you go
Exosite	• Feature set • Number of devices on the platform	• Not disclosed
GE	• Instance-based and/or consumption-based, depending on the type of service	• Subscription
IBM	• Amount of data ingested, analyzed, and stored • Number of devices for industry offerings	• Pay as you go (in public cloud mode) • Subscription • Local (and dedicated) deployment option
LogMeIn	• Number of messages • Number of devices • Feature set	• Subscription
Microsoft	• Number of messages • Number of devices • GB of storage used	• Pay as you go • Subscription • One-time fee for preconfigured solution
PTC	• Feature set • Property writes • Number of users	• Subscription
SAP	Base annual subscription plus number of devices differentiated by: • Low number of sensors (up to 5) • Medium number of sensors (6 to 20) • High number of sensors (20-plus)	• Subscription
Zebra Technologies	For prebuilt IoT applications: • Usage-based For IoT platform: • Number of devices • Number of messages	For prebuilt IoT applications: • Subscription-based SaaS and Zatar Platform capabilities embedded For IoT platform: • Subscription-based PaaS

FIGURE 4 Evaluated Vendors: Product Information And Selection Criteria

Vendor	Product evaluated	Initial release date
Amazon Web Services	AWS IoT	December 2015
Ayla Networks	Ayla Agile IoT Platform	June 2013
Cisco Jasper	Cisco Jasper Control Center	March 2006
Exosite	Murano IoT Platform by Exosite	January 2010
GE	Predix	February 2016
IBM	IBM Watson IoT Platform	October 2014
LogMeIn	Xively by LogMeIn IoT Connected Product Management Platform	May 2013
Microsoft	Azure IoT Suite	September 2015
PTC	ThingWorx	March 2011
SAP	SAP Hana Cloud Platform IoT Services	July 2015
Zebra Technologies	Zatar IoT Cloud Service	October 2013

Vendor inclusion criteria
Evaluated vendors focus on enabling industrial, commercial, or enterprise-class IoT devices.
Vendors demonstrate a mature approach with dedicated organizational resources.
Vendors provide a broad array of IoT software platform features and functions.
Vendors show evidence of market viability.
Forrester clients demonstrate interest in each vendor.

Vendor Profiles

We intend this evaluation of the IoT software platform market to be a starting point only. We encourage clients to view detailed product evaluations and adapt criteria weightings to fit their individual needs through the Forrester Wave Excel-based vendor comparison tool (see Figure 5).

FIGURE 5 Forrester Wave™: IoT Software Platforms, Q4 '16

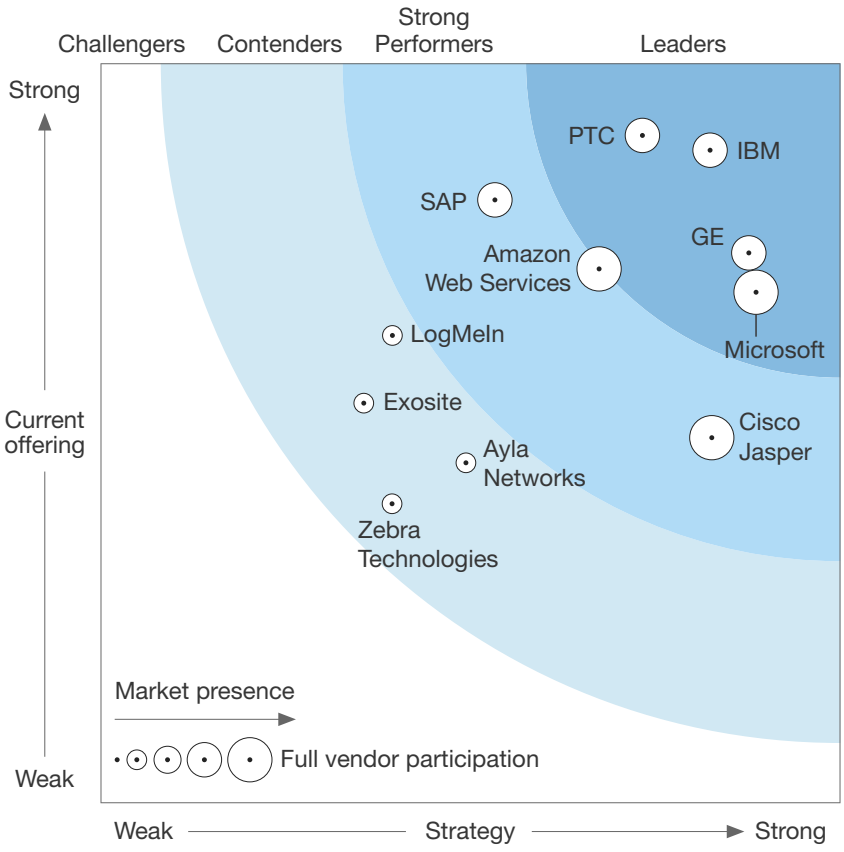


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FIGURE 5 Forrester Wave™: IoT Software Platforms, Q4 '16 (Cont.)

	Forrester's weighting	Amazon Web Services	Ayla Networks	Cisco Jasper	Exosite	GE	IBM	LogMeIn	Microsoft	PTC	SAP	Zebra Technologies
Current offering	50%	3.60	2.29	2.46	2.69	3.71	4.40	3.15	3.44	4.50	4.07	2.01
Connect functions	20%	2.50	1.95	2.50	2.40	3.90	5.00	2.80	2.20	5.00	3.80	2.80
Manage functions	20%	3.50	1.00	3.25	2.50	3.75	4.50	3.50	3.75	4.75	3.75	1.00
Security/identity and access management	10%	5.00	3.00	5.00	5.00	3.00	3.00	5.00	3.00	3.00	5.00	3.00
Application enablement functions	25%	2.60	3.60	1.25	2.35	5.00	4.30	2.55	3.30	5.00	3.75	2.30
Analyze functions	25%	5.00	2.00	2.00	2.50	2.50	4.50	3.00	4.50	4.00	4.50	1.50
Strategy	50%	3.36	2.47	4.13	1.78	4.38	4.12	1.97	4.43	3.66	2.66	1.97
Product strategy	50%	2.65	3.35	4.45	2.10	4.45	5.00	2.10	4.45	4.45	2.65	2.10
Professional services	15%	5.00	3.00	5.00	1.00	5.00	3.00	3.00	3.00	1.00	5.00	3.00
Partner strategy	35%	3.68	0.99	3.31	1.66	4.01	3.33	1.33	5.00	3.66	1.68	1.33
Market presence	0%	4.75	1.25	4.25	1.75	3.25	4.00	1.25	4.75	3.25	3.50	1.25
Installed base	50%	5.00	1.00	5.00	2.00	2.00	4.00	1.00	5.00	3.00	3.00	1.00
Geographic customer distribution	25%	4.00	2.00	4.00	2.00	4.00	4.00	2.00	4.00	4.00	4.00	2.00
Dedicated employee resources	25%	5.00	1.00	3.00	1.00	5.00	4.00	1.00	5.00	3.00	4.00	1.00

All scores are based on a scale of 0 (weak) to 5 (strong).

Leaders

› **IBM.** The Watson IoT Platform can serve a broad range of advanced IoT use cases. The tech giant doubled down on IoT in 2015 with an investment of $3 billion dollars to create a new IoT business unit. The new org includes more than 1,000 researchers, developers, and designers dedicated specifically to developing the Watson IoT Platform. Since then, IBM has added significant capabilities to the platform, including augmented reality, cognitive capabilities, blockchain,

edge analytics, analytics tooling, and natural language processing, to name a few. With a strong commitment to open source standards and a robust global partner ecosystem, IBM is well positioned for market leadership. However, according to some customers, Watson is not well integrated with analytics engines, and IBM's product portfolio terminology is confusing and hard to decipher.

- **PTC.** PTC has invested $1 billion in IoT offerings since its acquisition of the ThingWorx platform in 2013. The company's broad protocol support for both short-range and wireless connectivity options, strong digital twin functionality, and a multitude of prepackaged applications that include asset management, alert management, product relationship management, and workflow management place PTC in the top tier of vendors for this evaluation. The company also boasts the strongest augmented reality capabilities in this evaluation, due in part to its acquisition of Vuforia in 2015. Despite these advanced capabilities, however, some references reported a shortage of technical expertise within PTC's professional services division in addition to a lack of communication and clarity regarding newly released features.
- **GE.** The vendor offers its Predix platform primarily for industrial IoT applications. GE has been using its Predix platform to support its own native offerings before making it available to others to build upon. Predix enables remote monitoring and advanced predictive and edge analytics and features this evaluation's most advanced digital twin capability, which allows customers to design and test new capabilities of connected high-value assets like wind turbines and airplane engines using a high-fidelity digital model of the asset. Numerous customer references cited GE's intense focus and history in the industrial market as a key differentiator over its competition. This evaluation did uncover some areas to improve, such as developing more prepackaged, end-to-end solutions for IoT use cases beyond asset performance management.
- **Microsoft.** The Azure IoT Suite integrates an array of specialized tools and analytics services to support IoT platform functions. The offering includes preconfigured solutions for predictive maintenance and remote monitoring to help customers implement IoT solutions efficiently. These preconfigured solutions use Azure services such as IoT Hub for device connections, authentication, and monitoring and use Notification Hubs, Machine Learning, and Stream Analytics to capture insight from connected assets. Microsoft's Azure IoT Suite has a strong road map and extensive global reach in 13 regions, including China and Germany. In addition, Microsoft acquired Solair in March 2016 to expand its IoT solution capabilities for retail as well as food and beverage customers. However, Azure IoT Suite is currently available only in a public cloud environment and is not yet available in hosted private or private cloud environments. Microsoft is releasing virtual device functionality in IoT Hub in November 2016, but it was not available in time for this evaluation.

Strong Performers

- **Amazon Web Services.** The AWS IoT Platform is a managed service that provides connectivity and data ingestion services designed to support scalable IoT solutions on AWS's cloud service. The platform greatly speeds up batch deployments using AWS's recently released Just-In-Time registration, which allows customers to authenticate a device token to a certificate authority root and apply that certificate to a group of devices without the need to re-authenticate each device. Through AWS Command Line Interface (CLI), AWS IoT can leverage APIs to Amazon Kinesis, Amazon Machine Learning, Kibana, etc. Although it's a strong offering, AWS's platform does require some configuration and isn't a good fit for those seeking a more turnkey solution. AWS updated its user interface in November 2016 to make it much more user-friendly; its score does not reflect this enhancement because the update took place after the evaluation period of this Forrester Wave.
- **SAP.** The SAP Hana Cloud Platform IoT Services functionality significantly expanded through SAP's recent acquisition of Plat.One and its IoT software platform. This acquisition, along with the acquisition of Fedem Technology, strengthened SAP's ability to address industrial IoT use cases and cloud-based predictive maintenance services and highlights SAP's strategic focus on IoT, backed by plans to invest $2 billion in IoT initiatives over the next five years. SAP offers strong analytics solutions accessible via a built-in interface to the SAP Hana cloud platform's analytics engine, which can process high-speed transactions, analyze streaming data, and transform data into actionable insight. SAP offers customers a wide array of prepackaged operational applications, including ones focused on predictive maintenance, asset intelligence, and vehicle insights. SAP's IoT partner ecosystem is not currently as large as those of some other vendors, particularly in the hardware and device category.
- **Cisco Jasper.** The acquisition of the connectivity management platform provider Jasper in March 2016 enabled Cisco to raise its stakes in pursuit of helping customers deliver and operate connected solutions. Cisco Jasper's greatest strength comes from its ability to leverage its massive telco partner network for SIM-based IoT initiatives. The platform solution offers a strong, user-friendly, rules-based billing and subscription engine, which allows real-time location monitoring of SIM cards across carrier networks and offers proactive alerting for potential roaming charges. Today, Cisco Jasper is ideal for organizations that are primarily pursuing cellular-based IoT use cases and don't require connection to Wi-Fi and/or personal area networks (PANs). While Forrester expects Cisco to supplement current Cisco Jasper capabilities with more-advanced functions like edge analytics in the future, these functions are not yet available.

Contenders

- **LogMeIn.** LogMeIn has made several acquisitions in the past five years to jump-start its efforts to help product manufacturers simplify the process of connecting, managing, securing, and capturing insight from IoT-enabled products. In September 2016, Xively added Product Launcher to the

platform, which includes 300 standard device templates to help users set up virtual models of products, identify captured product data, and visualize data in a meaningful manner. The company introduced the update after the evaluation period for this Forrester Wave; thus, the vendor's score does not reflect it. The Xively platform offers native integration with Salesforce that enables use cases such as having malfunctioning products automatically trigger push notification alerts to the Salesforce mobile app that field service technicians use. LogMeIn's IoT partner ecosystem is not currently as strong as those of some other vendors in this evaluation.

- **Ayla Networks.** Ayla Networks targets the Agile IoT platform at helping product manufacturers develop IoT-enabled products and provides tools for them to monitor, modify, and analyze connected product performance. Ayla Networks' customer base includes many consumer product manufacturers, but the company is focusing on expanding its footprint into the B2B sector. The vendor also has a key partnership with Apple. The Agile IoT platform supports Wi-Fi and a wide range of short-range connectivity options, including 6LoWPAN, Bluetooth LE, Thread, ZigBee, and Z-Wave, but lacks support for other types of cellular connectivity. The Ayla Agile IoT Platform has a global presence in North America, Europe, and Asia, including China. Currently, Ayla Network's Agile IoT platform supports a limited number of interfaces to other data analytics platforms and does not currently offer data enrichments at the edge.
- **Exosite.** Exosite targets its Murano platform at helping product manufacturers deliver connected offerings. Exosite's strengths include its sizable API library, which allows integrations with external sources such as AWS, Azure, and Salesforce data; an intuitive user interface with the ability to build multitier views for tenant management; and an identity-focused security strategy that supports administration workflow and delegation functionality. Exosite lags behind the competition in a few areas, including broad protocol support, advanced analytics capabilities, augmented reality, and machine learning. Although Forrester spoke with one customer who cited frustrations three years ago with the difficulty and length of time it took to deploy a solution that fit the company's needs, the customer also noted that Exosite's professional services have improved since the beginning of the project.
- **Zebra Technologies.** The cloud-based Zatar platform, launched in 2013, was an early entrant into the IoT software platform space. Today, Zatar is a central component in Zebra's Enterprise Asset Intelligence platform strategy, which focuses on delivering applications to improve critical workflows in retail, healthcare, transportation and logistics, and manufacturing. Zatar supports open protocols, including CoAP, MQTT, HTTP, and Lightweight M2M, which are particularly relevant for devices like active RFID tags. The Zatar platform offers several prepackaged applications, including patient-flow analytics, advanced-load analytics, and food-safety applications, with plans to deploy additional vertical applications. Zebra's vertically focused platform aligns with its strategic focus on addressing the needs of customers in specific markets; however, many of the other vendors in this evaluation offer a wider range of functionality and have developed broader partnership ecosystems.

Supplemental Material

Online Resource

The online version of Figure 5 is an Excel-based vendor comparison tool that provides detailed product evaluations and customizable rankings.

Survey Methodology

Forrester's Global Business Technographics® Networks And Telecommunications Survey, 2016, was fielded in December 2015. This online survey included 3,563 respondents in Australia, Brazil, Canada, China, France, Germany, India, New Zealand, the UK, and the US from companies with two or more employees.

Forrester's Business Technographics ensures that the final survey population contains only those with significant involvement in the planning, funding, and purchasing of business and technology products and services. ResearchNow fielded this survey on behalf of Forrester. Survey respondent incentives include points redeemable for gift certificates.

Please note that the brand questions included in this survey should not be used to measure market share. The purpose of Forrester's Business Technographics brand questions is to show usage of a brand by a specific target audience at one point in time.

Data Sources Used In This Forrester Wave

Forrester used a combination of three data sources to assess the strengths and weaknesses of each solution. We evaluated the vendors participating in this Forrester Wave, in part, using materials that they provided to us by September 7, 2016.

- **Vendor surveys.** Forrester surveyed vendors on their capabilities as they relate to the evaluation criteria. Once we analyzed the completed vendor surveys, we conducted vendor calls where necessary to gather details of vendor qualifications.
- **Product demos.** We asked vendors to conduct demonstrations of their products' functionality. We used findings from these product demos to validate details of each vendor's product capabilities.
- **Customer reference calls.** To validate product and vendor qualifications, Forrester also conducted reference calls with three of each vendor's current customers.

The Forrester Wave Methodology

We conduct primary research to develop a list of vendors that meet our criteria for evaluation in this market. From that initial pool of vendors, we then narrow our final list. We choose these vendors based on: 1) product fit; 2) customer success; and 3) Forrester client demand. We eliminate vendors that have limited customer references and products that don't fit the scope of our evaluation.

After examining past research, user need assessments, and vendor and expert interviews, we develop the initial evaluation criteria. To evaluate the vendors and their products against our set of criteria, we gather details of product qualifications through a combination of lab evaluations, questionnaires, demos, and/or discussions with client references. We send evaluations to the vendors for their review, and we adjust the evaluations to provide the most accurate view of vendor offerings and strategies.

We set default weightings to reflect our analysis of the needs of large user companies — and/or other scenarios as outlined in the Forrester Wave evaluation — and then score the vendors based on a clearly defined scale. We intend these default weightings to serve only as a starting point and encourage readers to adapt the weightings to fit their individual needs through the Excel-based tool. The final scores generate the graphical depiction of the market based on current offering, strategy, and

market presence. Forrester intends to update vendor evaluations regularly as product capabilities and vendor strategies evolve. For more information on the methodology that every Forrester Wave follows, go to http://www.forrester.com/marketing/policies/forrester-wave-methodology.html.

Integrity Policy

We conduct all our research, including Forrester Wave evaluations, in accordance with our Integrity Policy. For more information, go to http://www.forrester.com/marketing/policies/integrity-policy.html.

Endnotes

[1] Business leaders are beginning to recognize that digital is central to their business initiatives. But now your customers, your products, your business operations, and your competitors are fundamentally digital. For further discussion and analysis, see the following Forrester report: "The Digital Business Imperative."

[2] The IoT opportunity is new to many firms and requires modifications to DevOps principals to achieve operational excellence. I&O pros must change the continuous delivery pipeline for IoT application deployment to account for the numerous variety of physical devices that have varying connectivity methods, models, and operating systems. See the following Forrester report: "IoT Success Requires A DevOps Mindset."

[3] 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. For more information, see the following Forrester report: "The Internet Of Things Heat Map, 2016."

[4] Many IoT technologies are diverse and immature — making it a struggle for infrastructure and operations (I&O) professionals to help their business executives take advantage of their transformational potential. To help, Forrester identified and investigated the 19 most important IoT technologies. For a breakdown of these technologies, see the following Forrester report: "TechRadar™: Internet Of Things, Q1 2016."

[5] IoT software platforms are emerging as an important type of enterprise software. These IoT software platform solutions support a wide range of functionality and are provided by a broad ecosystem of vendors and service providers. For a look at some of the major types of IoT software platforms and how they will evolve in the enterprise, see the following Forrester report: "Internet-Of-Things Software Platforms Simplify Transformation Of Business Operations."

[6] The IoT has evolved beyond a hyped buzzword into commercially available technologies that can significantly improve customer outcomes and deliver business benefits. However, the interlinked set of hardware, software, and ubiquitous connectivity of the IoT ecosystem creates new security challenges and exacerbates legacy security problems. This report summarizes the current IoT attack surface and provides guidance for security and risk (S&R) professionals on how to protect and defend against IoT-based threats. See the following Forrester report: "The IoT Attack Surface Transcends The Digital-Physical Divide."

[7] The business expects infrastructure and operations (I&O) pros to be emergency responders. When customer and business applications are not performing — or not working at all — it affects the entire business. I&O pros must drop everything and wade through the increasingly complex web of infrastructure and applications to quickly find and fix the problem. Predictive analytics can reduce the find-and-fix time. But more importantly, it can help you prevent problems before they even occur. See the following Forrester report: "Predictive Analytics Can Liberate I&O Pros From The Tyranny Of Firefighting."

[8] Sir Francis Bacon, a 16th-century founder of the modern scientific method, famously argued that "knowledge is power." With all due respect to this great scientist, in the 21st century, prediction is power. It's the power that all firms need to strengthen their BT agendas, helping them transform their technology, systems, and processes to win, serve, and retain customers. Predictive analytics is a key capability to make better decisions, avoid risks, and create differentiated, more individualized customer experiences. Predictive models may lie in your data, but only if you look for them. That's what predictive analytics is all about. Every application development and delivery (AD&D) professional and every technology management leader should know what predictive analytics is. This report gets AD&D professionals up to speed quickly so that they can lead the charge. See the following Forrester report: "Predictive Analytics Can Infuse Your Applications With An 'Unfair Advantage'."

[9] With internet of things (IoT) projects proliferating, software development teams are successfully applying best practices from high-velocity mobile app development, modifying them on the fly to meet connected devices' specific needs. As AD&D teams adopt IoT platform services to accelerate product delivery, they build on a core design pattern that we call the "digital doppelgänger." The Forrester brief describes why IoT platform providers created this pattern, what its benefits are, and how it will become integral to next-gen software architecture. See the following Forrester report: "Brief: The Digital Doppelgänger Accelerates IoT Software."

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