Predictions 2017: Customer-Obsessed Enterprises Launch Cloud's Second Decade

Ten Key Developments In Cloud Computing Shape The Industry In 2017

by Dave Bartoletti, Lauren E. Nelson, Andras Cser, Sophia I. Vargas, William Martorelli, Liz Herbert, Andre Kindness, Paul Miller, Charlie Dai, and Frank Liu
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Why Read This Brief

Cloud computing has been one of the most exciting and disruptive forces in the tech market in the past decade. The cloud market will accelerate faster in 2017 as enterprises around the world look to cloud to power their core business systems in addition to their customer-facing applications. This brief outlines the 10 key factors that will shape the cloud computing landscape in 2017 and advises infrastructure and operations (I&O) leaders how to respond.

Key Takeaways

Get Your Private Cloud Platform And Software Strategy In Shape In 2017
New hyperconverged infrastructure platforms and simpler private cloud management tools will help enterprises avoid private cloud failures and deliver true cloud benefits on-premises.

Enterprise-Grade Security, Networking, And Container Solutions Expand In 2017
Enterprises use multiple clouds today, and they'll use even more in 2017, exacerbating your cloud management challenges. Plan to take specific steps to secure cloud workloads, orchestrate services, improve hybrid cloud networking, and include new container platforms in your cloud portfolio.

Regional And Industry-Specific Innovations Drive SaaS And Cloud Platform Evolutions
One size doesn't fit all. From software-as-a-service (SaaS) applications to regional public cloud platform providers, vendors seek geographic and industry specialization to serve local markets and drive cloud adoption. While the megaclouds set the pace, don't ignore regional players.

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Ten Factors Shape Enterprise Cloud Computing In 2017

Cloud computing is no longer an adjunct technology bolted onto I&O strategy as a place to build a few customer-facing apps. Cloud applications such as SaaS; business services; and platforms like infrastructure-as-a-service (IaaS) and platform-as-a-service (PaaS) now drive a full spectrum of end-to-end enterprise transformation, from the core enterprise systems powering the back office to the mobile apps delivering new customer experiences. The global public cloud market will be $146 billion in 2017, up from just $87 billion in 2015, and is growing faster than we predicted just two years ago, at a 22% compound annual growth rate (CAGR).[1] Public cloud platforms, the fastest-growing segment, will generate $32 billion in 2017. Yet only about 28% of North American and European enterprise infrastructure technology decision-makers indicate that their firms have adopted public cloud, and 44%% are building private clouds, with an additional 25% planning to implement in the next 12 months, so there's plenty of runway ahead.[2] As overall cloud adoption and spending ramp up further in 2017, here's what you need to know:

› **Beyond pay-per-use, buyers will save money in cloud many ways.** There are more ways to buy cloud services — on-demand, prepaid, reserved capacity, and enterprise agreements — every month, and this trend will accelerate in 2017. Public cloud pricing isn't simple; SaaS and IaaS/PaaS pricing models vary widely; and cloud pricing disrupts traditional enterprise procurement processes. This complexity has spawned an active market for cloud cost management SaaS tools (e.g., Cloudability, Cloud Cruiser, CloudHealth, and Cloudyn) that are relatively inexpensive and easy to try. The cloud providers themselves now offer many in-cloud tools and services to track, optimize, and lower your spend (e.g., Amazon Web Services [AWS] Cost Explorer and Trusted Advisor).[3] Although there are more ways to buy, there will also be more ways to save next year.

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Action: Cloud cost management is your responsibility, so become the expert. I&O leaders must improve their cloud economics game. Whether you've been involved in technology sourcing, vendor management, or budgeting in the past, you'll need to evolve and contribute your skills as your cloud service use grows. Step up to the plate and learn how cloud economics work, which pricing models match your usage and budgeting constraints, and how to take advantage of third-party cost management tools. There's no reason in 2017 for your cloud costs to grow out of control, and there's no reason I&O can't take responsibility for guiding and limiting cloud spend without stifling usage. The cloud architect of a large US software company told us he saved $300,000 annually from a $2.5 million cloud bill through daily monitoring, regular resizing, and targeted use of reserved capacity.

› **Hyperconverged infrastructure (HCI) will help private clouds get real.** Private cloud must include advanced virtualization, standardization, automation, self-service access, and resource monitoring if it's to function as a true cloud service.[4] As a result, private clouds aren't easy or cheap for I&O leaders to build, and many private cloud initiatives have failed.[5] HCI platforms can help I&O leaders relieve some of these challenges because they have preintegrated compute and storage resources and also bundle and abstract a federated storage layer. In addition, HCI's automated configuration features help I&O leaders deliver simpler scale-out and faster implementation times. HCI vendors are steadily improving private cloud capabilities, and this trend will accelerate in 2017. For example, Nutanix has already made the move toward being a cloud building block with its own hypervisor as the heart of its future growth strategy. HCI is quickly becoming the default infrastructure platform upon which to build the private portion of a hybrid cloud.

Action: Adopt HCI to increase your chances of private cloud success. I&O leaders should consider HCI as the foundation for their private cloud development in 2017, particularly for net-new workloads that demand rapid, automated scale-out. Forrester's survey found that 31% of North American and European IT respondents used an HCI platform to build their private cloud in late 2015, with an additional 15% planning to implement over the next 12 months.[6] Two years on, with the strong rate of innovation across the HCI vendor landscape, leading I&O innovators are accelerating HCI adoption plans for private cloud. Re-engage with the major HCI vendors in the market to identify the best partner for your needs.[7]

› **Size still matters, but the megacloud providers won't be your only option.** Despite a growing gulf between the global public megacloud providers and regional players, the cloud vendor landscape remains crowded.[8] Megacloud providers like AWS, Google, IBM, and Microsoft keep opening new data centers and solidifying existing markets and entering new ones.[9] Even emerging providers like Alibaba and Tencent have ambitious plans for international expansion.[10] However, local support, data privacy, and local compliance concerns are still adoption barriers. In the European market, organizations prefer that data be stored in their own country.[11] That's why Microsoft and T-Systems offer a unique Azure service in Germany.[12] China poses similar challenges

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for foreign public cloud providers, as the government requires them to operate in partnership with local companies. Responding to this situation, many regional and national players quickly adapt with innovations like vertical focus and better local support services than global players.[13]

Action: The best cloud for you in 2017 might not be the biggest cloud. The megacloud vendors are setting the pace of innovation for the global cloud market, but they're not the only option, nor are they always best in every geography or industry. Keep your options open and don't be afraid to use multiple providers.[14] Keep pressure on the megaclouds to expand and innovate in your regional markets like Europe and China, especially on incumbent providers like Google, IBM, and Oracle. Choose regional vendors to get to cloud faster if necessary, but make sure they have a strong connectivity story and will help you manage a multicloud deployment when and if you need it.

› **Lift-and-shift tools will improve to make cloud migration easier.** For years, our advice for companies looking to just rehost existing applications on public cloud platforms was simple: don't. The optimum option to move an application is to rewrite it specifically to take advantage of cloud's elasticity, but lift-and-shift is becoming more viable. Emerging migration vendors have now started to deliver cheaper, lighter-weight workload migration tools. CloudEndure and CloudVelox, just to mention two examples, both offer much-improved migration solutions. Last year, enterprises started to expand public cloud plans to include systems-of-record applications. Enabled by a growing list of migration services from megacloud providers like AWS, IBM, and Microsoft, the "migrate first, transform later, when it makes sense," sentiment is growing. In 2017, lift-and-shift migration tools will accelerate the rate of cloud migration, given their low cost for bulk application migrations.

Action: Lift-and-shift is easier and more viable, but proceed with caution. Migration costs are still relatively high; cloud pricing still rewards variability; and your economic and performance benefits will likely be limited if you haven't redesigned your application to take advantage of a cloud platform architecture. Lift-and-shift is the cheapest and easiest of migration methods, but it's only one of several app modernization methods available. Lift-and-shift or not, at some point, customers still need to decide whether to undertake substantial renovation for those applications that require them. Pursue *selective* lift-and-shift, but if you adopt it too liberally, you'll limit the economic benefits you can expect from cloud migration.

› **Hybrid cloud networking will remain the weak link in hybrid cloud.** The hybrid cloud has arrived, albeit in a diminished capacity until the network catches up. Creating a mesh of multiple public cloud resources and private data centers will require the five tenets outlined in Forrester's virtual network infrastructure (VNI).[15] In its end state, this next-generation network should seamlessly connect into hybrid cloud management and orchestration tools. However, this will be a slow endeavor that could take most firms many years. While developers have started to build applications across multiple platforms, the free movement of application/virtual machines (VMs) across all private and public resources will be hampered until VNI becomes common in enterprise, carrier, and cloud provider networks.

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Action: Start now with cloud connections and software-defined networking (SDN). While VNI technology matures, enterprises should use a combination of tools to bridge the gap between I&O's current networking platform and VNI. You need the VNI benefits even without considering cloud developments. Instead of relying solely on internet connections, solution partners — like colocation, carrier, and interconnection providers — already offer managed connections to the cloud providers' private connection market (e.g., AWS Direct Connect and Azure ExpressRoute).[16] These dedicated transports will help manage application performance and increase security levels. In addition to managed links, I&O professionals should incorporate SDN overlay solutions, such as Nuage Networks, VMware NSX, and Zentera, to optimize cost and performance of the hybrid wide-area network (WAN) for applications, data, customers, and the business.[17]

› **Enterprises will shun large, complex, and costly private cloud software suites.** In the early days of private cloud, vendors and I&O pros embraced the "journey to cloud" story, seeing private cloud as the first step. For enterprises building private clouds, the early bulky private cloud suites weren't easy, fast, or cheap.[18] Enterprises now prefer tools purpose-built for net-new workloads that minimize the costs of components and software licenses. The resulting solutions include an assortment of open source tools, configuration scripts, and lightweight interfaces that help simplify and accelerate the development process. In 2017, the private cloud market will aggressively shift away from traditional private cloud suites toward leaner, cheaper solutions that include and integrate PaaS capabilities, cloud management, and container support.

Action: Reevaluate your private cloud strategy and tools. Your private cloud software strategy needs a refresh as the market matures and the technology evolves. Revisit the scope of your private cloud strategy, and objectively measure current success at accelerating development cycles. If you're still using a private cloud suite, evaluate which functionality you actually use to determine if you're overspending on private cloud and still missing key functionality. You'll likely need to supplement aspects of your cloud strategy to ensure that it's accelerating your path towards more-effective DevOps.

› **SaaS will move away from one-size-fits-all to regional and industry solutions.** Enterprises have long perceived SaaS as vanilla and horizontal, with limited verticalization and customization options. In 2017, this one-size-fits-all model will shift as even the purest of SaaS providers branch out into multiple flavors of their solution. For example, Salesforce buyers can now buy a financial services-specific version or European data law-friendly version (hosted by T-Systems under the covers). SaaS vendors are offering these solutions themselves or through partners, such as the Deloitte restaurant solution built on Oracle Cloud.

Action: Don't jump in headfirst without understanding long-term implications. For some buyers, these emerging industry- and regional-specific SaaS offerings are a welcome sight. But beware, as you may lose some benefits by going in a non-vanilla direction. For example, industry editions are likely to cost more, such as the additional cost for Oracle's and Salesforce's

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Government Cloud editions. Industry versions may also limit the dream of many-to-many collaboration on a single version as the gap widens between the features you have and the features other collaborating parties have.

› **Chinese firms will be key drivers of global cloud evolution.** Chinese firms have, to date, been mainly acting as followers in the cloud market, but in 2017 Forrester believes that visionary Chinese firms will become leaders in several areas and help accelerate cloud maturity and adoption. First, security is one of the key issues for container adoption.[19] HyperHQ, for example, is innovatively addressing container security with bare-metal, hardware-level container isolation, and its approach is one of only two VM runtime implementations for containers authorized by the Open Container Initiative.[20] Second, public cloud internet-of-things (IoT) platforms ease infrastructure challenges for enterprise adoption.[21] Leading Chinese cloud players like Alibaba and Tencent already provide IoT services in their public cloud platforms and enable firms to try new IoT initiatives; we predict that both will mature rapidly. Third, blockchain is still an early-stage, emerging technology but is showing great promise.[22] Cloud-based blockchain services from Chinese pioneers like Wancloud will accelerate innovation for financial technology (fintech) companies.[23]

Action: Put Chinese ISVs and service providers on your radar. Chinese cloud firms are becoming a formidable force globally, not just in China. Proactively engage with enterprise architects and business decision-makers to determine how Chinese independent software vendors (ISVs) and service providers might fit into your business technology (BT) strategy. You should determine the technology and regulatory requirements on regional capabilities in your company's business agenda and evaluate the necessity to include Chinese companies in your value ecosystem for cocreation. You should also adjust your processes of emerging technology introduction, making sure that globalization capabilities are part of the vendor selection criteria to choose the right Chinese vendors for your digital initiatives.

› **Containers everywhere will shake up cloud platform and management strategies.** Linux containers, popularized over the past two years by Docker and its exploding ecosystem of enabling tools, will be available in every major public and private cloud platform by early 2017. Developers will consume them directly and often build DIY stacks to power microservices development. Every major PaaS platform, from Cloud Foundry-based distributions to OpenShift, offers developers containers as well. All of the leading public cloud platforms offer containers-as-a-service alongside VMs (a less curated approach than PaaS), and VMware has added containers to its private cloud platform.[24] With such ubiquity, enterprise production use of containers will jump in 2017 from today's modest levels. That means I&O teams will need to start solving container management and operations challenges, including new security, monitoring, storage, and networking difficulties that arise as containers are deployed broadly in production.

Action: Reweigh your PaaS, container orchestration, and cloud management needs. Container-based PaaS solutions offer service catalogs, runtime deployment support, scaling, orchestration, and monitoring. They both complement and compete with emerging standalone

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container orchestration, monitoring, networking, and related tools. Take a fresh look at your existing VM-based app and infrastructure cloud management tools to chart a course toward container support. Your first step should be to evaluate the pros and cons of on-premises private PaaS versus a managed public cloud development platform; you might need both. This will determine which components of a complete container-optimized platform you need to build, which to integrate with existing private cloud management tools, and which you should source from a public cloud provider.

› **Cloud service providers will design security into their offerings.** Securing cloud workloads is important as companies make the push to move their workloads from on-premises to the cloud. Large cloud platform providers (e.g., AWS, Azure, and Salesforce) have already launched their cloud workload security management and bring-your-own-keys (BYOK) encryption schemes. Cloud security gateways (CSGs) will come of age to discover use of unsanctioned or poorly governed cloud apps ("shadow IT"), protect data, and check for sensitive data patterns moving between on-premises and cloud workloads or between cloud workloads.[25] More clients will make their move to the cloud dependent on deploying and operationalizing a CSG solution. Monitoring access to the data will be a prerequisite for moving data to the cloud. Container security solutions will start covering the following areas: 1) integrity monitoring; 2) system call tracking; and 3) privileged access management.

Action: Retain control of your own security destiny. Major cloud providers offer robust security, but your true security remains in your own hands. Use cloud workload security solutions (e.g., Alert Logic, CloudPassage, and TrendMicro) and augment them with cloud platform/native security features for file integrity monitoring, configuration file management, and IDS/IPS. Rely on behavioral intelligence of CSGs and security user behavior analytics (SUBA) solutions to have an automatic definition of normal user activity, then flag anomalous access. Demand bring-your-own-encryption (BYOE) solutions from your cloud provider. Salesforce has taken the lead and spotlighted the path through its BYOK initiative.

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Supplemental Material

Survey Methodology

For Forrester's Global Business Technographics® Infrastructure Survey, 2015, Forrester conducted a mixed methodology phone and online survey fielded in May and June 2015 of 3,592 business and technology decision-makers located in Australia, Brazil, Canada, China, France, Germany, India, New Zealand, the UK, and the US from companies with two or more employees.

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Endnotes

[1] For a complete and detailed public cloud market forecast through 2020, see the "The Public Cloud Services Market Will Grow Rapidly To $236 Billion In 2020" Forrester report.

[2] Source: Forrester's Global Business Technographics Infrastructure Survey, 2015.

[3] Now that cloud is the preferred platform for apps that win, serve, and retain customers, adoption and spending are both up. Clients often seek Forrester's help to spend wisely. Beyond simple pay-per-use pricing, the leading public cloud platform providers now offer a broad range of discount plans, prepurchase options, and large enterprise discounts. This report explores how leading public cloud providers approach pricing to help infrastructure and operations (I&O) leaders make sense of this dynamic market and keep their own cloud costs down. See the "Understand Public Cloud Pricing Strategies To Save Money Today And Tomorrow" Forrester report. We also recommend that you read the following report to optimize the financial aspect of your cloud strategy. See the "Brief: Top 10 Facts Every I&O Pro Should Know About Cloud Economics" Forrester report.

[4] By building a private cloud the right way, Waste Management (WM) reduced resource deployment time from two and a half months to around 20 minutes and gave existing public cloud users a satisfactory alternative. This refuse disposal and recycling leader got private cloud right by engaging with the customer from the beginning and working with an experienced partner to craft a solution focused on ensuring agility and sustainability. To learn more about WM's cloud success story, see the "Case Study: Waste Management Builds A True Private Cloud" Forrester report.

[5] It's hard to get private cloud right. Forrester has lamented its lack of success for years, pointing out how few private cloud environments met basic functionality requirements. But infrastructure and operations (I&O) pros want to know more. Rather than just focusing on best practices, Forrester clients want to understand how and why private cloud environments have failed. For a deeper dive into common causes of failed private cloud initiatives, see the "Q&A: Understanding Private Clouds That Failed" Forrester report.

[6] Source: Forrester's Global Business Technographics Infrastructure Survey, 2015.

[7] In our 28-criteria evaluation of hyperconverged system providers, we identified the 12 most significant ones — Atlantis Computing, Cisco, EMC, Hewlett Packard Enterprise (HPE), Huawei, HyperGrid (formerly Gridstore), Nutanix, Pivot3, Scale Computing, SimpliVity, Stratoscale, and VMware — 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 for their business technology (BT) agenda. See the "The Forrester Wave™: Hyperconverged Infrastructure (HCI), Q3 2016" Forrester report.

[8] Public cloud platforms are the foundation for developing and running applications in the age of the customer. The market has matured rapidly as two vendors — Amazon Web Services and Microsoft — separate further from the pack. Over the next two years, enterprise app migrations, new microservice-based app designs, and container technologies will create further disruption and fuel innovation. We recommend that you read the following report to understand the key segments in the public cloud platforms market and how new requirements and technologies will drive the next phase of growth. See the "Vendor Landscape: Public Cloud Platforms Consolidate, But New Disruptions On The Way" Forrester report.

[9] In our 34-criteria evaluation of global public cloud platform providers for enterprise developers, we identified the eight most significant ones — Amazon Web Services (AWS), CenturyLink, Google, IBM, Microsoft, Oracle, Salesforce, and SAP — and researched, analyzed, and scored them. This report shows how each provider measures up to enterprise software development requirements to balance application platforms with infrastructure control to help application development and delivery (AD&D) professionals select the right public cloud platform partner. See the "The Forrester Wave™: Global Public Cloud Platforms For Enterprise Developers, Q3 2016" Forrester report.

[10] We recommend that readers consult this report, which analyzes how new requirements and technologies will drive the development of the public cloud market in China and reviews the landscape of public cloud platform vendors to help CIOs understand the offerings, positioning, and local capabilities of 38 vendors to better engage with them. See

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the "Vendor Landscape: The Public Cloud Platform Market Is Consolidating In China" Forrester report. For an analysis of the trend of Chinese cloud providers expanding into the European market, see the "Brief: China's Clouds Come To Europe" Forrester report. And for our vendor portrait of Aliyun, see the "Vendor Profile: Aliyun, Q2 2016" Forrester report.

[11] This report discusses the European market's preference for keeping data within its originating country's borders and in compliance with strict regulatory requirements. See the "Market Overview: Public Cloud Infrastructure-As-A-Service (IaaS) In The European Market" Forrester report.

[12] Microsoft and Germany's T-Systems have announced a novel solution for European customers that want the features offered by US-based public cloud providers although they're concerned about entrusting their customer data to those same US-based public cloud providers. In this report, we place this announcement in the context of a complex and shifting commercial, legal, and political landscape. See the "Quick Take: Trust Us, We Are European" Forrester report.

[13] There are many regional and national cloud service providers in the European market, such as iomart Group, KPN International, and Open Telekom Cloud; for more information on the vendor marketplace, see the "Market Overview: Public Cloud Infrastructure-As-A-Service (IaaS) In The European Market" Forrester report. Only AWS and Microsoft have officially launched cloud services in China that comply with local regulations; by default, local vendors are the major players in China. For more information on this phenomenon, see the "Vendor Landscape: The Public Cloud Platform Market Is Consolidating In China" Forrester report.

[14] The systems of engagement driving today's business growth often exploit cloud computing to leverage its agility, flexibility, and cost-effectiveness. In isolation, each of these systems may depend on a single cloud provider, but the broad portfolio of tools deployed across the enterprise creates a far more complex landscape. See the "Brief: A Clear Multicloud Strategy Delivers Business Value" Forrester report.

[15] The five tenets of VNI include the ability to: 1) leverage virtualized and physical infrastructure; 2) act as a vertically integrated layer 2 to layer 7 module within the infrastructure; 3) creates a fabric of horizontally interwoven networking components; 4) automate and orchestrate the infrastructure to deliver the right services for each user; and 5) empower other teams to leverage the platform. For more information, see the "Five Tenets Define Virtual Network Infrastructure, A Bold New Business Network" Forrester report.

[16] For more information on the value of hybrid cloud networking and why internet connects aren't a long-term network strategy, see the "Beware The Pitfalls Within Networking For Hybrid Cloud" Forrester report.

[17] For more information on SDN overlays, see the "Why Overlays Are Getting The Most Attention In The Software-Defined Network Market" Forrester report.

[18] For an analysis of the common causes for failed private cloud initiatives, see the "Q&A: Understanding Private Clouds That Failed" Forrester report. We also recommend that you review the following report for a better understanding of the rates of private cloud adoption, why companies are adopting private cloud, and what their motivations and concerns are when it comes to private cloud. See the "Adoption Profile: Private Cloud In North America, Q1 2016" Forrester report.

[19] The Docker team expresses strong commitment to security, but questions remain as to how far its security features will go, how robust its code base will become, and how fast it will get there. For more details, see the "Nine Questions To Ask About Docker" Forrester report.

[20] Hyper.sh's container hosting service innovatively applies hardware-enforced isolation to containers to achieve inherent multitenancy and runs on bare-metal servers instead of nesting in virtual machines to maximize performance and agility. Source: Hyper.sh (https://hyper.sh/features.html).

The Open Container Initiative is an open governance structure to create open industry standards around container formats and runtime. Two implementations are official projects for virtual machine runtime — HyperHQ and Intel. Source: Open Container Initiative (https://www.opencontainers.org/) and "Implementations," GitHub (https://github.com/opencontainers/runtime-spec/blob/master/implementations.md).

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[21] Public cloud platforms provide low-cost, on-demand environments to enable firms to try new IoT initiatives. For more details, see the "Accelerate IoT Initiatives With Cloud Platforms" Forrester report.

[22] At this stage, it's not possible to rule out completely any of the scenarios hailed by blockchain supporters. For more details, see the "Blockchain — Don't Believe In Miracles" Forrester report.

[23] Wancloud is a cloud-based blockchain service provided by Wanxiang Blockchain Labs. It already supports Bitcoin blockchain, Ethereum blockchain, and Factom. Source: "Wan Yun platform presentation," Wancloud (http://baas. blockchainlabs.org/company/).

[24] Though developers use containers primarily in the dev/test cycle today, we predict rapid adoption of containers for production in 2017. For a detailed review of the multiple ways developers can consume containers and the impact each has on how containers will be rolled out in production, see the "Vendor Landscape: Public Cloud Platforms Consolidate, But New Disruptions On The Way" Forrester report.

[25] Cloud security gateways offer a packaged way to monitor traffic — both by using a proxy and by connecting to the API of a SaaS or IaaS service.

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