



IDC TECHNOLOGY SPOTLIGHT

Transformation in the Age of the 3rd Platform: The Role of Cloud Architecture

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Adapted from *The Emergence of Microservices as a New Architectural Approach to Building New Software Systems* by Al Hilwa, IDC #256906 and *Platform as a Service: The Battle for Developers and Apps* by Larry Carvalho, IDC #DR2015_T1_LC

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Cloud, as one of the key transformative forces of the 3rd Platform, is impacting all areas of IT supply and delivery. Organizations across industries are projected to shift steadily toward cloud-first strategies to enable digital transformation, drawing on the huge increase in the number and diversity of services available in the market. This IDC Technology Spotlight examines the role of cloud architectures in the form of platform-as-a-service (PaaS) technologies provisioned publicly or made available for on-premise enterprise operation in the increasingly more sophisticated processes of application development, deployment, and life-cycle management. The paper highlights technology available from Pivotal that is designed for the development and management of cloud-native applications.

Introduction

The "innovation stage" of the 3rd Platform has brought to the forefront the role of developers and the supporting cast of tools and platforms that enable them. A central character in the cast is cloud technology in both public form and private form. Indeed, the offloading of hardware and infrastructure procurement and management to public cloud providers has dominated the discourse, but the software architecture of cloud computing environments, in many ways, is considered the more critical strategic element in the overall enablement of developer productivity and agility needed for innovation. IDC ROI studies have shown significant benefits tied to streamlining the software development life cycle because of improvement in provisioning, testing, deployment, and life-cycle management related to the adoption of cloud architectures and accompanying DevOps processes. IT departments are looking for application development tools, environments, and methodologies that leverage cloud architectures and allow them to accelerate application development in both public clouds and private clouds.

Cloud architectures, often used in the form of PaaS software, whether provisioned in-house or through public cloud platforms, are key enablers of digital transformation and provide productive and agile self-service environments for software developers to accelerate the delivery of innovation. Such platforms are providing new possibilities for how businesses innovate by supporting newly forged developer workflows applying long-promoted agile practices in software development. In the IDC Technology Spotlight *Agile Transformation in the Age of the 3rd Platform*, published in March 2016, we discussed the role of agile practices. In this document, we highlight the role of the cloud architecture baked into the PaaS software layer in the enablement of developers.

Tools and technologies that enable cloud architectures, such as PaaS offerings, containers, and container orchestration platforms, as well as approaches to software development such as DevOps

and microservices have been evolving, giving developers unprecedented options to meet the growing demand for applications. Additionally, compositional approaches to application construction through the use of prebuilt modules on marketplaces or from open source galleries and repositories have revolutionized the ways businesses go to market with products and services. Developers are able to compose an application from a variety of services much faster now than they could in the past.

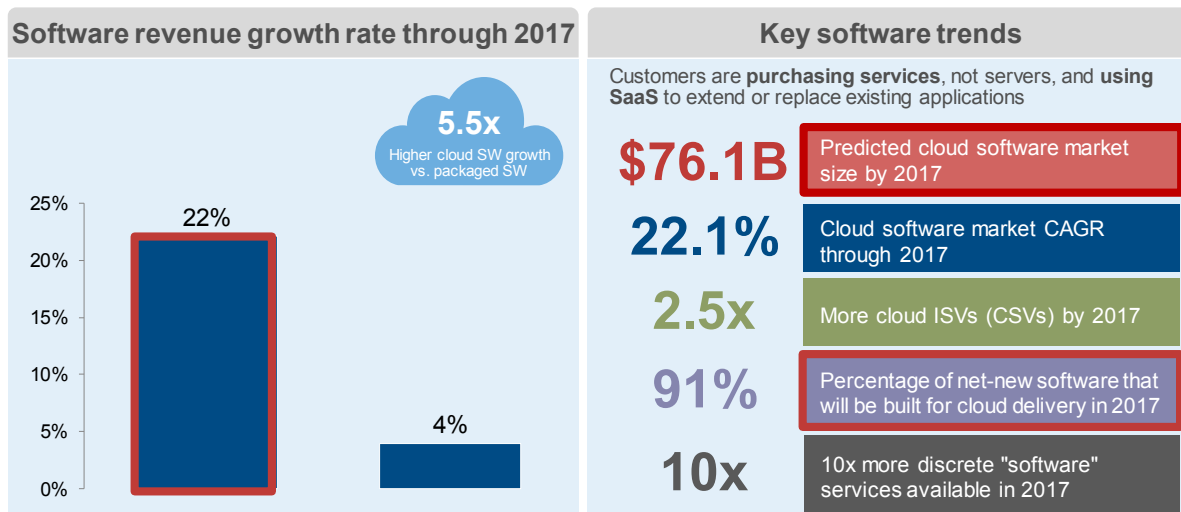
Innovation around software development technologies has occurred at a rapid and frenzied pace over the past 5 to 10 years, likely stimulated by a confluence of factors including the mobile app revolution and the crossing of the chasm that various digital application spaces such as ecommerce and digital media have undertaken. Technologies such as continuous integration and continuous delivery, automated testing tools, and abstracted deployment-centric PaaS offerings in both public cloud settings and private cloud settings are examples that demonstrate this innovation.

While some of the approaches to PaaS have been undergoing rapid evolution, the productivity and agility sought by software development teams have given an early lead to more integrated cloud platforms such as Cloud Foundry, compared with more recently introduced container orchestration technologies built around Docker. It is early days, and while the battles for platform supremacy will continue for some time, enterprises can take advantage of PaaS technologies today with some of the more mature offerings, and IDC expects the market to continue to cluster strategically around multiple approaches for a long time to come.

IDC expects the demand for cloud solutions to grow and software to be a key component of that growth (see Figure 1). Major upticks in developer cloud services adoption and big data–driven solutions will make PaaS the fastest-growing category for worldwide public cloud computing.

FIGURE 1

Demand for Cloud Solutions: Cloud Services Are Changing How IT Services Are Created and Delivered



Source: IDC, 2016

Customer Expectations of PaaS

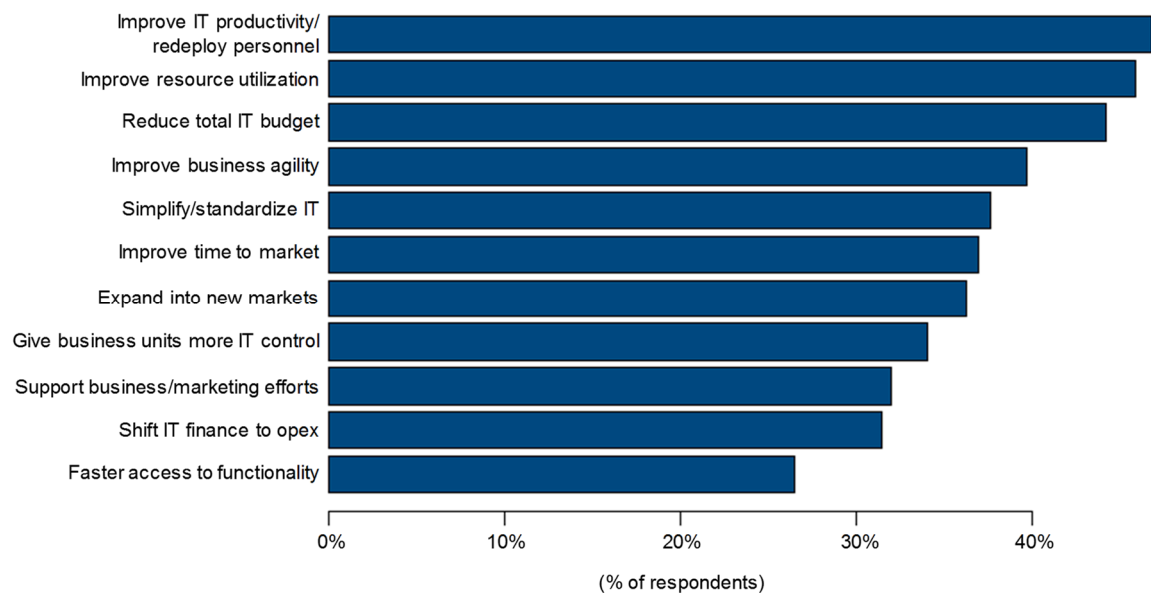
Penetration of cloud architectures is on a trajectory of growth across both the private service model and the public service model as companies make significant decisions around digital transformation. Many of these cloud-first decisions will be driven by line-of-business functional executives seeking new competitive advantage capabilities within their transforming industries. Many businesses facing disruption have already instituted innovation teams or centers of excellence around digital transformation to handle the key areas where they are encountering disruption. In almost all cases IDC is aware of, such environments involve software developers following modern DevOps practices and using cloud architectures to support a highly accelerated pace of innovation delivery. As aptly put by Andy Zitney, at the time a senior executive at Allstate, modern PaaS technology enables an idea to emerge on Monday and be put into production on Friday.

IDC's *CloudView Survey* highlights the top 6 cloud drivers enabled by cloud technology (see Figure 2). These desirable criteria of services are met by PaaS capabilities whether in public or private form. The differentiating factors that allow PaaS offerings to make infrastructure more consumable while reducing developer barriers to deploy applications will drive PaaS adoption as cloud computing matures.

FIGURE 2

Top 6 Cloud Drivers: Driving an Increase in Cloud Adoption

Q. Of the following potential reasons for moving to cloud, which are considered important drivers that you expect to achieve when moving to cloud?



n = 6,159 worldwide respondents

Note: Results are weighted by GDP and company size.

Source: IDC's *CloudView Survey*, January 2016

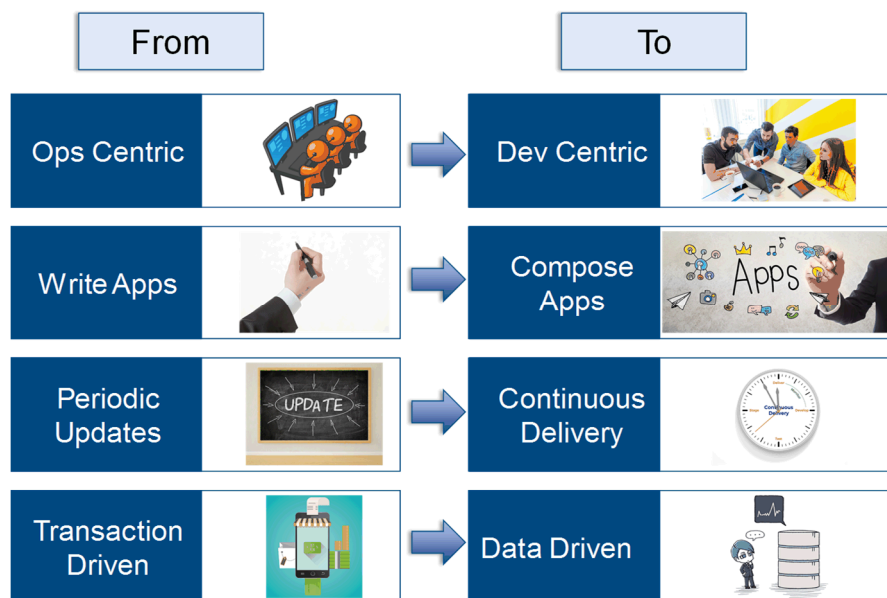
Evolving PaaS Technology

The shift to the 3rd Platform and the coping mechanisms being adopted to deal with the onslaught of disruption have led to several shifts in focus in application architectures and developer expectations (see Figure 3). The ability to manage applications has been moved from operations to developers while availability of services has increased the ability to compose applications from these services. Developers are able to compose an application from a variety of services much faster now than they could in the past.

The API revolution has meant that much of what developers need to create is often available through API Marketplaces driving this compositional approach to application construction. Decoupling services through microservices architecture has made it much easier for applications to be constantly upgraded to new versions, improving the ability to meet evolving business demands. The ability of automated decision making from data coupled with proliferating big data platforms that provide a deep level of real-time analytics has shifted the center of application focus from transactions to leveraging data in applications.

FIGURE 3

Cloud Application Development Evolution



Source: IDC, 2016

Cloud-Native Approach to Application Development

Cloud computing technologies such as PaaS, containers, and container orchestration platforms have been rapidly evolving, giving developers unprecedented benefits to meet the growing demand for applications. Applications developed using these technologies are often referred to as "cloud native" applications to highlight the productive and agile way in which they are developed, managed, and evolved.

The cloud-native approach is becoming the preferred approach that enterprises use to handle the demand for new applications by business users to address disruptive challenges. What is characteristic of these applications is their ability to scale and be evolved with minimal impact on other system components. Architecting applications to break up functions into microservices provides the ability to independently make changes without risk of bringing down the entire application.

Microservices is an architectural approach that draws on long-evolving experience in software engineering and system design, including the service-oriented architecture (SOA) efforts of the past two decades. Microservices architecture is enabled by a spectrum of tool categories. The ability to build microservice capabilities along with appropriate governance for delivery is helping enterprise developers architect solutions that are similar to solutions built by born-on-the-Web companies. This enables the rollout of new functionality much faster than what was possible before. Chiefly, we are seeing new offerings and reengineered products under development built on a microservices architecture, which involves breaking down capabilities into single-purpose containers accessible by APIs that are then assembled into larger solutions.

The adoption of containers, one of the core building blocks for PaaS and cloud architectures, has accelerated over the past 12 to 18 months. Ecosystem activity in the market has also moved rapidly with the open container project now housed under the Linux Foundation, and open source PaaS initiatives such as Cloud Foundry, now also an established foundation under the Linux Foundation, have shown a strong increase in interest among vendors.

Other approaches have emerged in recent years around the meteoric success of Docker containers. Docker has taken the concept of PaaS containers and promoted a standard container image and a standardized basic set of tools around it but has left the container orchestration problem for the ecosystem to address. A number of solutions have emerged (e.g., Kubernetes) or have been adapted (e.g., Apache Mesos) to manage clusters of Docker containers. The evolution of container orchestration and scheduling offerings around Docker is still in its infancy from a maturity perspective but is rapidly emerging as a second pole of thought leadership in the cloud architecture platform battles, potentially challenging integrated PaaS offerings such as Cloud Foundry for strategic adoption. Nevertheless, the landscape is constantly evolving, and Cloud Foundry has announced support for Docker images. IDC believes that while it is indeed early days as the maturity of all solutions will be evolved aggressively over the next few years, more than a single solution is likely to achieve wide-scale adoption over the next decade. The competition accommodates the different approaches the rapidly expanding user base is likely to require.

Considering Pivotal

Company Background

Founded in 2013, Pivotal (Palo Alto, California) was launched to offer cloud platform and data analysis software and services, based upon products and services from co-owners EMC and VMware and more than \$100 million in backing from General Electric (GE), a 10% stakeholder. Pivotal brought together platform technologies that VMware and EMC had built or acquired with Pivotal Labs, an agile software development company founded in 1989 that EMC acquired in 2012. In May 2015, Pivotal closed a series C financing round with investments from Ford Motors and Microsoft.

Pivotal's main businesses include Pivotal Cloud Foundry, a PaaS for private and public cloud; Pivotal Big Data Suite, a set of data products for data storage and manipulation; and Pivotal Labs, which focuses on an "opinionated" agile approach to modern software development.

Pivotal Labs offers engagements with product designers and developers to help organizations define and prioritize software development in a focused, informed, and disciplined manner. Pivotal trains companies to use its rigorously designed tools and methodologies, such as data modeling, discovery

and framing, paired programming, and test-driven development, to deliver products at a predictable, productive, and sustainable pace. The agility and flexibility of its frameworks speed up time to market and enable companies to react more swiftly to the dynamics of a changing market through continuous iteration.

Pivotal also offers engagements with seasoned data scientists, who train companies on how to define, design, and execute on a data strategy and analytics road map. Pivotal's data scientists identify the best tools and environments for data aggregation and organizations and provide frameworks for how to access and use data and data modeling to provide more expansive perspectives in solving business problems. The result is letting the data uncover insights that drive action. Pivotal's development services and tools are integrated with Pivotal Cloud Foundry and Big Data Suite offerings.

Pivotal has built a competitive PaaS offering for supporting cloud-native applications with the Pivotal Cloud Foundry cloud application platform. Pivotal has assembled products, services, and sales forces from parent companies EMC and VMWare and investors such as GE and combined them with its differentiated service model to create a powerful offering for digitally transforming enterprises. The company is a strong supporter of and contributor to PaaS-related standards. Its integrated container-based approach is not only consistent with existing Cloud Foundry open source heritage but also cognizant of changing technology in this area. Built-in support for data and mobile services is a capability of the platform that is showing strong growth propelled by customer interest.

Pivotal Cloud Foundry is also at the forefront of cloud-native architecture, which many adherents believe is a requirement for supporting the application life cycle in a faster, more reliable, and more efficient manner than is possible with traditional products and architectures. As a result of Pivotal's work with standards bodies such as the Open Container Initiative and Cloud Native Computing Foundation, the product can use a collaborative approach leveraging the larger community in providing customer value. Measured by market disruption or strategic vision, IDC has identified Pivotal Cloud Foundry as one of the vendors that notably shaped the market in 2014.

The Pivotal Ready Partner Program is a worldwide program targeted at independent software vendors (ISVs), independent hardware vendors (IHVs), and software-as-a-service (SaaS) vendors that provide solutions that enhance or extend offerings of the Pivotal product families.

Challenges and Opportunities

- **Market maturity and fragmentation.** IDC is observing approximately 30 active PaaS market participants, including a variety of infrastructure vendors, existing and emerging — public cloud platform titans (Amazon, Google, and Microsoft), traditional software stack vendors (IBM, Oracle, and SAP), secondary infrastructure providers (Rackspace, Digital Oceans), hardware vendors, telcos, and regional cloud service providers. All these players are vying for what is essentially the same strategic goal: to play a strong role in supporting the next generation of applications, a role that is relevant to their respective financial success. In this context, this space has to be seen in an early stage of evolution where more bets are still to be placed in the cloud architecture wars and a considerable amount of vendor consolidation has yet to take place. Enterprises should be mindful of this as they make their evaluations.

- **Evolving approaches.** Just as the cast of infrastructure players is still changing rapidly, so is the underlying technology of PaaS, partly because of PaaS-related, standards-based open source initiatives such as Cloud Foundry, Docker, and Kubernetes. Thus while Cloud Foundry offers an integrated approach making the bet that enterprises will seek an integrated solution, others are assembling more modular environments from a variety of open source projects to create an offering. The modular environments may well be more widely and aggressively embraced by a rich ecosystem of start-ups and vendors but require more work in filling the gaps in the overall solution. This presents a different and opposing approach that may unrealistically and impractically require enterprises to do more integration than they have typically been willing to do in the past. IDC foresees that both approaches have a durable role to play in the market for a long time to come and that enterprises will choose different approaches based on their technical culture.

Conclusion

Cloud services will remain the essential foundation of the IT industry's 3rd Platform of growth, and the cloud-native approach can help enterprises take full advantage of Web scale in their cloud adoption journey. As the cloud market enters an "innovation stage," there will be an explosion of new solutions and value creation on top of the cloud. IDC predicts that there will be more industry-specific cloud services platforms and marketplaces run by leaders in each industry seeking to attract communities of thousands of innovators to create valuable new services. The adoption of public cloud technology is creating a wide slipstream of pent-up demand within enterprises for cloud architectures.

Pivotal spearheaded the effort that resulted in creating Cloud Foundry as a community-based standard for PaaS and, in particular, for application platforms. Cloud Foundry is optimized for a continuous delivery style of application development, which is growing in importance in the developer community. IDC believes that cloud-native application development in the cloud will continue to be important and grow, presenting players such as Pivotal with a golden opportunity to be standard-bearers for next-generation application architectures.

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Global Headquarters: 5 Speen Street Framingham, MA 01701 USA P.508.872.8200 F.508.935.4015 www.idc.com