BALANCING FREEDOM AND CONTROL:
Evolution of the Cloud — 2006–2030
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Executive Summary

When was the cloud born? A strong case can be made for 2006, when the first enterprise cloud services came to market and industry use of the term cloud became mainstream. In the 10 years since then, cloud has transformed how businesses compete and engage with customers. Looking ahead to the next decade, the cloud promises to play an even greater role in shaping both business strategy and customer expectations.

In this study, we set out to answer a few essential questions being asked by business and IT leaders alike:

- How fast have we moved from traditional, manual IT to automated private and public clouds in the first decade of cloud growth?
- How many cloud services does the average business use today?
- Can we project the future growth of private and public clouds over the next five years? Ten years?
- When will cloud become the dominant model for managing IT workloads?
- Are we moving away from the old “do it yourself” approach to data center infrastructure to a more service provider-centric world of cloud and IT?
- How will the evolving concept of “hybrid cloud” affect investment in IT?

A Changing Definition of “Hybrid Cloud”

The concept of hybrid cloud is evolving rapidly. Not long ago, many IT leaders thought of hybrid cloud in relatively simple terms: as an on-premises private cloud (we define private cloud as a virtualized pool of resources with self-service, fully automated, on-demand provisioning) connected to an off-premises cloud service. That early model has given way to a new one in which enterprises are running their applications on numerous Infrastructure-as-a-Service (IaaS) platforms while utilizing a broad array of Software-as-a-Service (SaaS) offerings—combined with private clouds that increasingly sit on top of both on-premises and service-provider infrastructure.

The accessibility and flexibility of cloud infrastructure and cloud-delivered software and services is driving decentralization in technology decision-making. This decline in centralized planning leads to a complex, patchwork IT environment that is in some ways highly responsive to business needs, but creates challenges related to managing multiple vendors, monitoring application performance, and enforcing consistent security and compliance policies.

Cloud Freedom vs. Control

To address these challenges, organizations are seeking to address two opposing requirements: they want the **freedom** to innovate on a wide range of flexible cloud-based platforms, and **control** over governance, security, and cost that is essential to the health of the enterprise.

Organizations will need new solutions for successfully developing, delivering, and securing applications in this decentralized, multi-cloud environment.
“I don’t think people have really understood how big this opportunity really is. It starts with the premise that the data services and architecture should be on servers. We call it cloud computing—they should be in a ‘cloud’ somewhere.”

ERIC SCHMIDT, CEO, GOOGLE
SEARCH ENGINE STRATEGIES
CONFERENCE
AUGUST 9, 2006

A Brief History of Time…And Cloud
VMware conducted extensive research¹ to explore enterprise use of cloud computing: how it evolved, how it is being deployed today, and projections on how it will be used in the future.

In 2006, we estimate IT teams worldwide were managing a total of 29 million workloads². Of that total, just 2 percent³ were run in the cloud, with the remaining 98 percent running in traditional IT environments (Fig. 1). The critical distinction here is that traditional workloads were managed manually, with no automation.

The majority of that 2 percent of workloads sitting in public clouds in 2006 was managed by Salesforce.com, a recognized pioneer of cloud computing launched in 1999⁴.
By 2011, just five years later, VMware’s data shows adoption of the cloud—both private and public—had grown significantly. Private cloud usage rose to 6 percent of total workloads, while public clouds, almost in tandem, rose to 7 percent (Fig. 2). The benefits of the cloud, namely the automated provisioning and self-service capabilities it enables, were driving this growth. And yet the traditional IT approach, based on manual operations, still dominated the vast majority of workloads at 87 percent of the total.
By 2016, the percentage of workloads on public and private clouds has doubled as more businesses have recognized the agility and flexibility benefits that cloud provides. Of that total, 12 percent are run on private clouds while 15 percent are run on public clouds (Fig. 3). The share of workloads still running in traditional IT environments continues to shrink, decreasing to 73 percent overall.

Equally explosive is the growth in the number of Server OS Instances, which more than doubled from 2012 to 2016, reaching a total of 160 million managed globally by IT teams.

What does this brief history tell us? The migration to the cloud is accelerating across multiple dimensions, with use of both private and public clouds expanding at a rapid rate.
How will this future in the cloud take shape? As the data from the VMware research suggests, by 2021, 50 percent of all workloads, for a total of 255 million (overall shipments of servers were assumed to grow at a forecasted rate of 3 percent from 2016 to 2030), will run in the cloud (Fig. 4). Of that total, 30 percent will run in public cloud and 20 percent in private clouds.
Taking a deeper dive into that total, there will be about a 50/50 split between public cloud services supplied as software as a service (SaaS) and infrastructure as a service (IaaS) (Fig. 5). In other words, public cloud will be delivered and hosted by a cloud service provider.
By the year 2030, VMware estimates that public cloud will house more than 50 percent of all workloads. By that point, approximately 30 percent of those workloads will run on private clouds while just under 20 percent will run in traditional IT environments (Fig. 6).
An even more comprehensive view of this future is evident in the way that enterprise customers are running their workloads. The data suggests that enterprises increasingly prefer a managed hosting model over the previous do-it-yourself (DIY) approach that requires building and managing data center infrastructure. The number of enterprises turning to a managed service hosted by a cloud provider will continue to grow.

An IDC study suggests late 2016 as the crossover when service providers build and deliver the majority of workload hosting12 (Fig. 7). Projecting even further into the future, the percentage of workloads moving to service provider-supplied public and private clouds will continue to grow. At the same time, the transformation to a multi-cloud environment will also accelerate.

Evolving in tandem with this development is the concept of hybrid cloud. The industry is moving beyond the current definition of hybrid cloud as a cloud-computing environment that uses an orchestrated mix of on-premises, private cloud, and third-party public cloud services, into a new model that defines a state of dynamically managing across clouds.

As these parallel digital transitions continue, cloud will be a driving force that will fuel expanded investment in IT. While cloud usage continues growing in the enterprise, IT becomes more cost-effective and more accessible. Just as the market for computer processing expands with each innovation, so will the market for cloud as it continues to expand and permeate every aspect of business—and with the Internet of Things (IoT), every aspect of the physical world as well.
Business Mobility and IT Sprawl in the Enterprise

A similar evolution is occurring in the enterprise mobility market. It is an evolution driven by employee demand in the workplace for the same experience they share and enjoy on their consumer devices.

Mobility devices are already pervasive in the enterprise. According to a report published by Citrix, the number of devices managed in the enterprise increased 72 percent from 2014 to 2015 alone, and the average employee uses at least three or more devices per day. But mobile devices are not just connecting employees with each other in the enterprise; increasingly, these devices talk to each other.

The growth of IoT, or machine-enabled devices, is expected to dwarf human-driven devices within five years (Fig. 8).

In 2016, an estimated 8.2 billion human-driven devices, including tablets, PCs, and mobiles, and 4.1 billion IoT devices exist. Our definition of an IoT device is a “smart” device which will be secured and managed remotely or locally. By 2021, the amount of human-driven devices will grow just slightly, to 8.7 billion. Out of the total universe of IoT endpoints, VMware estimates 18 billion devices would need to be secured and managed by IT.
An Environment Not of IT’s Own Making

As a result of these converging trends—the growth of cloud, business mobility, and IT sprawl within the enterprise—IT admins are increasingly coping with an environment not of their own making. It is an environment where lines of business (LOBs) introduce their own workplace products, systems, and technologies and, as a consequence, contribute to speeding technology decentralization across the enterprise.

![Figure 9](image)

Originally Marketing led the move to “shadow IT” or “self-starting IT” to control digital engagement with customers. According to a recent Economist Intelligence Unit (EIU) report on technology in the enterprise, sponsored by VMware, the scope of IT technology sprawl in the enterprise shows that virtually every other function in the enterprise is taking a similar approach (Fig. 9). Non-IT departments expect to increase their IT spend by an average of 11 percent over the next two years.
“So, in an environment where you no longer own the device, you no longer wrote the application, you no longer control the data centers, and you no longer control the networks those applications are running on, you’re 100-percent responsible.”

PAT GELSINGER
CEO, VMWARE

The Economist Intelligence Unit report details that the average enterprise supports:

• 8 different cloud services
• 188 different internally developed applications
• 175 external, third-party applications
• 11 different categories of devices
• Windows, Android, and iOS devices

It is a world where IT owns nothing but is responsible for everything. While this sprawl presents challenges to IT organizations, it also reveals the extent to which IT skills are increasingly mission-critical to every part of the business.
The Next Great Challenge: Cloud Freedom and Control

In this rapidly changing environment, what is the role of IT? What is its future? It is a future in which IT must manage workloads across multiple clouds—many of them public clouds delivered as a service.

The questions then become: How do IT leaders provide the cloud freedom business units, developers, and employees want and the level of security, compliance, and control their organizations need? How do they provide the freedom users want to choose any cloud service?

These are fundamental challenges every CIO must address. Some guiding principles for decision-making should include automation, adoption of a DevOps point of view, and an enterprise-class approach to maximum uptime and flexibility. Managing successfully in this new era of cloud freedom and control will require innovations—primarily in software.

Here are four key aspects to consider: security, network virtualization, cloud management, and the digital workspace.

- **Security** that allows you to set and extend your security policies across clouds and protect your apps from a cyber attack using micro-segmentation.
- **Network Virtualization** that provides security, IT automation, and application continuity.
- **Cloud Management** that will offer you common management and visibility, networking, and security across both private and public clouds.
- **Digital Workspace** that will allow you to deliver anytime, anywhere access to all applications, services, and resources across all devices, including IoT and clouds.

Simply put, the next great organizational challenge is to simplify and manage all this complexity. But it is also the next great opportunity.

Enterprises that solve the complexities of managing this multi-cloud environment will position themselves for growth and success for the next decade—and beyond.
Enterprise Cloud: Two Decades of Growth

The consistent, exponential growth of cloud since its inception in 2006 will continue in the coming decades, reshaping the role of IT and the enterprise IT environment. By the year 2030, VMware estimates public cloud will house more than 50 percent of all IT workloads. By that point, 30 percent of those workloads will run on private clouds, while just 20 percent will run in traditional IT environments.

Public and private clouds will increasingly be delivered as a service, either as SaaS or IaaS. Due to the inherent costs and complexities involved, the growth in the number of enterprises turning to a managed service hosted by a cloud provider will continue to grow. In 2016, the number of clouds being built and hosted by a cloud provider exceeded for the first time those built and hosted by the individual enterprise.

Technology decentralization in the enterprise will continue to accelerate in response to the growth of cloud services, business mobility, and third-party applications. As a result, IT is increasingly coping with an environment not of its own making.

As cloud, apps, and mobility grow increasingly essential to every aspect of business, IT faces an unprecedented opportunity—not only to respond to growth but also accelerate it. As cloud computing continues to transform the way businesses operate, it offers both new competitive advantages and fresh ways to engage customers.

For organizations to take full advantage of these opportunities and successfully manage applications and workloads across clouds, they need solutions that will enable and facilitate common, comprehensive, efficient, cost-effective policies for security, governance, and compliance, and the evolution of a new digital workspace.

Enterprises that tap into IT to solve the complexities of managing this multi-cloud environment will be well-positioned to thrive in the next decade.
Methodology

A workload model was built to map the evolution of cloud from 2006 to 2030. The model estimates total IT workloads and splits these workloads across different deployment types—traditional IT, private cloud, and public cloud (IaaS, PaaS, SaaS).

We performed calculations starting with consensus historical server shipments[^1] and VMware internal data to establish an install base of servers in 2006 and workloads running on those servers. Revenues for IaaS, PaaS, and SaaS were used to estimate private cloud workloads. Internal data on private cloud adoption was used to estimate private cloud workloads. The model then back-solves for traditional IT workloads using total workloads and private and public cloud workloads.

The model was extended through 2011, 2016, 2021, to 2030 using analyst data, VMware internal data, and company surveys as a basis for secondary calculations. The output of the model is a distribution of workloads across traditional IT, private cloud, and public cloud.

A detailed explanation of the methodology is available on request.

References

1 See “Methodology” above on research process.

2 Install base of servers was calculated from server shipments and refresh cycle for 2002 to 2006. 29M workloads were estimated for this server count, based on internal data on rate of virtualization, consolidation ratio, and market share.


4 www.salesforce.com

5 Based on VMware internal data of adoption of management and automation products and analyst published reports of public cloud revenues. We estimated split of workloads across deployment models using channel data from IDC “WW Quarterly Server Virtualization Tracker, 2015Q3 Historical Release.”

6 Private cloud usage estimate is based on VMware internal data of adoption and management.

7 Public cloud workloads calculated from revenues, rate of virtualization in cloud consolidation ratios, server shipments, and pricing per instance for the years 2006 – 2011.

8 Workloads that are not in public cloud or managed as a private cloud are treated as traditional IT (virtualized and non-virtualized).

9 Based on public cloud revenues, server shipments, vSphere Core Metrics Study & Inner Circle company surveys by VMware, and analyst interviews on internal estimates. For comparison purposes: 1) JP Morgan (published April, 2016), “CIO Survey Foreshadows Changing of the Guard” estimates 16.2% workloads in public cloud. 2) Barclays CIO Survey (published Nov. 2015) estimates 9% of workloads in public cloud in 2015. 3) vSphere Core Metrics Study (published April 2016; covers 1,607 businesses across Enterprises, Commercial & SMB, 4 geographies, and 12+ industry segments) by VMware estimates 19% of workloads in public cloud. 4) Inner Circle company survey (published May 2016; covers 589 VMware customers and partners who are members of the Inner Circle online feedback community) by VMware estimates 10% of workloads in public cloud.


11 Breakdown of public cloud workloads based on revenue forecasts for IaaS, SaaS for the years 2016 – 2030.


