

The Myths and Realities of Cloud Computing

A Joyent White Paper

Executive Summary

Businesses are discovering that cloud computing can save them both operating and capital expenses. However, cost is not the only reason companies are moving to cloud computing. This paper examines the benefits behind the adoption of cloud computing for companies of all sizes. As with many new technologies customers have many questions; myths and misperceptions readily spread with little to no basis or justification. This paper addresses potential concerns and misperceptions of cloud computing and offers concrete advice while describing Joyent's cloud computing architecture and unique approach to pricing, flexibility, performance, and business resilience.

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Introduction

Cloud computing can dramatically lower the cost and complexity of computing for large and small businesses. Prior to selecting a cloud computing solution, a business should have an understanding of the cloud's capabilities and limitations.

Perhaps the best way to begin to appreciate the potential for cloud computing is through a concise definition of the term:

“Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” – The National Institute of Standards and Technology, U.S. Department of Commerce; October, 2009.¹

The delivery of computing resources *on-demand* is key. Until recently, one needed to buy, install, and maintain computer equipment and software for any computing task. Under this wholly-owned computing paradigm, whether an application was used by thousands of people or merely once a year by a single person, the company had to purchase, maintain, and provide the infrastructure required by that application. The idea of allowing on-demand access to computing resources has tremendous cost-benefit advantages, as this paper examines in more detail later.

Cloud computing could not have become a viable business market offering until the second half of the cloud computing definition became a reality:

“...a shared pool of resources that can be rapidly provisioned and released with minimal management effort or service provider interaction.”

The key component in the evolution of cloud computing was virtualization of computing resources. (Virtualization is the creation of a virtual version of a resource—such as a server, a disk, or CPU—inside a computing framework.) A large physical server, for example, could run many virtual servers, each with their own virtual memory, CPU and disk. A pool of virtual resources can be more rapidly provisioned and deployed than a physical resource.

Today, dozens of companies offer cloud computing products of varying sophistication and capability. As a testament to the features and business benefits of cloud computing, this diverse market segment has grown tremendously over the last three years. In fact, the cloud services market is one of the bright spots in the IT landscape, according to industry analysts at Gartner Group, Inc.. Enterprise spending is expected to grow from \$91 billion worldwide in 2011 to \$109 billion in 2012. By 2016, Gartner estimates enterprise spending on public cloud services to reach \$207 billion.²

While much of the growth in cloud applications and infrastructure is driven by cost-conscious enterprise businesses, the cloud computing industry is increasingly developing products specifically for mid-sized and small businesses. Even the smallest business can realize immediate reductions in capital expenditures for application software. Some industry analysts, such as Forrester Research, explicitly advise large and small customers to adopt cloud computing as a cost-savings strategy.³

Although trimming costs is one benefit of cloud computing, it is not the only motivation for using an on-demand, configurable pool of computing resources. Cloud computing can save maintenance and downtime, reduce human capital required to manage a data center, and can better accommodate business growth.

The Business Case for Cloud Computing

The primary motivation for businesses to move to cloud computing is to save money. However, cloud computing also arms companies with cutting-edge computing platforms that are more scalable and higher - performing.

Flexibility, Scalability, and Resilience Using Cloud Computing

Companies are discovering that cloud computing offers business advantages that are difficult to realize in any other fashion. The ease with which new resources can be added when using cloud technologies allows companies to respond quickly to unexpected increases in demand rather than wait for infrastructure upgrades—a wait that could cause lost business and create lasting damage to the perceived value of a service. Businesses can throttle back their consumption of computing resources during off-peak hours or during slower business seasons, rather than paying for capacity they will not use. Rapid, elastic response to business requirements through cloud computing provides a competitive advantage in the marketplace over companies clinging to a fixed computing asset model.

Faster Development Cycles

Companies using cloud infrastructure can develop and deploy new applications in a fraction of the time required in more traditional computing environments. Testing and development resources can be allocated and isolated from production processes, and can just as easily be removed. Development can be conducted safely and under nearly identical environments as final production deployments, ensuring more reliable and predictable application performance. Cloud computing delivers scalable and high-performance capabilities when needed without requiring operating expenses or capital outlays.

Companies that deploy applications on cloud computing platforms are guaranteed a level of business continuity and resilience nearly impossible to duplicate in on-premise computing systems without a significant investment in disaster recovery, replication software, and high-cost personnel.

Higher Utilization of Resources

Computer hardware such as CPU, disk, memory, and network I/O is notoriously under-utilized in data centers. Typical server utilization may be from 15 to 30 percent of capacity on average, with only intermittent spikes of activity pushing the server environment to approach its full capacity. In a recent study, one accounting firm found typical server utilization rates as low as 12 percent. In monetary terms roughly \$4400 US of every \$5000 US server investment is idle. Data centers are wasting a huge percentage of their hardware investment.⁴

In an ideal cloud computing environment, companies would pay only for the resources they use, when they use them. Additionally, the cloud platform should seamlessly add more resources during peak computing periods and during unexpected spikes in activity.

Hardware, Software, and Maintenance Savings

While accounting for the initial expense of buying and installing applications at a business is simple, the true cost of ongoing maintenance and support of that software is often hidden. Upgrades, backups, configuration, and technical support multiply the cost of the software beyond the original purchase price. Support and productivity losses such as downtime during upgrades or recovery of lost data are rarely figured into the bottom line, yet are significant cost multipliers. Delivery and configuration of software can be significantly streamlined under cloud computing, and the reliability of cloud computing data centers ensure that downtime and data loss can be minimized.

Lower Personnel Costs

Cloud computing significantly reduces the number of IT personnel at a business by shifting maintenance, IT expertise, and many compliance requirements to the cloud infrastructure provider. Depending on the competency of the cloud computing provider, most companies will receive support and expertise that far exceeds what they could possibly afford to recruit on their own.

Energy and Space Savings

With fewer servers, storage sub-systems, and network routers on the premises, companies that move a significant portion of their computing infrastructure to a cloud provider save money on both the electricity to power those systems and the air conditioning systems required to keep them cool. Floor and rack space for equipment is also reduced. As most sophisticated cloud computing data centers are more energy efficient, this energy savings is not just shifted to the cloud provider but constitutes actual savings and a net reduction in total energy consumption, resulting in a positive impact on the environment.

Cloud Computing Concerns

While the business benefits of cloud computing are clear, some businesses are still reluctant to move critical data and applications to cloud computing, and especially to a third-party cloud infrastructure. Some common concerns include the following.

Lack of Direct Control

With data hosted by a cloud provider and not on the company's premises, management may feel that data is no longer under the direct control of the business and somehow more vulnerable. However, once business managers and IT directors are familiar with cloud-based applications, many of these control issues can be dismissed. The cloud provider should give the customer tools for data management, and the

provider should have ample disaster recovery and fault tolerance measures in place to protect the data 24X7.

Uncertain Security

Once customers become familiar with the security procedures and measures that most cloud computing providers have deployed, they find there is little concern about security. In fact, depending on the cloud provider, customer data in most cases is far safer at a cloud computing facility than on typical network LANs, where decentralized security management can introduce any number of ongoing security vulnerabilities.

Utility Pricing

Unpredictable pricing is a frequent concern of many companies considering cloud computing. As many cloud providers operate on a utility pricing model, customers are charged by usage—similar to cell phone or electricity. Some companies are concerned that computing costs may fluctuate. However, some cloud computing providers offer fixed price plans, keeping computing costs predictable.

Data Lock-in

Many companies fear that once they commit to cloud computing, their data and businesses are locked in, making them "hostage" to a particular provider of cloud services. Companies should ensure that any hosted applications or services they use are based on open standards and open data formats in the event that they need to migrate their resources to another vendor.

Supplier Viability and Reliability

Customers should be concerned about the viability of any IT supplier, especially one tasked with hosting critical applications and data. Potential cloud customers should check not only the viability of the host's infrastructure but also check its financial health and market standing.

Cost of Converting to Cloud Computing

Many customers are concerned about the cost of adopting cloud-based applications. In many cases, such as SQL databases, spreadsheets, and word processing documents, the cost will be nominal as cloud-based applications can preserve the formats most businesses are currently using. Many companies moving to cloud computing often do so incrementally. They may first offload their email, word processing, or data storage tasks to the cloud on a trial basis before committing larger aspects of their business infrastructure to a new platform. A recent Gartner survey found that 49% of mid-market businesses planned to implement cloud computing services in the next 12 months.⁵ However, other companies find that just one or two applications delivered on cloud computing can make a big difference in their bottom line and productivity, and may never see a need to move any other data or applications to a cloud provider.

Myths and Misperceptions about Cloud Computing

Cloud computing, like many new products, is subject to misperceptions and myths. These myths probably arise from a poor understanding of the technology or the capabilities of the providers.

Myth: Cloud security and compliance is impossible to achieve.

Cloud computing security is no different than any secured network service. Not all cloud computing vendors utilize the same technology measures, and for that it remains up to the customer to scrutinize the cloud provider's security; however, cloud computing in itself does not introduce any new or unforeseen vulnerabilities or weaknesses. Also, cloud computing companies can provide a unified platform for conducting and verifying compliance audits.

Myth: All clouds scale on demand. Not all cloud vendors have the resources or architecture to adequately scale applications and traffic on demand. While all try to maintain a certain number of extra resources to

accommodate fluctuations, many cannot dynamically scale operations when demands exceed predicted thresholds. For example, in most cloud computing environments, scaling requires manual reconfiguration and allocation of additional resources. As a result, companies should carefully select their cloud computing provider to ensure it can accommodate increased user demand; otherwise applications and users may be subject to frequent and disruptive slow-downs and system bottlenecks.

Myth: Performance is worse in the cloud. If the cloud infrastructure and applications are poorly managed and deployed, this might be true. But when properly configured, most users notice no difference when using cloud-based applications. In some cases, cloud computing provides noticeable improvements in performance as better provisioned machines with access to more resources can better handle more complex processes than poor-performing, local desktop computers. The most significant potential bottleneck for cloud computing is access to the network itself. If users are connecting over high-speed connections, performance should never be an issue.

Myth: Virtualization = cloud computing. Virtualization makes dynamic, scalable cloud computing possible, but does not constitute a cloud architecture on its own. Virtual machines deployed without intelligence or dynamic scalability can be nearly as inefficient and costly as physical resources they replace. In fact, many enterprises have identified this inefficient use of virtualization and dubbed it “virtual sprawl.” This unchecked proliferation of virtualization can easily translate into a decrease in disk and network performance.

Myth: The cloud requires more IT management. In the beginning of a deployment, as users and applications are carefully migrated to cloud infrastructure, this may be true. But once conversion is completed, local IT no longer must manage the software, the hardware, or the data

protection of the applications and associated data. In fact, every application migrated to a cloud infrastructure cuts maintenance costs and management overhead.

Myth: Cloud computing is only good for low end applications and software as a service.

Many vendors have jumped into the cloud computing market with simple software applications and declared themselves “cloud computing” experts. While their applications may certainly fill a need, delivering a simple application over the Internet does not approach the complexity of delivering computing infrastructures on demand. Cloud computing is the backbone on which businesses worldwide can perform thousands of transactions a second, transfer massive amounts of data across the globe, and securely process trillions of dollars of financial transactions. The most robust, secure, and scalable business applications available today can operate using cloud computing.

Myth: Cloud computing is less reliable than in-house systems.

Some of the most secure and reliable installations in the industry are cloud computing data centers. The best cloud computing centers are built from the ground up with multiple layers of redundant components, power, physical and cyber security measures, and staffed by trained personnel. Using an economy of scale impossible to duplicate except at the largest enterprise IT centers, the best cloud computing centers deploy reliability, security, and failsafe measures that most businesses simply cannot afford.

Joyent’s View of Cloud Computing

Business computing is constantly evolving as business needs change and technology advances. The first wave of business computing was centrally managed. This mainframe-centric world meant that all data was kept, processed, and managed from one central location. Users could access and enter data, but only through strict central control. This

central control caused problems with productivity as users struggled for adequate access to produce and share timely work.

With the advent of the PC and LAN, data and computing resources became decentralized, spread across numerous servers, and on individual desktops. Now data was easier to access, productivity increased, yet the chaotic dispersal of data caused problems with security, data reliability, and wasted computing resources. Finding and retrieving data in a decentralized system is often difficult as well, causing numerous inefficiencies. Similarly, computing resources increased dramatically, but they were not easily accessible throughout the network.

With a distributed computing architecture based on cloud architecture, users are looking for the security, protections, and reliabilities of the centralized mainframe computing systems combined with the access and connectivity of a decentralized LAN environment. Joyent's smart computing software enables a network of data centers to work together as a computing platform on which companies can build their next-generation applications.

The Joyent Approach to Cloud Computing

Joyent's approach to cloud computing is to help enterprises and developers meet the growing demands of today's most user-intensive applications. Enterprises need a cloud infrastructure that is battle-tested and built with the instant scalability and performance demands of today's applications. Traditional cloud infrastructure can't meet these demands; Joyent's cloud infrastructure delivers a multiplier effect of 2X the performance and as much as 50% lower cost, fundamentally changing the economics of public and private cloud computing.

Joyent's infrastructure is unique in the variety of ways it can be deployed – public, private, and hybrid deployment is supported, all on the same code base, giving enterprises a unique level of operational dexterity.

Joyent provides public cloud services to some of the most innovative industries in the world, including gaming, eCommerce, and media, and licenses the software that runs our public cloud to enterprises who want to run their own private or hybrid clouds. Joyent is also home to Node.js, the rapidly and widely embraced server-side JavaScript development environment.

Joyent SmartMachines provide the first level of abstraction for an application developer. Similar to virtual machines, the advantage SmartMachines provide is that they are lighter weight and provide greater transparency of execution to the underlying operating system, Joyent SmartOS. Joyent SmartOS uses this visibility to substantially enhance performance, improve hardware utilization, and provide greater flexibility to the Joyent SmartDataCenter.

Joyent SmartOS allows SmartMachines to burst onto additional CPUs that are underutilized when an application requires the extra capability. The Joyent SmartOS file system provides synchronous copy-on-write replication and is coupled with point-in-time data snapshots for greater fault tolerance. SmartOS's aggressive in-memory caching of data provides greater I/O performance for applications. The SmartOS storage system also allows for dynamic allocation of disk space, ensuring that applications always have the required amount of storage available.

A library of SmartMachines optimized for specific uses is ready for immediate provisioning. Joyent SmartOS, Zeus load balancing and traffic management, MySQL, and Node.js are among the popular SmartMachines that can be created and used immediately for building or extending an architecture.

The next layer of abstraction is Joyent SmartDataCenter.

SmartDataCenter plays two roles: 1) it manages a collection of SmartMachines to ensure that resources are fully utilized and optimized; and 2) it provides a fully programmable API that allows creation, introspection, and manipulation of SmartMachines and other resources throughout SmartDataCenter.

SmartDataCenter has been designed to be highly scalable, configurable, and extensible with some deployments managing tens of thousands of SmartMachines. The core management technologies have been demonstrated to scale to millions of clients in real-world applications.

In addition to these layers of the cloud stack, as the corporate steward of Node.js, Joyent offers exclusive debugging and performance tools for Node.js applications. These capabilities, combined with our deep expertise and global support, transform companies' ability to manage and scale cloud applications.

The Joyent Public Cloud

In addition to building infrastructure software, Joyent owns and operates the largest implementation of Joyent cloud infrastructure. Joyent Cloud uses SmartDataCenter to manage a series of data centers distributed nationwide and in Amsterdam. Each of the data centers houses massive computing resources coordinated into a single, multi-tenant, public cloud that provides on-demand resources and services to tens of thousands of companies who serve millions of customers with billions of page views each month.

Within its public cloud Joyent provides on-demand resources to its customers that easily scale both vertically and horizontally. Multiple CPU, RAM, and disk configurations can be allocated for any number of dedicated customer applications, with memory, disk, and network I/O scaling dynamically to optimally meet needs. Multiple application

processes can be spread along shared CPUs and memory, while increased raw traffic is served with greater network throughput and disk I/O. As a result, SQL and other I/O intensive applications run up to five times faster on Joyent than more traditional cloud infrastructures. Customers can grow their business applications in smaller increments than would be possible using physical, traditional computing components or even virtual hosting. They can also just as easily scale back their resources during off-peak hours or seasons. For the first time, customers can now grow their business computer use at the same rate they grow their businesses.

Joyent supports small businesses and multinational corporations alike with the same highly efficient and high performance distributed data centers. Customers can purchase data center resources in increments that improve their business processes, not through arbitrarily assigned virtual machines or rack spaces.

Customers only pay for what they need. Resources can be added easily at any time. Month-to-month subscriptions as well as long-term leasing with substantial discounts are available.

For larger companies in need of extensive cloud development resources and internal management, Joyent can provision private or virtual private configurations that meet any enterprise development effort.

Customers, Facilities, and Background

Joyent customers include some of the largest and most innovative customers in the world, including LinkedIn, Digital Chocolate, ModCloth, Voxer, and many others. Thousands of Joyent customers enjoy high performance and reliability on Joyent's multi-city, distributed data centers. Backed by a satisfied and growing global customer base and financing from firms such as Intel Capital and Telefonica, Joyent is one of the industry's most stable enterprise computing providers.

Summary

Cloud computing is evolving into a major strategy for businesses. Companies can save capital expenses, software maintenance, personnel, and energy costs by shifting significant portions of their business processes to cloud computing platforms. The flexibility of cloud computing also allows them to more quickly develop and deploy innovative software applications.

Despite fears of lack of data control or application security, cloud computing has proven itself to be a safe, reliable platform for enterprise computing throughout its evolution. In many cases, next-generation cloud-based applications are more secure and perform better than traditional data center-based solutions.

Modern cloud computing technologies, such as Joyent's high performance infrastructure, can provide a full range of computing resources for customers. Available for private deployment or within Joyent's high performance public cloud, Joyent provides an on-demand enterprise resource on which companies can build and deploy their next-generation applications.

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