

# Separating Hype from "How To"

A Practical Guide to Understanding and Deploying  
Cloud for the Enterprise

*By Hitachi Data Systems*

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## Executive Summary

When faced with the moment-by-moment business and IT pressures swirling around any large data center, a boiling cauldron may come to mind. Today's enterprise organizations are keenly seeking ways to securely and cost-effectively address rampant multifaceted data growth with flat or shrinking budgets. An unprecedented upsurge in new unstructured data types, such as rich media, picture archiving and communication systems (PACS), and e-discovery documents, as well as their storage requirements are also buckling the data center's ability to maintain control. According to many industry experts, keeping up with data growth is the top challenge of IT managers.

So, where do manageable costs and unparalleled data growth become simpatico? Answers may lie in cloud computing. Representing a paradigm shift in the way organizations can reduce capital and operational costs (CAPEX and OPEX), cloud computing transitions conventional storage methods to a utility-type service model. Similar to an electric company that charges customers based on consumption, cloud offers a way for IT organizations to subscribe to on-demand capacity and usage services, and it can be metered either internally or through an external provider. Savings are amplified as subscribers shift their storage burdens to this pay-as-you-use model. In some instances, the organization's need for upfront capital investment goes down; and in other cloud offerings, operational expenses such as power, cooling and storage management tasks move to the cloud provider. Cloud fosters a more agile IT environment.

While the promise of cloud is heady, especially in a tumultuous business climate, there is much confusion about the different types of cloud, what they actually offer, and which, if any, will meet stringent business requirements. Knowing when and how best to deploy cloud is critical to protecting the lifeblood of the organization — the data itself. Enterprises are concerned about security beyond the firewall and gaining the most value from cloud without undergoing forklift changes to existing investments.

As a global leader and longtime innovator in data center technologies and services, Hitachi Data Systems has been integrally involved in researching and maturing cloud best practices and end-to-end cloud solutions. This paper focuses on separating the hype of cloud from the crux of how to deploy cloud safely and cost-effectively for the enterprise.

## Introduction

Along with the promise of better cost models for managing astronomical data growth, cloud computing brings forward an entire evolution for the IT industry. As enterprise organizations experience the crush of relentless demands for greater availability, performance and rapid deployment of new applications, the edict to do more with less prevails. Plenty of new storage requirements are being driven by unstructured data types, such as file and print records, emails, and medical and legal imaging, as well as vast content repositories for rich media and static reference data. These new data types are growing faster than any other previous categories of data, such as relational databases or business continuity copies. In the mix are the far reaching complexities of many IT environments, such as changing business models, mergers and data security regulations across a global landscape, and maintenance of legacy systems. It is no wonder the enterprise data center needs a better solution.

The limitations of networked storage and the clamor to significantly shrink the total costs of ownership are driving the IT industry into the next evolution — cloud computing.

As early as 1961, the idea for utility-type computing was being developed. John McCarthy, the computer scientist responsible for coining the term "artificial intelligence," gave a speech at MIT on computer time-sharing technology and how it could lead to computing power and specific applications being sold through the utility business model, like water or electricity. The idea faded a decade later, as hardware, software and telecommunications technologies of the time were not ready.

Historically, the IT industry has sought and found technology solutions for improving how data is managed, stored and accessed. Data centers first created islands of SCSI disk drives as direct attached storage (DAS), with each drive dedicated to an application or server, and no network in between. When IT managers needed more flexible ways to share data and utilize resources across platforms, DAS gave way to networked storage architectures, such as network attached storage (NAS) and storage area networks (SAN). Intended to consolidate and virtualize disk capacity, networked storage helped improve provisioning flexibility and efficiency, especially for the data center managing several terabytes.

In today's Internet Era, the emphasis is on cost-effectively managing multiple petabytes of storage and a more stringent compliance landscape. Traditional networked storage technologies alone are no longer able to scale and perform at the demanding levels needed to keep pace with punishing data growth rates and requirements using existing budgets and resources. More data storage usually means additional CAPEX for infrastructure and floor space. In turn, operating OPEX climb between four and eight dollars for every dollar spent on capital equipment for: power and cooling; the administrative cycles to manage aging systems and manual processes; and time-consuming backup, recovery, migration and upgrades.

Enterprises clearly are looking to take big spending out of the data center while still meeting data management responsibilities. The limitations of networked storage and the clamor to significantly shrink the total costs of ownership are driving the IT industry into the next evolution — cloud computing. Hitachi Data Systems recognizes that cloud computing is not a singular product, but rather a means to provide IT services. Cloud is a way to simplify infrastructure while providing resiliency and lower CAPEX and OPEX for both service providers and end users. Operating as a delivery mechanism, cloud uses a flexible pay-per-use utility model in multitenant, virtualized environments that allow organizations to divest themselves of infrastructure management and instead focus on core competencies.

## Another Paradigm Shift in the IT Industry

Industry analysts predict that keeping up with data growth will be the top challenge of both midmarket and enterprise IT managers in the next two years.<sup>1</sup> Data held in content depots, large repositories of digital content amassed and organized for information sharing or distribution, are consuming disk storage space in rapid volume. IDC anticipates a compound annual growth rate of more than 100 percent for data housed in these repositories over the next 12 to 24 months. The drive to reduce capital expenses and operating costs associated with IT equipment will be instrumental in maturing cloud service models. Already, Gartner analysts are forecasting that software delivered as a service will account for 25 percent of the business software market in the year ahead, while IDC predicts that storage will outgrow all other types of cloud IT spending, nearly US\$6.2 billion through 2013.<sup>2</sup>

So, as the industry swings toward cloud service models, what can the enterprise organization expect to achieve? By taking advantage of the economies of scale in a multitenant deployment, where multiple customers or users share the same physical infrastructure, the enterprise is able to transfer CAPEX costs into more flexible OPEX spending, and subsequently lower OPEX costs as well. Cloud offers greater elasticity to enable the enterprise to grow or shrink capacity requirements on demand and simplify deployment for faster time to market or time to value. And with cloud, the IT organization may have more choices for setting multiple service level agreement (SLA) options, while gaining greater functionality, such as: content indexing and search, geographic dispersion of data, compliance, encryption and versioning without backup.

## A Practical Understanding of Cloud

What is cloud, really? While there are still varying definitions and much hype around what cloud does and does not mean, Hitachi Data Systems has established a set of key characteristics that cloud computing must provide:

- The ability to rapidly provision or de-provision a service
- A consumption model where users pay for what they use
- The agility to flexibly scale — "flex up" or "flex down" — the service without extensive pre-planning
- A secure, direct connection to the cloud without having to recode applications
- Multitenancy capabilities that segregate and protect the data

### Key Terms

With cloud come a few key terms:

- **Infrastructure as a Service (IaaS).** This cloud service model provides the consumer or subscriber the capabilities to provision storage, networks and other essential computing resources, including operating systems and application software, without management or control of the underlying cloud infrastructure.

<sup>1</sup> The Enterprise Strategy Group, March 2009

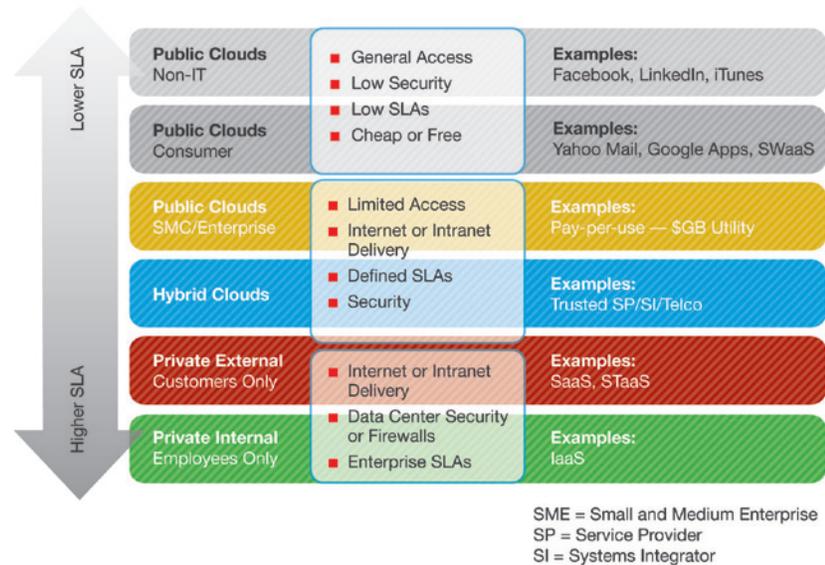
<sup>2</sup> Source: IDC

- **Software as a Service (SaaS).** The consumer is able to use the cloud provider's applications running on a cloud infrastructure, accessible from various client devices through a thin client interface such as a web browser, but without management or control of the underlying cloud infrastructure.
- **Storage as a Service (STaaS).** This cloud model uses a combination of hardware, software and processes to efficiently deliver storage services.
- **Multitenancy.** This architectural model allows multiple customers to share a single instance of the infrastructure by partitioning that infrastructure (application, storage pool, network, etc.). The storage pool, for example, is divided into namespaces, either for separate customers in a hybrid or public cloud, or for business units in private cloud.
- **Representational State Transfer (REST).** This is a type of software architecture for client or server communications over the web.

### Cloud Models

Hitachi Data Systems recognizes three main cloud models: private, hybrid and public. Each model may offer varying levels of security, services, access, SLAs and value to end users. See Figure 1.

Figure 1. This diagram delineates the types and quality levels of service typically provided with each cloud category.



### Private Cloud

In a private cloud, all components reside within the firewall of an organization. The infrastructure is either managed internally by the IT department and is deployed to create an agile data center or may be managed and delivered as a service by a cloud provider. Behind the security of the firewall, private cloud embraces high levels of automation to virtualize the infrastructure, including servers, networks and storage, and to deliver services to business units or other branches.

Private clouds can deliver IaaS internally to employees or business units through an intranet or the Internet via a virtual private network (VPN), as well as software (applications) or storage as services to its branch offices. In both cases, private clouds are a way to leverage existing infrastructure, and deliver and chargeback for bundled or complete services from the privacy of the organization's network. Examples of services delivered through the private cloud include database on demand, email on demand or storage on demand.

With private cloud, security of the data and physical premises are determined and monitored by the IT team, and its high quality service level agreements (SLAs) remain intact. The organization maintains its own strong security practices of both the data and the physical location, such as key codes, passwords and badging. Access to data is determined internally and may resemble existing role-based access controls or grant separate administration and data permissions based on data types and security practices.

The values of private cloud to the end user are quick and easy resource sharing, rapid deployment, self service and the ability to perform chargebacks. The value to the service provider, or in this case, the organization, is an ability to initiate chargeback accounting for usage while maintaining control over data access and security.

### **Hybrid Cloud**

The hybrid cloud model consists of a combination of internal and external cloud infrastructures whereby selected data, infrastructure or applications are allowed to "punch through" the corporate firewall and be provided by a trusted cloud provider. Here, the multitenant infrastructure outside the firewall delivered by a trusted cloud provider is leveraged for further cost reduction. The subscriber and the hybrid cloud provider are bound together by standardized or proprietary technologies that enable data and application portability. The IT organization makes decisions regarding what types of services and data can live outside the firewall to be managed by a trusted third-party partner, such as telcos, systems integrators and Internet service providers.

Hybrid cloud usually provides an attractive alternative to the enterprise when internal processes can no longer be optimized: for example, when the organization's cost infrastructure can only be amortized across business units or a small customer base. By moving certain data and applications to a hybrid cloud, the enterprise is able to significantly reduce the costs of providing services by taking advantage of the multitenant capabilities and economies of scale. The overall outlay of service delivery shifts to the pay-for-usage model for the organization, while the trusted provider appreciates higher utilization rates through its shared infrastructure. The result is reduced costs for any given service offered through the hybrid cloud.

Building bridges between the enterprise and its trusted partners is critical to assuring data is protected. Hybrid cloud providers use stringent security practices and uphold high quality SLAs to help the enterprise mitigate risks and maintain control over data managed services and application hosting services delivered through multitenancy. The enterprise also determines access limitations for the provider and whether the services will be delivered via VPNs or dedicated networks.

The value to the enterprise, beyond cost reductions and perhaps the divestiture of infrastructure requirements, is well managed services that are seamlessly and securely accessed by its end users. The value to the trusted provider comes with the economies of scale, supplying services to multiple customers while increasing utilization rates of highly scalable cloud enabled infrastructure.

## Public Cloud

In a public cloud model, all major components are outside the enterprise firewall, located in a multi-tenant infrastructure. Applications and storage are made available over the Internet via secured IP, and can be free or offered at a pay-per-usage fee paid with credit cards. This type of cloud supplies easy-to-use consumer-type services, such as: Amazon and Google on-demand web applications or capacity; Yahoo mail; and Facebook or LinkedIn social media providing free storage for photographs. The elasticity, low entry costs and ease of use of public cloud seem well suited to supporting applications that follow web design, service oriented architecture or virtual server environments.

While public clouds are inexpensive and scale to meet needs, they typically provide "consumer-level" or lower SLAs and may not offer the guarantees against data loss or corruption found with private or hybrid cloud offerings. Public cloud is appropriate for consumers and entities not requiring the same levels of service that are expected within the firewall. Also, the public IaaS clouds do not necessarily provide for restrictions and compliance with privacy laws, which remain the responsibility of the subscriber or corporate end user.

In many public clouds, the focus is on the consumer and small and medium businesses where pay-per-use pricing is available, often equating to pennies per gigabyte. Examples of services here might be picture and music sharing, laptop backup or file sharing.

The value of public cloud will continue to grow, especially as security and availability measures mature. Public cloud creates an opportunity for more "greenness" by removing infrastructure responsibilities and facility costs for subscribers and by enabling providers to employ environmentally friendly multi-tenant facilities where resources are more efficiently shared.

## Why Cloud Is Important

The buzz around cloud computing indicates something significant beyond what is happening in just the IT industry. Cloud is an elastic delivery model that will enable businesses across all industries to become more adaptable and interconnected. Monolithic and aging infrastructures give way or progress toward a "rent versus buy" state of agility, where noncore competencies are shed for not just on-demand technology but also on-demand business innovation and savings.

Enterprises don't shift overnight, and many C-level executives remain hesitant to adopt cloud too quickly or wholly. Commonly used to gauge the adoption of technology is Rogers' bell curve, which describes the acceptance of a new product or innovation over time. The model indicates that the first group of people to use a new product is called "innovators," followed by "early adopters." Next come the early and late majority, and the last group to eventually adopt a product are called "laggards." If the industry were to use Rogers' bell curve to examine the adoption of cloud computing, it might reveal that the early majority of the industry is waiting for early adopters to demonstrate the real value of cloud computing in business.<sup>3</sup> Yet, the draw of dramatically lower CAPEX and simultaneously reduced OPEX is valid and difficult to ignore.

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<sup>3</sup> *Cloud Computing: It's about Management Innovation*, by Peter Fingar, Executive Partner, Greystone Group, December 2009 (<http://www.bptrends.com/publicationfiles/12-09-COL-EXT%20Comp-Cloud%20ComputingMgtInnovation-Fingar-final.pdf>)

### **Value to the Enterprise**

Cloud is important for the enterprise because it is designed to distribute business value in a most cost-effective, efficient and nimble way to existing infrastructure and processes. Consumption driven cloud commerce moves the enterprise focus from fixed costs and large purchases, which typically are not fully utilized, to smaller, incremental and variable operating costs. Examples are when organizations overprovision in order to manage storage bursts or attempt to meet capacity planning, or even when they buy because there is budget available. These organizational efforts result in a lot of idle capacity and a longer time to realize a return on assets (ROA). Engaging cloud instead can simplify long range financial and storage planning, as the redeployment of resources is performed instantly, anytime and anywhere, to scale up or down, to support business objectives as needed.

For private clouds, the service delivery layer sits on top of enterprise IT infrastructure. In hybrid or public clouds, the enterprise's existing infrastructure can be repurposed more efficiently for core data, freed up or retired as needed. As a result, less infrastructure equates to lower data center power, cooling, facility and maintenance costs.

Also noteworthy is the opportunity for the enterprise to engage in new functionality and services through cloud deployments. For example, in the case of mergers and acquisitions, where infrastructure, platforms and protocols may not integrate, cloud computing can come to the table with on-demand services. So, rather than assimilating architecture, the expanded business can leverage cloud-based deployment of services and instead focus on generating revenue.

IT organizations must respond quickly to internal requests for new applications, infrastructure or capacity. In some cases, if IT is unable to provision, implement or respond fast enough, the business units may go out and "get their own." As any IT manager knows, ad hoc platforms can lead to unnecessary compliance ramifications and financial or litigation risks, and IT will eventually wind up supporting those different platforms anyway. In cloud computing, IT departments can quickly meet requests for services and time to market while mitigating risk and maintaining influence.

### **Win-Win for Subscribers and Providers**

Cloud involves the subscriber and the provider. The service provider can be a company's internal IT group, a trusted third party or some combination of both. The subscriber is anyone using the services. Cloud storage economics enable both subscribers and providers to benefit. Providers gain economies of scale using multitenant infrastructure and a predictable, recurring revenue stream, while the subscriber list of benefits includes:

- Shifting storage costs to an operating expense: pay for use
  - Lowering of operating expenses and the drain on IT resources
  - Trimming management overhead and operational expenses
  - Balancing the value of data with SLAs and costs
  - Gaining business flexibility with subscriber controlled, on-demand capacity and performance
  - Future-proofing: storage media can change below the cloud layer without disrupting services
-

To fully realize these benefits, cloud storage needs to be:

- Rapidly scalable, both up and down, and to tremendous multipetabyte capacities
- Elastic, to quickly adapt underlying infrastructure to changing subscriber demands
- SLA driven, automated and integrated to provide swift response times
- Policy-based, with deep levels of automation to move data as required
- Secure and reliable
- Able to control geographically dispersed data
- Able to provide on-ramps that eliminate disruption of existing infrastructure, offer connectivity choices and provide functionality to populate the cloud from multiple sources

## Getting Started

Enterprise and large organizations are trying to gain traction in the cloud space, evaluating when and where to start. They are weighing the opportunities to efficiently manage massive, and growing, amounts of digital asset storage with potential risks and costs of offloading assets beyond the firewall.

But moving to cloud is more than figuring out which type of services might best suit the business at any given time. To be successful at reducing costs and building fluidity, Hitachi Data Systems recommends taking a measured approach to deploying cloud for the enterprise. By evaluating the risks and benefits of any given cloud deployment, and understanding how to ensure alignment with business needs, the enterprise is better equipped to proceed. Below are key areas of concern that enterprise organizations are examining.

### How to Spend More Efficiently for Lower IT Costs

Increasing business demands and regulations, the explosion of new data requirements, growing complexities and the burden of legacy systems with suboptimal utilization rates are all part of the daily balancing act between cost and delivery in the enterprise data center. Managing it all has traditionally involved the capital outlay and upfront purchases of more equipment than is needed at the time, to handle fluctuations in storage requirements and internal business processes. Over time, a buildup occurs of underutilized storage, multiple retention copies and RAID protection needs, and the lack of mobility materializes. Yet, when we examine the big picture more closely, it is plain to see that hardware costs make up only a portion of the overall costs of ownership. Enter the lurking OPEX for device migration, backup and recovery, scheduled downtime, change management and environmental inefficiencies, plus the human resources to manage it all. Then, as equipment ages and flexibility wanes, the IT organization is left to sweat the assets and manage against flat-tened budgets.

In a cloud deployment, the opportunity to shrink both CAPEX and OPEX arises, and the agility factor swells. Cloud methods allow harmonious sharing of resources flexibly across the business needs, thereby reducing the expense of deploying clouds on private infrastructure or initiating on-demand services through hybrid and public clouds. Fewer resources are needed to manage more storage in the cloud and utilization rates dramatically improve because of the higher levels of virtualization and automation in a multitenancy environment. What emerges may be the room and money to do new things.

## What to Know about Emerging Standards

Cloud computing is still evolving. While no standard protocols for operating cloud have been adopted across the industry at this time, standards are being built to encompass access, security and other critical elements. Hitachi Data Systems is an active participant in the industry organizations, which are evaluating and developing standards. Because storage systems and the data they contain play an important role in helping organizations comply with regulatory and legal obligations, it is essential to understand and protect that data, no matter where it resides. Cloud storage standards can help define roles and responsibilities for data ownership, archival, discovery, retrieval and retirement. SLAs around data storage assessments, assurance and auditing will also benefit from being defined in a consistent mode.

## How to Scrutinize SLAs in the Cloud

SLAs set a common understanding about services, priorities, responsibilities and guarantees, and usually contain specific metrics around uptime, performance or other attributes. In cloud scenarios, understanding exactly how SLAs are measured is critical to maintaining the enterprise's day-to-day business operations. Reporting and analysis are also integral to ensuring that there are no surprises. For IT professionals to trust and adopt cloud services outside the organization, SLAs and expected quality of service (QoS) will need to be part of the contractual relationship with the service provider that owns the infrastructure.

Hitachi Data Systems recognizes the importance of asking the right SLA questions of potential service providers. Ask if there are guarantees on data resilience. Ask what metrics are used for availability in the cloud. SLAs for data storage availability, reliability and resilience have typically been measured on a time-based metric (e.g., how many minutes of downtime or outage are acceptable per year for a certain type of data). The same should hold true in cloud; however, not all SLAs are alike. Some cloud providers may offer availability guarantees of just the service and not the underlying infrastructure levels. Another example might be a metric that computes the number of executed tries rather than the standard availability measurement of three, four or five nines, resulting in less-than-acceptable service levels. Enterprise organizations will want to "get granular" and ask providers about each level of infrastructure within the multitenant environment to ensure that SLAs are thoroughly defined and can be guaranteed. Consider the application, server, network and storage layers of infrastructure.

## How Security and Legalities Translate to the Cloud

Apart from inherent advantages that cloud brings to business, the scare of exposing potentially sensitive data or failing to meet fiduciary and legal mandates keeps some organizations from deploying. Protecting data is a legal requirement in most countries, and organizations must also comply with industry standards, internal security policies and customer requirements for data handling. Most enterprises don't yet have the depth of experience with cloud to be confident that service providers are implementing security and limiting access in the manner that meets the enterprise's corporate standards or compliance requirements. Knowing the provider's security procedures and understanding any risks with approaching cloud can assist the enterprise in continuing to meet SLAs and alleviate security and regulatory issues.

Hitachi Data Systems has identified seven areas of cloud security concern:

- Lack of common standards to apply across entire IT infrastructure
- Data leakage due to inadvertent exposure
- Accountability
- Access and control over sensitive data
- Access and control over business processes
- Compliance regulations, including data retention, chain of custody, e-discovery, etc.
- High costs to recover from data breach, data loss or malicious activity

And, in examining the drivers for cloud security, they are consistent with drivers for storage security:

- Compliance with external regulations: data retention, secure transactions, data preservation and sanitization, and protection of personally identifiable information
- Compliance with internal and corporate mandates, finance and human resources policies, and protection of intellectual property
- Protection of IT infrastructure
- Defense of company brands and customer retention

These areas of risk in the storage ecosystem are the reasons why enterprise organizations must remain stalwart in their data security strategies. Data continues to be the most valuable asset of any company and where the most exposure resides. It is important when moving to cloud, to be sure that security extends to storage management tools and the layers of the infrastructure upon which the cloud sets.

IT managers may be reluctant to hand over data and services to a third party because of the lack of visibility; they may not know if there is proper segregation from other tenant data and what security protocols are in place for the physicality of the cloud, including both the infrastructure and the housing facility. Inquire whether the cloud provider is capable of performing functionality such as encryption, masking, immutability and shredding if those will be required to meet SLAs and security needs. For legal services in the cloud, such as e-discovery and sustaining the chain of custody, the organization needs to ensure that the cloud environment will not impact or change these. Also, having audit logs readily available and tamperproof is essential, as is the ability for employees of the security vendor or cloud provider to make unauthorized changes.

More in-depth analysis on security as it pertains to cloud computing is outside the scope of this paper. Monitor the Hitachi Data Systems website and other cloud security organizations to stay abreast of developing progress.

## How Cloud Addresses Changing Storage Needs

Knowing what type of cloud to deploy and at what time can lead to highly efficient storage management for the enterprise. Cloud offers the advantages most desired in an agile data delivery model, including:

- Ease of deployment
- High levels of automation

- Consolidation of storage tiers
- Provisioning of storage to fluidly scale up or down
- Increased storage utilization
- Integrated management of heterogeneous devices

Take migration of data, for example. Research has found that when implementing energy efficient systems, IT managers are challenged by the costs, disruptions and complexities associated with migrating data from legacy systems to the new ones.<sup>4</sup> In cloud deployments, IT managers will want to ensure that service providers are operating highly efficient infrastructure capable of seamlessly migrating data to new tiers of storage in accordance with SLAs and security needs.

Effectively tiering data in the cloud also helps organizations align the business value of data with the cost of storage. Managing tiers in the cloud will require automated movement of data so that the entire environment can be managed via policies and without human intervention. And by employing highly scalable, virtualized block and file storage, the service provider can shield subscribers from changes to underlying infrastructure while providing exceptional efficiency gains.

Cloud storage is also well suited for latency-tolerant enterprise applications such as backup, archive, disaster recovery and cyclical peak workloads; for nearline file storage capacities; and for leveraging subscriber policies across geographic distances.

## Best Practices and Use Cases for Deploying Cloud

To date, adoption of cloud by the enterprise is seen predominantly in the private cloud space. Over time, the assumption is that enterprise organizations will garner more confidence in the maturity of external cloud offerings and security through trusted partners. Hitachi Data Systems takes the stance that enterprise organizations can best capitalize on the cost advantages of cloud computing while protecting data, by moving in a phased approach from private to hybrid and eventually to public models over time. These practices can help the enterprise business enter the cloud environment safely and cost-effectively, to quickly begin seizing operational cost reductions.

### Adopt Cloud at Your Own Pace

A good rule of thumb for the enterprise is to adopt cloud based on business needs. By deploying private cloud, the enterprise forgoes painful and expensive forklift changes and leverages existing investments. In this phased approach, the enterprise can realize incremental improvements and cost reductions by first adopting private cloud and gaining a more thorough understanding of how to deploy and utilize cloud services within the safety of the data center. Then, the business is able to make better decisions about what data and applications to deploy through a trusted partner and eventually within a public cloud.

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<sup>4</sup> Source: ESG Report, *Global Green IT Priorities: Beyond Data Center Power and Cooling*, November 2008

## Move from Peripheral to Core Data

Start by identifying data that may have lower business value and less stringent SLA requisites, such as "Tier 3" data types, including stale, unstructured content, home directory shares or static content. See Figure 2. This peripheral data is usually parked on primary NAS storage or other storage repositories. File tiering can be a very effective way to offload this type of burden from primary data center storage to the cloud.

Often, the file environment grows out of control, leaving the IT team to straddle protection copies, de-duplication, virtual tape libraries and tape backup to keep these copies online or at higher performance levels than are necessary. By moving it to the cloud as secondary storage, the enterprise is able to reclaim and even centralize primary file share space, reduce backup and lower OPEX costs associated with tending to legacy data that often requires much care and feeding to maintain, without impact to existing business processes. The enterprise also can save on backup hardware and software licensing, since the amount being backed up is reduced. SLAs can still be driven to allow rapid, online access to older inactive content, and the enterprise gains more efficient usage of storage, power consumption and staff resources. Upfront CAPEX may also be reduced, including capacity planning, oversubscription of storage, unpredictable business usage and storage refreshes.

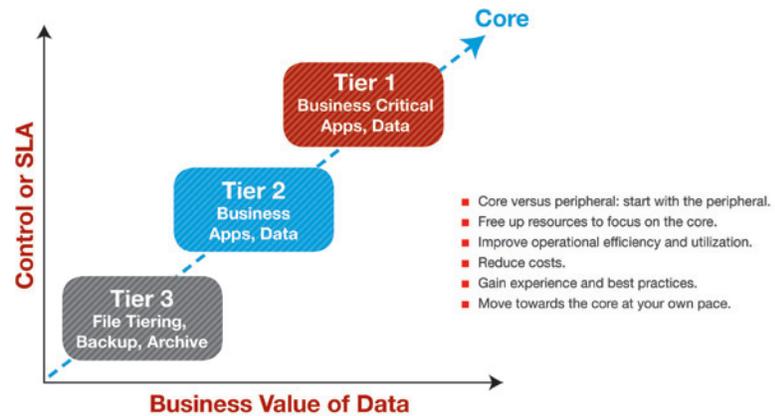
## Simplify for Greater Operational Efficiencies

Along the continuum of offloading data to the cloud, it is important to consider services that can quickly elevate savings by freeing up resources and improving operational efficiencies. Moving archive content, for example, out of the data center to a managed pay-per-use service in the cloud can alleviate the need to maintain (or purchase new) onsite archive systems while upholding compliance requirements. For the private cloud physically located on the premise, the day-to-day management is trimmed, as are those CAPEX dollars. As the enterprise later shifts to its trusted partner providers, so do the cost implications of the footprint, such as power, cooling and floor space. In both cases, the enterprise can avoid developing irrelevant expertise or applications, and continue consolidation efforts on a pay-per-use scale.

## Target Cost Centers for Adding Business Value

When assessing what to move into the cloud, consider areas of the data center that are cost centers. Backup often surfaces to the top of this elimination wish list for many IT groups. Backup is expensive and recovery can be problematic; it basically can become a cost center in itself. The use case for backup-to-the-cloud as a storage service can reduce total costs of ownership by minimizing or eliminating manual processes centered on often less critical applications, plus the storage costs of physical media, data reduction technologies, shuttling or shipping services, and so on. Finding a trusted repository, appropriate levels of availability and SLAs for corporate backups are paramount here.

Figure 2. Hitachi Data Systems recommends a phased approach to deploying cloud.



## Understanding Cloud Enablement from Hitachi Data Systems

For the enterprise considering private cloud, and for providers seeking cloud enabled infrastructure, Hitachi Data Systems facilitates highly scalable and reliable SLA driven deployments that are safe, secure and cost-efficient. We recognize that there is no assembly line approach to producing or deploying cloud, and we believe that an integrated portfolio of technologies is required to sustain successful cloud operations. Hitachi Data Systems already has an integrated portfolio and is a trusted infrastructure vendor, with deep roots in virtualized, scalable and high performance architecture built for the multipetabyte environment.

Through its agile cloud enabled technologies, Hitachi Data Systems is able to help the enterprise virtualize all existing storage resources into a single, agile, service oriented infrastructure to reduce storage costs, mitigate risks and simplify management amid changing demands. And as Hitachi Data Systems continues to expand its focus into vertical markets, it makes an excellent strategic partner for telecommunication companies, service providers and systems integrators dedicated to providing hybrid and public cloud offerings. Beyond cloud enabling architecture and services, Hitachi Data Systems is focused on providing a sound strategy and guidance for its enterprise customers. We offer end-to-end cloud solutions that foster true value and ease of deployment, and triumph over the typically stressed enterprise data center.

## NEW! HITACHI CLOUD SERVICES FOR PRIVATE FILE TIERING

Hitachi Data Systems has recently made generally available Hitachi Cloud Services for Private File Tiering, a fully managed, consumption-based cloud service that moves legacy or lower value unstructured data into a cloud storage environment located within an organization's data center.

### How It Works

Data stays at the organization's site and facilitates pay-for-usage storage. The physical infrastructure at the organization's site is remotely managed by Hitachi Data Systems. When new storage is required, the request is automated and fulfilled based on the pre-defined thresholds and policies, and it is remotely provisioned and managed by Hitachi Data Systems.

### Benefits

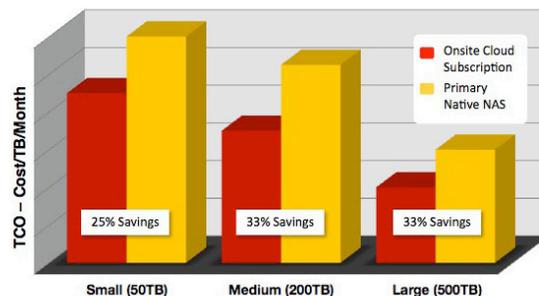
This Private File Tiering cloud offering allows organizations to:

- Tier multiple NAS filers to their resident cloud infrastructure over local high speed networks (LAN/MAN)
- Reduce management overhead and provide necessary skills to optimize storage
- Consume resources as a service and pay only for what is used
- Gain operational and capital expense savings while simplifying IT management
- Improve performance of primary NAS environment

Hitachi's Cloud Service for Private File Tiering helps organizations manage the explosive growth of unstructured content in their environment, reducing operational and capital costs as well as providing an agile infrastructure to maintain an edge in today's competitive marketplace

### Storage Economics for the Hitachi Cloud Services for Private File Tiering

The Hitachi Data Systems Private File Tiering solution helps enterprise organizations lower the total cost of ownership (TCO) by at least 25%. When comparing estimates of business as usual (local NAS data storage TCO) to those of the Hitachi cloud solution, there is a significant cost benefit with the Hitachi cloud solution. With all configuration sizes, there is at least a 25% reduction in the unit cost TCO for owning and managing the file and content environment. The graph below shows the relative unit cost (TCO/TB/Year) comparison for each configuration size. The TCO model consists of costs related to storage capacity, number of storage systems managed, software, services, management labor, power, cooling and depreciation and assumes a data growth rate of 30%, a utilization rate of 66% and a depreciation term of four years.



## Cloud Strategy Simplifies Adoption

Hitachi Data Systems amplifies its heritage of data center reliability, availability, storage efficiency and performance with an agile cloud strategy. By now, the enterprise organization is aware that cloud is not a particular product, but a way of delivering IT services that are consumable on demand, elastic to scale up and down as needed, and follow a pay-for-usage model. To enable the diverse uses within an agile cloud or data center, Hitachi Data Systems is able to capitalize on its proven virtualized and integrated block, file and object technologies. Using a single, underlying infrastructure that is reliable, scalable, multitenant and multitiered, Hitachi technology delivers integrated search, migration and archive capabilities, and securely virtualizes IT assets into consolidated, easy-to-manage pools of resources. Subsequently, these resources can be provisioned as needed to support a wide range of infrastructure and content services in private, hybrid and public clouds. Advanced architectures such as a single Hitachi Content Platform, for example, can support an enterprise and cloud simultaneously.

### Core Principles and Differentiators

This agile cloud strategy and Hitachi cloud enabling technologies are built upon a core set of principles to best support enterprise and provider organizations with deployment solutions and services. Every feature or functionality within our products is built to be applicable to the dynamic data center and the cloud.

- **Flexible and Dynamic Infrastructure.** These core attributes are designed to meet the notions of on-demand and just-in-time services, and enable seamless continuity from the data center into the cloud with zero learning curve or application disturbance.
- **Automation and Integration.** These built-in software tools ensure highly automated, reliable, repeatable and scalable processes that help diminish operating costs associated with manual steps and human interaction.
- **Security and Privacy.** End-to-end security practices and authenticity can guarantee privacy and data protection for the entire data asset lifecycle, including encryption of data at rest (while residing on internal drives) and in flight (during transfer); support of object-level encryption at the source; credential interlock between core cloud and edge customers; and immutability with "write once, read many" (WORM) technology. Namespaces provide segregation of storage in multitenant or shared environments, and their use with encryption throughout ensures that data cannot be read or accessed without permission.
- **Data Mobility.** In the virtualized environment, data must be fully liberated, policy bound and allowed to move freely and reliably between instances, locations or geographies.
- **Reliability.** Inherent protection functionalities, such as object-based replication and hardware-based RAID, bolster resiliency and data sentry.
- **Cost-effectiveness.** Use common management and integrated technologies that orchestrate highly efficient automation, processes, utilization, migration, tiering and scalability to support rapid resource deployment for lower CAPEX and OPEX opportunities.
- **Scalable and Flexible.** Ensure that the core infrastructure behind cloud deployments is truly scalable and flexible to eliminate silos of data and able to deliver services for less.

Delving further into what makes the distinction between cloud offerings, Hitachi Data Systems delineates the following competitive differentiators of its architecture:

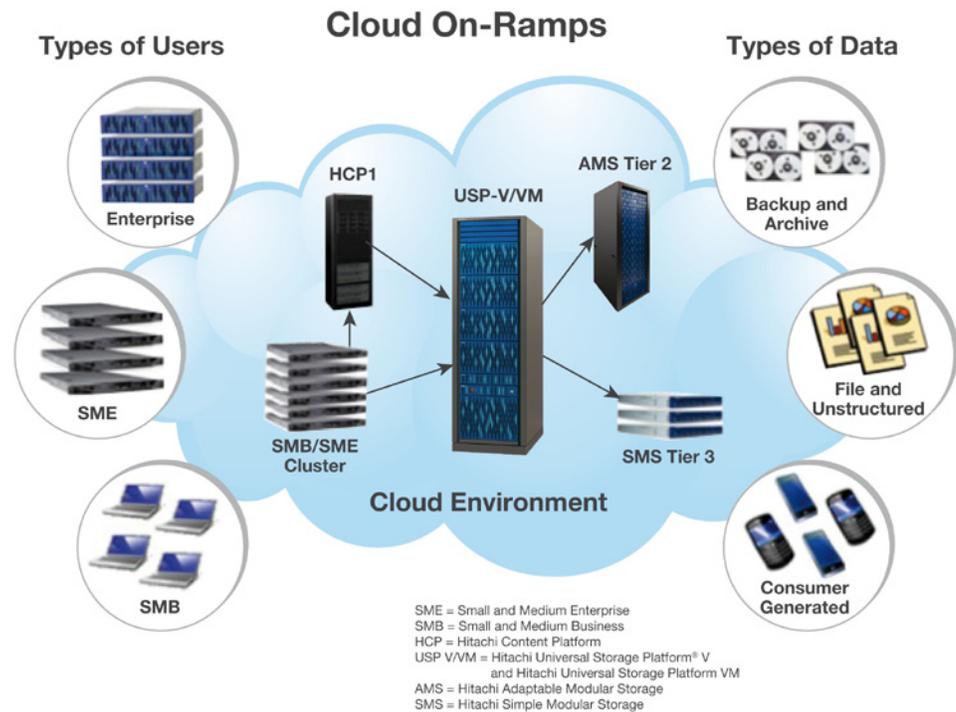
- **One Platform, All Data.** There is no need to purchase separate islands.
- **Multitenancy.** Logical partition ensures segregation of administration.
- **REST Interface.** Industry standard protocol is embedded for direct and reliable connection to the cloud.
- **Chargeback Enabled.** Instant cost visibility and accountability is provided.
- **Tenants and Namespaces.** Logical segregation of management and of data is supported with customizable data management personalities and access rights, and security layers to prevent unauthorized access.
- **Compression and Single Instancing.** Capabilities improve cloud storage profitability.

### Key Benefits

The Hitachi cloud offers up important business benefits, including:

- **Safeguard for Data Assets.** Logical partitioning and safe multitenancy, access rights, end-to-end encryption and on-the-fly encryption, and security control layers thwart unauthorized admittance, and immutable media prevents alteration of fixed content.
  - **CAPEX and OPEX Savings.** Consolidation and multitenancy, plus just-in-time consumption support increased returns on assets. Many of the existing Hitachi products found in enterprise data centers can be extended for new use case because of built-in capabilities, including multitenancy, encryption and immutability.
  - **Greater Utilization Rates.** Useful lifetime of onsite assets is extended, and aged or reference content moves from primary assets (such as NAS) to cloud, which frees up assets.
  - **Storage Service Level Management.** Multiple QoS tiers become available to cloud to better leverage data mobility services and increase flexibility.
  - **Enhanced Business Continuity.** Higher levels of automation for policy management, provisioning and nondisruptive migrations keep assets available at all times; superior reliability and "always there" cloud storage improve uptime, minimize reliance on legacy data protection and even save on licensing fees.
  - **Investment Protection.** Connectivity choice and on-ramps (see Figure 3) allow population of the cloud from multiple sources within existing environments, without disrupting applications or users.
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Figure 3. Cloud on-ramps allow population of the cloud from multiple sources within existing environments.



## At the Ready with Managed Services for Cloud

As commerce shifts its focus to cloud, service providers will want to further develop existing managed services offerings to include a broader set of information requirements. IDC reports that managed services is among the fastest growing segment within the delivery of storage professional services to address the growth and management of tremendous volumes of data. To support the evolving needs of enterprise organizations, Hitachi Data Systems Professional Services has expanded its suite of managed services pertinent to cloud deployment, including Residency Services and Remote Management Services. These managed services offer critical building blocks for Hitachi to now provide Utility-based Services to the enterprise or service provider deploying cloud, and help derive greater value and optimized performance from existing assets for new use cases.

### Residency Services

Developed to facilitate a higher and quicker return on storage investments, Residency Services help the enterprise to fill critical gaps in staff skills or experience while improving asset utilization and performance, and achieving service level objectives. Experienced and "best fit" Hitachi Data Systems consultants are assigned to the engagement in the areas of SAN, mainframe, open systems and replication evaluation. The consultants implement industry standard processes, tools, training and best practices.

**Success Story Highlight:****Telstra**

Telecommunications leader Telstra signed a \$50 million, five year contract to provide cloud computing services to Visy, a global manufacturing company based in Melbourne, Australia, with over 8,000 staff and operations in 140 locations across Australia, New Zealand, Asia and the United States. Visy needed cost reduction solutions to migrate its global SAP environment, and deemed Infrastructure-as-a-Service cloud computing as a way to go.

The Telstra cloud layer is built upon infrastructure from Hitachi Data Systems, chosen for its multitenant storage management abilities and tools.

*Source: IDC, July 2009*

**Remote Management Services**

Complementary to Residency Services, the Remote Management Services comprise robust reporting, real time monitoring, alerting and provisioning services, often the essential keys to efficiently managing storage infrastructure. While most organizations have flatlined their resource investments and budgets, the demands for capacity and services sharply rise and fall. The results are the need to do more and do it better, faster and cheaper. Remote Management Services help the enterprise manage and align the storage environment with established service-level requirements and best practices that enable flexible service delivery to meet changing business requirements.

**Utility-based Services**

Most cloud offerings provide flex-up options to accommodate changes in capacity or service needs. Hitachi Data Systems is unique in its ability and offering to also provide flex-down opportunities in which the enterprise actually pays only for what is used. Utility-based Services is a culmination of breadth and depth of Hitachi experience in providing managed services, allowing us to offer guidance and packaged or custom services to both the enterprise and the provider seeking revenue generation from optimal use of cloud capabilities.

## Partnering with Hitachi Data Systems

The Hitachi Data Systems team is passionate about bringing tangible results and solutions to the rapidly maturing cloud universe, to channel agility and alignment with business needs for the enterprise. The Hitachi approach to cloud allows organizations to choose the best possible product mix and delivery methods for addressing their particular cloud needs, from a selection of highly integrated products for cloud. Hitachi Data Systems is able to deliver elastic, secure and end-to-end storage infrastructure that solves the most pressing business challenges, by:

- Reducing cost with intelligent management of multitiered infrastructure
- Simplifying the IT environment and achieving operational efficiency
- Mitigating risks with a secure, highly available infrastructure
- Ensuring QoS and SLAs with enterprise-class hardware and software capabilities

To learn more about the architectures, platforms, services and end-to-end Agile Cloud Solutions available to deploy, please contact Hitachi Data Systems or visit [www.hds.com/cloud](http://www.hds.com/cloud).

## Hitachi Data Systems Corporation

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### Corporate Headquarters

750 Central Expressway  
Santa Clara, California 95050-2627 USA  
[www.hds.com](http://www.hds.com)

### Regional Contact Information

**Americas:** +1 408 970 1000 or [info@hds.com](mailto:info@hds.com)  
**Europe, Middle East and Africa:** +44 (0) 1753 618000 or [info.emea@hds.com](mailto:info.emea@hds.com)  
**Asia Pacific:** +852 3189 7900 or [hds.marketing.apac@hds.com](mailto:hds.marketing.apac@hds.com)

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