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Cloud Storage FOR DUMMIES®

Hitachi Data Systems Edition

A Reference for the Rest of Us!®

Maximize your IT resources with cloud computing

Linda Xu
Miklos Sandorfi
Tanya Loughlin

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Cloud Storage FOR DUMMIES®

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Publisher's Acknowledgments

We're proud of this book; please send us your comments through our online registration form located at `http://dummies.custhelp.com`.

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Table of Contents

Introduction

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, PACs and eDiscovery documents, and 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 compatible? Answers may lie in cloud computing. Representing a paradigm shift in the way organizations can reduce capital and operational costs, 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 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. Regardless of the offering or deployment model, cloud fosters a more agile IT environment. Therefore, cloud storage is the foundation and focus of *Cloud Storage For Dummies*, which is written on behalf of Hitachi Data Systems.

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 an overhaul of their existing investments and processes.

This book separates the hype of cloud from the crux of how to deploy cloud safely and cost effectively.

About This Book

Cloud Storage For Dummies is your guide to the exciting world of cloud storage. We guide you through what cloud storage is, the types of cloud available and the best one for your organization, as well as cloud's many benefits.

Conventions Used in This Book

All web addresses appear in monofont, which looks like `this`. When this book was printed, some web addresses may have needed to break across two lines of text. If that happened, rest assured that we haven't put in any extra characters (such as hyphens) to indicate the break. So, when using one of these web addresses, just type in exactly what you see in this book, pretending the line break doesn't exist.

How This Book Is Organized

This book comprises five chapters.

Chapter 1 sets the framework of cloud computing, giving you a summary of what it is, as well as an outline of how cloud came about. This chapter also analyses how cloud will help you manage data growth.

In **Chapter 2** we talk about the reasons for using cloud and the three main categories of cloud. **Chapter 3** looks at translating security and legalities to cloud, as well as understanding the implications for storage requirements. **Chapter 4** delves into deciding what to move to cloud and how to phase it in while adding business value and improving savings.

Last but not least, no *For Dummies* book would be complete without a chapter of tens (although in this case it's a chapter of sevens). So **Chapter 5** explains seven ways Hitachi can help you accelerate cloud storage solutions that will help you adopt the right kind of cloud storage for your organization with minimal disruption.

Icons Used in This Book

Throughout this book we use a series of icons in the margins that help flag special information. Here's what to look for.

When we tell you something about cloud computing that bears remembering, we mark it with the Remember icon. Descriptions that appear beside this icon are worth storing away because they help build your understanding.

This icon indicates a resource on the Internet you can go to for further information.

Chapter 1

Cloud Overview

In This Chapter

- Discovering what cloud is
- Exploring new ways to deliver IT resources
- Managing explosive data growth

Along with the promise of reduced costs for managing explosive data growth, cloud computing brings forward an entire evolution for the IT industry. As organizations experience demands for greater agility, availability, performance and rapid deployment of new applications, the desire to do more with less prevails.

In this chapter we explore what cloud is and reasons to adopt it.

What Is Cloud, Really?

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.

Cloud is an elastic delivery model that enables businesses to become more adaptable and interconnected. Monolithic and ageing infrastructures give way or progress toward a 'rent versus buy' state of agility, where non-core competencies are shed for not just on-demand technology, but also for on-demand business innovation and savings.

Cloud can relate to many things (storage-as-a-service, compute-as-a-service, application-as-a-service), but without the fundamental storage pieces, none of the other applications are possible. Cloud is built on the premise that you're running in a

virtualized world and virtual computing is nothing more than big data files.

While there are still varying definitions and much hype around what cloud does and does not mean, the key attributes that cloud computing must provide include

- The ability to rapidly provision or deprovision 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 cloud without having to recode applications
- Multi-tenancy capabilities that segregate and protect the data

Many storage requirements are being driven by unstructured data, such as files, emails, medical records, legal imaging and videos. In addition to data growth, companies also need to deal with other complexities that impact on IT, such as:

- Changes in business models
- Data security regulations
- Maintenance of legacy environments
- Mergers and acquisitions

No wonder today's data centers need a better solution.

Another Paradigm Shift in IT?

Over the last decade, the IT industry experienced the evolution from direct attached storage (DAS) to network attached storage (NAS) and storage area networks (SAN). Networked storage helped improve storage utilization and data center efficiency.

With cloud, the IT industry is experiencing another paradigm shift (see Figure 1-1). Cloud is not a point product or a singular technology, but a way to deliver IT resources in a manner that provides self-service, on-demand and pay-per-use consumption.

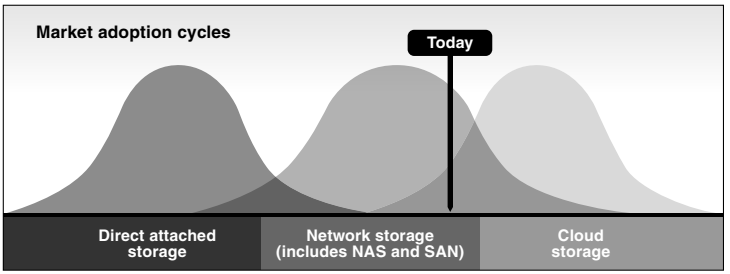

Figure 1-1: Market adoption cycles in IT storage.

The concept of utility-based computing, which includes storage-as-a-service, was first developed as early as 1961, but the idea faded as technologies at that time were not ready to make the utility model a reality.

This wave of adoption is now made possible by the recent technological developments and adoption of new strategies within today's data center environments. Key catalysts for cloud adoption are

- Automation
- Data center consolidation
- Data mobility
- Multi-tenancy
- Server and storage virtualization

Why Adopt Cloud?

In many ways, cloud is changing the way vendors develop their products and IT procure their resources. Organizations adopt cloud for various reasons:

- Cost reduction by leveraging the economies of scale beyond the four walls of the data center
- IT agility to respond faster to changing business needs
- 100 per cent resource utilization

Key technical terms in cloud

Here are some of the key technical terms used when discussing cloud.

Multi-tenancy is a secure way to partition the infrastructure (application, storage pool and network) so multiple customers share a single resource pool. Multi-tenancy is one of the key ways cloud can achieve massive economy of scale.

Representational state transfer (REST) is a type of software architecture for client/server communications over the web.

Chargeback is the ability to report on capacity and utilization by application or dataset and charge business users or departments based on how much they use.

As seen in Figure 1-2, customers buy and provision for peak demand in order to be able to service and respond to business demand in a timely fashion. This leaves customers with a significant amount of unused storage. If demand dips even lower after the initial purchase, the amount of unused storage sitting idle versus what is needed gets even larger. In contrast, a cloud service delivery model allows customers access to storage resources when they need it, but they pay only for what they use.

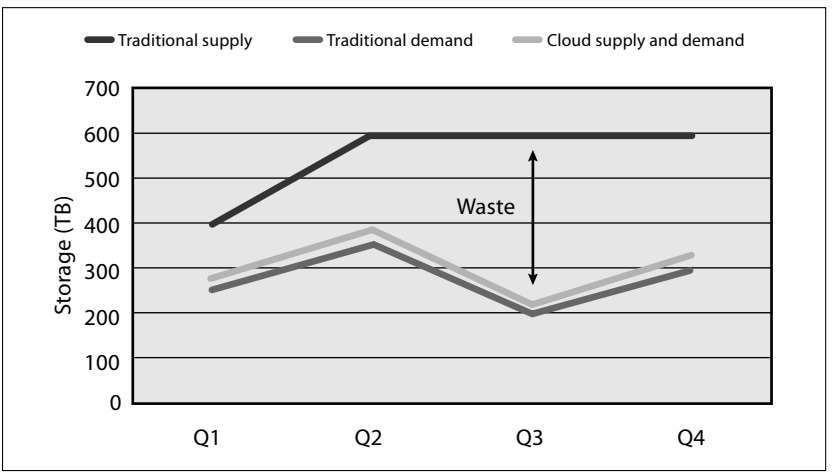

Figure 1-2: Storage supply and demand: Traditional versus cloud.

Chapter 2

Discovering the Benefits of Cloud

In This Chapter

- Understanding the reasons to use cloud
- Discovering the three main categories of cloud models

Simplifying planning and using resources more cost effectively is appealing to all organizations. Utilizing cloud delivers time and cost savings.

This chapter explores the reasons for using cloud, as well as considering the advantages of each type of cloud — private, hybrid and public.

Why Use Cloud?

Cloud is designed to distribute IT resources in a cost-effective and nimble way. Consumption-driven cloud commerce moves an organization's focus from CAPEX (capital expenditure), which typically isn't fully utilized, to smaller, incremental and variable OPEX (operating expenditure)

Organizations may overprovision to manage storage bursts or attempt to meet capacity planning, or even 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).

Employing 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, and to support business objectives as needed.

In private clouds, the service delivery layer sits on top of an organization's IT infrastructure. In hybrid or public clouds, an organization'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. (To find out more about private, hybrid and public clouds, see the discussion later in this chapter.)

Also noteworthy is the opportunity for an organization 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 must respond quickly to internal requests for new applications, infrastructure or capacity. Otherwise, the business units might 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 a combination of both. The subscriber is anyone using the services. Cloud storage economics benefit both subscribers and providers. Providers gain economies of scale using multi-tenant infrastructure and a predictable, recurring revenue stream. Subscriber benefits include

- Shifting storage costs to an operating expense: pay for use
- Lowering operating expenses and the drain on IT resources

- Balancing the value of data with service level agreements (SLAs) and costs
- Gaining business flexibility with subscriber-controlled, on-demand capacity and performance
- Future-proofing, because storage media can change below the cloud layer without disrupting services

To fully realize these benefits, cloud storage needs to be

- Elastic, quickly adapting 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

The myth surrounding 'as-a-service'

A frequently used term in any cloud-related book is *as-a-service*. It really means that a resource or task has been packaged so it can be delivered automatically to customers on demand in a repeatable fashion. It is commonly used to describe cloud delivery models. For example:

- **Infrastructure-as-a-Service (IaaS)** delivers compute hardware (servers, network or storage) as a service. The characteristics commonly seen with IaaS are
  - Subscribers provision the resource without control of the underlying cloud infrastructure.
  - The service is paid for on a usage basis.
  - Infrastructure can be automatically scaled up or down.

  An example of infrastructure-as-a-service is Amazon's Elastic Compute Cloud (EC2), `http://aws.amazon.com/ec2`
- **Storage-as-a-Service (STaaS)** provides storage resources as a pay-per-use utility to end users. It is one flavor or type of infrastructure-as-a-service and therefore shares the common characteristics described earlier.

Hitachi's Private File Tiering Cloud (www.hds.com/solutions/storage-strategies/cloud/index.html?WT.ac=us_hp_flash_r1) is an example of storage-as-a-service.

- **Platform-as-a-Service (PaaS)** provides more than just the infrastructure. It is a comprehensive stack for developers to create cloud-ready business applications. The characteristics commonly seen with PaaS are that it:
  - Is multi-tenant
  - Supports web services standards
  - Is dynamically scaling based on demand

An example of platform-as-a-service is Microsoft Azure www.microsoft.com/windowsazure.

- **Software-as-a-Service (SaaS)** cloud providers host and deliver business applications as a service. The characteristics commonly seen with SaaS include:
  - Multi-tenancy
  - Consumer uses applications running on a cloud infrastructure
  - Accessible from various client devices through web browser
  - CRM (customer relationship management) is one of the most commonly seen SaaS

Salesforce.com (www.salesforce.com) is an example of software-as-a-service.

Private, Hybrid and Public Cloud Models

The three main categories of cloud models are private, hybrid and public. Each one may offer varying levels of security, services, access, service level agreements (SLAs) and value to end users.

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, or 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 — servers, networks and storage — and deliver services to business units or other branches.

How is private cloud used?

Private clouds can leverage existing infrastructure, deliver massive scale and enable chargeback either by an organization's own IT staff, or as a vendor-managed service, but within the privacy of an organization's network. Additionally, private clouds:

- Can deliver IaaS or STaaS internally to employees or business units through an intranet or the internet via a virtual private network (VPN)
- Can deliver software (applications) as a service to branch offices
- Include database on demand, email on demand or storage on demand

Security in private cloud

With private cloud, security of the data and physical premises are determined and monitored by the IT team, and its high-quality SLAs remain intact. In a private cloud environment, the network bandwidth is under IT's control as well, which also helps ensure SLAs.

An 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 separate administration and data permissions, based on data types and security practices, may be granted.

Why use private cloud?

Reasons for using private cloud include

- **To the end users:** Quick and easy resource sharing, rapid deployment, self-service and the ability to perform chargeback to departments or user groups.

- **To the service provider (in this case, an organization):** The ability to initiate chargeback accounting for usage while maintaining control over data access and security.

Hybrid cloud

Hybrid cloud is a combination of private and public cloud infrastructures. Selected data, infrastructure or applications are allowed to 'punch through' the corporate firewall and be provided by a trusted cloud provider.

In hybrid cloud, multi-tenant 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, system integrators and internet service providers.

How is cost saving achieved?

Hybrid cloud usually provides an attractive alternative to an organization when internal processes can no longer be optimized because further cost reduction is provided by leveraging a trusted service provider's ability to deliver to more than a single customer.

The service provider's costs are lower because they amortize infrastructure across many customers and this helps even out supply 'peaks and valleys'. The service provider passes along those savings to the customer base.

An organization's cost infrastructure may only be amortized across business units or a small customer base. By moving certain data and applications to a hybrid cloud, the organization is able to take advantage of the multi-tenant capabilities and economies of scale.

The overall outlay of service delivery shifts to the pay-for-usage model for an 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 an organization and its trusted partners is critical to ensuring data is protected. Hybrid cloud providers use stringent security practices and uphold high-quality SLAs to help the organization mitigate risks and maintain control over data managed services and application hosting services delivered through multi-tenancy. An organization also determines access limitations for the provider and whether the services will be delivered via VPNs or dedicated networks.

Why use hybrid cloud?

Reasons for using hybrid cloud include:

- **To the organization:** Cost reductions — well-managed services that are seamlessly and securely accessed by its end users.
- **To the trusted provider:** The economies of scale — supplying services to multiple customers while increasing utilization rates of highly scalable cloud-enabled infrastructure.

Public cloud

In *public cloud,* all major components are located in a multi-tenant infrastructure outside an organization's firewall. Applications and storage are made available over the internet and can be free or offered at a pay-per-usage fee.

The key characteristics of public cloud are

- Elasticity
- Low entry costs
- Ease of use
- Pay-per-use

Examples of public cloud services include picture and music sharing, laptop backup and file sharing. Examples of providers include Amazon and Google on-demand web applications, Yahoo mail, Facebook and LinkedIn.

Why use public cloud?

In many public clouds, the focus is on the consumer and small-to-medium businesses where pay-per-use pricing is available, often equating to pennies per gigabyte.

Reasons for the end user to employ public cloud include inexpensive, quick and easy resource sharing, rapid deployment and self-service.

A word of caution

Public clouds typically provide 'consumer level' or lower SLAs and may not offer guarantees against data loss or corruption.

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.

Future prospects

The value of public cloud continues to grow, especially as security and availability measures mature.

Chapter 3

Getting Started

In This Chapter

- Taking a pragmatic approach
- Translating security and legalities to cloud
- Understanding the implications for storage requirements

Moving to cloud is more than figuring out which type of services may best suit the business at any given time. To be successful at reducing costs and building fluidity, an organization may want to take a pragmatic approach by adopting cloud at a measured pace, which is what this chapter is about.

Ensuring an Organization Is Well Equipped to Deploy Cloud

By evaluating the risks and benefits of any given cloud deployment, and understanding how to ensure alignment with business needs, an organization is better equipped to proceed.

Key areas of concern for organizations are discussed in the following sections.

Spending efficiently

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 an organization's data center.

Managing it all has traditionally involved 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 build-up of underutilized storage, multiple retention copies, and varying tiers of storage and RAID (redundant array of independent disks) protection requirements occurs. This leads to an imbalance in the ratio between hardware costs and the value of the information stored on that hardware. To improve the total cost of ownership and to maximize utilization, the need for mobility becomes apparent.

However, closer examination shows that hardware costs make up only a portion of the overall costs of ownership. Enter the lurking OPEX (operating expenditure) for device migration, backup and recovery, scheduled downtime, change management and environmental inefficiencies — and 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 flattened budgets.

In a cloud deployment, the opportunity to shrink both CAPEX (capital expenditure) and OPEX arises, and the agility factor swells. This is achieved through

- Sharing resources flexibly across the business needs, thereby reducing the expense
- Needing fewer resources to manage more storage in cloud
- Improving utilization rates because of the higher levels of virtualization and automation in a multi-tenancy environment

Understanding SLAs

Service level agreements (SLAs) set a common understanding about services, responsibilities and guarantees. SLAs usually contain specific metrics around uptime, performance or other attributes.

Because storage systems and the data they contain play an important role in helping organizations comply with regulatory and legal obligations, understanding and protecting that data, no matter where it resides, is essential.

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 also benefit from being defined in a consistent mode.

In cloud scenarios, understanding exactly how SLAs are measured is critical to maintaining the organization'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 an organization, SLAs and expected quality of services need to be part of the contractual relationship with the service provider that owns the infrastructure.

When considering a cloud service, ensure you ask the questions associated with SLAs, such as:

- Are there guarantees on data resilience?
- What metrics are used for availability?
- What level of reliability is provided?

SLAs for data storage availability, reliability and resilience have typically been measured on a time-based metric; for example, how many minutes of downtime/outage are acceptable per year.

Not all SLAs are alike! Some cloud providers may offer availability guarantees of just the service and not the underlying infrastructure levels. Another provider may establish 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 should ask providers about each level of infrastructure within the multi-tenant environment to ensure that SLAs are thoroughly defined and can be guaranteed. Consider the application, server, network and storage layers of infrastructure.

Emerging standards

Cloud computing is still evolving. While no standard protocols for operating cloud have been widely adopted across the industry at this time, standards are being developed and implemented.

Standards are especially important in cloud because they help simplify integration, reduce costs and enable users to make informed decisions.

Standards are critical for cloud in the areas of:

- Interoperability and access
- Security and privacy
- Integration
- Portability

Many organizations have come together to develop and promote standards related to cloud. Following are some examples.

Storage Networking Industry Association (SNIA)

The Storage Networking Industry Association (SNIA, www.snia.org) is a not-for-profit global organization made up of some 400 member companies spanning virtually the entire storage industry. SNIA's mission is to lead the storage industry worldwide in developing and promoting standards, technologies and educational services to empower organizations in the management of information.

SNIA's Cloud Data Management Interface (CDMI) standard provides an interface for storage vendors to implement the required metering of storage and data service usage, as well as the interface to feed the billing applications that IT organizations will be putting into place.

SNIA's new initiative, the Cloud Storage Initiative (CSI), promotes the adoption of cloud storage as a new delivery model which provides elastic, on-demand storage billed only for what is used. More information can be found at www.snia.org/forums/csi.

Open Cloud Consortium (OCC)

The Open Cloud Consortium (OCC) is a member-driven organization that:

- Supports the development of standards for cloud computing and frameworks for interoperating between clouds
- Develops benchmarks for cloud computing
- Supports reference implementations for cloud computing

The OCC also manages test beds for cloud computing, such as the Open Cloud Testbed, and operates cloud computing infrastructure to support scientific research, such as the Open Science Data Cloud.

For more information about Open Cloud Consortium, go to `www.opencloudconsortium.org`.

Open Grid Forum (OGF)

Open Grid Forum (OGF) is an open community committed to driving the evolution and adoption of distributed computing. Distributed computing is critical to developing new applications and infrastructures to increase the productivity in the organization and within the science community. OGF accomplishes its work through open forums that build the community, explore trends, share best practices and consolidate these best practices into standards.

The Open Cloud Computing Interface Group (OCCI) is a working group within the OGF and focuses on the creation of an application programming interface (API) for interfacing infrastructure cloud facilities.

For more information about Open Grid Forum, go to `www.ogf.org`.

Translating Security and Legalities to Cloud

Cloud brings inherent advantages to businesses. However, the risk of exposing potentially sensitive data or failing to meet fiduciary and legal mandates keeps some organizations from using cloud.

Protecting data is a legal requirement in most countries. Organizations must also comply with industry standards, internal security policies and customer requirements for data handling.

Most organizations 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 an organization's corporate standards or compliance requirements.

Knowing the provider's security procedures and understanding any risks with approaching cloud can assist an organization in continuing to meet SLAs and alleviate concern over security and regulatory issues.

Some common areas of concern related to cloud security include

- Lack of common standards to apply across the 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 and eDiscovery
- High costs incurred to recover from data breach/loss/malicious activity

The following drivers for cloud security are consistent with the drivers for storage security:

- Compliance with external regulations, including 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 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. When moving to cloud, it is important to ensure 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, and not knowing whether there is proper segregation from other tenant data and what security protocols are in place for the physicality of the cloud — both infrastructure and housing facility.

Inquire if the cloud provider is capable of performing functionality such as encryption, masking, immutability and shredding if they are required to meet SLAs and security needs.

For legal services in cloud, such as eDiscovery and sustaining chain of custody, an organization needs to ensure that the cloud environment will not impact or change the policies and processes put in place to ensure that compliance and governance regulations can be met. Also, having audit logs readily available and tamper-proof is essential, as is the ability for employees of the security vendor or cloud provider to make authorized changes.

Addressing Changing Storage Needs

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

- Ease of deployment
- High levels of automation
- Consolidation of storage and mobility of data between tiers
- Provisioning of storage to fluidly scale up or down
- Increased storage utilization
- Integrated management of heterogeneous devices
- Automated data migration

Take data migration, 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.

In cloud deployments, IT managers want to ensure that service providers are operating a highly efficient infrastructure capable of seamlessly migrating data to new tiers of storage in accordance with SLAs and security needs.

Effectively tiering data in cloud also helps organizations align the business value of data with the cost of storage. Managing tiers in cloud requires automated movement of data so that the entire environment can be managed via policies and without human intervention.

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 applications such as backup, archive, disaster recovery and cyclical peak workloads; nearline file storage capacities; and leveraging subscriber policies across geographic distances.

Chapter 4

Best Practices and Use Cases

In This Chapter

- Phasing in the use of cloud
- Improving savings and operational efficiencies
- Assessing what to move to cloud
- Adding business value

To date, adoption of cloud by enterprise organizations 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.

Enterprise organizations may best capitalize on the cost advantages of cloud computing while protecting data, by moving in phases from private to hybrid and eventually to public models over time. This chapter talks about how these practices can help organizations enter the cloud environment safely and cost-effectively to quickly begin seizing operational cost reductions.

Adopting Cloud at Your Own Pace

A good general rule is to adopt cloud based on business needs. By deploying private cloud, enterprise organizations can forgo painful and expensive forklift changes and leverage existing investments.

In this phased approach, organizations 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.

Moving from Peripheral to Core Data

Start by identifying data that may have lower business value and less stringent service level agreement (SLA) requisites, such as 'Tier 3' data types, including stale, unstructured content residing in home directory or file shares, or static content such as backup or archive data.

By starting with the peripheral data types (Tier 3 as shown in Figure 4-1), organizations are able to free up both storage resources and staff to focus on the business-critical, core applications. This allows organizations to improve operational efficiency and utilization, reduce costs and gain experience and best practices, so they can move towards the core applications at their own pace.

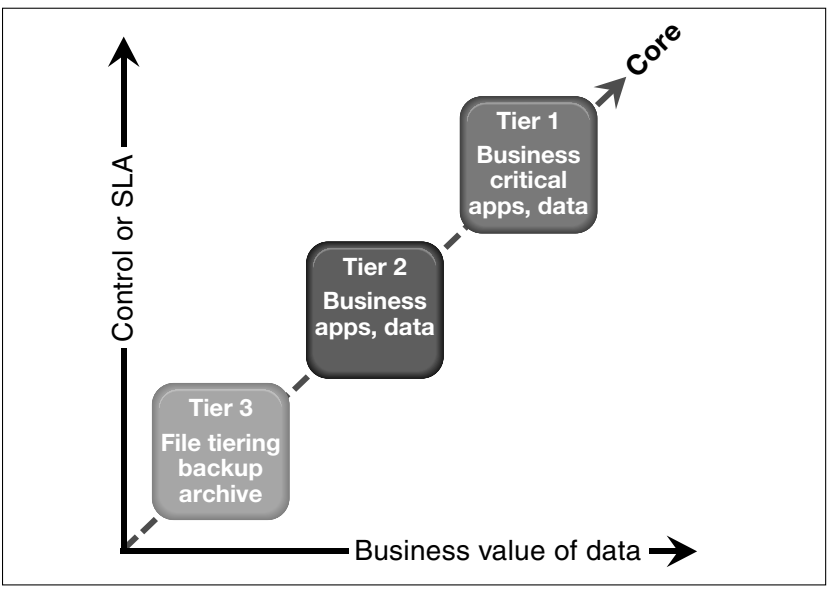

Figure 4-1: A practical approach to adopting cloud.

Here's a deeper look at a typical example. Peripheral data is often parked on primary network attached storage (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 cloud.

Often, the file environment grows out of control, leaving the IT team to straddle protection copies, deduplication, virtual tape libraries and tape backup to keep these copies online or at higher performance levels than are necessary.

By moving this inactive file data to cloud as secondary storage, an organization 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 a lot of care and feeding to maintain, without impact on existing business processes.

Organizations also can save on backup hardware and software licensing, since the amount of data being backed up is reduced. SLAs can still be driven to allow rapid, online access to older inactive content; meanwhile, the organization 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.

Simplifying for Greater Operational Efficiencies

Along the continuum of offloading data to cloud, considering services that can quickly elevate savings by freeing up resources and improving operational efficiencies is important.

Moving long-tail content, for example, out of the data center to a managed pay-per-use service in 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 premises, the day-to-day management is trimmed, as is money spent on CAPEX. 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.

Targeting 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 — basically becoming a cost center in itself.

The use case for backup-to-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.

Chapter 5

Ten (Okay, Seven) Ways Hitachi Can Help With Cloud

In This Chapter

- Adopting cloud with minimum disruption
- Taking a pragmatic approach to establishing a cloud enabling portfolio
- Looking at cloud platforms, services and storage-as-a-service solutions

In this book we give you an introduction to cloud storage — what it is, how it works and how it saves your organization time and money. In this chapter we give you the rundown on how Hitachi Data Systems provides your cloud solutions. (In this chapter, when we refer to Hitachi Data Systems, most of the time, we simply say Hitachi.)

Cloud Doesn't Have to be Disruptive!

For the enterprise organization considering private cloud and for providers seeking cloud-enabled infrastructure, Hitachi Data Systems facilitates highly scalable SLA-driven deployments that are reliable, cost efficient and complementary to existing data center infrastructure.

As the industry embraces the evolution to cloud, knowing that cloud doesn't have to be disruptive to the existing infrastructure or practices within the data center is important. Using cloud doesn't have to be another island to manage.

Vendors like Hitachi focus on providing a path to enable enterprises to adopt cloud at their own pace with no need to

rip and replace their existing infrastructure. Implementing cloud can complement their current environment and improve the return on their existing asset.

Looking At Cloud-Enabling Platforms

Hitachi takes an integrated approach to its cloud strategy and portfolio of offerings. Hitachi can offer cloud ready platforms and services to customers looking to manage their own cloud environment (see Figure 5-1). By leveraging the integrated set of cloud enabled platforms and technologies along with Hitachi-managed services and/or third party technologies, Hitachi has developed storage-as-a-service solutions for customers that want to procure storage resources on a consumption basis.

Hitachi also provides reliable and integrated infrastructure to companies such as telecommunication companies, independent software vendors (ISVs), service providers and system integrators — a foundation on which to build their hybrid and public cloud offerings.

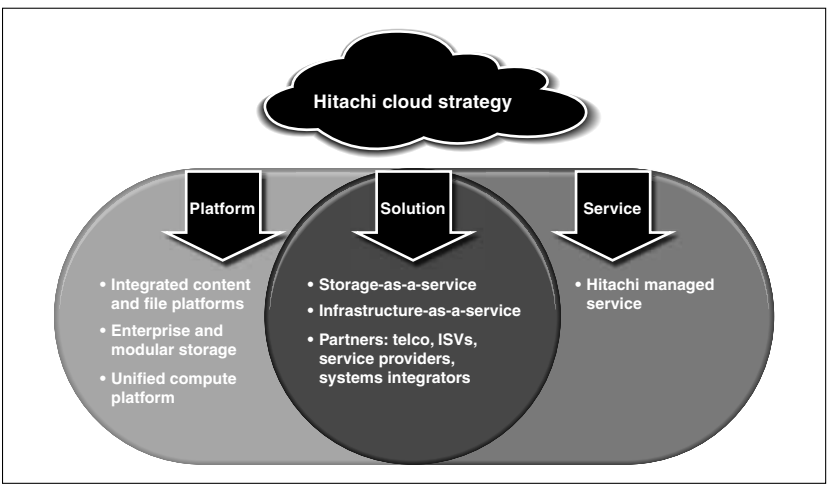

Figure 5-1: Hitachi Data Systems' integrated cloud strategy.

By leveraging the cloud-enabling capabilities of Hitachi platforms, organizations can apply the appropriate delivery mechanisms and deployment methodology on top to facilitate and optimize their cloud deployments. This approach helps customers strengthen their data center agility, reliability, availability, storage efficiency and performance.

Hitachi recognizes that there is no assembly-line approach to producing or deploying cloud, and believes that an integrated portfolio of technologies is required to sustain successful cloud operations.

To enable diverse uses within a cloud environment, Hitachi capitalizes on proven virtualized and integrated block, file and object technologies. Using a single, underlying infrastructure that is reliable, scalable, multi-tenant and multi-tiered, Hitachi technology provides 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.

Hitachi has an integrated portfolio and is a trusted infrastructure vendor, with virtualized, scalable and high-performance architecture built for the multi-petabyte environment.

Telstra: A success story

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 more than 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 the way to go.

The Telstra cloud layer is built upon infrastructure from Hitachi which was chosen for its multi-tenant storage management abilities and tools.

Through its agile cloud-enabled technologies, Hitachi can help organizations virtualize all existing storage resources into a single and agile infrastructure to reduce storage costs, mitigate risks and simplify management amid changing demands. This approach eliminates the need to manage separate silos of information and allows customers to apply common management tasks across all types of data (as shown in Figure 5-2).

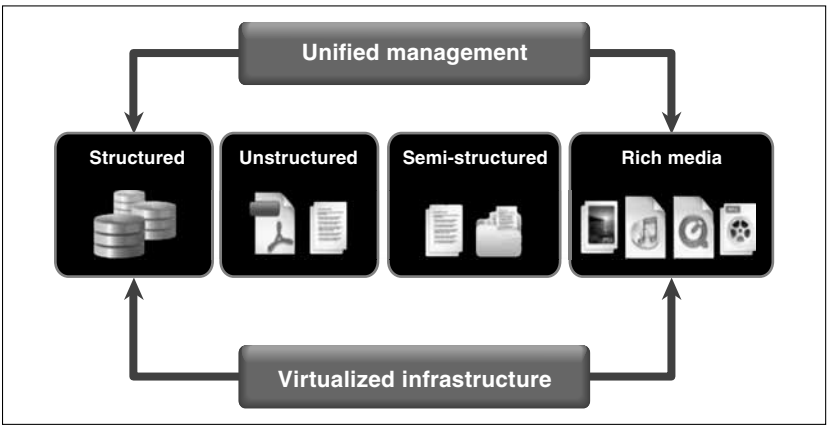

Figure 5-2: Common approach for managing all data types.

Beyond cloud-enabling architecture and services, Hitachi provides a sound strategy and guidance for its enterprise customers, and end-to-end cloud solutions that foster true value and ease of deployment, and which triumph over the typically stressed enterprise data center.

Building an Integrated Portfolio, Not Another Island

Hitachi's cloud technologies are built upon a core set of principles to best support enterprise and provider organizations with deployment solutions and services. Key features or functionality within Hitachi's products are built to be applicable to the dynamic data center and cloud (see Figure 5-3).

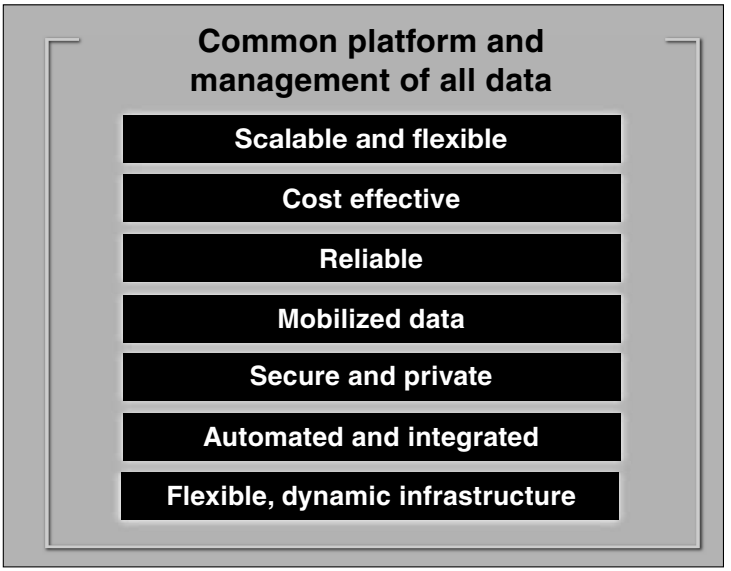

Figure 5-3: Hitachi's design philosophy.

Key features of Hitachi's cloud technologies include

- **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 cloud with zero learning curve or application disturbance.
- **Automation and integration:** Built-in software tools that ensure highly automated, reliable, repeatable and scalable processes to help diminish operating costs associated with manual steps and human interaction:
  - The integrated Hitachi file and content portfolio offers the ability to transparently move data across tiers, on filers or storage systems, at both file and object levels, from network attached storage (NAS) to archive devices, triggered by policies on both file content and metadata.
  - Federated search across silos can be conducted with a single query. The search results can also trigger migration among different tiers.

- **Security and privacy:** End-to-end security practices and authenticity can guarantee privacy and data protection for the entire data asset life cycle, including
  - **Multi-tenancy:** Logical partition to ensure segregation of administration
  - **Encryption:** Data at rest (while residing on internal drives) and in flight (during transfer) is encrypted; support of object-level encryption at the source; credential interlock between core cloud and edge customers
  - **Write Once Read Many**: Immutability for compliant retention is delivered with this technology
  - **Tenants and Namespaces:** Logical segregation of management and of data with customizable data management personalities and access rights, and security layers to prevent unauthorized access
- **Cloud Ready with representational state transfer (REST) Interface:** Industry-standard protocol embedded for direct and reliable connection to cloud
- **Reliability:** Bolster resiliency and data sentry with inherent protection functionalities, such as object-based replication and hardware-based redundant array of independent disks (RAID)
- **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

Paving the Way to Private Cloud with Unified Compute Platform

Data centers have undergone tremendous transformation over the last decade. The early wave of consolidation enabled enterprises to achieve cost saving and efficiency improvement. Today, most large organizations have leveraged virtualization technology to modernize their data centers.

Virtualization has been implemented at the server, storage or data network layers at many data centers. While virtualization enables automation within the technology domain — for

example, server or storage — gaps remain at the 'connection point' across these domains.

A foundational layer is the core cloud storage infrastructure. In a fully virtualized world, the common thread is the storage layer: 'Machines' are nothing more than large data files; the user- or application-generated content needs to be available flexibly across virtual domains; disaster resilience and recovery need to be managed universally. The core cloud storage platforms need to provide this basic underpinning.

The next step in the data center evolution is to achieve an end-to-end automation across the gaps of these domains. In other words, the next step is to provide a holistic and horizontal view from the perspectives of the business and the applications. Converged infrastructure is a first step towards bridging the gap from current emphasis on virtualization and consolidation to a more automated and dynamic data center in order to create a foundation for what comes next (see Figure 5-4).

The desire to achieve this holistic view has triggered a dynamic wave of activities toward the converged infrastructure.

The converged infrastructure treats server, storage and network infrastructure resources as pools, to be assigned as needed to business services.

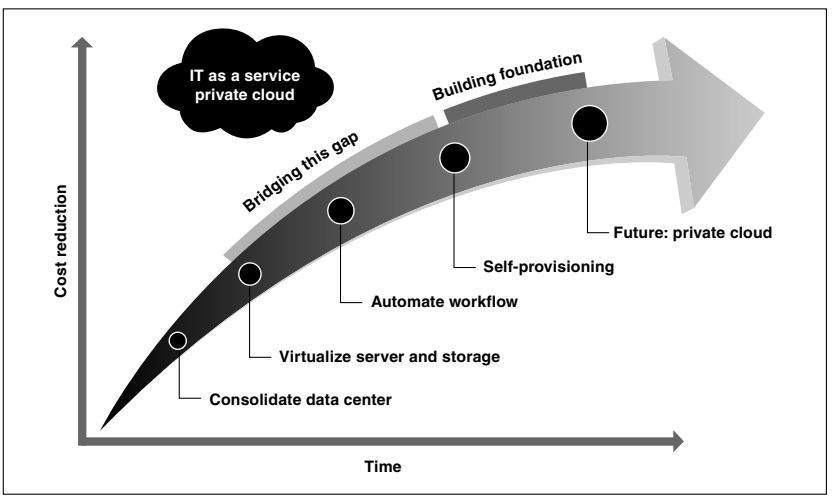

Figure 5-4: Path of IT evolution.

The goal is no longer to deploy each element (server, storage, network) individually, but to build the optimal platform in unified packages. Companies can then manage these packages based on service level agreements (SLAs).

Converged infrastructure serves as the foundation for private cloud. In essence, private cloud is defined by key attributes enabled by the converged infrastructure:

- Self-service provisioning
- End-to-end automation across the entire workflow
- Highly virtualized IT resources
- Billing and chargeback enabled

Hitachi will deliver an open, unified platform designed to achieve SLA-based workflow automation across the boundaries of server, storage and data network components, as shown in Figure 5-5.

The platform will centralize and orchestrate the management of servers, storage, networking and applications with end-to-end automation and SLA-based templates.

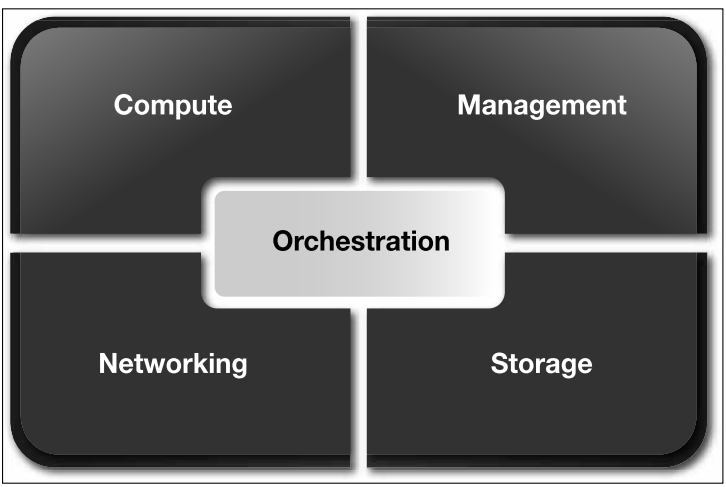

Figure 5-5: Hitachi's unified compute platform.

The platform's holistic and simplified management will significantly reduce time to market and operational costs. Improved agility and predictability will make possible dynamic and cost-effective data centers that can quickly respond to business needs.

The Hitachi Unified Compute Platform will differ from other solutions in several ways:

- The platform will be an open platform, not a vendor lock-in vehicle:
  - Multi-Hypervisor support that permits multiple hypervisors, including Microsoft Hyper-V and VMware ESX
  - Flexibility in supporting existing x86 server infrastructure
  - Virtualized third-party storage behind Hitachi Universal Storage Platform V family
  - Open APIs to enable third-party or cloud providers to leverage and build upon the infrastructure
  - Key benefits will include investment protection; leveraging existing infrastructure; no rip and replacement
- End-to-end orchestration software will coordinate the management of the server, storage and data network:
  - Business-aligned automation through SLA templates as opposed to loosely coupled management tools
  - Designed from day one to solve business-level issues, as opposed to packaging existing solutions with disjointed management tools
  - Key benefits are business alignment with an SLA-aware environment; lower management cost with automated process; lower risk with repeatable process
- Hitachi Unified Compute Platform will have tight integration down to the hardware level:
  - Integration with storage hardware will enable Hitachi Unified Compute Platform to leverage the unique features at the storage level — intelligent tiering, virtualization and broad replication capabilities.
  - Key benefits will include the built-in intelligence native to Hitachi storage that will be leveraged to make orchestration more efficient, and make the virtual machine (VM) deployment and replication faster.

Hitachi Managed Services for Cloud

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, Remote Management and utility-based services.

Hitachi now provides Utility-based Services to the enterprise or service provider deploying cloud, and helps derive greater value and optimized performance from existing assets for new use cases. Hitachi offers the following:

- **Residency Services:** Developed to facilitate a higher and quicker return on storage investments, Residency Services help organizations to fill critical gaps in staff skills or experience while improving asset utilization and performance, and achieving service level objectives. Hitachi Data Systems consultants are assigned to the task — storage area networks (SAN), mainframe, open systems, replication evaluation — and implement industry-standard processes, tools, training and best practices.
- **Remote Management Services:** Complementary to Residency Services, Remote Management Services comprise robust reporting, real-time monitoring, and 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: 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 introduce best practices that enable flexible service delivery to meet changing business requirements.
- **Managed Storage Utility:** Most cloud offerings provide flex-up options to accommodate changes in capacity or service needs. Hitachi 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 allow Hitachi to offer guidance as well as packaged or custom services to both the enterprise and the provider seeking revenue generation from cloud optimality.

Hitachi Storage-as-a-Service

Hitachi is helping customers deploy low-risk cloud at their own pace with two new cloud offerings.

The first, Hitachi Cloud Service for Private File Tiering, is a fully managed storage-as-a-service solution that will enable customers to tier inactive file data into an onsite private cloud environment and pay only for what they consume. The second, a joint solution with Digi-Data, will deliver an end-to-end cloud infrastructure, enabling telcos, service providers and systems integrators to leverage Hitachi flexible storage infrastructure and Digi-Data's applications and services, to create a differentiated cloud storage offering for their consumers and SMBs (small and medium businesses).

Private File Tiering

Private File Tiering is a fully managed, utility-based cloud service that moves legacy or lower-value unstructured data into a cloud storage environment located within the customer's data center.

The Private File Tiering cloud service enables customers to tier inactive file data into a fully managed private cloud environment and pay only for what they consume.

By leveraging the Hitachi Cloud Service for Private File Tiering, enterprise customers can reduce costs, simplify management and improve the efficiency and longevity of the primary NAS environments.

Hitachi offers an integrated, fully managed, consumption-based service located within an organization's firewall, ensuring existing security measures remain intact.

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

Because this service is remotely managed by Hitachi, customers can reduce management overheads while simultaneously ensuring that their storage environment is being optimized.

The Hitachi Cloud Service for Private File Tiering will help customers to:

- Reduce the amount of storage residing on the primary NAS by tiering to the cloud
- Improve backup performance by cutting the amount of storage that requires backup
- Eliminate capital expense through a utility-based, cost per gigabyte per month consumption model and by cutting out oversubscription of storage
- Reduce operating costs by moving inactive data to a management-free environment and cutting down on the amount of backup media, licensing and management overhead required

Online Storage-as-a-Service

In partnership with Digi-Data, Hitachi offers a public online cloud storage solution that provides a complete services menu for telecommunications companies, service providers and systems integrators looking to develop or expand their cloud service offerings. This joint solution enables providers to deliver differentiated cloud services to their consumers and SMBs.

Leveraging Hitachi flexible storage infrastructure and Digi-Data's applications and services, this solution gives providers access to multiple connectivity options into the cloud, and a reliable architecture for building and deploying an online cloud service.

With Digi-Data's comprehensive set of application programming interfaces (APIs), providers can integrate their own applications, business and processing systems, and end-user interfaces into the cloud infrastructure. Providers also get a comprehensive set of technologies and services that help to:

- Reduce costs by replacing costly legacy storage with a consumption-based, pay–as-you grow model
- Improve customer retention by becoming the center of their customer's digital universe, enabling them to store, organize, protect and share their important digital assets
- Increase return on investment and monthly revenues per user and build stronger relationships with consumers by delivering value-added services

Sify: A success story

Sify is one of India's leading managed services providers, delivering end-to-end solutions for enterprises as well as consumers. Sify designs and develops a host of customized e-commerce and network connectivity solutions to connect critical business systems and offers a seamless data network that encompasses customers, suppliers, vendors and staff.

To leverage the growing opportunities in cloud storage, Sify wanted to develop an on-demand and highly scalable platform for storage to cater to its enterprise customers. Sify chose to build on Hitachi storage and software because the basic architecture of the solution enables scaling up as and when required without huge changes to the existing setup or investments.

Sify's on-demand storage service combines award-winning Hitachi Adaptable Modular Storage 2500 and Hitachi NAS Platform 3080, powered by BlueArc. Together, they create consolidated, easy-to-manage pools of storage capacities that can be provisioned as needed to support a wide range of applications and data types.

According to P J Nath, executive president, enterprise services, Sify 'wanted the on-demand storage platform to be future ready for technologies like storage virtualization and thin provisioning, as these would become a key game changer for the business as our customers grow.'

The integrated portfolio of Hitachi cloud technologies, solutions and services simplifies and accelerates the adoption of private, hybrid and public cloud environments.

Partnering with Hitachi Data Systems

The Hitachi 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 customers to choose the best possible product mix and delivery methods for addressing their particular cloud needs, through an offering of highly integrated products for cloud. Hitachi 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 multi-tiered 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, please contact Hitachi or visit `www.hds.com/cloud`.

Understand cloud computing and save your organization time and money!

Cloud computing is taking IT by storm, but what is it and what are the benefits to your organization?

Hitachi Data Systems' *Cloud Storage For Dummies* provides all the answers. With this book, you discover a clear explanation of cloud storage, and tips for how to choose the right type of cloud storage for your organization's needs. You also find out how cloud storage can free up valuable IT resources, saving time and money.

Cloud Storage For Dummies presents useful information on setting up a secure cloud storage environment. It also details how you can ensure a smooth transition of your IT system to cloud storage, with minimum disruption.

Discover how to:

- *Select the most suitable cloud storage solution for your organization*
- *Assess the benefits and savings of a cloud storage model*
- *Plan for the implementation of cloud storage*
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