



White Paper

Build a Private Cloud That Evolves to a Hybrid Cloud in a Single Platform

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Abstract

Cloud computing is increasingly being adopted as a way for IT organizations to decrease costs, improve efficiency, and enhance business agility. NetApp has been helping companies succeed in cloud deployment to achieve tangible results since long before the term *cloud* entered the popular lexicon. NetApp has the people, technologies, and partnerships in place to help organizations evolve existing IT infrastructure into an efficient cloud-based service delivery model. The NetApp® Unified Storage Architecture and clustered Data ONTAP® operating system integrate all storage capabilities into a single, easy-to-use platform. By choosing NetApp when making the transition to a private cloud or a hybrid cloud, organizations will be able to meet their storage business needs now and in the future.

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1 Introduction

The traditional approach to designing IT infrastructures is rapidly evolving. Although the application-based silo (in which compute and storage infrastructure is dedicated for the exclusive use of a single application) remains the standard for some IT shops, many organizations have deployed zones of virtualization to improve utilization and efficiency.

The next evolutionary step beyond virtualization is cloud computing and the delivery of IT as a service (ITaaS). A recent ESG survey of IT decision makers revealed that approximately half of the respondent organizations already have a private cloud infrastructure in place, and an additional 20% plan to deploy one in the future.*

Cloud computing is achieved through a shared, virtualized infrastructure; automated provisioning for faster resource allocation; and automated operations for more efficient management. The returns promise reduced overall total cost of ownership, improved efficiencies, and increased business agility. In this paper, the term *cloud* is used to refer to this type of efficient, automated IT infrastructure, with a further distinction between:

- **Private clouds.** Hosted inside an organization's firewall primarily for use by the organization's own employees
- **Public clouds.** Infrastructure or applications hosted by service providers and offered as services to enterprises that have decided to outsource some applications for financial, architectural, management, or other business reasons
- **Hybrid clouds.** Private clouds linked to public clouds

If your organization is considering a private cloud deployment, virtualization is a natural and necessary step. Subsequent steps might include mechanisms to implement showback or chargeback and self-service provisioning. If you plan carefully and make the right technology choices at the start of your transition, you can build your private cloud by evolving what you have rather than ripping out and replacing infrastructure as you go.

NetApp, with its innovative storage and data management solutions, has been helping companies evolve to a private cloud infrastructure since before the term became popularized. This white paper discusses the business drivers that are leading companies to a private cloud, important steps you should consider when following the path to cloud deployment, and the benefits of NetApp unified storage and clustered Data ONTAP for the private cloud.

**Trends in Private Cloud Infrastructure, Enterprise Strategy Group, April 2014.*

2 Private Cloud Business Drivers

IT budgets in most organizations remain stubbornly flat, but demands on IT continue to rise year over year. The main forces driving organizations to implement private clouds are requirements to increase business agility, reduce costs, and improve efficiencies:

- **Business agility** results from an improved ability to elastically scale infrastructure up or down to meet dynamically changing and new business needs. Slashing the time to provision a system and activate a new application from weeks to days, hours, or even minutes can accelerate application development and test—improving quality and time to market—and can also have a dramatic effect on your business's ability to innovate.
- **Costs** can be reduced by leveraging a virtualized, shared IT infrastructure. This not only reduces hardware acquisition costs, but also results in significant savings in IT staffing costs and data center space, power, and cooling.
- **Efficiency** improvements result from standardization, better resource allocation and utilization, simplified and automated provisioning processes, and overall operational efficiency improvements in the automation of all aspects of IT management.

To understand how a private cloud can lead to improvements in these three areas, consider a typical purchasing organization. It is not unusual to have a surge in workload at the end of each quarter. Unless the department has enough compute power to handle this surge, throughput suffers, and orders do not get processed on a timely basis.

With a private cloud, the purchasing department can request and receive extra resources as needed and be charged accordingly. Because resources are shared among all departments, this is accomplished without the need to have a lot of extra computing capacity sitting idle most of the quarter, so it is more cost effective.

Efficiency improves because the purchasing department simply requests the necessary resources without red tape or excessive IT intervention. Purchasing can respond to increasing or changing business needs either by scaling infrastructure for existing applications or by provisioning infrastructure for new ones, and that significantly improves business agility. Naturally, the same benefits apply to other departments or business units that utilize the same shared IT infrastructure.

3 Evolving to a Private Cloud

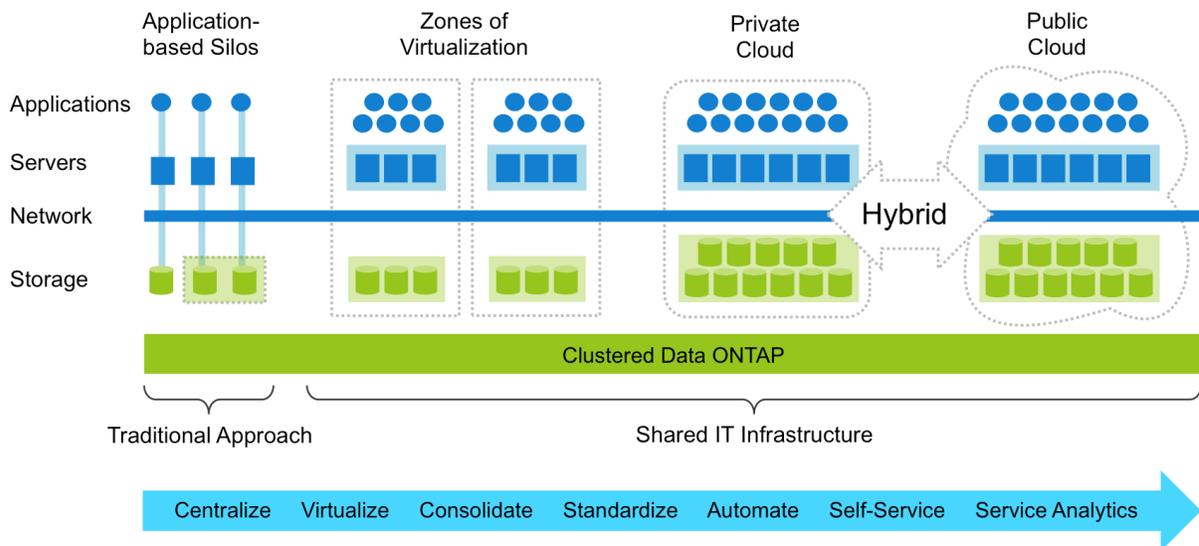
When planning to evolve your IT infrastructure to a cloud computing model, there are two fundamental questions that you want to be able to answer:

- **What is my destination?** As a starting point, you need to evaluate your applications to determine the right infrastructure for each, based on business requirements.
- **How do I get there?** After you know where you want to be, making a smooth transition that addresses both business and technology requirements is essential.

3.1 What Is My Destination?

NetApp defines the following IT infrastructure models, as illustrated in Figure 1, that enterprises leverage for various applications.

Figure 1) Evolving models of IT infrastructure.



Application-Based Silos

Application-based silos are still the standard in many IT shops. These traditional environments were built and optimized to run specific applications. This approach typically delivers poor server and storage utilization (on average, 10–15% utilization for servers and 30–40% for storage). One of the challenges in deploying applications in a silo topology is the inability to share resources to better leverage the investment in servers, networks, and storage.

As an example, an application such as Microsoft® SharePoint® can consume server and storage resources rapidly and quickly need extra capacity in order to keep scaling. Within the same environment, a Microsoft Exchange application might have extra server and storage capacity and support only a small population of users, yet that extra capacity cannot be redeployed efficiently to address the SharePoint requirements because they are not managed in a shared environment.

However, some applications are appropriate for this type of environment, and there might be a variety of reasons for maintaining them in dedicated infrastructures, such as security requirements that warrant complete isolation.

Zones of Virtualization

Many organizations have virtualized some servers and storage, creating zones of virtualization. Virtualization can significantly improve utilization and efficiency. After you have virtualized your environment, you have the foundation of a shared IT infrastructure of pooled compute, network, and storage resources to deliver capacity on demand and meet fluctuations in resource requirements.

Private Clouds

With a private cloud, IT infrastructure remains internal, but applications are decoupled from servers and can be moved without disruption to address usage and performance needs. Services are offered to internal customers from a service catalog with metering and showback or chargeback capabilities on a shared IT infrastructure. A high degree of automation makes these processes simpler to manage.

Public Clouds

In the public cloud model, IT infrastructure or complete applications are hosted by external service providers. Public clouds might be ideal for routine processes or applications as well as for organizations that do not have the in-house expertise to manage their own environment. Applications such as those for e-mail and payroll have been moved to public clouds for several years.

Examining all your applications to understand how they are currently deployed and whether to move them to a private cloud is a valuable exercise. You might decide to keep business-critical applications in dedicated, application-based silos. Many of these applications will be candidates for virtualization and the cloud, but it might be too expensive or disruptive to move some applications in the near term.

NetApp believes that enterprises will have a mixed data center model—in which organizations maintain some applications in dedicated infrastructures; embrace virtualization for the majority of applications; and evolve over time toward a private, public, or hybrid cloud—and that this will be the typical pattern for many established IT organizations.

3.2 How Do I Get There from Here?

Most enterprises that have already moved to private cloud computing did so by evolving their traditional IT infrastructures over time.

The path that your company will take depends on from where you are starting as well as your specific requirements and objectives. NetApp has worked with enterprises that typically follow the following steps, not necessarily in this order. In general, an enterprise will centralize IT; consolidate, virtualize, and standardize its IT environment; and then evolve to deliver IT as a service with advanced automation and self-service capabilities:

- Centralize management
- Consolidate and virtualize
- Standardize
- Automate
- Enable self-service
- Analyze and optimize

Centralize Management

Centralizing IT management is necessary to gain visibility of costs, take control of your IT offerings, and achieve the economies of scale you will need to begin the transition toward a service-oriented private cloud. You cannot make any meaningful progress until you have a complete picture of what resources you already have and reach a general consensus regarding the strategy and direction of IT within the company. For example, many IT organizations can relate to the need to reduce costs while managing year-over-year storage growth. Through multiple acquisitions and/or organic growth, some companies end up with multiple IT departments, each with its own staff and infrastructure, resulting in a great deal of redundancy and wasted resources. Through a detailed analysis of previous storage usage and expenditures and a projection of future storage usage and expenditures, this information can identify overlaps and opportunities for improvement and justify the need to centralize management of IT to the organization.

Consolidate and Virtualize

Early adopters of the private cloud have found that virtualizing and consolidating servers and storage are necessary prerequisites to cloud implementation. Virtualization and consolidation by themselves provide a number of significant benefits:

- **Increase asset utilization**, reducing the amount of IT infrastructure needed to accommodate your existing workloads.
- **Simplify management** by reducing the number of devices you have to manage and allowing yourself to manage many virtual machines from a single console. Virtualization also facilitates the movement of both applications and data, making such tasks easier to perform.
- **Enhance availability** by providing simplified means for implementing high availability and disaster recovery for many applications with more rapid restart in the event of failed services.

Desktop virtualization is emerging as another area of opportunity for faster and more efficient provisioning through private cloud-based services, with the potential for reducing costs of hardware and management and reducing management complexity.

Standardize

Standardizing procedures and creating repeatable processes are key to improving quality and provisioning times and reducing support costs and risk in a cloud computing environment. Creating a service catalog of storage services attached to service-level agreements that satisfy the majority of infrastructure requests from your internal customers introduces consistency and streamlines the IT request and delivery process. Standardizing takes the headaches out of provisioning, transforming it from a long, drawn-out process to a simple and repeatable one.

Automate

Automation is a vital component of the cloud infrastructure in that it sets the stage for self-service. Policy-based automation can be used to map end-user requirements to specific levels of service. After policies are established, new resource subscribers (representing a new application, business unit, and so on) can request and receive storage, server, or network resources through a self-service interface. In addition, consumers get the appropriate level of data protection and other services automatically. Organizations that are able to automate and integrate multiple disparate technologies and processes can achieve even greater levels of productivity, operational efficiency, and opex and capex savings.

Enable Self-Service

One of the forces driving organizations to move from virtualized infrastructures to a private cloud is the enhanced efficiency that comes from a fully automated, service-oriented environment: one that translates pooled resources into services that can be requested easily and delivered rapidly. Self-service is a key cloud computing element that leverages automation and orchestrated cloud management solutions to take virtualized environments to higher levels of productivity and business agility. It streamlines the relationship between the subscribers (consumers) and providers of IT resources and services. For example, users such as application or virtualization infrastructure administrators can be empowered to request and receive computing and storage resources for a variety of applications on demand, with appropriate quality of service from a secure, virtualized, or cloud resource pool.

An automated self-service environment enables greater time savings and cost effectiveness than virtualization alone by using policies to cut through tedious manual provisioning processes, getting resources to users more quickly, and enabling IT personnel to focus on higher level objectives. For example, storage provisioning and data protection processes that might normally take weeks could be reduced to minutes. Think about the tremendous operational benefits that result when this scenario is extended across tens or hundreds of application environments in a large enterprise data center. Self-service is usually implemented after consolidation, virtualization, and automation, and it often represents the most advanced stage of the enterprise's path toward a private cloud.

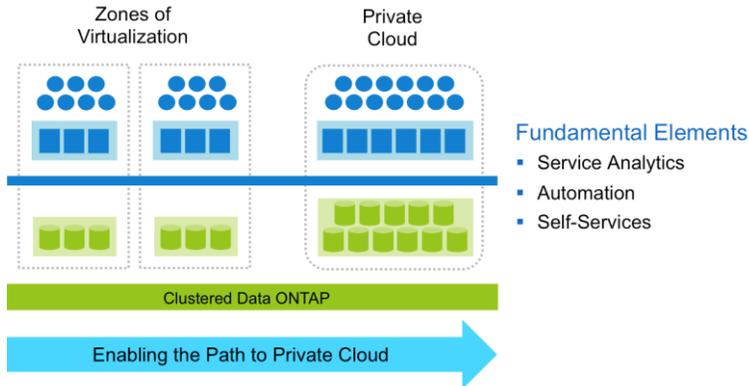
Analyze and Optimize

Silo-centric monitoring is no longer sufficient nor capable of providing the level of service assurance that critical business applications require, particularly in a shared environment. Suddenly, the visibility and insight that can be gained from in-depth, near-real-time analytics become absolutely critical to effectively manage complex infrastructures, maintain service levels at expected rates or commitments, and provide business continuity. In addition, to encourage users to adopt a shared IT infrastructure model, IT organizations need to provide more visibility and be more transparent in how resources are used to deliver services.

4 NetApp for the Private Cloud

NetApp private cloud solutions are built on a virtualized, shared IT infrastructure with advanced automation capabilities. The NetApp approach to private cloud deployment combines the right people and processes with innovative technologies from NetApp and our partners to transform your IT infrastructure into a services delivery model.

Figure 2) Virtualization is the foundation for the private cloud.



4.1 The Right Approach: Fundamental Elements

NetApp has helped many industry-leading enterprises evolve to a service delivery model using our storage solutions as the foundation for their private clouds. Based on our experience, we've identified four fundamental elements that enterprises should incorporate as they evolve to a private cloud. These fundamental elements do not necessarily need to be implemented in this order and can be deployed together or separately depending on requirements.

- **Universal data platform.** A single storage and data management platform that enables unrestricted, secure movement of data across public and private clouds, allowing you to move to hybrid cloud architectures.
- **Service analytics.** Optimize your services with centralized monitoring, metering, and chargeback to enhance visibility and both cost and SLA management.
- **Automation.** Automate and deploy storage services rapidly (physical, virtual, and cloud). Integrate with orchestrators and service catalogs for automated end-to-end service delivery.
- **Self-service.** Empower IT and your end users by enabling services requests to be fulfilled through a self-service portal.

4.2 The Right Technology

NetApp private cloud solutions are based on our industry-leading storage and data management technology. Our single hardware and software platform handles any workload, providing a future-ready design for evolving to a private cloud.

Universal Data Platform

The NetApp clustered Data ONTAP storage operating system provides unrestricted, secure data movement across multiple cloud environments, offering advanced performance, availability, and efficiency. Data ONTAP clustering capabilities can keep your private cloud running nonstop. More organizations use Data ONTAP than any other storage operating system. In a single, feature-rich platform, clustered Data ONTAP lets you scale your infrastructure without increasing IT staff.

- **Unified architecture.** Unlike competing storage systems, every NetApp storage system that is based on Data ONTAP provides truly unified storage. Most widely used storage protocols—including SAN protocols such as iSCSI, Fibre Channel, and Fibre Channel over Ethernet, as well as NAS protocols such as NFS and SMB/CIFS—can be served from the same storage system. No matter which storage protocols you choose, all your data volumes are managed using the same set of tools for integrated data protection, enhanced storage efficiency, and other storage functions. Other vendors have separate, and often incompatible, tools for each storage protocol. With NetApp, one system, one platform, and one investment in training can address all your storage needs and grow with your business as you progress from application silos to virtualization to cloud computing.
- **FlexArray storage virtualization.** To protect your existing storage hardware investments as you evolve to a private cloud computing model, NetApp FlexArray can be used as a front end for all major storage arrays. Building on 10 years of storage virtualization experience with V-Series, NetApp FlexArray virtualization software lets FAS8000 systems provide full storage virtualization of EMC, HP, Hitachi, and NetApp E-Series arrays. With FlexArray, you can take advantage of storage efficiency technologies for cloud computing, such as Snapshot™, thin provisioning, FlexClone®, deduplication, compression, and more.
- **Secure multi-tenancy.** Secure multi-tenancy is required to cost-effectively and securely partition a single system to support multiple tenants, such as applications, business units, workgroups, and security zones. A storage cluster can be subdivided into secure partitions governed by rights and permissions. These storage virtual machines (SVMs) can be used to securely isolate individual tenants—for instance, in a service provider environment—or individual applications, workgroups, business units, and so on. Because SVMs are not tied to particular physical resources, you can move an SVM or adjust the resources available to it without disruption.
- **Nondisruptive operations.** The requirement to keep your IT environment running 24x7 in a cloud environment necessitates the ability to move users, applications, and data dynamically and transparently across your infrastructure while routine lifecycle management activities occur. Our nondisruptive capabilities allow you to perform critical tasks without interrupting your business. The ability to dynamically assign, promote, and retire storage resources lets you improve service levels over the lifecycle of an application. Storage controllers and disk shelves can be replaced without disruption. When data movement is required to achieve management objectives, you can nondisruptively move data between controllers and storage media—for instance, as an application transitions from development to production or to adjust service levels. Because you can mix generations of hardware, you can add new storage systems and retire older ones without affecting operations. All storage maintenance operations and software upgrades can be performed without interrupting your business.
- **Storage efficiency.** Maximizing your storage efficiency can significantly decrease your operational costs. It also can increase your business agility by quickly aligning computing resources with rapidly changing business and workload requirements that are inherent in a shared IT infrastructure. Clustered Data ONTAP drives pervasive cost reductions with the most comprehensive storage efficiency offering in the industry, including innovative Snapshot copies, replication and cloning technologies, thin provisioning, compression, and deduplication. NetApp is the only storage provider to deliver proven efficiencies for both SAN and NAS on entry-level, midtier, enterprise, software-based, converged infrastructure, and virtualized third-party arrays.
- **Integrated data protection.** Protecting a shared IT infrastructure from outages and data loss is imperative in a private cloud computing model. NetApp provides flexible and efficient integrated data protection capabilities with near-instant backup and recovery, replication for disaster recovery, and best-in-class integration with enterprise backup vendors and leading applications. This allows you to leverage NetApp storage efficiency to maximize cost savings and simplify administration of data protection activities. NetApp integrated data protection provides you with the flexibility to offer a range of SLAs to meet varying requirements within your organization.
- **Ability to scale up and out.** In a cloud environment, your storage infrastructure must be able to scale on the fly as your business grows, your data increases, and your business needs change. NetApp storage provides the industry's only truly unified scale-up and scale-out architecture. Scale up individual storage controllers by adding high-capacity hard disk drives (HDDs), high-performance

hard disk drives, or low-latency SSDs. Or scale out by adding additional storage controllers to a cluster. Most scale-out storage solutions provide a single large repository. Clustered Data ONTAP takes a different approach that gives you more flexibility and greater control. NetApp Infinite Volumes let you create large, flexible, and easy-to-manage content repositories within a cluster, but you also have the ability to isolate workloads and offer different levels of service using different controller technologies, storage tiers, and QoS policies. In addition, you can span multiple controllers for nearly limitless scalability.

- **Intelligent caching.** The intelligent use of caching can dramatically improve storage performance for a wide variety of applications. From the beginning, NetApp has pioneered innovative approaches to both read and write caching that allow you to do more with less hardware and at less cost. Storage systems that utilize sophisticated intelligent caching can give you faster performance at a lower cost. Because intelligent caching technologies immediately adapt to changes in workload, they can eliminate much of the time-consuming and complicated manual load balancing and performance tuning required with traditional storage approaches. As a result, intelligent caching can help reduce both capital and operating expenses.

Service Automation

One of the keys to achieving the benefits of a private cloud is automating and simplifying management.

NetApp OnCommand® Workflow Automation can play a vital role, enabling integration between storage and orchestration layers for cloud service delivery. It is a flexible framework that lets you build an automated solution based on your existing processes and integrate with your existing infrastructure. OnCommand Workflow Automation includes over 50 standard workflows out of the box, so you can start standardizing and automating existing processes quickly. You can also create custom workflows using building blocks and adapt these workflows over time, so as business needs change, you can easily update them to meet new requirements. For example, if you are deploying a private or a hybrid cloud, those same storage provisioning workflows can be executed in those new environments.

Although the NetApp Unified Storage Architecture represents an ideal platform for standardizing storage *infrastructure*, OnCommand Workflow Automation lets you standardize the *utilization* of the storage infrastructure for improved performance, availability, and compliance with company- or industry-wide requirements such as ITIL. To optimize service efficiency in a cloud environment, you need to make sure that the storage operations are as stable and predictable as possible when resources are added or replaced by standardizing the services deployed and automating as many processes as possible.

Leading server and desktop virtualization vendors, such as Citrix, Deskton, Fluid Ops, Microsoft, VMware, and others, have also recognized the benefits of integrating NetApp storage into their toolsets so that you can easily tap into advanced storage features. These partners use OnCommand Workflow Automation or the NetApp Management SDK to integrate and deliver storage monitoring, alerting, provisioning, and data protection functions through a single console. NetApp has also created a select set of integrated management tools or plug-ins for rapid backup and recovery, space-efficient VM cloning, and more, all of which integrate with VMware® vCenter™. Similar capabilities are available for Microsoft Hyper-V® and Citrix XenServer and XenDesktop environments.

Service Analytics

As IT organizations migrate applications from silos to virtualized, shared IT infrastructures to private clouds, IT managers measure success by the efficiency of the infrastructure in providing end users with flexible and cost-effective services and service levels. NetApp's objective in offering service analytics is to help you manage the complexity of this transition and provide the tools to efficiently manage private cloud services. This is accomplished with NetApp OnCommand Insight storage resource management software, part of the NetApp OnCommand suite of products, which provides:

- Transparency, visibility, and management of the cloud infrastructure
- Information that makes sure service levels are being met

- Planning for capacity management and forecasting capabilities
- Service analytics to measure and balance performance for higher service efficiencies

4.3 The Right People and Processes

Making the transition to a private or hybrid cloud requires more than technology; it requires a paradigm shift in IT that includes significant changes to IT processes and the roles and responsibilities of IT staff. NetApp understands this and can help you make the transition with as little risk and disruption to your ongoing operations as possible. NetApp Professional Services and our Authorized Professional Service Partners can help you with requirements definition to solution architecture planning to installation, testing, setup, deployment, and—after the solution is deployed—knowledge transfer. In addition, NetApp offers a Fast-Start Workshop that can help you take the first steps to evolve your IT infrastructure to a private cloud. The workshop delivers an end-to-end evaluation of your data center environment from an organizational, technological, capacity, and operational viewpoint. In this workshop, we:

- **Identify** application and infrastructure targets for the cloud based on capacity, performance, and service-level needs
- **Assess** impacts in terms of cost savings, efficiency gains, and performance improvements
- **Identify** process improvements in terms of impact on cost and efficiency, agility and timeliness, and progress toward an IT-as-a-service delivery model

The result is a summary of the top areas for near-term improvement, a project road map, and actionable next steps for solution implementation.

4.4 Partnerships for Your Success

NetApp has cultivated a vendor-neutral approach and a global ecosystem of best-in-class partners to help you on your path to a private cloud. We partner in a number of different areas and specialties:

- **Cloud infrastructure partners and solutions.** We partner to create cloud solutions built on NetApp and integrated with the technologies of industry leaders such as Cisco, Citrix, Microsoft, and VMware. For example, NetApp joined with Cisco and VMware to develop and validate a reference architecture for secure multi-tenancy in a private cloud environment.
- **Cloud management partners.** NetApp works closely with our cloud management partners to enable integration with our management software. Through this approach, you can select from multiple management solutions to solve your business requirements for service automation and orchestration to manage service delivery throughout the infrastructure in a private cloud deployment.
- **Cloud system integrators.** We have established relationships with global and regional delivery partners who understand NetApp technology and how to successfully integrate NetApp into multivendor private cloud solutions. Our partners work with us to deliver an integrated private cloud solution that is tailored to your unique requirements.
- **Cloud services built on NetApp.** To meet the needs for external cloud services, NetApp has developed a global network of cloud service provider partners. These partners offer a portfolio of enterprise-class cloud services built on NetApp. We can help you engage with our service provider partners to integrate external cloud services into your overall cloud strategy.

5 Practical Applications of the Private Cloud

5.1 Industry: Software as a Service

Overview

LogMeIn is a public company that provides software as a service–based remote connectivity, collaboration, and support solutions to businesses and consumers. The company’s cloud services free millions of people to work from anywhere, empower IT professionals to securely embrace the modern cloud-centric workplace, give companies new ways to reach and support today’s connected customer, and help businesses bring the next generation of connected products to market.

Challenge

LogMeIn needed a reliable and fast storage solution to serve the internal IT needs of a growing company.

Solution

The company deployed NetApp FAS storage for more than 20 virtual machines and a physical server cluster running under VMware.

Benefits

- Set to meet an annual data growth rate of 20%
- Achieved performance needs easily
- Reduced administration with tight integration of NetApp and VMware products
- Enjoyed up to 51% of freed storage capacity with deduplication

5.2 Industry: Healthcare

Overview

Xerox has transformed from its early days as the premier manufacturer of photocopiers and printers into one of the largest business services and outsourcing providers in the world. Today, Xerox offers solutions to virtually every member of the healthcare ecosystem, including providers, payers, employers, and government agencies. Xerox serves nearly 2,000 different hospitals or hospital systems and processes more than 900 million claims annually, contributing more than \$2 billion in revenue annually.

Challenge

Xerox wanted to offer its customers high availability and rapid turnaround times while complying with regulations in a rapidly changing marketplace.

Solution

The company deployed NetApp storage and encryption solutions as the foundation of a private cloud based on VMware, including NetApp Flash Cache™ to accelerate performance.

Benefits

- Met increasingly stringent customer SLAs
- Encrypted data to comply with healthcare regulations
- Boosted performance with intelligent caching
- Reduced storage costs by 85% and storage footprint by 50%

6 Conclusion

The maturity of virtualization technology is accelerating the adoption of cloud computing. Private cloud computing is gaining traction as more and more organizations look for ways to achieve higher levels of cost reductions, improved efficiency, and increased business agility for their virtualized environment. The move to a private cloud requires careful planning and execution, taking a holistic view of your IT environment, and balancing business needs and costs.

Leading companies are already delivering cloud services built on NetApp. We can help you get on the path to evolve your IT infrastructure to deliver IT as a service. Taking that next step involves building your virtualized environment into a fully automated, service-oriented infrastructure of pooled resources—server, storage, and network—that enables you to easily and efficiently deliver IT services to your internal users.

For more information about NetApp solutions and services for private or hybrid clouds, visit netapp.com/cloud. If you're ready to get started, contact your NetApp representative or consider engaging with NetApp Professional Services to attend a NetApp Fast-Start Workshop.

References

NetApp Fast-Start Workshop Sign-Up

www.netapp.com/us/forms/sales-fsw-contact.html

Clustered Data ONTAP

<http://www.netapp.com/us/system/pdf-reader.aspx?cc=us&m=ds-3475.pdf&pdfUri=tcm:10-110501>

OnCommand storage and data management software (including Workflow Automation and Insight)

www.netapp.com/oncommand

Professional Services for Cloud Enablement

www.netapp.com/us/services-support/professional/cloud-services.aspx

Cloud Services Built on NetApp

<http://solutionconnection.netapp.com/partner-listing-cloud-service.aspx>

NetApp Cloud Management Partners

www.netapp.com/us/partners/alliance-technology/infrastructure/cloud-management.html

Refer to the [Interoperability Matrix Tool \(IMT\)](#) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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