



White Paper

Enabling the Path to Private Cloud: Self-Service

Kristina Brand, NetApp
August 2014 | WP-7139

Abstract

Self-service is an advanced element of private cloud environments that improves management efficiency and business agility, as well as lowering operating expenses. A self-service environment streamlines the interaction between users and the IT department. It empowers internal consumers of IT services to request and receive appropriately configured resources on demand with minimal IT intervention. NetApp® OnCommand® Workflow Automation, the NetApp Management SDK with open APIs, and key ecosystem partnerships enable enterprises to easily integrate their orchestration solutions and custom management tools with the NetApp storage service catalog for automated storage provisioning and protection. Customers can thereby create a self-service, web-based portal that efficiently delivers IT as a service to virtualization administrators, application administrators, and users, while enabling IT staff to focus on higher value activities.

TABLE OF CONTENTS

1 Private Cloud White Paper Series	3
2 Why Self-Service Is an Essential Element of Private Cloud	4
3 Self-Service Requirements	5
3.1 On-Demand Service Delivery for Productivity and SLA Management	5
3.2 Automation	5
4 The Role of Orchestration in Delivering Self-Service	6
4.1 Centralized, Coordinated Management of Cloud Resources	6
4.2 Integrating Storage Services with Cloud Management Frameworks	7
5 NetApp Approach to Enabling Self-Service	8
5.1 NetApp Integration with Orchestration and ITSM Partners	9
5.2 Developing a Self-Service Model	10
5.3 Example of Integrated, Automated Self-Service	11
5.4 NetApp Integration with Virtualization Solutions	12
6 Examples of Self-Service in Practice	13
6.1 Example 1: Telecommunications Service Provider	13
6.2 Example 2: Service Provider for Supply Chain Management	13
7 Conclusion	15

LIST OF TABLES

Table 1) NetApp private cloud white papers	3
--	---

LIST OF FIGURES

Figure 1) Self-service is an advanced stage of private cloud deployment	4
Figure 2) Orchestrating storage, compute, and network resources for self-service	6
Figure 3) NetApp cloud management ecosystem partners	8
Figure 4) Integrating automated NetApp storage services with data center orchestration	9
Figure 5) Self-service portal through OnCommand Workflow Automation	10
Figure 6) Use VMware vCloud Automation Center to manage NetApp storage using a self-service portal	12

1 Private Cloud White Paper Series

Enterprise IT departments are under extreme pressure to reduce capital and operating expenses, driving them to virtualize infrastructures to improve hardware utilization and scalability and move toward the enhanced operational efficiency and flexibility of cloud computing. The cloud landscape includes private, public, and hybrid clouds. A private cloud is a shared virtualized infrastructure that remains within the control of the enterprise's IT organization behind a firewall. IT departments in a private cloud essentially take on the role of brokers of services in delivering applications, storage, and server resources to internal customers as services. A hybrid cloud is when a company uses a combination of private and public clouds.

Many organizations have virtualized portions of their infrastructures but are not sure how to navigate the next steps toward a fully automated, service-driven model that enables them to further reduce costs, improve efficiency, and deliver IT as a service. The transition to cloud computing is a multiyear and multiphase effort, and most enterprises are still in the early stages of data center transformation. This transformation involves a fundamental shift in focus from the infrastructure optimization provided by virtualization to the service optimization necessary for the cloud.

NetApp has helped many industry-leading firms deliver data and applications as an on-demand service delivery model built on clustered Data ONTAP®. This model can evolve from a private cloud to a hybrid cloud on a single platform. Based on NetApp's experience with countless IT environments, we have identified some fundamental elements that organizations of all types and sizes should include as they move to a private cloud. These elements are captured and explained in the NetApp private cloud white paper series shown in Table 1. These white papers explain how NetApp helps enterprises transition from a shared virtualized infrastructure to a private cloud. Each paper describes the design, deployment, and benefits of one of the key elements as it relates to a service-oriented infrastructure.

An important point: these papers are not focused on NetApp hardware. Instead, they explore the NetApp management software that enables policy-driven service efficiency as well as many advanced storage efficiency capabilities. They also describe how NetApp APIs integrate with third-party or customized orchestration solutions at each step, enabling organizations not only to deliver comprehensive storage management, but also to select other cloud resources tailored to their needs as part of their automated, end-to-end service fulfillment capabilities.

The NetApp private cloud white papers do not necessarily have to be read in sequence. In addition, some elements described in the documents overlap and can be deployed together.

Table 1) NetApp private cloud white papers.

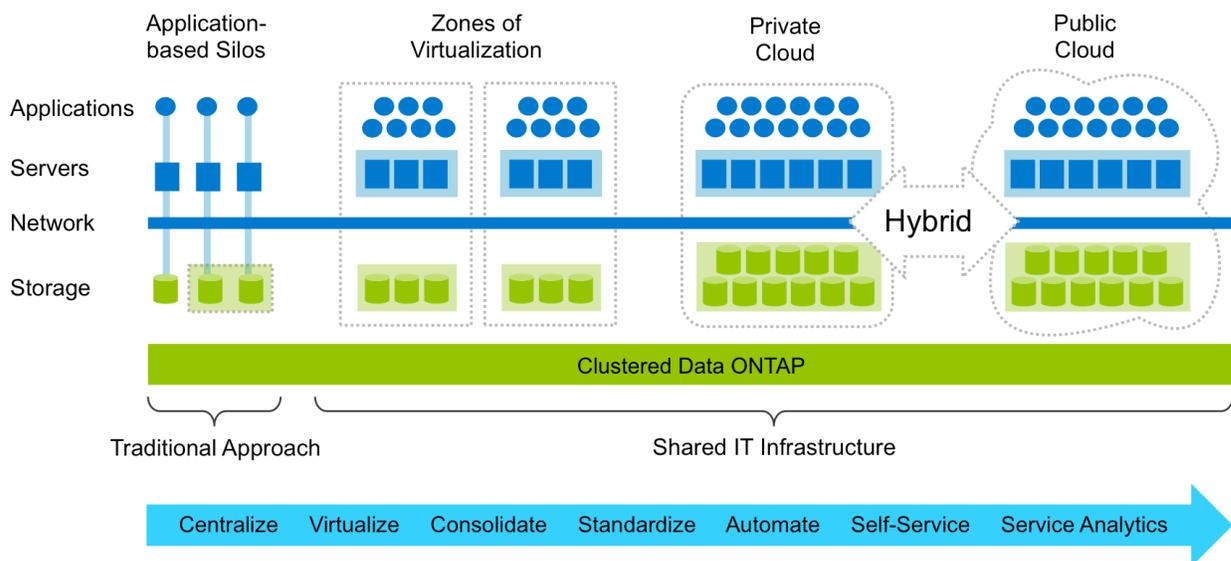
Service Analytics	Optimize your services with centralized monitoring, metering, and chargeback to enhance visibility into both costs and service-level agreement (SLA) management.
Automation	Rapidly deploy new services by automating storage processes and integrating with third-party orchestrators for automated end-to-end service delivery.
Self-Service	Empower IT and users by allowing service requests to be fulfilled through a self-service portal.

2 Why Self-Service Is an Essential Element of Private Cloud

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. This effort 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 (VI) 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, 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 can 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. It often represents the most advanced stage of the enterprise's path toward a private cloud.

Figure 1) Self-service is an advanced stage of private cloud deployment.



3 Self-Service Requirements

The need for a self-service model becomes clearer when we view resource delivery and consumption from the perspective of a subscriber (consumer) of IT resources. The subscriber might be an IT professional such as an application administrator or a virtualization administrator. In some cases, the subscriber might also be an end user from a non-IT department within the organization. Although the subscriber might not necessarily be a direct consumer of IT resources, that user has the responsibility to procure resources such as storage or compute capacity for end users, often under very tight deadlines to meet fluid application and business needs.

The following capabilities represent some of the key subscriber requirements for self-service and are described in greater detail later in this paper:

- On-demand service delivery
- SLA management
- Self-service capabilities build upon and leveraging policy-based automation

3.1 On-Demand Service Delivery for Productivity and SLA Management

As cost-conscious IT departments step up to manage more resources with the same number of staff members, it is no surprise that storage, server, and network administrators who fulfill IT requests are finding it increasingly difficult to keep up with user demand. This creates frequent occurrences in which IT subscribers experience extended delays in receiving their new services. For example, this might prevent their new or rapidly growing applications from getting the resources they need to meet scalability, performance, availability, and other service-level objectives.

Organizations that have implemented private clouds have taken a new approach. Instead of trying to adjust IT headcount to achieve cost and productivity goals, they are introducing automated and integrated services. As a result, they are able to improve service efficiency and business agility. Because these services can be delivered on demand, there are little or no time constraints, and minimal IT involvement is required.

Self-service operations should be as simple as possible, because IT subscribers do not necessarily have deep technical knowledge about the resources they are requesting. Subscribers of services should be able to perform common operations (for example, provisioning, data protection, cloning, and decommissioning) by themselves using an interface or portal that does not expose them to the underlying complexity of the technologies used to automatically deliver the requested services.

A self-service IT model enables subscribers to easily gain almost immediate access to hardware and associated software resources. As a result, they are able to consistently meet their application SLAs and maintain end-user productivity. At a higher level, self-service enables enterprises to scale IT services dynamically and add new cloud-based applications throughout the organization in accordance with client demand.

3.2 Automation

Automation is a vital component of the cloud infrastructure because 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.

4 The Role of Orchestration in Delivering Self-Service

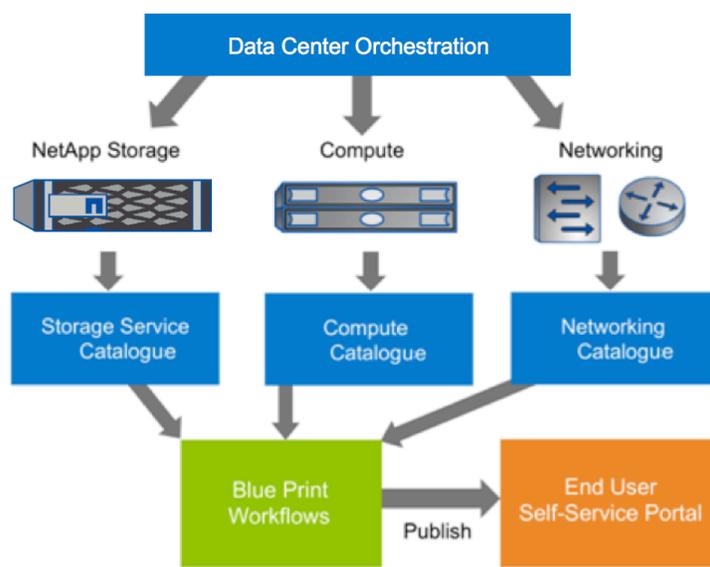
Virtualized infrastructures can improve hardware resource utilization, but these complex environments can be difficult to manage. They can include countless applications, virtual machines, physical servers, desktops, and storage systems. In addition to vendor-specific hardware management tools, virtualized environments typically rely on a variety of device managers, network management tools, hypervisors, and other virtualization solution interfaces. As is often the case, these collections of tools are not completely integrated, nor do they function across all storage and server platforms. Not having centralized cross-domain management capabilities adversely affects administrative productivity and responsiveness, and that does not take into account the management of complex operations such as storage and VM provisioning, backup, and disaster recovery.

Many leading-edge IT departments that are moving toward a private cloud have deployed broad cloud management solutions, also known as orchestration or IT service management (ITSM) frameworks. With orchestration, they can deliver centralized, end-to-end deployment, monitoring, and management of the entire cloud infrastructure, including all physical and virtual resources. The orchestration solution enables management of the IT environment in real time—and in accordance with defined policies for automation—to achieve desired business goals.

4.1 Centralized, Coordinated Management of Cloud Resources

Because orchestration solutions can provide integrated management and coordination of storage, network, and compute resources, as well as automated workflows, they represent an ideal location for self-service interfaces. Although “single pane of glass” management consoles are available for many vendor-specific storage, network, server, and virtualization solutions and can be shared by various users throughout an organization, “self-service” in a private cloud environment implies something more powerful and therefore more valuable to have in place. A request for IT resources often encapsulates multiple requests and requires a higher degree of coordination and automation to execute. For example, a request for an additional physical server might also be accompanied by the need for more virtual machines and storage capacity to support the new compute resources. This means that a single, centralized user interface for storage or servers alone does not help coordinate the request across multiple IT resource layers. For this reason, self-service models in private cloud environments are often created within the context of larger orchestration or ITSM frameworks that can provide end-to-end coordination.

Figure 2) Orchestrating storage, compute, and network resources for self-service.



4.2 Integrating Storage Services with Cloud Management Frameworks

The key to a successful self-service model is the ability to access and manage advanced storage functionality, as well as compute and network resources, directly from an end-to-end IT management or orchestration solution. In this manner, the workflow to deliver storage resources as a well-defined service can be automatically coordinated with the compute and network resources necessary to meet the broader needs of the user and application, beyond the request for storage alone.

In order to make this happen, enterprises require a simple self-service interface or web-based portal that integrates the storage and/or server management solution with the orchestration solution, as well as their virtualization or “homegrown” customized management solutions. The portal should enable users, VI administrators, application administrators, or even end users to request and obtain storage resources easily in the form of policy-based services. In addition, the details regarding resource selection, configuration, provisioning, and other processes should be handled in the background to minimize the burden on the orchestration solution administrator and to hide the underlying complexity from the users of the self-service portal. As a result, both the subscriber (consumer) and provider of the resources can realize tremendous productivity improvements.

A self-service model also facilitates rapid scalability and responsiveness to business needs. For example, when an integrated self-service portal is used, the storage provisioning and data protection processes for a new production environment can be reduced from weeks to minutes. Although some critics have positioned the self-service model as a means of eliminating IT staff, this is often not the case or the intention when implementing such a solution. Self-service does something more important in that it enables IT staff to minimize the amount of time spent on repetitive administrative tasks, allows them to keep up with growth and changing business demands, and lets them focus their time on higher level IT objectives and projects.

5 NetApp Approach to Enabling Self-Service

Many storage vendors do offer centralized management for their solutions, but their technologies usually do not easily coordinate with third-party virtualization management solutions or larger cloud management or orchestration frameworks. As a result, organizations often have to use separate proprietary tools to accomplish advanced storage capabilities, which increases management complexity and reduces operational efficiency. This is where NetApp provides a key differentiator over other storage solutions.

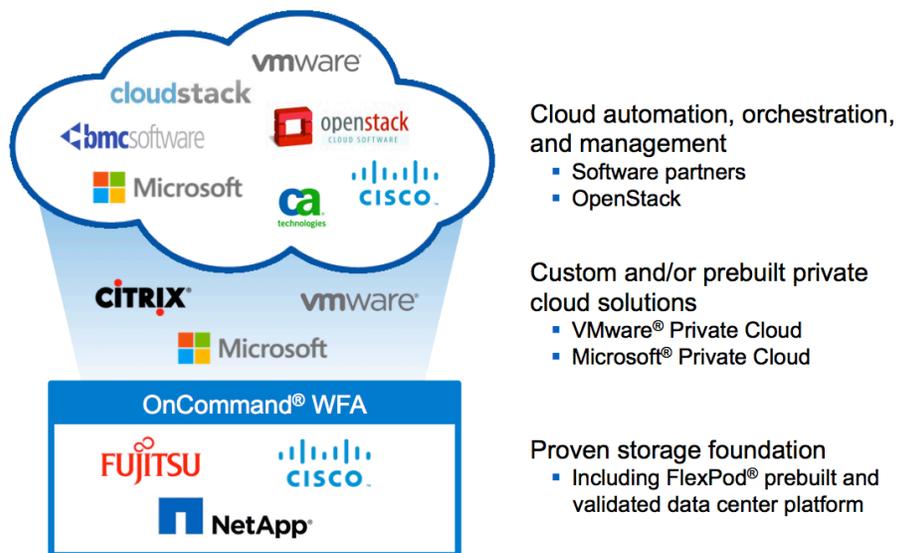
NetApp has adopted an open strategy when it comes to storage management, automation, and self-service within a private cloud infrastructure. Storage is NetApp's area of concentration and expertise, so we focus on helping organizations optimize storage resources and service efficiencies. We then integrate our solutions with best-in-class partners that provide broader IT service management and self-service capabilities for an end-to-end cloud solution.

NetApp solutions include NetApp OnCommand Workflow Automation (WFA), OnCommand Insight, and the NetApp Management SDK. This open management approach enables superior, faster integration and greater storage abstraction so that software partners and in-house development teams can easily leverage our automation and metering capabilities. This open storage management approach also gives organizations the choice to provision new services from a variety of (or combination of) management interfaces that best suits the environment, including solutions from NetApp partners and in-house "homegrown" management solutions.

The NetApp ecosystem of cloud management partners includes:

- ITSM or orchestration platforms
- Virtualization management solutions provided by VMware, Microsoft, and Citrix

Figure 3) NetApp cloud management ecosystem partners.



5.1 NetApp Integration with Orchestration and ITSM Partners

Large enterprises and service providers with complex IT environments are challenged to manage thousands of moving parts from different domains in order to provide the required service levels as prescribed by the various businesses they support. Many organizations are currently using or are considering ITSM or orchestration platforms from vendors such as BMC, CA, DynamicOps, Fujitsu, or NewScale to address this challenge. These orchestration platforms consolidate the management of various data center elements and give enterprises and service providers the ability to orchestrate their entire infrastructure operations from a single management console.

Unlike other storage vendors that offer their own infrastructure management solutions, but are unlikely to offer comparable levels of functionality, NetApp's approach is to make it as easy as possible for orchestration and ITSM platforms to integrate automated NetApp storage functionality within their self-service workflows employing OnCommand Workflow Automation and the NetApp Management SDK.

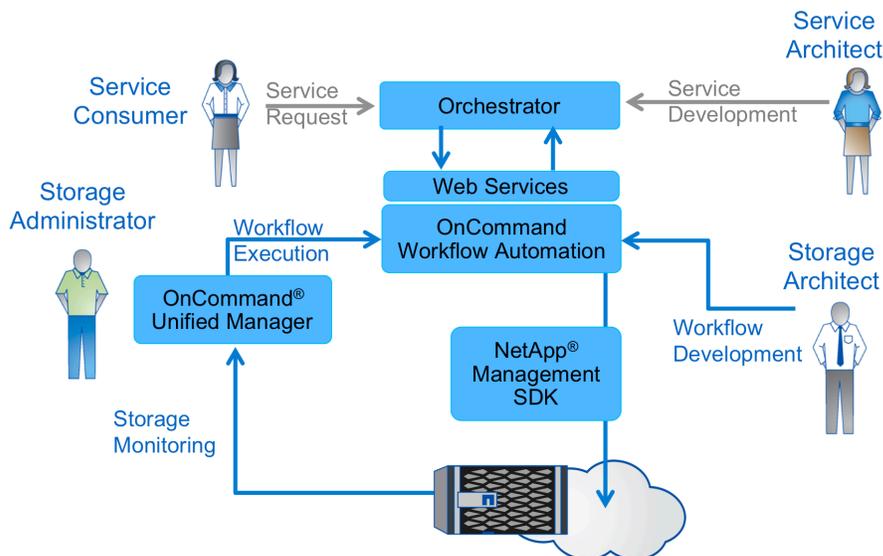
NetApp Integration and Open Interfaces

The REST APIs in OnCommand Workflow Automation and the APIs in the NetApp Management SDK enable organizations to integrate with NetApp technologies at a high storage abstraction layer. This openness provides third-party management solutions or customized tools the same level of access to NetApp technologies as our own management tools. In other words, we provide everything an orchestration solution and administrator need to deliver automated storage management from a single pane of glass and simplify their ability to develop self-service capabilities.

OnCommand Workflow Automation and our APIs also provide access to OnCommand data repositories that contain capacity utilization statistics, protocol usage, I/O performance, and other metrics. For example, OnCommand Workflow Automation can use OnCommand Unified Manager as a data source and call on it to automate storage processes such as automation of data protection processes using SnapMirror® and SnapVault®.

NetApp has taken measures to make sure that our partners can easily leverage our APIs. We support all industry standard operating systems and offer web services, API documentation, solution guides, sample code, developer tools, and workflow packs for all NetApp technologies related to automating storage and data protection processes, including OnCommand Workflow Automation and the SDK.

Figure 4) Integrating automated NetApp storage services with data center orchestration.

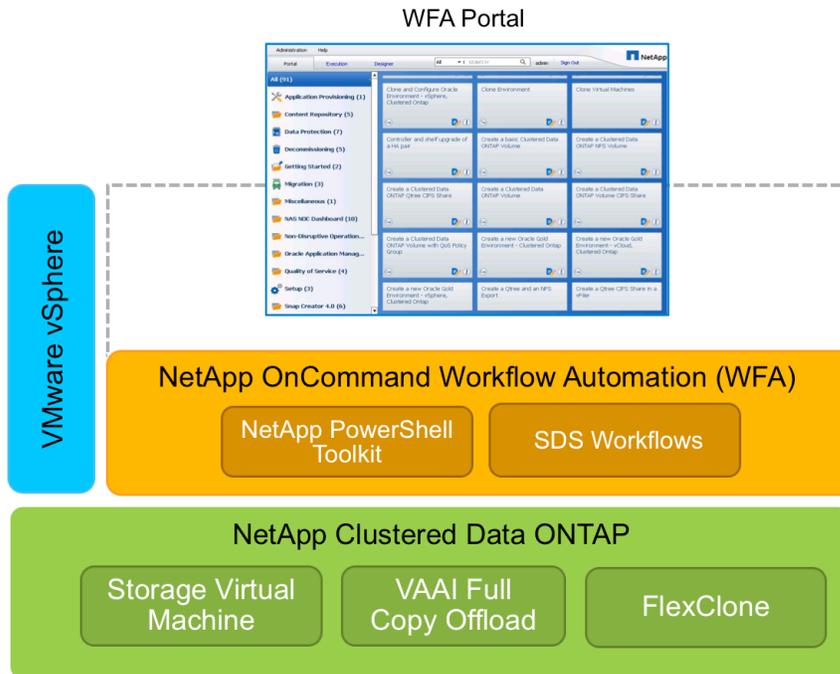


5.2 Developing a Self-Service Model

Defining Storage Service Policies

Defining storage service policies is an essential first step for the automation and self-service of storage services. It defines standard levels of service based on user and application needs. Storage and service architects can use OnCommand Workflow Automation in conjunction with OnCommand Unified Manager to define policies for automatically provisioning and protecting storage according to SLAs. Numerous storage policies can also be defined—such as cloning, migrating, decommissioning, and setting up virtual or cloud storage for an application—as part of an end-to-end orchestration process. After the policies and automated workflows are in place, they are accessible in the OnCommand Workflow Automation operator portal for self-service.

Figure 5) Self-service portal through OnCommand Workflow Automation.



For more information on getting started with OnCommand Workflow Automation and creating workflows, explore the NetApp OnCommand Workflow Automation community: netapp.com/oncommand_community.

Integrated Orchestration Workflows

NetApp enables storage architects to create both a customized self-service portal and an orchestration workflow for automating storage processes using OnCommand Workflow Automation. The self-service portal can be accessed within OnCommand Workflow Automation (operator portal). However, in the scenario described here, the self-service portal resides at the orchestration layer. The requestor accesses the self-service portal to execute a request from the orchestration layer. This request is communicated to OnCommand Workflow Automation, which automatically handles the request to provision, clone, and so on from the virtual or cloud storage resource pools. The workflow driven by the orchestration software might also include services from compute and network catalogs for coordinated provisioning of multiple resources to more completely meet subscriber and application requirements.

Self-Service Portal

The self-service portal can be created using the orchestration solution web services in conjunction with OnCommand Workflow Automation. The APIs provide direct access to all of the available storage workflows. OnCommand Workflow Automation uses role-based access control (RBAC), so users are only able to execute the workflows that they are authorized to use. OnCommand Workflow Automation can be made available to service subscribers such as application administrators, VI administrators, and engineering end users.

Subscribers can select the service-level offering that best meets the required SLA for their application from a pull-down menu and enter the size of the storage share to be provisioned without getting lost in the details of how the storage is provisioned and protected each time new resources are required. The service-level offerings within the self-service portal can be very simple (for example, gold, silver, and bronze) or can include more choices associated with storage efficiency, performance, availability, and data protection. Regardless of the type and number of service levels offered through the self-service portal, all of the complex provisioning and protection capabilities within the policies—thin provisioning, deduplication, creation and scheduling of backup copies, remote mirroring, and much more—are handled automatically and are not exposed to the subscriber or the orchestration administrator. This simplifies and greatly speeds up the process for integrating automated storage management into the orchestration workflows.

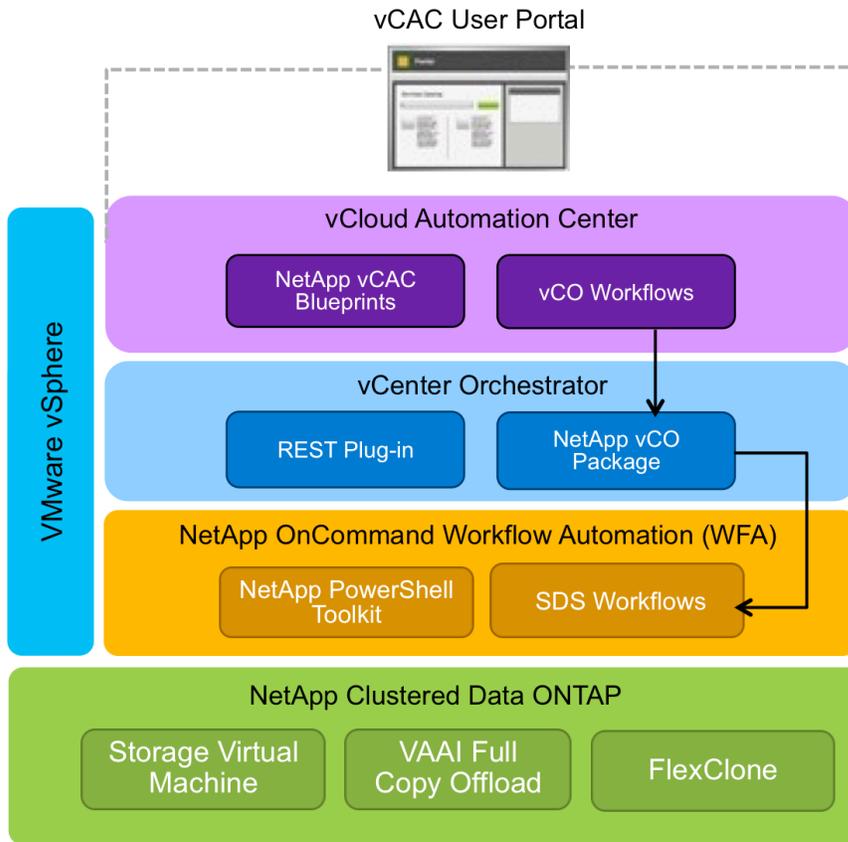
Developing a self-service environment in which internal customers can request and receive appropriately configured IT resources with little or no intervention is an important step in cloud deployment and overall business agility. As a result, organizations can:

- Consistently meet service levels
- Rapidly scale and add new cloud-based applications and services
- Respond to changing business demands with minimal effort
- Efficiently use IT resources to maximize hardware utilization
- Improve productivity by automating repetitive activities
- Streamline administration with integrated tools and automated provisioning processes

5.3 Example of Integrated, Automated Self-Service

The self-service portal is available to consumers and enables them to submit their request and have it fulfilled within minutes. Take as an example a multihypervisor environment that requires hardware orchestration and automation. In this scenario, we have a combination of OnCommand Workflow Automation and VMware® vCenter™ Orchestrator and VMware vCloud® Automation Center that can be used to automate and orchestrate the NetApp environment. Here a NetApp storage service catalog can be created using a combination of OnCommand Workflow Automation, vCenter Orchestrator, and vCloud Automation Center to create an end-to-end deployment process across all levels of the data center. The result is delivery of seamless self-service while also meeting the requirements for software-defined storage (SDS) and a software-defined data center (SDDC).

Figure 6) Use VMware vCloud Automation Center to manage NetApp storage using a self-service portal.



5.4 NetApp Integration with Virtualization Solutions

Leading server and desktop virtualization vendors such as Citrix, Desktone, Fluid Ops, Microsoft, VMware, and others have also recognized the benefits of integrating NetApp storage into their toolsets, allowing organizations to 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.

6 Examples of Self-Service in Practice

6.1 Example 1: Telecommunications Service Provider

Background

A telecommunications company was building an internal cloud environment and self-service portal. The company relied heavily on time-consuming manual scripting to manage its storage processes. In addition, the provisioning process was cumbersome and could take up to seven days to complete. These factors significantly slowed application development and testing, which could take up to three weeks. This meant that applications were sometimes released without sufficient testing due to pressure to push new services out to internal users quickly. To address these issues, the company wanted to deliver storage provisioning as a true cloud service for the dev/test environment.

Solution

By leveraging OnCommand Workflow Automation, the company was able to create a self-service portal that lets developers quickly and easily provision storage on their own. What used to take seven days has been reduced to just over an hour, speeding up the dev/test process without compromising quality. Application testing that previously took three weeks can now be completed in three days. Plus, the company no longer takes testing shortcuts in an effort to speed time to market. Now, upgrades to existing services and the rollout of new services can be completed with a high level of quality assurance, which has improved end-user and customer satisfaction. The company has also been able to reduce database restoration time from seven days to five minutes, significantly reducing the amount of downtime for developers working on revenue-generating applications.

6.2 Example 2: Service Provider for Supply Chain Management

Background

This example features a supply chain service provider for multichannel retailers, consumer goods manufacturers, pharmaceutical companies, third-party logistics companies, and wholesale distributors. The service provider partners with more than 1,200 firms globally, representing many of the world's best-known brands. The service provider was looking to do a technology refresh to address two problem areas.

The service provider must meet varied, unique customer needs, which means that software must be highly customized at customer sites. In each case, the service provider must recreate a customer environment, then test and validate that the solution meets the customer's specific needs. It took a minimum of one day and required senior-level developers and engineers to oversee and complete. This process was time-consuming and expensive.

Maintaining efficient business operations was the second area of concern. The service provider's problems were not unlike those of many other companies. The service provider experienced triple data growth in a five-year period, attrition and underskilled staff, and lack of a clear strategic data center plan. Standalone solutions from various vendors were put in place, which caused large-scale virtualization sprawl. This in turn led to the overuse of some assets and the underuse of others, resulting in an unbalanced infrastructure that began to negatively affect performance and availability.

The service provider required a consolidated storage solution that would automate workflow processes for its global business, while making it simple for the IT team and the CIO to manage and oversee.

Solution

Because the service provider is a software development company, the benefits of automating workflows to streamline development time caught its attention. By using OnCommand Workflow Automation and FlexClone® technologies, the service provider was able to orchestrate a simple set of processes to accelerate provisioning and offload its high-priced engineers to focus on other high-value projects. This solution not only satisfied the needs of the IT organization, but also satisfied the needs of the CFO. It was clear that this investment would result in driving value immediately back into the service provider's business.

The service provider implemented OnCommand Workflow Automation to automate storage processes such as provisioning, setup, migration, and decommissioning. The service provider was able to ease the burden on the IT staff while reducing the overall storage management costs as a result. It also automated storage data tiering, which gave the service provider the flexibility to move infrequently accessed data to lower cost disk drives, saving money and improving overall system performance by lightening the load.

Finally, OnCommand Workflow Automation enabled tight integration with a variety of business applications, eliminating the need for business units to purchase solutions to remedy single-point issues. The IT team can now deliver services centrally in a seamless manner. The team also uses OnCommand Insight and OnCommand Balance for added visibility into whether or not SLAs are being met. Now the company is able to provide services in a more streamlined, optimized, and holistic manner.

7 Conclusion

Self-service builds upon the efficiencies of virtualization and automation to deliver enhanced productivity and reduced operating expenses. It simplifies the process for requesting and procuring resources from IT departments, thus empowering subscribers of IT services. Due to the complexity of most virtualized, shared infrastructures, it is recommended that an integrated management framework including an orchestrator be used to enable self-service capabilities for the cloud. These solutions provide end-to-end management of the entire IT infrastructure and make it easier for self-service storage, server, and network workflows to be centrally coordinated, automated, and executed.

From a storage perspective, NetApp experts plays a key role in enabling self-service storage built on clustered Data ONTAP for private clouds. NetApp's open management approach, including OnCommand Workflow Automation and the SDK, enables NetApp to work with a broad ecosystem of virtualization and orchestration partners that integrate automated storage management, provisioning, protection, and other advanced capabilities into their solutions. NetApp has been able to help remove complexity from the self-service process by enabling orchestration administrators to easily build self-service portals without exposing users (or themselves) to the underlying sophisticated technologies and processes that deliver these advanced storage services. The benefit of using NetApp OnCommand Workflow Automation is that it is accessible to users of orchestration solutions.

By leveraging NetApp and its ecosystem partners to deliver a self-service model, enterprises can meet or exceed service-level requirements, reduce time to deploy new resources, and rapidly scale environments to meet business needs. A self-service model also helps organizations improve productivity by automating many manually intensive tasks and enabling IT staff to better handle growth and data center management complexity. All of these advantages represent the expected outcome of a successful, advanced private cloud deployment and prepare organizations for evolution to a hybrid cloud to meet future business needs.

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.

NetApp provides no representations or warranties regarding the accuracy, reliability, or serviceability of any information or recommendations provided in this publication, or with respect to any results that may be obtained by the use of the information or observance of any recommendations provided herein. The information in this document is distributed AS IS, and the use of this information or the implementation of any recommendations or techniques herein is a customer's responsibility and depends on the customer's ability to evaluate and integrate them into the customer's operational environment. This document and the information contained herein may be used solely in connection with the NetApp products discussed in this document.

© 2014 NetApp. All rights reserved. No portions of this document may be reproduced without prior written consent of NetApp, Inc. Specifications are subject to change without notice. NetApp, the NetApp logo, Data ONTAP, FlexClone, FlexPod, OnCommand, SnapMirror, and SnapVault are trademarks or registered trademarks of NetApp, Inc. in the United States and/or other countries. Microsoft and Hyper-V are registered trademarks of Microsoft Corporation. VMware, VMware vCloud, and VMware vSphere are registered trademarks and vCenter is a trademark of VMware, Inc. All other brands or products are trademarks or registered trademarks of their respective holders and should be treated as such. WP-7139-0814