FlexPod for SAP Applications

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Cisco Validated Design

Building Architectures to Solve Business Problems

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FlexPod for SAP Applications

Introduction

This Cisco® Validated Design reports the results of a study evaluating the usability of an shared infrastructure for SAP applications and SAP landscapes on Cisco® UCS B-Series Blade Servers running VMware vSphere connected to the NetApp Storage array.

Audience

This document is intended to assist solution architects, sales engineers, field engineers and consultants in planning, design, and deployment of SAP application landscapes on the Cisco Unified Computing System. This document assumes that the reader has an architectural understanding of the Cisco Unified Computing System, VMware vSphere, NetApp storage system, and SAP software.

The Challenge

Today's IT departments are increasingly challenged by the complexity and management of disparate components within their data centers. Rapidly proliferating silos of server, storage, and networking resources combined with numerous management tools and operational processes have led to crippling inefficiencies and costs.

Savvy organizations understand the financial and operational benefits of moving from infrastructure silos to a virtualized, shared environment. However, many of them are hesitant to make the transition due to potential short-term business disruptions and long-term architectural inflexibility, which can impede scalability and responsiveness to future business changes. Enterprises and service providers need a tested, cost-effective virtualization solution that can be easily implemented and managed within their existing infrastructures and that scales to meet their future cloud computing objectives.

Business Challenges Facing the SAP Customer

Corporations deploying SAP software today are under pressure to reduce cost, minimize risk, and control change by accelerating deployments and increasing the availability of their SAP landscapes. Changing market conditions, restructuring activities, and mergers and acquisitions often result in the

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creation of new SAP landscapes based on the SAP NetWeaver® platform. Deployment of these business solutions usually exceeds a single production instance of SAP. Business process owners and project managers must coordinate with IT management to optimize the scheduling and availability of systems to support rapid prototyping and development, frequent parallel testing or troubleshooting, and appropriate levels of end user training. The ability to access these systems as project schedules dictate with current data sets and without affecting production operations often determines whether SAP projects are delivered on time and within budget.

The Solution-FlexPod for SAP Applications

To meet this challenge NetApp and Cisco have collaborated to create FlexPod for SAP Applications™. FlexPod is a proven, long term data center solution built on a flexible, shared infrastructure that can scale easily or be configured for secure multi-tenancy and Cloud environments. FlexPod is a prevalidated configuration that delivers a virtualized data center in a rack composed of leading computing, networking, storage, and infrastructure software components.

FlexPod for SAP Applications differs from other virtualized infrastructure offerings by providing:

- Validated technologies from industry leaders in computing, storage, networking and server virtualization
- A single platform, built from unified computing, fabric, and storage technologies, that lets you scale to meet the largest data center requirements without disruption or architectural changes in the future
- Integrated components that enable you to centrally manage all your infrastructure pools
- An open design management framework that integrates with your existing third-party infrastructure management solutions
- Support of bare metal server and VMware based virtual machines
- Virtualization on all layers of the solution stack
- Secure Multi-Tenancy for operating fenced SAP systems or landscapes
- Application and data mobility
- Integrated storage-based backup
- Provisioning of infrastructure components, like tenants and operating systems
- Automated SAP system copies
- Provisioning of fenced SAP systems based on clones of production systems

The key benefits of the FlexPod for SAP Applications infrastructure solution are:

Cloud-Ready Architecture Together, NetApp, Cisco, and VMware provide a unified flexible architecture that is ready for virtualized environments today, yet is flexible enough to grow at your own pace to a fully private cloud.

IT Investment Protection The Ethernet-based FlexPod framework fits right into your current infrastructure, eliminating the cost of replacing your existing technology.

Improved Predictability FlexPod components are integrated and standardized to help you achieve timely, repeatable, consistent deployments and eliminate guesswork from the following areas:

- Resource procurement and planning
- Capacity and data center sizing

- Identification of operations and provisioning requirements

As a result, you can understand and better predict the exact power, floor space, usable capacity, performance, and cost for each FlexPod deployment.

Scalable Architecture FlexPod configurations can be right-sized up or out, and then duplicated in modular fashion to fit your specific organizational needs. For example, large enterprises or service providers with mature IT processes and rapid growth expectations can deploy and scale out one or more FlexPod configurations to meet the following requirements:

- Migration to a shared infrastructure with many SAP applications
- Improved agility to meet growth and key critical business initiatives
- Lower cost per user without sacrificing scalability
- Simplified operating skills and processes and reduced costs
- Evolution to operations that align with ITIL-based standards

Medium-sized enterprises and customers with more moderate growth requirements can use FlexPod as a starting point for virtualization solutions. They can then scale up storage and compute pool capacity or performance within a FlexPod configuration while maintaining centralized management of the infrastructure solution.

Scope of This Document

In this document, we will show the required components and the related installation and configuration steps to build a SAP Applications Ready infrastructure with the FlexPod Infrastructure Solution. We show how to setup the components on the server, network and storage layer as well as the operating system, tools and application layer. At the end of this document we also show one of many use cases and how this solution can simplify operational tasks for SAP applications

Solution Overview and Component Description

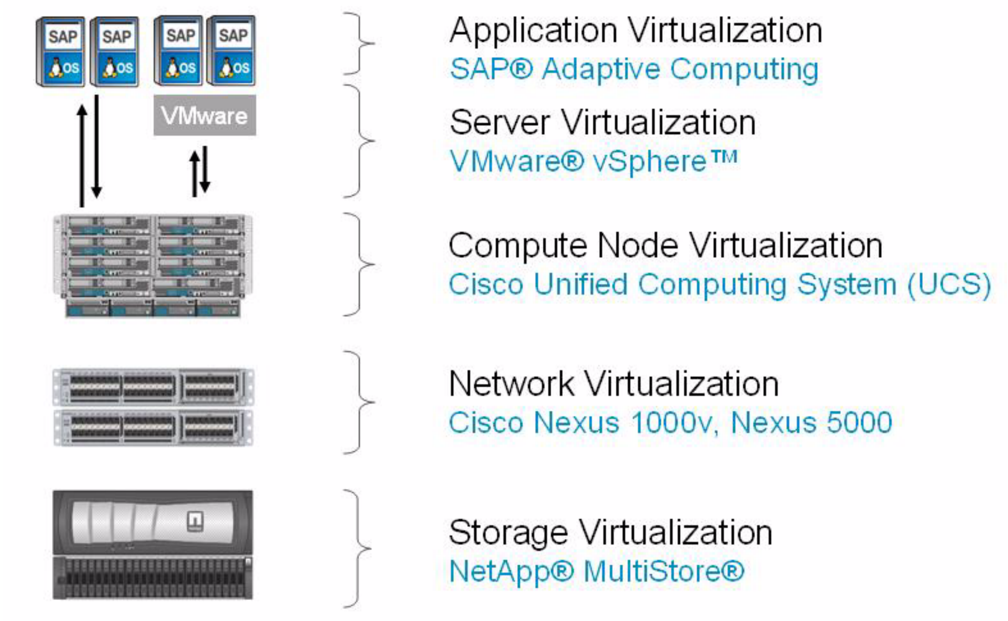
FlexPod for SAP Applications Architecture

FlexPod for SAP Applications introduces an infrastructure that is based on virtualization technologies on all layers of the solution stack within a pool of shared resources. SAP applications can be run on Vmware virtual machines as well as on bare metal servers.

As the name details, the FlexPod architecture is highly modular or “pod” like. While each customer's FlexPod may vary in its exact configuration, once a FlexPod is built it can easily be scaled as requirements and demand change. This includes scaling both up (adding additional resources within a FlexPod) and out (adding additional FlexPod units).

Specifically, FlexPod is a defined set of hardware and software that serves as an integrated building block for all virtualization solutions. FlexPod for SAP Applications includes NetApp® storage, Cisco® networking, the Cisco Unified Computing System™ (Cisco UCS), and VMware® virtualization software in a single package in which the computing and storage fit in one data center rack with the networking residing in a separate rack. Due to port density the networking components can accommodate multiple FlexPod configurations. Figure 1 shows the FlexPod for VMware components.

Figure 1 Reference Architecture



Some of the key architecture features are:

- Secure Multi-Tenancy
- Application and data mobility
- Integrated storage-based backup
- Provisioning of infrastructure components
- Automated SAP® system copies
- Provisioning of fenced SAP systems or landscapes

Technology Components

FlexPod for SAP Applications includes the following technology components:

- Storage
  - NetApp Multistore
- Network
  - Cisco Nexus 5000 series
  - Cisco Nexus 1000v
- Compute
  - Cisco Unified Computing System (B-Series Blades)
- Virtualization
  - VMware vSphere
- Operating Systems
  - RedHat Enterprise Linux 5.x

  - Suse Linux Enterprise Server 11 SP1
- Applications
  - SAP Business Suite with Oracle RDBMS

Management Components

FlexPod for SAP Applications includes the following management software components from the different partners.

- SAP application management
  - SAP Adaptive Computing Controller
- Vmware management:
  - VMware vCenter Server
- Server management:
  - Cisco Unified Computing System Manager
- Storage management:
  - Operations Manager
  - Provisioning Manager
  - Protection Manager
  - SnapManager for SAP
  - Virtual Storage Console (VSC) including SnapManager for VI (SMVI) and Rapid Cloning Utility (RCU)

The following sections detail the various components used in the reference architecture configuration.

Server Overview-Cisco Unified Computing System

The Cisco Unified Computing System (UCS) is a next-generation data center platform that unites compute, network, and storage access. The platform, optimized for virtual environments, is designed within open industry standard technologies and aims to reduce TCO and increase business agility. The system integrates a low-latency, lossless 10 Gigabit Ethernet unified network fabric with enterprise-class, x86-architecture servers. The system is an integrated, scalable, multi-chassis platform in which all resources participate in a unified management domain.

The Cisco Unified Computing System represents a radical simplification of the traditional blade server deployment model by providing simplified, stateless blades and a blade server chassis that is centrally provisioned, configured, and managed by Cisco UCS Manager. The result is a unified system that significantly reduces the number of components while offering a just-in-time provisioning model that allows systems to be deployed or redeployed in minutes rather than hours or days.

The Cisco Unified Computing System is designed to deliver:

- Reduced TCO at the platform, site, and organizational levels
- Increased IT staff productivity and business agility through just-in-time provisioning and mobility support for both virtualized and non-virtualized environments
- A cohesive, integrated system that is managed, serviced, and tested as a whole

- Scalability through a design for up to 320 discrete servers and thousands of virtual machines, and the capability to scale I/O bandwidth to match demand
- Industry standards supported by a partner ecosystem of industry leaders
- Innovations Supporting Business Benefits

Each of the system's business benefits is supported by a rich set of technical innovations that contribute to this first implementation of the Cisco® unified computing vision:

- Embedded system management through Cisco UCS Manager
- Just-in-time provisioning with service profiles
- Unified fabric using 10-Gbps Ethernet
- VN-Link virtualization support
- Cisco Extended Memory technology
- State of the art performance using Intel Xeon Processors
- Energy efficient platform design

The following section details the Cisco UCS components.

Cisco UCS Components

Cisco UCS 6100 Series Fabric Interconnects-Comprising a family of line-rate, low-latency, lossless, 10-Gbps Ethernet interconnect switches that consolidate I/O within the system. Both 20-port one-rack-unit (1RU) and 40-port 2RU versions accommodate expansion modules that provide Fibre Channel and 10Gigabit Ethernet connectivity.

Cisco UCS Manager-Provides centralized management capabilities, creates a unified management domain, and serves as the central nervous system of the Cisco Unified Computing System.

Cisco UCS 2100 Series Fabric Extenders-Bring unified fabric into the blade-server chassis, providing up to four 10-Gbps connections each between blade servers and the fabric interconnect, simplifying diagnostics, cabling, and management.

Cisco UCS 5100 Series Blade Server Chassis-The Cisco UCS 5100 Series Blade Server Chassis (model 5108) is a logical part of the Cisco Unified Computing System's fabric interconnects, adding no management complexity to the system.

Cisco UCS 5108-Fits on a standard rack, is 6RU high and physically houses blade servers and up to two Cisco UCS 2100 Series Fabric Extenders. It also houses eight cooling fans and four power supply units. The cooling fans and power supply are hot swappable and redundant. The chassis requires only two power supplies for normal operation; the additional power supplies are for redundancy. The highly-efficient (in excess of 90%) power supplies, in conjunction with the simple chassis design that incorporates front to back cooling, makes the Cisco UCS system very reliable and energy efficient.

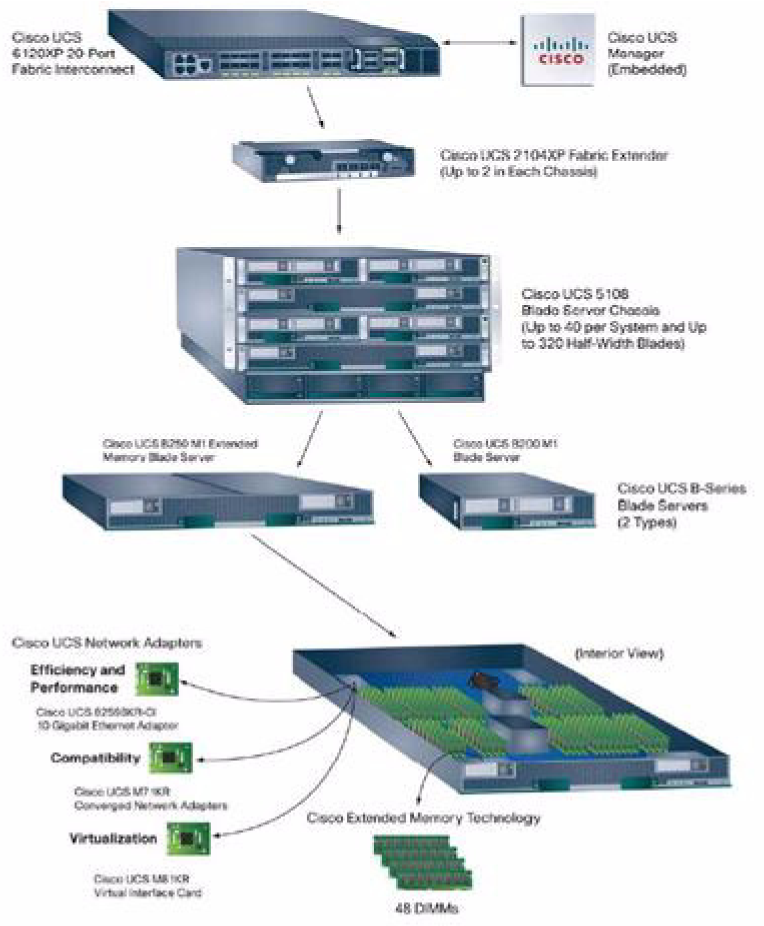
Cisco UCS network adapters-Offers a range of options to meet application requirements, including adapters optimized for virtualization, converged network adapters (CNAs) for access to unified fabric and compatibility with existing driver stacks, Fibre Channel host bus adapters (HBAs), and efficient, high-performance Ethernet adapters.

Cisco UCS B-Series Blade Servers-Based on Intel Xeon 5500 and 5600 series processors, adapt to application demands, intelligently scale energy use, and offer best-in-class virtualization. These socket blade servers come in two forms: the Cisco UCS B200 half-slot, and the Cisco UCS B250 full-slot extended memory server. Cisco UCS first generation, M1 series, features the Intel Xeon processor 5500 series while the next generation, M2 series, features the Intel Xeon 5600 processor.

Each Cisco UCS B200 server uses one CNA and each Cisco UCS B250 server uses two CNAs for consolidated access to the unified fabric. This design reduces the number of adapters, cables, and access-layer switches needed for LAN and SAN connectivity.

The Cisco UCS B250 features Cisco's patented Extended Memory Technology. This Cisco technology provides more than twice as much industry-standard memory (384 GB) as traditional two-socket servers, increasing performance and capacity for demanding virtualization and large-data-set workloads. Alternatively, this technology offers a more cost-effective memory footprint for less-demanding workloads.

Figure 2 Cisco Unified Computing System


Cisco UCS 6120XP 20-Port Fabric Interconnect
Cisco UCS Manager (Embedded)
Cisco UCS 2104XP Fabric Extender (Up to 2 in Each Chassis)
Cisco UCS 5108 Blade Server Chassis (Up to 40 per System and Up to 320 Half-Width Blades)
Cisco UCS B250 M1 Extended Memory Blade Server
Cisco UCS B200 M1 Blade Server
Cisco UCS B-Series Blade Servers (2 Types)
Cisco UCS Network Adapters
Efficiency and Performance
Cisco UCS 82598KR-CI 10 Gigabit Ethernet Adapter
Compatibility
Cisco UCS M71KR Converged Network Adapters
Virtualization
Cisco UCS M81KR Virtual Interface Card
(Interior View)
Cisco Extended Memory Technology
48 DIMMs

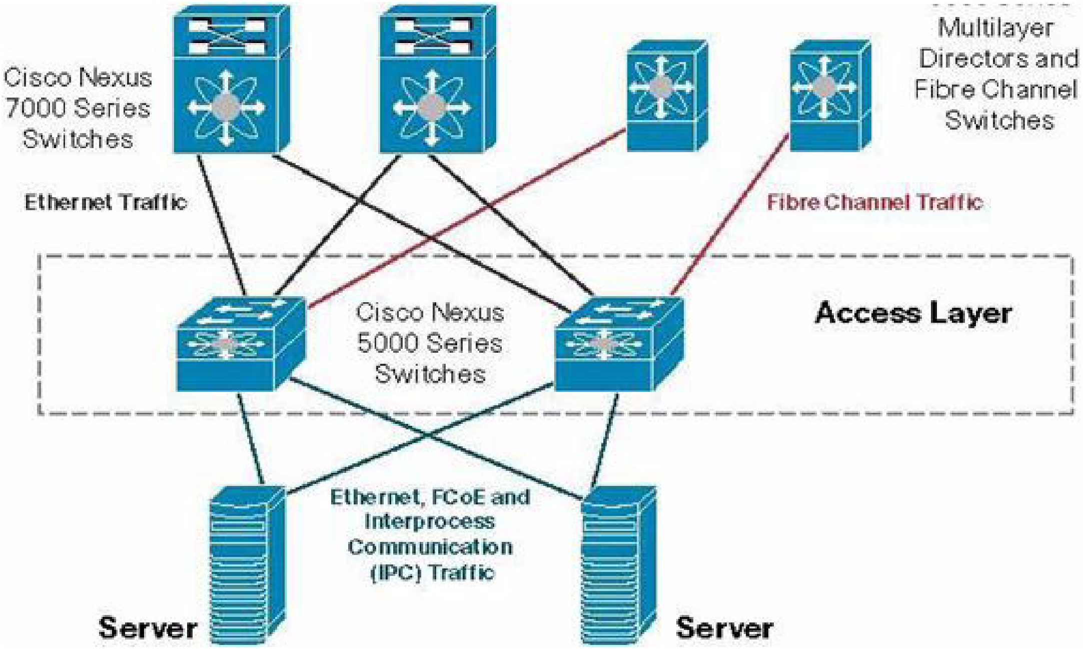
Network Overview-Cisco Nexus Switches

The innovative architecture of the Cisco Nexus Series Switches simplifies data center transformation with a standards-based, high-performance unified Gigabit Ethernet and 10 Gigabit Ethernet fabric that connects servers, storage, and users, greatly simplifying network management while delivering advanced capabilities with end-to-end security for all network traffic. Cisco TrustSec provides role-based security for all network traffic. TrustSec makes your network fabric role aware through secure access control, a converged policy framework, and pervasive integrity and confidentiality.

Cisco Nexus 5000 Series Switches

The Cisco Nexus® 5000 Series Switches, part of the Cisco Nexus family of data center-class switches, delivers an innovative architecture to simplify data center transformation by enabling a high-performance, standards-based, Ethernet unified fabric. The platform consolidates separate LAN, SAN, and server cluster network environments into a single unified fabric. Backed by a broad system of industry-leading technology partners, the Cisco Nexus 5000 Series is designed to meet the challenges of next-generation data centers, including dense multisocket, multicore, virtual machine-optimized services, in which infrastructure sprawl and increasingly demanding workloads are commonplace. Figure 3 shows the position of the Cisco Nexus 5000 Series in one network scenario.

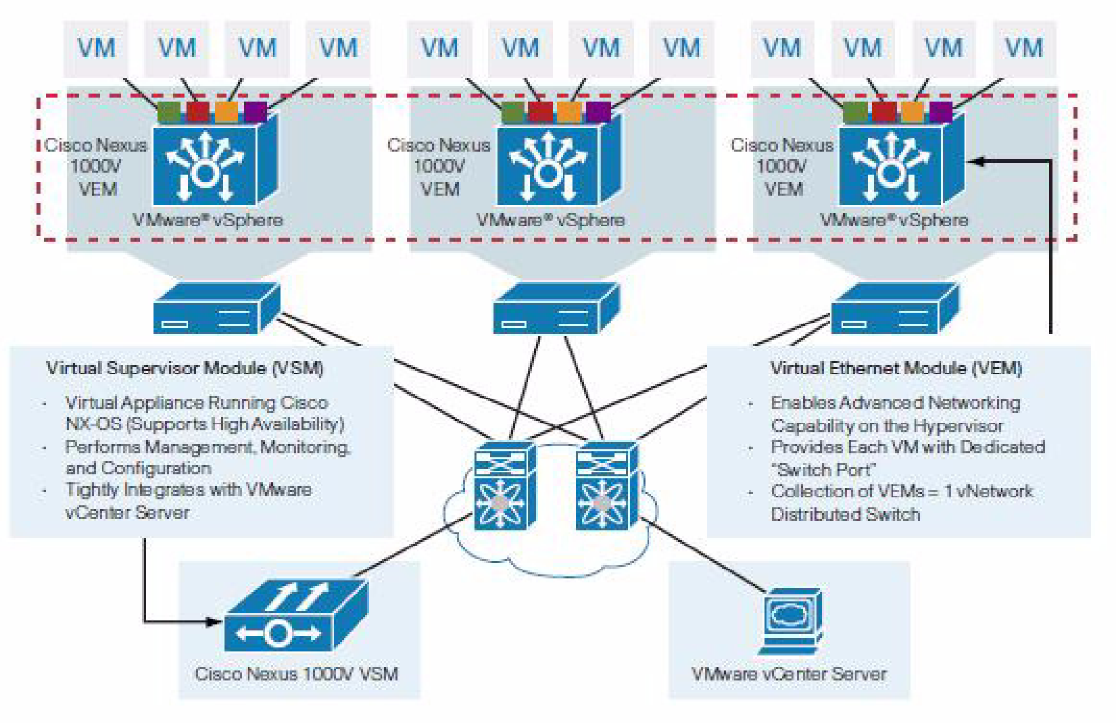
Figure 3 Cisco Nexus 5000 Series in the Data Center Network


Cisco Nexus 7000 Series Switches
Multilayer Directors and Fibre Channel Switches
Ethernet Traffic
Fibre Channel Traffic
Cisco Nexus 5000 Series Switches
Access Layer
Ethernet, FCoE and Interprocess Communication (IPC) Traffic
Server
Server

CISCO NEXUS 1000V SERIES SWITCHES

The Cisco Nexus 1000V Series (Figure 4) provides a common management model for both physical and virtual network infrastructures through Cisco VN-Link technology, which includes policy-based virtual machine connectivity, mobility of virtual machine security and network properties, and a non-disruptive operational model.

Figure 4 Cisco Nexus 1000v Series Architecture

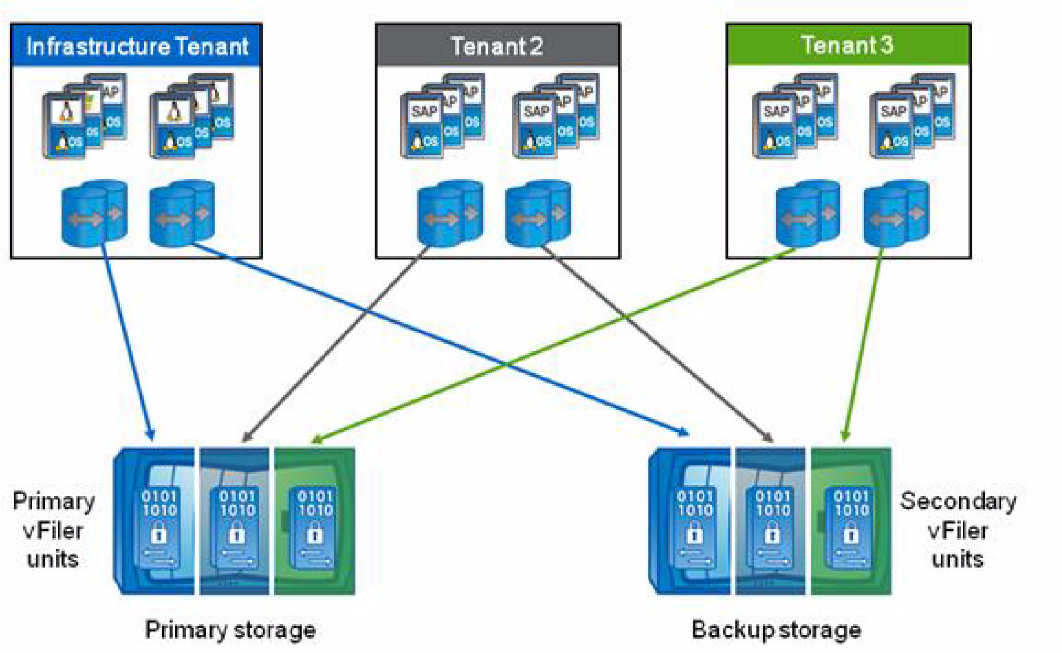

VM
Cisco Nexus 1000V VEM
VMware® vSphere
Virtual Supervisor Module (VSM)
- Virtual Appliance Running Cisco NX-OS (Supports High Availability)
- Performs Management, Monitoring, and Configuration
- Tightly Integrates with VMware vCenter Server
Virtual Ethernet Module (VEM)
- Enables Advanced Networking Capability on the Hypervisor
- Provides Each VM with Dedicated "Switch Port"
- Collection of VEMs = 1 vNetwork Distributed Switch
Cisco Nexus 1000V VSM
VMware vCenter Server

Storage Architecture

SAP on FlexPod uses the NetApp MultiStore® software, which lets you quickly and easily create separate and private logical partitions on a single storage system. Each virtual storage partition maintains separation from every other storage partition, so you can enable multiple tenants to share the same storage resource without compromise to privacy and security. You can be confident that no information on a secured virtual partition can be viewed, used, or downloaded by unauthorized users. MultiStore can help you achieve a truly dynamic data center environment, since data can be provisioned, moved, and protected based on user and application boundaries. Since your critical information is kept in virtual storage containers, you can establish operational and business continuity policies that are data and application centric and not tied to specific hardware configurations. Your ability to easily migrate datasets from one physical storage system to another is particularly important for nondisruptive system upgrades and system load balancing. MultiStore virtual partitions allow you to achieve this type of flexibility within the framework of a unified multiprotocol architecture.

Figure 5 shows an overview of how storage is provided by SAP on FlexPod.

Figure 5 SAP on FlexPod Storage Overview



With SAP on FlexPod, each tenant is assigned a vFiler unit that is hosted on a primary physical storage system and a vFiler unit that is assigned to a secondary physical storage system. Therefore, each tenant can access fast primary storage for production SAP systems as well as secondary storage for backup purposes or for SAP systems with low I/O requirements like development or training systems.

Integrated Storage-Based Backup

FlexPod for SAP Applications has an integrated backup solution for all infrastructure and application data.

Non-application data are backed-up using Protection Manager. All storage volumes are provisioned with Provisioning Manager and are automatically assigned to a protection policy.

- Automated backup processes
- Fast and space-efficient Snapshot based backups
- Fast and space-efficient replication with SnapVault based on block level changes

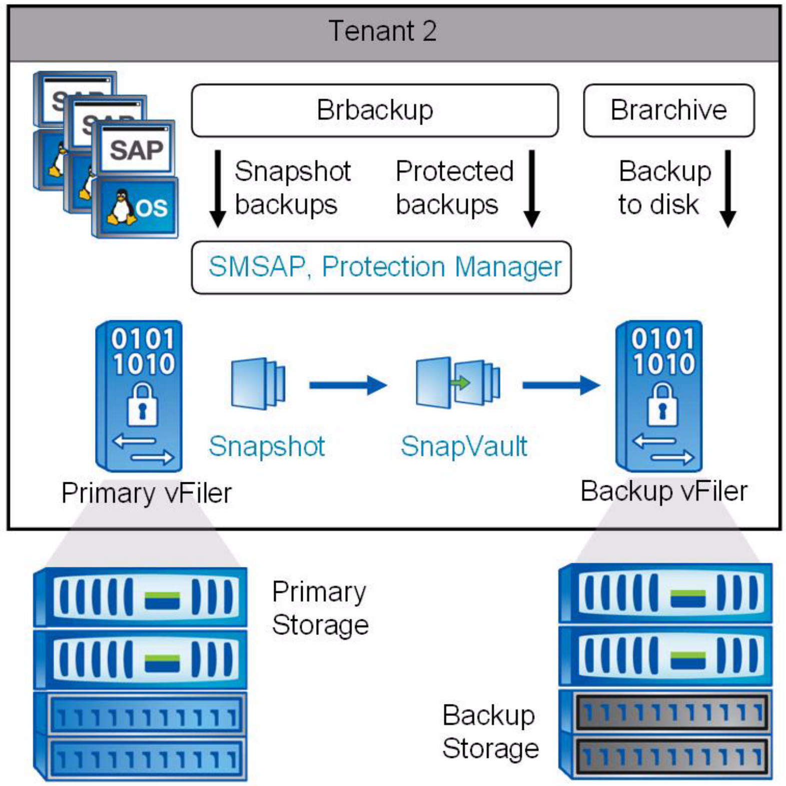
Virtual machines and templates will be backed up with SMVI, part of VSC. SMVI integrates into VMware vSphere and provides consistent storage Snapshots of individual VMs or complete datastores. These consistent Snapshots will be replicated to a secondary storage system through Protection Manager.

SAP application data is backed with SnapManager for SAP and Protection Manager. SnapManager for SAP offers a backint integration into the SAP Br*tools. Therefore backup and restore processes can be controlled with SAP Brbackup and Brrestore. Backups executed by Brbackup will create Snapshot backups on the storage level. Snapshot backups on the primary storage will be replicated to the secondary storage using the SnapVault functionality controlled by SMSAP and Protection Manager.

- Backups of SAP systems are done using an SAP certified interface with SnapManager for SAP
- Backups are done in a few minutes independent from the database size

- Restoring a database is done in a few minutes independent from the database size
- Fast and space-efficient replication with SnapVault based on block level changes
- Backup load fully decoupled from server layer

Figure 6 Integrated Storage Backup



NetApp Snapshot technology can create an online or offline database backup in minutes. The time needed to create a Snapshot copy is independent of the size of the database, because a Snapshot copy does not move any data blocks. The use of Snapshot technology has no performance effect on the production SAP system because the NetApp Snapshot implementation does not copy data blocks when the Snapshot copy is created or when data in the active file system is changed. Therefore, the creation of Snapshot copies can be scheduled without having to consider peak dialog or batch activity periods. SAP and NetApp customers typically schedule several online Snapshot backups during the day, for instance, every four hours. These Snapshot backups are typically kept for three to five days on the primary storage system.

Snapshot copies also provide key advantages for the restore and recovery operation. The NetApp SnapRestore functionality allows restore of the entire database or parts of the database to the point in time when any available Snapshot copy was created. This restore process is done in a few minutes, independent of the size of the database. Because several online Snapshot backups were created during the day, the time needed for the recovery process is also dramatically reduced. Because a restore can be done using a Snapshot copy that is at most four hours old, fewer transaction logs need to be applied. The mean time to recover, which is the time needed for restore and recovery, is therefore reduced to several minutes compared to several hours with conventional tape backups.

Snapshot backups are stored on the same disk system as the active online data. Therefore, NetApp recommends using Snapshot backups as a supplement, not a replacement for backups to a secondary location such as disk or tape. Although backups to a secondary location are still necessary, there is only a slight probability that these backups will be needed for restore and recovery. Most restore and recovery actions are handled by using SnapRestore on the primary storage system. Restores from a secondary location are only necessary if the primary storage system holding the Snapshot copies is damaged or if it is necessary to restore a backup that is no longer available from a Snapshot copy, for instance, a two-week-old backup.

A backup to a secondary location is always based on Snapshot copies created on the primary storage. Therefore, the data is read directly from the primary storage system without generating load on the SAP database server. The primary storage communicates directly with the secondary storage and sends the backup data to the destination. The NetApp SnapVault functionality offers significant advantages compared to tape backups. After an initial data transfer, in which all the data has to be transferred from the source to the destination, all following backups copy only the changed blocks to the secondary storage. The typical block change rate for a SAP system is around 2% per day. Therefore the load on the primary storage system and the time needed for a full backup are significantly reduced. Because SnapVault stores only the changed blocks at the destination, a full database backup requires significantly less disk space.

VMware Overview

VMware vSphere

VMware® vSphere provides a foundation for virtual environments, including clouds. Besides the hypervisor itself, it provides tools to manage the virtual landscape such as VMotion® and allows creating secure private landscapes. VMotion allows you to move a virtual machine from one physical compute node to another without service interruption.

The powerful VMware virtualization solution enables you to pool server and desktop resources and dynamically allocate them with service-level automation so you can deploy a private cloud and deliver IT as a service (ITaaS). VMware components provide a scalable approach to virtualization that delivers high availability and agility to meet your changing business requirements. VMware vSphere, the industry's most complete and robust virtualization platform, increases IT efficiency through consolidation and automation, dramatically reducing your capital and operating costs while giving you the freedom to choose your applications, OS, and hardware. VMware vCenter Standard offers proactive end-to-end centralized management of virtual environments, delivering the visibility and responsiveness you need for cloud-ready applications.

VMware Network Distributed Switch

VMware vNetwork Distributed Switch maintains network runtime state for VMs as they move across multiple hosts, enabling inline monitoring and centralized firewall services. It provides a framework for monitoring and maintaining the security of virtual machines as they move from physical server to physical server and enables the use of third-party virtual switches such as the Cisco Nexus 1000V to extend familiar physical network features and controls to virtual networks.

Secure Multi-Tenancy and Operational Modes

FlexPod for SAP Applications is based on a multi-tenancy concept. Secure Multi-Tenancy architecture allows customers and service providers who have internal or external cloud infrastructures to securely isolate shared, virtualized data storage, network fabrics, and servers as a single end-to-end entity. Limiting potential security risks associated with the deployment of multiple tenants within the same physical infrastructure. Tenants can be thought of as various business units, departments, customers, etc.

A tenant is defined as a set of standardized, virtualized resources taken from a shared pool. Each tenant is isolated by VLAN technology on the networking and vFiler technology on the storage layer. FlexPod for SAP Applications always consists of at least two tenants, one infrastructure tenant and at least one tenant for all SAP applications. Additional tenants can be created based on multi-tenancy requirements, like isolation of subsidiaries or isolation of clients. Additional tenants are also used to cover specific use cases like fenced clones of SAP systems or landscapes.

Single Managed Tenant Operation

Figure 7 shows how a SAP landscape is deployed with a single managed tenant. All SAP systems are running within this tenant (Tenant 2).

Figure 7 FlexPod for SAP Applications with a Single Managed Tenant

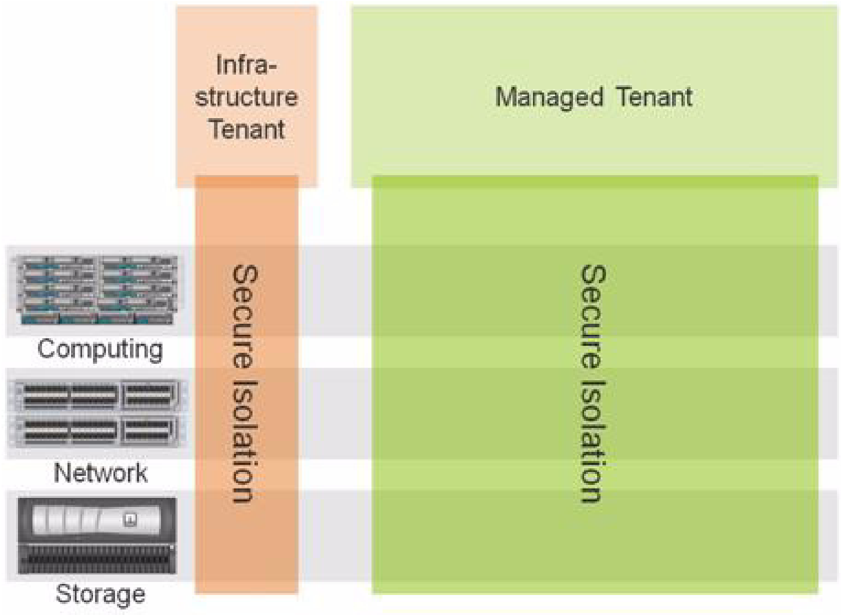
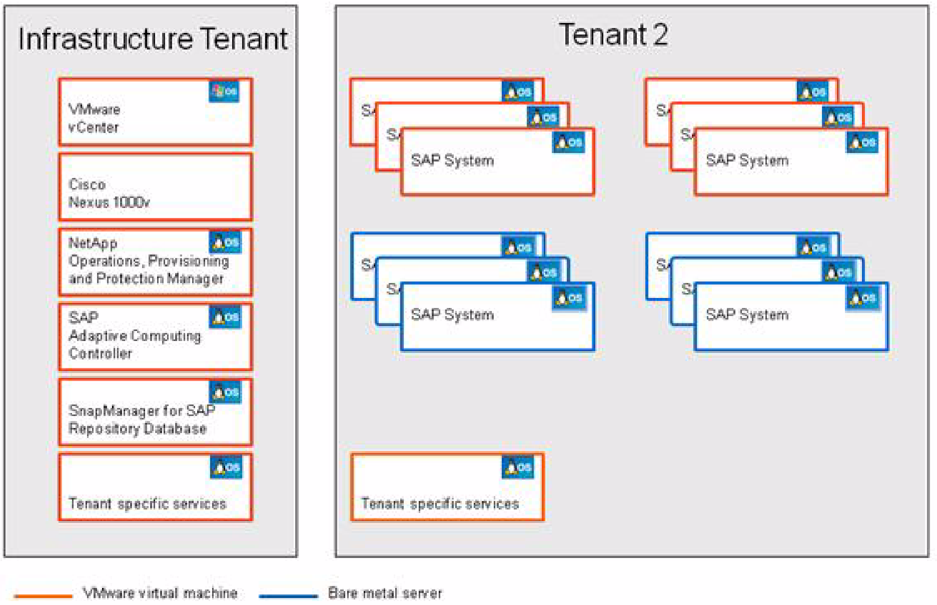


Figure 8 shows a sample deployment of a single-managed tenant.

Figure 8 FlexPod for SAP Applications with Single Tenants



The SAP systems can run on VMware virtual machines or on bare metal servers. All management applications are installed within the infrastructure tenant. These management applications always run on VMware virtual machines.

Within the infrastructure tenant, the following management applications run on VMware virtual machines:

- VMware vCenter Server
- Cisco Nexus 1000v switch
- NetApp Operations Manager, Protection Manager, and Provisioning Manager
- SnapManager for SAP repository database
- Tenant-specific services running in a VMware virtual machine providing Domain Name System (DNS) services

Within the second tenant, all SAP applications are running:

- SAP systems running on VMware virtual machines
- SAP systems running on bare metal servers
- Tenant-specific services running in a VMware virtual machine providing Dynamic Host Configuration Protocol (DHCP), DNS, and Network Information Service (NIS)

Multiple Managed Tenant Operation

Figure 9 shows FlexPod for SAP Applications with multiple managed tenants.

Figure 9 *Multi-Managed Tenant Environment*

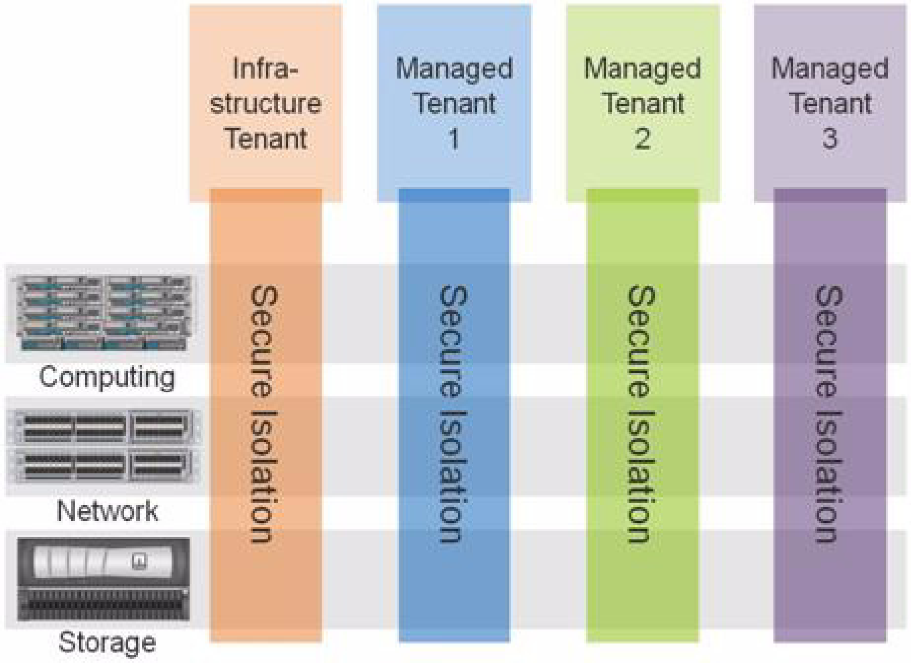
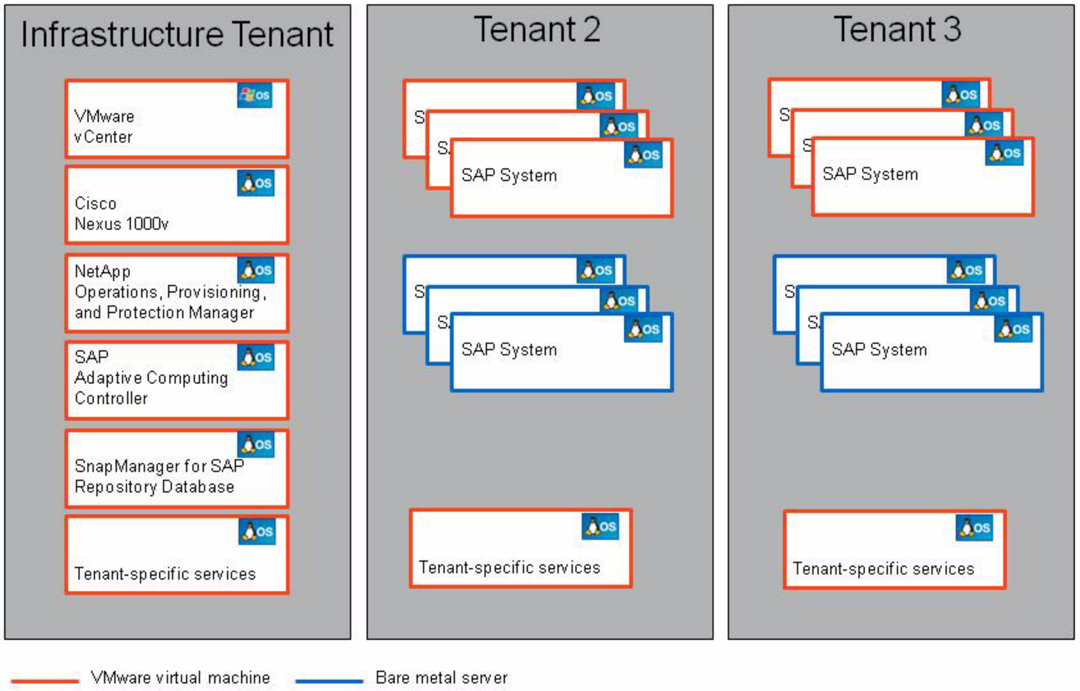


Figure 10 shows how multiple tenants can be used to isolate different subsidiaries, clients or specific SAP landscapes.

Figure 10 *Multiple Tenants*



When using multiple tenants, the tenant specific services will run within every tenant. The SAP systems can run on Vmware virtual machines or bare metal servers.

Application and Data Mobility

SAP on FlexPod provides mobility on all layers of the solution stack:

Application Mobility With SAP Adaptive Computing

The SAP Adaptive Computing Application virtualization functionality allows to start, stop and relocate an SAP application instance from one running operating system to another running operating system. Hereby it is possible to relocate an SAP application instance from an bare metal operating system to an bare metal OS or to an virtual machine based OS or vise versa.

Server Mobility With Cisco UCS Service Profile Technology

The Cisco UCS Service profile technology allows the migration of an full installed stack of OS and application from one physical server to another physical server. UCS takes care that all important characteristics of an server like the WWN, MAC addresses and UUID will be applied before the OS and application starts. With this type of migration it is possible to do a server migration for a planned hardware maintenance or to cover a hardware failure or to scale-up or scale-down the server to cover performance requirement of the Application. The SAP Hardware key is always the same and therefore also the SAP licence is always valid as long a valid licence key is applied to the SAP system.

Server Mobility With VMware

Live migration of VMs with VMware vMotion. VMotion allows you to move a virtual machine from one physical compute node to another without service interruption

Data Mobility With NetApp Datamotion

MultiStore can help you achieve a truly dynamic data center environment, since data can be provisioned, moved, and protected based on user and application boundaries. Since your critical information is kept in virtual storage containers, you can establish operational and business continuity policies that are data and application centric and not tied to specific hardware configurations. Your ability to easily migrate datasets from one physical storage system to another is particularly important for nondisruptive system upgrades and system load balancing. MultiStore virtual partitions allow you to achieve this type of flexibility within the framework of a unified multiprotocol architecture.

These technologies are used for migrating applications and data without or with minimal downtime and support the following use cases:

  - Changing performance requirements
  - Migration of vFiler units and data to different physical storage system
  - Migration of VMs to a different ESX server
  - Migration of SAP systems or databases from VM to bare metal server or vice versa

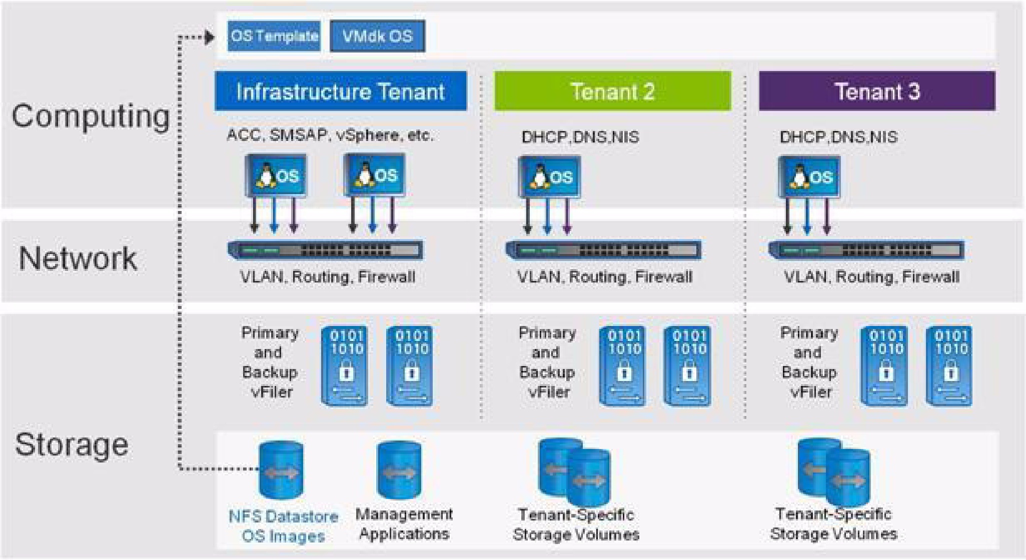
- Minimize planned downtime (hardware exchange)
  - Migration of vFiler units and data, VMs, or SAP applications to new hardware
- Support requirements
  - Migration of database from VM to bare metal server

FlexPod Provisioning Overview

The provisioning of an SAP Application ready infrastructure within FlexPod is realized through standardized components. In general the provisioning of required components within a FlexPod solution is divided into three sections.

- Tenant Provisioning
- Operating System Provisioning
- SAP System Provisioning

Figure 11 Overview



In order to enable the system, the FlexPod infrastructure must be provisioned properly. The following sections details this process.

Automated Provisioning of Infrastructure Components

FlexPod for SAP Applications offers the possibility of provisioning automatically infrastructure components such as the creation of new tenants and deploying of operating systems based on templates.

Tenant Provisioning

The creation of new tenants includes the network setup including the creation of new VLANS, configuration of network routes and setting access control lists to fence the new tenant, creates new vFilers for both primary and secondary data including tenant specific volumes and shares. In addition the tenant specific network services appliance, which offers DNS and DHCP services, will be deployed and configured.

Operating System Deployment

The combination of NetApp cloning technology, templates of operating systems, and virtualized applications with SAP Adaptive Computing allows fast provisioning of operating systems (OSs) for new servers or virtual machines and simplified patching of operating systems.

New patches will be applied and tested at a new golden image and afterward, cloned and in combination with VMware vSphere and the Cisco Unified Computing System, provisioned to new servers (physical or virtual), and the SAP application will be moved to the new hosts.

All required services for operating an SAP systems are pre installed, for example backup services and will be automatically configured during deployment of an operating system.

This reduces the amount of time and resources required to apply patches to operating systems as only one operating system must be patched and tested and not the operating systems of all involved hosts and to configure an operating system with the required services.

Storage Provisioning

At the storage level new space can be provisioned using MultiStore and FlexVol® technology, and new SAP systems can be provisioned with FlexClone technology. In addition, NetApp MultiStore, together with NetApp Data Motion, provides data mobility at the storage level. This makes it easy to move SAP systems, for example, to higher performance storage and servers when operations require greater throughput. All of the functionality mentioned above is integrated into NetApp OperationsManager, Protection Manager, and Provisioning Manager allowing central management and monitoring of storage related activities.

With FlexPod for SAP Applications each tenant has assigned a vFiler that is hosted on primary physical storage system and a vFiler that is assigned to secondary physical storage system. Therefore each tenant can access fast primary storage for production SAP systems as well as secondary storage for backup purposes or for SAP systems with low IO requirements like development or training systems.

Solution Setup and Operation Overview

Infrastructure Setup Tasks

The following lists the steps involved to setup your infrastructure:

1. FlexPod for VMware setup
2. Additional FlexPod for SAP Applications configuration steps
3. Infrastructure tenant setup
    a. NetApp Operations, Provisioning and Protection Manager configuration
    b. Setting up infrastructure volumes
    c. Backup configuration of infrastructure volumes
    d. SAP Adaptive Computing Controller installation
    e. SnapManager for SAP repository database installation
    f. SnapManager for SAP installation on the DFM host
    g. Tenant-specific services configuration (DHCP, DNS, NIS)

4. Installation and configuration of OS
   a. OS template for VMware
   b. OS auto install framework for bare metal
5. Provisioning of one or more tenants
   a. Network configuration
   b. Storage configuration
   c. Tenant specific services configuration (DHCP, DNS, NIS)

Initial Operation Tasks

The following lists the tasks involved in the initial setup:

1. OS provisioning into target tenants
2. SAP system provisioning
   a. Preparation
   b. System installation
3. Configuring backup services for SAP systems
   a. Protection Manager Protection Policy
   b. Creating SnapManager for SAP profile
   c. Configuring data protection
   d. Configuring Br*tools and backint
4. Configuring SAP ACC for SAP systems

Setup FlexPod for VMware

The first step in setting up SAP on FlexPod is setting up FlexPod for VMware according to the FlexPod for VMware Cisco Validated Design Guide. The following sections describe only the differences and additional tasks.

Differences of NetApp Components to FlexPod for VMware

NetApp Operations Manager is installed on a Linux VM Instead of a Windows VM. The configuration steps are the same in the FlexPod for VMware Cisco Validated Design Guide.

The NetApp Virtual Storage Console is installed on the Windows vCenter VM instead of a new Windows VM (Chapter 3.11 of FlexPod for VMware Implementation guide) . It is required to add a second network card to the vCenter VM connected to the NFS network.

Every application other than the management components runs in an additional tenant or additional tenants and not within the infrastructure tenant.

Additional Storage Configuration

To configure additional storage, log on to controller A and set the following option:

options vfiler.vol_clone_zapi_allow on

Set this option also at controller B.

Create a new VLAN for NDMP traffic and configure SnapVault and SnapMirror® access on each controller.

Log on to controller A and execute the following commands:

```
vlan add vif0 <<var_ndmp_vlan_id>>

wrfile -a /etc/rc <<vlan add vif0 <<var_ndmp_vlan_id>>

ifconfig vif0-<<var_ndmp_vlan_id>> mtusize 9000

wrfile -a /etc/ "ifconfig vif0-<<var_ndmp_vlan_id>> mtusize 9000"

ifconfig vif0-<<var_ndmp_vlan_id>> partner vif0-<<var_ndmp_vlan_id>>

wrfile -a /etc/ "ifconfig vif0-<<var_ndmp_vlan_id>> partner
vif0-<<var_ndmp_vlan_id>>

ifconfig vif0-<<var_ndmp_vlan_id>> <<var_ndmp_ip_contr_a>> netmask
<<var_ndmp_netmask>>

wrfile -a /etc/ "ifconfig vif0-<<var_ndmp_vlan_id>>
<<var_ndmp_ip_contr_a>> netmask <<var_ndmp_netmask>>

options ndmpd.preferred_interface  vif0-<<var_ndmp_vlan_id>>

wrfile -a /etc/snapmirror.allow <<var_ntap_B_hostname>>

wrfile -a /etc/snapmirror.allow  <<var_ndmp_ip_contr_b>>

Options snapvault.access
host=<<var_ntap_B_hostname>>,<<var_ndmp_ip_contr_b>>
```

Log on to controller B and execute the following commands:

```
vlan add vif0 <<var_ndmp_vlan_id>>

wrfile -a /etc/rc <<vlan add vif0 <<var_ndmp_vlan_id>>

ifconfig vif0-<<var_ndmp_vlan_id>> mtusize 9000

wrfile -a /etc/ "ifconfig vif0-<<var_ndmp_vlan_id>> mtusize 9000"

ifconfig vif0-<<var_ndmp_vlan_id>> partner vif0-<<var_ndmp_vlan_id>>

wrfile -a /etc/ "ifconfig vif0-<<var_ndmp_vlan_id>> partner
vif0-<<var_ndmp_vlan_id>>

ifconfig vif0-<<var_ndmp_vlan_id>> <<var_ndmp_ip_contr_b>>  netmask
<<var_ndmp_netmask>>

wrfile -a /etc/ "ifconfig vif0-<<var_ndmp_vlan_id>>
<<var_ndmp_ip_contr_b>>  netmask <<var_ndmp_netmask>>

options ndmpd.preferred_interface  vif0-<<var_ndmp_vlan_id>>

wrfile -a /etc/snapmirror.allow <<var_ntap_A_hostname>>

wrfile -a /etc/snapmirror.allow <<var_ndmp_ip_contr_a>>
```

```
Options snapvault.access
host=<<var_ntap_A_hostname>>,<<var_ndmp_ip_contr_a>>
```

Additional Network Configuration

Management Network for Physical Components

In the Flexpod for Vmware documentation, the management ports of the components are connected to Port "any." For the SAP on FlexPod solution, detailed documentation of the management ports and the routing between all components is required. Table 1 documents a sample configuration with an additional Cisco Catalyst® switch representing the customer data center network. The Catalyst switch is not part of the solution.

Table 1 Catalyst 4900M Ethernet Cabling Information

Local Device	Local Port	Connection	Remote Device	Remote Port
Cisco Catalyst 4900M	Eth1/2	10GbE	Cisco Nexus 5548 A	Eth1/3
	Eth1/7	10GbE	Cisco Nexus 5548 B	Eth1/3
	Eth3/11	1GbE	Cisco Nexus 5548 A	Mgmt0
	Eth3/12	1GbE	Cisco Nexus 5548 B	Mgmt0
	Eth3/13	1GbE	lstorn14a	E0m
	Eth3/14	1GbE	lstorn14b	E0m
	Eth3/15	1GbE	Cisco UCS fabric interconnect A	Mgmt0
	Eth3/16	1GbE	Cisco UCS fabric interconnect B	Mgmt0

To configure the network on the Catalyst 4900M, log onto the switch and execute the following commands:

```
Enable


Conf terminal


interface TenGigabitEthernet1/2
 description <<var_nexus5548_A_hostname>>:Eth1/3
 switchport trunk native vlan <<var_global_mgmt_vlan_id>>
 switchport trunk allowed vlan
<<var_global_mgmt_vlan_id>>,<<var_physmgmt_vlan_id>>
 switchport mode trunk
 no shutdown
```

```
interface TenGigabitEthernet1/7
 description <<var_nexus5548_B_hostname>>:Eth1/3
 switchport trunk native vlan <<var_global_mgmt_vlan_id>>
 switchport trunk allowed vlan
<<var_global_mgmt_vlan_id>>,<<var_physmgmt_vlan_id>>
 switchport mode trunk
 no shutdown

interface GigabitEthernet3/11
description <<var_nexus5548_A_hostname>>:mgmt
 switchport access vlan <<var_global_mgmt_vlan_id>>
 switchport mode access
 no shutdown

interface GigabitEthernet3/12
description <<var_nexus5548_B_hostname>>:mgmt
 switchport access vlan <<var_global_mgmt_vlan_id>>
 switchport mode access
 no shutdown

interface GigabitEthernet3/13
 description <<var_ntap_A_hostname>>:e0m
 switchport access vlan <<var_global_mgmt_vlan_id>>
 switchport mode access
 no shutdown

interface GigabitEthernet3/14
 description <<var_ntap_B_hostname>>:e0m
 switchport access vlan <<var_global_mgmt_vlan_id>>
 switchport mode access
 no shutdown

interface GigabitEthernet3/15
 description <<var_ucsm_A_hostname>>:mgmt
 switchport access vlan <<var_global_mgmt_vlan_id>>
 switchport mode access
 no shutdown
```

```
interface GigabitEthernet3/16
 description <<var_ucsm_B_hostname>>:mgmt
 switchport access vlan <<var_global_mgmt_vlan_id>>
 switchport mode access
 no shutdown
exit

exit
copy run start
exit
```

Configure the network on the Nexus 5548 switches to enable the communicating to the Catalyst 4900M,. Log onto <<var_nexus_A_hostname>> and execute the following commands:

```
Conf terminal

interface port-channel100
  description cat4900
  switchport mode trunk
  switchport trunk native vlan <<var_global_mgmt_vlan_id>>
  switchport trunk allowed vlan
<<var_global_mgmt_vlan_id>>,<<var_physmgmt_vlan_id>>,<<var_software_vlan_id>>
  spanning-tree port type network
  vpc 100
exit

interface Ethernet1/3
  description cat4900:Eth1/2
  channel-group 100 mode active
  no shutdown
exit

copy run start
exit
```

Log onto <<var_nexus_B_hostname>> and execute the following commands:

```
Conf terminal

interface port-channel100
  description cat4900
  switchport mode trunk
  switchport trunk native vlan <<var_global_mgmt_vlan_id>>
  switchport trunk allowed vlan 
<<var_global_mgmt_vlan_id>>,<<var_physmgmt_vlan_id>>
  spanning-tree port type network
  vpc 100
exit

interface Ethernet1/3
  description cat4900:Eth1/7
  channel-group 100 mode active
  no shutdown
exit

copy run start
exit
```

Inter-VLAN Routing

The Flexpod environment forces an introduction of predefined access rules in order to implement a strict separation of the different tenants combined with specific access rights to the general available services.

In the first step, standard access lists are implemented that match only on IP network prefixes to separate the networks and define on a low granular layer the basic access rights. In the next step, access lists are defined with focus on the application layer, and therefore extended access lists must be used.

For each tenant IP network, its own VLAN is defined and separates the different networks on Layer2. Each VLAN is configured on the central switch with a Switch Virtual Interface (SVI). That interface represents a logical Layer3 interface on a switch and id bound to a specific VLAN. The SVI offers the capability of basic Layer3 routing functionality on a Layer2 switch without the requirement of specific routing protocols in order to implement inter-VLAN routing.

The following items define the access rights:

- No global inter VLAN routing is allowed.
- Each tenant is allowed to ping its own SVI, the Layer3 interface dedicated to a specific VLAN and defined as Default Gateway in each VLAN.
- The Central Software Tenant Network (`<<var_software_network>>`) must have access to each tenant and vice versa.
- The Global Management tenant (`<<var_inftastructure_network>>`) must have access to each tenant and vice versa.

To establish the inter-VLAN routing functionality, we used the Catalyst 4900M switch.

Log on to the Catalyst 4900M and execute the following commands:

```
Enable
Conf terminal
```

```
ip access-list standard Vlan <<var_physmgmt_vlan_id>>
 permit <<var_infratructure_network>> 0 0.0.0.255
 permit <<var_physmgmt_net_addr>> 0.0.0.255
 deny   any

interface Vlan <<var_physmgmt_vlan_id>>
 ip address <<var_physmgmt_gw_addr>> <<var_physmgmt_netmask>>
ip access-group Vlan<<var_physmgmt_vlan_id>> in
 ip access-group Vlan<<var_physmgmt_vlan_id>> out

Exit
Copy run start
Exit
```

NDMP-Traffic Network

NDMP-traffic network is used for data transfer from Netapp storage to Netapp storage.

The NDMP-Traffic VLAN is required only between the storage controllers within a FlexPod solution; therefore the VLAN ID is configured only on the Cisco Nexus® 5548 and storage devices.

Log on to `<<var_nexus_A_hostname>>` and `<<var_nexus_B_hostname>>` and execute the following commands:

```
Conf terminal
  vlan <<var_ndmp_vlan_id>>
  name NDMP-VLAN
exit
  interface Vlan <<var_ndmp_vlan_id>>
  no shutdown
  ip address <<var_ndmp_network>> <<var_ndmp_netmask>>
exit

interface port-channel11
  switchport trunk allowed vlan <<var_ndmp_vlan_id>> 
<<var_global_nfs_vlan_id>>
  exit

interface port-channel12
  switchport trunk allowed vlan <<var_ndmp_vlan_id>> 
<<var_global_nfs_vlan_id>>
  exit
```

```
 exit
copy run start
exit
```

The NDMP-Traffic network is not routed in our configuration; therefore, we do not configure inter-VLAN routing on the Catalyst 4900 and do not allow the VLAN ID on the port-channel 100.

Central Software Share Network

The Central software repository is used to store configuration files, installation images, and additional software components. In fact that all servers need access to this share a dedicated network segment is defined.

Log on to <<var_nexus_A_hostname>> and <<var_nexus_B_hostname>> and execute the following commands:

```
Conf terminal
vlan <<var_software_vlan_id>>
  name CentralSW
  exit
interface Vlan<<var_software_vlan_id>>
  no shutdown
exit

interface port-channel11
  switchport trunk allowed vlan <<var_software_vlan_id>>
<<var_ndmp_vlan_id>>, <<var_global_nfs_vlan_id>>
exit

interface port-channel12
  switchport trunk allowed vlan <<var_software_vlan_id>>,
,<<var_ndmp_vlan_id>>, <<var_global_nfs_vlan_id>>
exit

exit
 copy run start
exit
```

Configure the inter VLAN routing function on the Catalyst 4900 switch. Log onto the catalyst 4900 and execute the following commands:

```
Enable
Conf terminal

vlan <<var_software_vlan_id>>
```

```
 name CentralSW
exit

interface Vlan<<var_software_vlan_id>>
 ip address <<var_software_gw_addr>> <<var_software_netmask>>
 no shutdown
exit

interface TenGigabitEthernet1/2
  switchport trunk allowed vlan , <<var_global_mgmt_vlan_id>>,
<<var_physmgmt_vlan_id>>,<<var_software_vlan_id>>
exit

interface TenGigabitEthernet1/7
switchport trunk allowed vlan , <<var_global_mgmt_vlan_id>>,
<<var_physmgmt_vlan_id>>,<<var_software_vlan_id>>
exit



copy run start
exit
```

Cisco UCS Configuration for Bare Metal Operating Systems

In addition to the FlexPod for VMware solution, this FlexPod for SAP Applications solution includes bare metal operating systems. To provision a physical server with Cisco UCS a service profile is required. The creation of a Cisco UCS Service Profile can be simplified by using Service Profile templates.

Create Service Profile Template for Bare Metal Linux Installations

Create the virtual host bus adapter (vHBA) templates.

Log on to `<<var_ucsm_A_hostname>>` or `<<var_ucsm_B_hostname>>`.

```
scope org FlexPod
create vhba-template vHBA_Linux_A
set descr "vHBA Fabric A"
set fabric a
set fc-if name VSAN_A
set wwpn-pool WWPN_Pool_A
commit-buffer
```

```
exit

create vhba-template vHBA_Linux_B
set descr "vHBA Fabric B"
set fabric b
set fc-if name VSAN_B
set wwpn-pool WWPN_Pool_B
commit-buffer
exit
```

Create the service profile template:

```
scope org FlexPod
create service-profile linux_a initial-template
 set descr "Template for BM Linux Server"
 set identity uuid-suffix-pool UUID_Pool
 set identity wwnn-pool WWNN_Pool
 power down
 commit-buffer
 create vhba vHBA_A
  set template-name vHBA_Linux_A
  commit-buffer
  exit
 create vhba vHBA_B
  set template-name vHBA_Linux_B
  commit-buffer
  exit
 create vnic vNIC_A
  set fabric a-b
  set mtu 9000
  set identity mac-pool MAC_Pool_A
  set adapter-policy Linux
  set nw-control-policy Net_Ctrl_Policy
  create eth-if default
   commit-buffer
   exit
  exit
 create vnic vNIC_B
  set fabric b-a
  set mtu 9000
  set identity mac-pool MAC_Pool_B
  set adapter-policy Linux
  set nw-control-policy Net_Ctrl_Policy
  create eth-if default
   commit-buffer
   exit
  exit
 set boot-policy lstorn14a
 commit-buffer
 exit
commit-buffer

create service-profile linux_b initial-template
 set descr "Template for BM Linux Server"
 set identity uuid-suffix-pool UUID_Pool
 set identity wwnn-pool WWNN_Pool
 power down
 commit-buffer
 create vhba vHBA_A
  set template-name vHBA_Linux_A
  commit-buffer
  exit
 create vhba vHBA_B
  set template-name vHBA_Linux_B
  commit-buffer
  exit
 create vnic vNIC_A
  set fabric a-b
  set mtu 9000
  set identity mac-pool MAC_Pool_A
  set adapter-policy Linux
  set nw-control-policy Net_Ctrl_Policy
  create eth-if default
   commit-buffer
   exit
  exit
 create vnic vNIC_B
  set fabric b-a
  set mtu 9000
  set identity mac-pool MAC_Pool_B
  set adapter-policy Linux
  set nw-control-policy Net_Ctrl_Policy
  create eth-if default
   commit-buffer
   exit
  exit
 set boot-policy lstorn14b
 commit-buffer
exit
commit-buffer
```

Infrastructure Tenant Setup

Additional Software Components

Besides the components described in the FlexPod for VMware Implementation Guide , the following additional components are needed. For each component, an additional VM with Linux operating system must be used. All of these components are part of tenant infrastructure, and the management and NFS network must be assigned to each VM.

- SAP Adaptive Computing Controller 7.30
- SnapManager for SAP repository database

In addition, VMware vSphere PowerCLI is used to manage some of the workflow. Therefore, install VMware vSphere PowerCLI and the required Microsoft PowerShell V 2.0 at a Windows system within the Infrastructure tenant; for example, at the vCenter VM. It is necessary to use the 32-bit version of PowerShell because some commands used within some workflow scripts do not run with the 64-bit version.

In addition, perform the following preparation steps for using the PowerShell scripts:

- Open a PowerShell command line and execute the following commands.
  - set-executionpolicy remotesigned
  - connect-VIServer <name of virtual center server>
- Accept the default values
- If operating system authentication cannot be used to connect to the vSphere server, save the credentials with the first connect.

  ```
  connect-VIServer -server "Name or IP of the Virtual Center server"
  -user <name of vCenter administrator> -password <password of vCenter
  administrator> -savecredentials
  ```

Central Volumes Within Tenant Infrastructure

Table 2 shows the volumes and the resource pools for source and backup as well as the recommended Protection Manager policy.

Table 2 Volumes Within Tenant Infrastructure

Purposes	Volume Names	Qtrees	Source Resource Pool	Backup Policy	Target Resource Pool
Datastore for VMs and templates	infrastructure_ datastore_1		«var_primary_ respool»	Mirror (SMVI)	«var_secondary_ respool»
Datastore for swap space	infrastructure_ swap		«var_secondary_ respool»	None	N/A
Software share	software		«var_primary_ respool»	Back up	«var_secondary_ respool»
SMREPO	_log	oracle oracle	«var_primary_respool »	Mirror	«var_secondary_ pool»
Backup destination for SMSAP Repo DB, etc.	infrastructure_ backup	data	«var_secondary_ respool»	Local backups only	N/A
ACC database volumes	According to storage layout for JAVA-based systems		«var_primary_ respool»	SMSAP Backup	«var_secondary_ respool»
SMSAP repository database volumes	smrepo_data smrepo_log	oracle oracle	«var_primary_ respool»	Mirror	«var_secondary_ respool»
SAN boot of ESX servers	esxi_boot_a esxi_boot_b		«var_primary_ respool» «var_secondary_ respool»	Mirror	«var_secondary_ respool» «var_primary_ respool»
vFiler root volumes controller A/primary resource pool	<vFiler>_root		«var_primary_ respool»	Back up	«var_secondary_ respool»
vFiler root volumes controller B/secondary resource pool	<vFiler>_root		«var_secondary_ respool»	Back up	«var_secondary_ respool»
Central share for infrastructure tenant	Infrastructure_ share	data sap	«var_primary_ respool»	Back up	«var_secondary_ respool»

Applies only if the minimal setup is used (one clustered storage system); otherwise, primary resource pool must be used

Applies only if the minimal setup is used (one clustered storage system)

Applies only if the minimal setup is used (one clustered storage system)

Controller B is in the secondary resource pool only if the minimal setup is used.

The setup of these volumes is described in Setup Infrastructure Volumes, if they have not already been part of the FlexPod for VMware setup. The software share is located within a separate vFiler unit.

Configuring the Operation, Protection, and Provisioning Manager

This section describes the configuration and creation of the policies needed for provision of new tenants, including vFiler units and volumes. This section assumes that the Operations Manager (OM) has been set up and configured according to the technical report NetApp FlexPod for VMware Deployment Guide (TR- 3892). The configuration is done through the NetApp Management Console connected to the Provisioning/Protection Manager (PM).

Defining Resource Pools

Provisioning Manager offers the ability to easily provision new tenants and volumes using resource pools. A resource pool can consist of several physical controllers and aggregates. Each pool should contain similar resources such as controllers and aggregates for primary storage, or controllers and aggregates for backup purposes.

The following are the steps to define a resource pool, in this case for the primary storage:

1. Click the Add button within the DATA - Resource Pools window.
2. Click Next in the wizard windows.
3. Provide a name for the resource pool: `<<var_primary_respool>>`
4. Add the desired physical controllers and aggregates as resources to this resource pool. Physical controllers are required to be able to provision new vFiler units.
5. Assign labels to the resource; for example, controller for the physical controller and aggr for the aggregate.
6. Set the desired thresholds.
7. Click Finish to create the resource pool.
8. Repeat the steps above to create a new resource pool for secondary storage; for example, `<<var_secondary_respool>>`.

Defining Provisioning Policies

A provision policy defines which physical storage is to be used based on several criteria. In combination with an assigned resource pools to a dataset, the desired aggregate will be used. It also allows restricting the possible storage by labels as defined in the previous section. These labels make sure the right choice of the storage in resource pools with different kind of controllers and disks (SATA vs SAS vs FCP).

The following are the steps to define a provisioning policy for NAS storage:

1. Click the Add button within the Policies - Provisioning window.
2. Click Next in the wizard window that appears.
3. Assign a name `<<var_backup_prov_profile>>` and provide a description, and select NAS as Storage Type.
4. It is recommended to choose Disk failure protection (RAID-DP) and Storage controller failure.
5. Select the desired resource label; for example, aggr.
6. It is not recommended to enable deduplication for SAP systems.
7. Accept the default by clicking Next.
8. Set the desired space utilization thresholds.
9. Select a provision script (Optional).

10. Create the provisioning profile by pressing the Finish button.

To create a new provisioning profile `<<var_backup_prov_profile>>` for secondary storage, repeat the above steps, but choose Secondary as Storage type in step 3.

Defining a vFiler Template

A vFiler template is used to provide general information for every vFiler to be created by the Provisioning Manager.

The following are the steps to create a Default profile:

1. Click the Add button within the Policies - vFiler Templates window.
2. Click Next in the wizard window that appears.
3. Assign a name `<<var_vfiler_template>>` and provide a description.
4. Do not provide DNS or NIS information now because this information is tenant specific.
5. If you want to access the vFiler unit from Windows also, provide the necessary information, but always choose Multiprotocol as Security protocol.
6. Click Finish to create the vFiler template.

Setup Infrastructure Volumes

This section describes the creation of the additional volumes, including export and backup configuration. This section describes the minimal setup (one clustered storage system). If a dedicated storage system is used as secondary storage, the backup vFiler unit must run at this system. That means that either infrastructure_vfiler_2 must run on the dedicated storage system or an additional vFiler running on this dedicated storage system must be used as Backup or Mirror node.

Software Share

This share contains the scripts and software that are needed for operating workflows within the different tenants later on. Because the content of this volume is replicated into every tenant, do not store any sensitive data within this volume.

The following are the steps to create the software share:

1. Log on to the dfm hosts and create the software vFiler unit with the following DFM command:

```
dfpm vfiler create -d  <<var_software_ip>> -s software -a
nfs,cifs,iscsi -f  <<var_primary_respool>> software
```

2. Set up the software vFiler unit with the following DFM command:

```
dfpm vfiler setup  -t  <<var_vfiler_template>>  -r <<var_vfiler_pw>>
-c -w workgroup -i  <<var
_software_ip":vif0:<<var_software_netmask>>:<<var_software_vlan_id
>>:9000:vif0 software
```

3. Log onto the storage controller A.
4. Create the volume software:

```
vol create software -s none aggr1 <<var_software_size>>
```

5. Add the software volume to vFiler software:

```
vfiler add software /vol/software
```

6. Change the context to vFiler software:

```
vfiler context software
```

7. Add the default network route:

```
route add default <<var_software_gate_ip>> 1
```

8. Export the volume to all hosts:

```
exportfs -p sec=sys,ro,rw=<<var_infratructure_network>>,anon=0
/vol/software
```

9. Log on to the dfm host.
10. Create a new dataset:

```
dfpm dataset create -v <<var_prim_prov_profile>> -r software
software
```

11. Add the software volume to the dataset:

```
dfpm dataset add  software  software:/software
```

12. Add the backup policy to the dataset:

```
dfpm dataset modify -p "Back up" -v <<var_backup_prov_profile>>
software Backup
```

13. Assign the secondary resource pool to the mirror node:

```
dfpm dataset respool add -N "Backup" software
<<var_secondary_respool>>
```

Volume Infrastructure Share

This volume is needed to store the /usr/sap/mnt/directory of the ACC, the log files of the infrastructure components.

The following are the steps to create the infrastructure share:

1. Log onto the dfm host.
2. Create a dataset for the infrastructure_share volume:

```
dataset create -v <<var_prim_prov_profile>> -r
infrastructure_vfiler_1 infrastructure_share
```

3. Add the primary resource pool to the infrastructure_share:

```
dfpm dataset respool add infrastructure_share
<<var_primary_respool>>
```

4. Assign the backup policy to the infrastructure_share volume, and set the destination to the secondary vFiler unit:

```
dfpm dataset modify -p "Back up"  -r infrastructure_vfiler_2
infrastructure_share Backup
```

5. Add the secondary resource pool to the backup destination of the infrastructure_share volume/dataset:

```
dfpm dataset respool add -N "Backup" infrastructure_share
<<var_secondary_respool>>
```

6. Provision the SAP qtree of the infrastructure_share dataset:

```
dfpm dataset provision -n data  -s <<var_infra_share_data_size>> -e
nfs -w all -N no -a 0 -S sys infrastructure_share
```

7. Provision the data qtree of the infrastructure_share dataset:

```
dfpm dataset provision -n sap  -s <<var_tenant_share_sap_size>>  -e
nfs -w all -N no -a 0 -S sys infrastructure_share
```

Volume Infrastructure Backup

This volume is used for backup purposes; for example, archive log backup of the ACC and backup of the DFM database.

The following steps create the infrastructure backup volume:

1. Log onto the DFM host.
2. Create a dataset for the backup volume:

```
dfpm dataset create -v <<var_backup_prov_profile>> -r
infrastructure_vfiler_2 infrastructure_backup
```

3. Add the secondary resource pool to the backup dataset:

```
dfpm dataset respool add  infrastructure_backup
<<var_secondary_respool>>
```

4. Assign the Local backups only policy to the central share volume, and set the destination to the secondary vFiler unit:

```
dfpm dataset modify -p "Local backups only" -r
infrastructure_vfiler_2 infrastructure_backup
```

5. Provision the backup dataset:

```
dfpm dataset provision -n data  -s <<var_infra_backup_size>> -e nfs -w
all -N no -a 0 -S sys infrastructure_backup
```

SMSAP Repository Volumes

These volumes are needed to store the repository database of SMSAP.

The following steps create the SMSAP repository volumes:

1. Log onto the DFM host.
2. Create a dataset for the SMSAP repository data volume:

```
dfpm dataset create -v <<var_prim_prov_profile>> -r
infrastructure_vfiler_1 smrepo_data
```

3. Create a dataset for the SMSAP repository data volume:

```
dfpm dataset create -v <<var_prim_prov_profile>> -r
infrastructure_vfiler_1 smrepo_log
```

4. Add the primary resource pool to the data dataset:

```
dfpm dataset respool add smrepo_data  <<var_primary_respool>>
```

5. Add the primary resource pool to the log dataset:

```
dfpm dataset respool add smrepo_log  <<var_primary_respool>>
```

6. Assign the Mirror policy to the data dataset and set the destination to the secondary vFiler:

```
dfpm dataset modify -p "Mirror"  -r infrastructure_vfiler_2
smrepo_data  Mirror
```

7. Assign the Mirror policy to the log dataset and set the destination to the secondary vFiler:

```
dfpm dataset modify -p "Mirror"  -r infrastructure_vfiler_2
smrepo_log  Mirror
```

8. Add the secondary resource pool to the backup destination of the data dataset:

```
dfpm dataset respool add -N "Mirror" smrepo_data
<<var_secondary_respool>>
```

9. Add the secondary resource pool to the backup destination of the data dataset:

```
dfpm dataset respool add -N "Mirror" smrepo_log
<<var_secondary_respool>>
```

10. Provision the data dataset:

```
dfpm dataset provision -n oracle  -s 30G -e nfs -w all -N no -a 0 -S
sys smrepo_data
```

11. Provision the log dataset:

```
dfpm dataset provision -n oracle  -s 10G -e nfs -w all -N no -a 0 -S
sys smrepo_log
```

SMSAP Repository Database Backup

The backup of the Repository is done with the export functionality from Oracle. A script is provided, which can be scheduled by cron.

The following are the steps to schedule SMSAP repository backups:

1. Create folder /mnt/backup/backup_repo.
2. chown 777 /mnt/backup/backup_repo.
3. oracle@t001-smrepo:~> /mnt/software/scripts/backup_repo.sh.
4. oracle@t001-smrepo:~> crontab -e.
5. Insert the following:

```
30 20 * * * /mnt/software/scripts/backup_repo.sh
```

SMSAP Repository Database Restore

The restore of a dedicated Repository schema can be done with `imp`. It is recommended that you delete and recreate the Repository user prior to the restore.

The following example is for the Repository of tenant t009:

```
Import of only one Schema for a dedicated user:
oracle@t001-smrepo:~> sqlplus / as sysdba


SQL*Plus: Release 10.2.0.1.0 - Production on Tue Apr 12 16:26:26 2011
Copyright (c) 1982, 2005, Oracle.  All rights reserved.
```

```
Connected to:
Oracle Database 10g Enterprise Edition Release 10.2.0.1.0 - 64bit
Production
With the Partitioning, OLAP and Data Mining options


SQL> drop user smrepo_t009 cascade;
User dropped.


SQL>
SQL> create user smrepo_t009 identified by "ucs4sap!" default
tablespace repdata_t009;
User created.


SQL> grant resource, connect to smrepo_t009;
Grant succeeded.
SQL>exit


oracle@t001-smrepo:~> NLS_LANG=AMERICAN_AMERICA.WE8ISO8859P1 ;export
NLS_LANG
oracle@t001-smrepo:~>imp system/ucs4sap! fromuser=smrepo_t009
file=/mnt/backup/backup_repo/backup_"time stamp"_REP.expdat
log=/mnt/backup/ imp.log
Import: Release 10.2.0.1.0 - Production on Tue Apr 12 16:34:01 2011
Copyright (c) 1982, 2005, Oracle.  All rights reserved.
Connected to: Oracle Database 10g Enterprise Edition Release 10.2.0.1.0
- 64bit Production
With the Partitioning, OLAP and Data Mining options
Export file created by EXPORT:V10.02.01 via conventional path
import done in WE8ISO8859P1 character set and AL16UTF16 NCHAR character
set
import server uses WE8ISO8859P1 character set (possible charset
conversion)
. importing SMREPO_T009's objects into SMREPO_T009
. . importing table      "SMO_31_AUTOGENPROFILE"        0 rows imported
. . importing table          "SMO_31_CONNECTION"        0 rows imported
. . importing table     "SMO_31_CONNECTMAPPINGS"        0 rows imported
. . importing table           "SMO_31_CONTAINER"        0 rows imported
. . importing table          "SMO_31_CREDENTIAL"        2 rows imported
. . importing table             "SMO_31_DATASET"        0 rows imported
. . importing table       "SMO_31_EXTERNALTABLE"        0 rows imported
. . importing table          "SMO_31_LOGMESSAGE"        20 rows imported
. . importing table  "SMO_31_NOTIFICATIONSETTINGS"          0 rows
imported
. . importing table       "SMO_31_OPERATIONCYCLE"        1 rows imported
. . importing table           "SMO_31_PARAMETER"        0 rows imported
. . importing table             "SMO_31_PROFILE"        1 rows imported
. . importing table   "SMO_31_PROFILENOTIFICATION"          0 rows
imported
. . importing table       "SMO_31_PROFILEVERSION"        1 rows imported
. . importing table    "SMO_31_REPOSITORYPROPERTY"          1 rows
imported
. . importing table      "SMO_31_RETENTIONPOLICY"        4 rows imported
. . importing table    "SMO_31_SCHEDULEDBACKUPSET"          0 rows
imported
. . importing table    "SMO_31_SCHEDULEDOPERATION"          0 rows
imported
. . importing table       "SMO_31_SNAPPOINTGROUP"        0 rows imported
. . importing table   "SMO_31_SUMMARYNOTIFICATION"          0 rows
imported
. . importing table      "SMO_31_SUMMARYPROFILES"        0 rows imported
About to enable constraints...
Import terminated successfully without warnings.
oracle@t001-smrepo:~>
```

Infrastructure Datastore Backup

This volume contains the VMware datastore where the operating systems of all VMs and the templates for provisioning are stored. This volume is mirrored to the backup destination. A consistent Snapshot copy of the datastore has to be created using SnapManager for Virtual Infrastructure (SMVI) part of Virtual Storage Console 2.0 (VSC). To do so, schedule a backup of the complete datastore as described within the Backup and Recovery Administration Guide .

The following steps create the infrastructure datastore backup:

1. Log onto the DFM host.
2. Create a new dataset:

   ```
   dfpm dataset create -v <<var_prim_prov_profile>> -r
   infrastructure_vfiler_1 infrastructure_datastore
   ```

3. Add the infrastructure_datastore volume to the dataset:

   ```
   dfpm dataset add  infrastructure_datastore
   infrastructure_vfiler_1:/infrastructure_datastore
   ```

4. Add the secondary vfiler as Mirror node to the dataset:

   ```
   dfpm dataset modify -p "Mirror" -v <<var_backup_prov_profile>> -r
   infrastructure_vfiler_2 infrastructure_datastore Mirror
   ```

5. Assign the secondary resource pool to the mirror node:

   ```
   dfpm dataset respool add -N "Mirror" infrastructure_datastore
   <<var_secondary_respool>>
   ```

Infrastructure Swap Backup

This volume contains the VMware swap space for all VMs. Because this volume contains only temporary data, a backup is not necessary. For management and monitoring reasons, this volume should be added to a DFM dataset.

The following steps create the dataset for volume infrastructure swap:

1. Log onto the DFM host.
2. Create a new dataset:

   ```
   dfpm dataset create -v  <<var_prim_prov_profile>> -r
   infrastructure_vfiler_2 infrastructure_swap
   ```

3. Add the infrastructure_swap volume to the dataset:

   ```
   dfpm dataset add  infrastructure_swap infrastructure_vfiler_2:/
   infrastructure_swap
   ```

vFiler Root Volumes Backup

It is recommended to backup the configuration of the vFiler units and the physical controllers (vfiler0).

The following steps backup the configuration of vFiler units and physical controllers:

1. Log on to the DFM host.
2. Create a new dataset for the primary vFiler units:

   ```
   dfpm dataset create backup_prim_vfilers
   ```

3. Create a new dataset for the secondary vFiler units:

   ```
   dfpm dataset create backup_bck_vfilers
   ```

4. Add the root volume of controller A to the backup_prim_vfilers dataset:

   ```
   dfpm dataset add  backup_prim_vfilers  <<var_ntap_A_hostname>>:/vol0
   ```

5. Add the root volume of infrastructure_vfiler_1 to the backup_prim_vfilers dataset:

   ```
   dfpm dataset add  backup_prim_vfilers
   infrastructure_vfiler_1:/infrastructure_root
   ```

6. Add the root volume of infrastructure_vfiler_1 to the backup_prim_vfilers dataset:

   ```
   dfpm dataset add  backup_prim_vfilers  software:/software_root
   ```

7. Assign the backup policy to the dataset:

   ```
   dfpm dataset modify -p "Back up" -v <<var_backup_prov_profile"
   backup_prim_vfilers Backup
   ```

8. Assign the secondary resource pool to the Backup node:

   ```
   dfpm dataset respool add -N "Backup" backup_prim_vfilers
   <<var_secondary_respool>>
   ```

9. Add the root volume of controller B to the backup_bck_vfilers dataset:

dfpm dataset add backup_bck_vfilers <<var_ntap_B_hostname>>:/vol0

10. Add the root volume of infrastructure_vfiler_2 to the backup_bck_vfilers dataset:

```
dfpm dataset add  backup_bck_vfilers
infrastructure_vfiler_2:/infrastructure_root
```

11. Assign the backup policy to the dataset:

```
dfpm dataset modify -p "Back up" -v <<var_prim_prov_profile>>
backup_bck_vfilers Backup
```

12. Assign the primary resource pool to the Backup node:

```
dfpm dataset respool add -N "Backup" backup_bck_vfilers
<<var_primary_respool>>
```

SAN Boot Volumes of ESXI Servers Backup

It is recommended to mirror the boot disks of the ESXi servers.

The following steps backup SAN boot volumes of ESXI servers:

1. Log onto the DFM host.
2. Create a new dataset for the volume esxi_boot_a:

```
dfpm dataset create esxi_boot_a
```

3. Create a new dataset for the volume esxi_boot_b:

```
dfpm dataset create esxi_boot_b
```

4. Add the esxi_boot_a volume to the dataset:

```
dfpm dataset add  esxi_boot_a  <<var_ntap_A_hostname>>:/esxi_boot_a
```

5. Add the esxi_boot_b volume to the dataset:

```
dfpm dataset add  esxi_boot_b  <<var_ntap_B_hostname>>:/esxi_boot_b
```

6. Add the protection policy Mirror to the dataset:

```
dfpm dataset modify -p "Mirror" -v <<var_backup_prov_profile>>   -
esxi_boot_a Mirror
```

7. Add the protection policy Mirror to the dataset:

```
dfpm dataset modify -p "Mirror" -v <<var_backup_prov_profile>>   -
esxi_boot_b Mirror
```

8. Assign the secondary resource pool to the mirror node:

```
dfpm dataset respool add -N "Mirror" esxi_boot_a
<<var_secondary_respool>>
```

9. Assign the secondary resource pool to the mirror node:

```
dfpm dataset respool add -N "Mirror" esxi_boot_b
<<var_primary_respool>>
```

Adaptive Computing Controller Setup

The SAP Adaptive Computing Controller (ACC) provides the possibility to monitor and operate SAP system landscapes. An adaptive computing-enabled SAP landscape contains the parts, the controller itself (ACC), and host agents that monitor and interact with hardware resources and SAP systems. This section describes the installation of the ACC. The installation of the host agents is described as part of the OS template installation.

The installation of ACC 7.30 is done on a dedicated host within the infrastructure tenant and consists of three steps:

1. Installation of SAP Netweaver CE 7.2
2. Deployment of ACC package.
3. Execution of ACC CTCs.

The installation of SAP NW CE 7.2 is done through SAPINST following the standard procedure of an SAP installation. Use the usage type "basic" to install the NW system.

The installation of the ACC package is a deployment of the LMACC.sda software archive. This can be done through telnet or through the SAP NW developer studio. This section describes the installation through telnet.

The following steps install the ACC package through telnet:

1. Copy the sda file to a folder on the ACC host; for example, `/tmp`.
2. Open a telnet session to the ACC system; for example, `telnet t001-acc 50008`.
3. Log in with the Administrator account.
4. Deploy the archive using the DEPLOY command; for example, `DEPLOY /tmp/LMACC.sda`.
5. A success message is displayed when the archive has been deployed.

The ACC basic configuration must be done by running the ACC CTC scripts within SAP Netweaver Administrator.

The following steps configure the ACC:

1. Open a browser window to the SAP NWA; for example, through `http://t001-acc:50000/nwa.`
2. Log in with the Administrator account.
3. Navigate to Configuration Management>Scenarios>Configuration Wizard.
4. Select and Start the Initial Setup for Adaptive Computing Controller script.

Note Keep the default values that were provided during the script execution.

SMSAP Repository Database

The SMSAP Repository is installed on Linux VM within the infrastructure tenant. This VM must be created with 4GB RAM, 20GB disk space, and two network interfaces; one interface connected to the management VLAN and one interface connected to the NFS VLAN.

Mount the volumes created for the repository database and install the SMSAP repository database with the following parameters:

```
Hostname: t001-smrepo.t001.company.corp
```

```
   SID: REP
   Listener Port: 1521
```

The configuration of the tenant-specific repositories is part of the tenant provisioning scenario and is described in this section.

SMSAP Installation on the DFM Server

The DFM host is used to run the script fp_clone4repair.sh within the workflow for the Clone of SAP production system.

The DFM host where the script is executed needs to run SMSAP commands. Therefore SMSAP needs to be installed on the host. There is no need to install SDU, and the SMSAP server does not need to be started at the host.

After SMSAP is installed, the following configuration must be done in the SMSAP configuration file:

```
t001-dfm:/mnt/software/scripts # vi
/opt/NetApp/smsap/properties/smsap.config

******

# If set to true the users OS password will be cached in the credential
file in an encrypted form.

host.credentials.persist=true

*******
```

Credentials for repository, hosts, and profiles are set during the workflow “Clone of SAP production system.”

Infrastructure Tenant-Specific Services

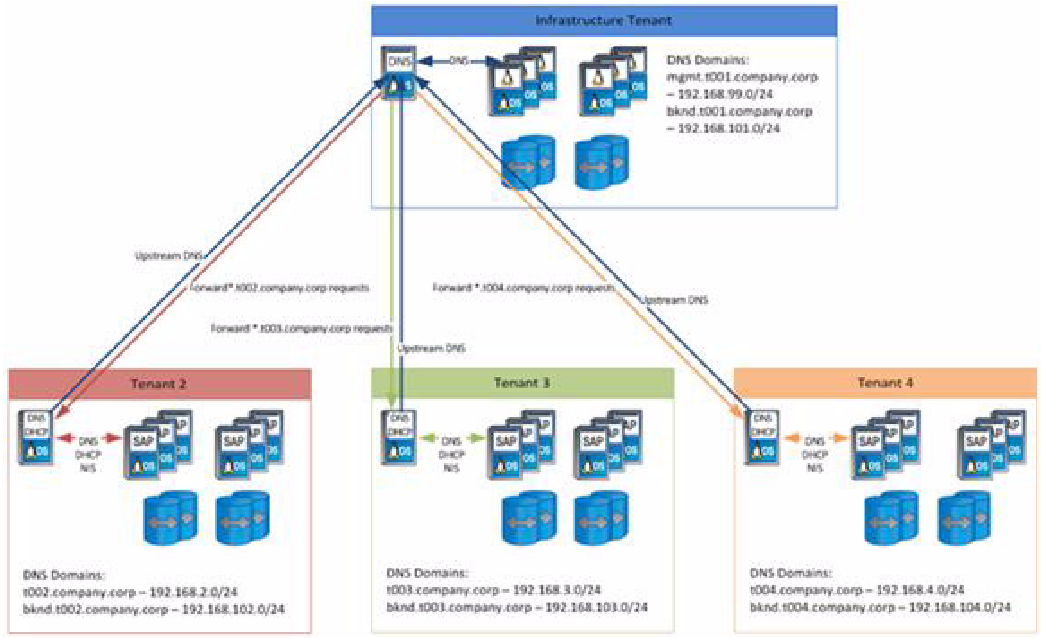
Tenant-specific services are currently provided by a Linux VM within each tenant.

Within the infrastructure tenant, the only service that is provided is DNS. The configuration is described in this section.

DNS

Figure 12 shows the DNS structure of the infrastructure tenant and the other tenants.

Figure 12 DNS Structure of Tenants


Infrastructure Tenant
DNS
DNS
OS
DNS Domains:
mgmt.t001.company.corp
– 192.168.99.0/24
bknd.t001.company.corp
– 192.168.101.0/24
Upstream DNS
Forward* t002.company.corp requests
Forward * t003.company.corp requests
Upstream DNS
Forward * t004.company.corp requests
Upstream DNS
Tenant 2
DNS
DHCP
OS
DNS
DHCP
NIS
SAP
OS
DNS Domains:
t002.company.corp – 192.168.2.0/24
bknd.t002.company.corp – 192.168.102.0/24
Tenant 3
DNS
DHCP
OS
DNS
DHCP
NIS
SAP
OS
DNS Domains:
t003.company.corp – 192.168.3.0/24
bknd.t003.company.corp – 192.168.103.0/24
Tenant 4
DNS
DHCP
OS
DNS
DHCP
NIS
SAP
OS
DNS Domains:
t004.company.corp – 192.168.4.0/24
bknd.t004.company.corp – 192.168.104.0/24

DNS service is provided using `DNSmasq`. `DNSmasq` is a standard package of the `SuSE` distribution and can be installed through yast. The configuration is done through the files `/etc/dnsmasq.conf` and `/etc/hosts`. The DNS in the infrastructure tenant on the one hand answers DNS queries from within the infrastructure tenant and on the other hand serves as upstream DNS for the DNS servers within each tenant. In the latter case, it accepts queries and routes them to the DNS server in the corresponding tenant.

This is done through the following entries in the `dnsmasq.conf` file:

```
## Definition of the infrastructure tenant domain

Domain=t001.company.corp

Local=/t001.company.corp/

## Section for each available tenant

## add new sections for newly provisioned tenants

# route forward queries for *.t002.company.corp to 192.168.2.50 (T002
DNS)

Server=/t002.company.corp/192.168.2.50

# route reverse lookups to 192.168.2.50 (T002 DNS)

Server=/2.168.192.in-addr.arpa/192.168.2.50

Server=/102.168.192.in-addr.arpa/192.168.2.50
```

…

Because no DHCP is required in the infrastructure tenant, it is disabled through the following lines:

```
no-dhcp-interface=eth0

no-dhcp-interface=eth1
```

To enable the configuration, the `dnsmasq` service must be restarted through the following command:

```
service dnsmasq restart
```

Logging information for `DNSmasq` can be found in `/var/log/dnsmasq.log`, and the configuration can be adapted by editing the active config files `/etc/dnsmasq.conf` and `/etc/hosts` or the according template files.

Table 3, Table 4, and Table 5 give an overview of fixed hostnames and IP addresses in the infrastructure tenant.

Table 3 Management LAN

Hostname	IP Address	Description
t001-smrepo.mgmt.t001.company.corp	192.168.99.30	NetApp SnapManager Repository
t001-0-lnx.mgmt.t001.company.corp	192.168.99.50	Tenant Specific Services VM
smt-dfm.mgmt.t001.company.corp	192.168.99.68	NetApp DataFabric Manager
ucsvmwvc.mgmt.t001.company.corp	192.168.99.78	VMware vSphere Center
t001-acc.mgmt.t001.company.corp	192.168.99.101	Adaptive Computing Controller
vsappesx001.mgmt.t001.company.corp	192.168.99.241	VMware vShield App ESX 001
vsappesx002.mgmt.t001.company.corp	192.168.99.242	VMware vShield App ESX 002

Table 4 Back-End LAN

Hostname	IP Address	Description
t001-1-prim.bknd.t001.company.corp	192.168.101.10	Infrastructure Tenant vFiler
smt-dfm.bknd.t001.company.corp	192.168.101.20	NetApp DataFabric Manager
t001-smrepo.bknd.t001.company.corp	192.168.101.30	NetApp SnapManager Repository
t001-acc.bknd.t001.company.corp	192.168.101.101	Adaptive Computing Controller

Table 5 Other Networks

Hostname	IP Address	Description
software.company.corp	192.168.96.10	Software share available to all tenants
lstorn14a.t001.company.corp	192.168.98.10	Infrastructure Filer 14a
lstorn14b.t001.company.corp	192.168.98.11	Infrastructure Filer 14b

Installing and Configuring the Operating System Images

SLES VMware

Operating System Template Installation

This section describes the creation of a VMware template, which is used for OS/VM provisioning.

- Log onto the VMware vCenter server and create a new virtual machine with the following criteria

  Name: `<<var_template_name_suse>>`

  Datastore: Infrastructure

  Virtual Machine Version: 7

  Guest Operating System: Linux -> Suse Linux Enterprise 11 (64bit)

  Number of virtual Processors: 4

  Memory Configuration: 8 GB

  Network connections: Define two network connections, one connected to the Global-MGMT network and one connected to the NFS-Network.

  Virtual Disk capacity: 60 GB

  ISO image mapping: Define the location of the Suse SLES 11 SP1 installation ISO image.
- Boot the virtual machine and start the operating system installation process.

  Please follow the installation steps on the screen and accept the defaults excepting the following requirements for FlexPod for SAP Application requirements.

  Disk Layout: Add two primary partitions, the first one with size of 20GB Linux Native with Ext3 FS Type mounted at / and the second one with size of 40GB as Linux swap.

  Software Selection: Add the following software components in addition to the standard: SAP Application Server Base, C/C++ Development tools, and your desired desktop. Also required packages are unixODBC, unixODBC-32bit, unixODBC-devel, and unixODBC-devel-32bit, java-1_4_2-ibm. Check whether Perl 5 is chosen for installation. If not, choose Perl 5, too.
- Check the box Change Hostname through DHCP.

  Open the SSH ports in the firewall and set the Network interfaces (eth0-ethX) to internal networks

  The network test can be skipped.

  Change the User Authentication Method to NIS. Configure the NIS and Check the boxes Use NIS and Open Ports in Firewall.

DHCP Client Configuration

This section describes the necessary DHCP Client configuration and other network-related configurations.

Adjust the DHCP Client timeout by setting it to 99 seconds. This makes surethat make sure the DHCP client does not go into background to get the DHCP lease. This is necessary because otherwise other scripts or services that require network access may fail to start at boot time. Edit `/etc/sysconfig/network/dhcp` and change the timeout value to 99:

```
DHClient_TIMEOUT='99'
```

As all interfaces should get the same hostname. Insert the line `hostname > /etc/HOSTNAME` into the section `case$state` in up into /etc/sysconfig/network/scripts/dhcpd-hook as shown below:

…

```
case $state in

up)
        write_cached_config_data  dhcp4_state up       $INTERFACE
        commit_cached_config_data                      $INTERFACE

        $debug && NC_OPTIONS="-v"
        /sbin/netconfig modify -s "dhcpcd" \
                -i $INTERFACE $NC_OPTIONS  \
                -l $leaseinfo 2>&1 | $log_dbg

        hostname > /etc/HOSTNAME
```

In addition, it is necessary that all other interfaces wait until the first interface (eth0) is up and gotst the new hostname assigned. Therefore, add the following line into the configuration files (for example, `/etc/sysconfig/network/ifcfg-eth1` for eth1 of all interfaces except for eth0.

```
PRE_UP_SCRIPT="wait4eth0"
```

Afterward, create the script "`wait4eth0`" in directory `/etc/sysconfig/network/script` with the following content:

```
#!/bin/bash
ifstatus eth0
eth0up=$?
while [ $eth0up -gt 0 ]; do
        echo "waiting for eth0...";
        sleep 5;
        ifstatus eth0;
        eth0up=$?;
done
```

Disable the use of persistent network device names by clearing the UDEV configuration for network interfaces according to the Novell/SUSE TID 3048119:

```
cat< /dev/null > /etc/udev/rules.d/70-persistent-net.rules
```

This step must be repeated if the template is started or rebooted for other changes.

Check whether the network interfaces are set to internal networks at the firewall.

Open `/etc/sysconfig/SuSEfirewall2` and check whether the network interfaces are included in `FW_DEV_INT` as shown below:

```
FW_DEV_INT="eth0 eth1 eth2"
```

NIS Configuration

The OS template is configured to run a NIS client communicating with a NIS server to provide central user management capabilities. The following maps are provided by the NIS server: `passwd, group, services`. This section describes the necessary configurations.

NSSWITCH

The file `/etc/nsswitch.conf` configures where to get data from for the different user configuration files. The OS template should contain the following `nsswitch.conf` entries:

```
passwd:      compat
shadow:      files
group:       compat

hosts:       dns files
networks:    files dns

services:    nis
```

PASSWD

The following line must be appended to the file /etc/passwd to merge NIS users with local users:

```
+::::::
```

Groups

The following line must be appended to the file /etc/group to merge NIS groups with local groups:

```
+:::
```

Services

The services definition is completely retrieved from the NIS server. No local services are possible.

Linux Kernel Configuration

No special kernal settings are required for the FlexPod for SAP Applications landscape other than the ones mentioned in SAP Note 1310037 for SLES 11 installations. The most important thing is to install the sapconf (fka sapinit) package. This is done automatically when you select the pattern “SAP Application Server Base” during the SLES installation process.

SAP Host Agents Installation

The SAPHOSTAGENT package contains all of the required elements for centrally monitoring any host. You can either install the host agent using SAPInst (only the kernel DVD is required) or install the package directly (download SAPHOSTAGENT.SAR from SAP Service Marketplace).

The following steps install the SAP host agents:

1. Login as user root.
2. Make sure the group sapsys exists on the host.
3. Make sure the user sapadm exists and is a member of the sapsys group.
4. Decompress the SAPHOSTAGENT.SAR archive with the SAPCAR tool (for example, into /tmp): sapcar -xvf SAPHOSTAGENT.SAR.
5. Go to the extracted path /tmp/hostctrl/exe.
6. Execute the installation procedure: ./saphostexec -install.

7. Verify that the centrally mounted `SAPOSCOL` working directory `/usr/sap/tmp` exists (if not, mount it accordingly) or change the working directory by adding the following line to the file `/usr/sap/hostctrl/exe/host_profile`:

   ```
   DIR_PERF = /usr/sap/hostctrl/work
   ```

SnapDrive Installation and Configuration

After the SnapDrive is installed, the following configuration file changes must be made:

- vFiler units do not support HTTPS. HTTP must be configured in the `snapdrive config` file.
- The SAP systems are installed as adaptive computing aware. There are no service-specific entries in `/etc/fstab`.
- Turn off the autosupport option:

  ```
  t002-1-lnx:/opt/NetApp/snapdrive # vi snapdrive.conf
  use-https-to-filer=off  # Communication with filer done via HTTPS
  instead of HTTP
  snapcreate-check-nonpersistent-nfs=off  # Check that entries exist
  in /etc/fstab for specified nfs fs.
  autosupport-enabled=off
  ```

Access configuration to Data Fabric Manager:

```
snapdrive config set -dfm <user_name> <<var_ntap_dfm_ip>>
```

SMAP Installation and Configuration

During the installation, user and group must be configured to `root/root`.

```
Please enter the operating system user name and group name that should
be used to run SnapManager for SAP commands.  Press <ENTER> to accept
the default
values.
   User Name (DEFAULT: oracle): root
   User Group (DEFAULT: dba): root
```

Insert the following option into `/opt/NetApp/smsap/properties/smsap.config`:

```
auto_support.on=off
```

JAVA.SECURITY File

Within the java.security file `/dev/urandom` must be changed to `/dev/./urandom`.

```
cat /opt/NetApp/smsap/jre/lib/security/java.security | grep
securerandom
# the securerandom.source property. If an exception occurs when
securerandom.source=file:/dev/./urandom
# Specifying this system property will override the securerandom.source
```

Authorization Configuration

Create `/etc/pam.d/snapmanger` for SMSAP:

```
t002-1-lnx:/etc/pam.d # vi snapmanager
Insert : auth required pam_unix.so
account required pam_unix.so

t002-1-lnx:/etc/pam.d # cat snapmanager
auth required pam_unix.so
account required pam_unix.so
t002-1-lnx:/etc/pam.d #
```

SMSAP Post Cloning Plugin Configuration

The scripts `os_db_authentication.sh` and `sap_follow_up_activities.sh` must be copied from `/opt/NetApp/smsap/plugins/examples/clone/create/post` to `/opt/NetApp/smsap/plugins/clone/create/post/`.

The function `execute` in the script `os_db_authentication.sh` must be adapted.

Original version:

```
function execute {
        EXIT=0
       [ -z "$SCHEMAOWNER" ] && EXIT=4 && echo "parameter [SCHEMAOWNER] not set"
        [ -z "$ORADBUSR_FILE" ] && EXIT=4 && echo "parameter [ORADBUSR_FILE] not set"
        [ -z "$SM_TARGET_SID" ] && EXIT=4 && echo "parameter [SM_TARGET_SID] not set"
        [ -z "$SM_ORIGINAL_SID" ] && EXIT=4 && echo "parameter [SM_ORIGINAL_SID] not set"
        [ $EXIT -ne 0 ] && echo "processing stopped due to missing parameters" && _exit $EXIT
       [ ! -f "$ORADBUSR_FILE" ] && echo "file [$ORADBUSR_FILE] is not a regular file" && _exit 4
        sqlplus /nolog @${ORADBUSR_FILE} $SCHEMAOWNER UNIX $SM_TARGET_SID x
        sqlplus /nolog <<EOF
                set echo on
                set termout on
                connect / as sysdba
                insert into OPS\$${SM_TARGET_SID}ADM.SAPUSER select * from OPS\$${SM_ORIGINAL_SID}ADM.SAPUSER;
                commit;
                exit
```

The following is the correct version:

```
function execute {
        EXIT=0
       [ -z "$SCHEMAOWNER" ] && EXIT=4 && echo "parameter [SCHEMAOWNER]
not set"
        [ -z "$ORADBUSR_FILE" ] && EXIT=4 && echo "parameter
[ORADBUSR_FILE] not set"
        [ -z "$SM_TARGET_SID" ] && EXIT=4 && echo "parameter
[SM_TARGET_SID] not set"
        [ -z "$SM_ORIGINAL_SID" ] && EXIT=4 && echo "parameter
[SM_ORIGINAL_SID] not set"
        [ $EXIT -ne 0 ] && echo "processing stopped due to missing
parameters" && _exit $EXIT
       [ ! -f "$ORADBUSR_FILE" ] && echo "file [$ORADBUSR_FILE] is not
a regular file" && _exit 4
        sqlplus /nolog @${ORADBUSR_FILE} $SCHEMAOWNER UNIX
$SM_TARGET_SID x
        . ${ORACLE_HOME}/../.profile && . ${ORACLE_HOME}/../.dbenv.sh
      ${DIR_LIBRARY}/brconnect -u / -c force -f chpass -o SAPSR3 -p sap
        _exit $?
}
```

Download `oradbusr10.zip` as described in SAP Note 50088. Extract the zip file and copy `ORADBUSR.SQL` to `/opt/NetApp/smsap/plugins/clone/create/post/.`

System Boot Configuration

The script `flexpod_config` is used to execute the following tasks during system boot:

- Mounting the read-only software share
- Mounting tenant-specific data share
- Configuring the SDU password for the primary vFiler
- Configuring the SDU password for the backup vFiler

The mount points `/mnt/software`, `/mnt/data`, and `/mnt/backup` must be created. The permissions of these mount points must be changed to 777.

The script `flexpod_config` must be copied to `/etc/rc.d/`for SuSe, for RedHat it is `/etc/rc.d/init.d`

A new directory, `/opt/NetApp/FlexPod`, must be created. The script `set_sdu_password.sh` must be copied to `/opt/NetApp/FlexPod`.

The system boot configuration is done with the `chkconfig` command.

```
t003-20-lnx:/etc/rc.d # chkconfig --add flexpod_config
flexpod_config          0:off  1:off  2:off  3:on   4:off  5:on   6:off
```

Prerequisites

The vFiler password is hardcoded in the script and must be the same for all tenants.

Converting the Virtual Machine to a Template

After any changes to the template the following checks have to be done before converting the virtual machine to the template.

SnapDrive

When the template is booted, SnapDrive gets started with a cron job that waits for 300 seconds. Before converting the virtual machine to the template, SnapDrive must have finished the starting process.

Cron job is still running. SnapDrive is not running yet:

```
t003-17-lnx:~ # ps -ef | grep snap
root      6609  6608  0 10:01 ?         00:00:00 /bin/sh
/opt/NetApp/snapdrive/snapdrived_cron
t003-17-lnx:~ # snapdrived status
9001-016 SOAP ERROR : 24 : A connection error occured. Please check if
snapdrived is running
```

Cron job finished. SnapDrive is running:

```
t003-17-lnx:~ # ps -ef | grep snap
root      6690     1  0 10:06 ?         00:00:00
/opt/NetApp/snapdrive/bin/snapdrived start
t003-17-lnx:~ # snapdrived status
Snapdrive Daemon Version    : 4.2  (Change 1189505 Built Sat Oct  2
10:27:12 PDT 2010)
Snapdrive Daemon start time : Mon Feb 21 10:06:01 2011
Total Commands Executed     : 1
Job Status:
        No command in execution
```

After SnapDrive is started, any appliance configuration must be deleted (this configuration has been configured during boot of the OS template). In the following example, the entries `t003-1-prim` and `t003-1-bck` need to be deleted.

```
t003-17-lnx:/opt/NetApp # snapdrive config list
username    appliance name                   appliance type
-----------------------------------------------------------
root        t003-1-prim                      StorageSystem
root        t003-1-bck                      StorageSystem
root        smt-dfm.mgmt.t001.company.corp   DFM

t003-17-lnx:/opt/NetApp # snapdrive config delete t003-1-prim
Deleted configuration for appliance: t003-1-prim
```

```
t003-17-lnx:/opt/NetApp # snapdrive config delete t003-1-bck
Deleted configuration for appliance: t003-1-bck
```

The `snapdrive config list` command should have only one entry for the DFM server.

```
t003-17-lnx:/opt/NetApp # snapdrive config list
username    appliance name                  appliance type
-----------------------------------------------------------
root        smt-dfm.mgmt.t001.company.corp  DFM
```

UDEV Configuration

Disable the use of persistent network device names by clearing the UDEV configuration for network interfaces according to the Novell/SUSE TID 3048119:

```
cat< /dev/null > /etc/udev/rules.d/70-persistent-net.rules
```

This step must be repeated if the template is started or rebooted for other changes. After all steps described in the previous sections have been completed, shut down the virtual machine by executing `halt` within a terminal window. When the virtual machine is turned off, right-click the virtual machine within the vSphere client and choose Template>Convert to template.

The template is now usable for deploying new virtual machines.

Redhat Enterprise Linux 5.X VMware

This section describes the creation of a VMware template for RedHat Enterprise Linux (RHEL) 5.5 virtual machines.

Operating System Template Installation

This section describes the creation of a VMware template, which is used for OS/VM provisioning.

Log onto the VMware vCenter Server and create a virtual machine as described in Installing and Configuring the Operating System Images.

Select RedHat Linux 5 (64 Bit) in the Operating System section and add the RedHat Enterprise Linux 5.x installation ISO to the virtual CD-ROM for installation.

1. Start the virtual machine.
2. Connect to the virtual console.
3. Boot from virtual CD-Rom to start the installation process.
4. Create a partitioning layout with a 40 GB swap and 20 GB root file system.
5. Activate on Boot for all Ethernet interfaces.
6. Select or deselect the Gnome and KDE desktop. And add Development Libraries and Development Tools.
7. After the operating system is installed log into the server as root for the next steps.
8. Click System >Authentication. In the newly opened window Authentication Configuration, select Enable NIS Support and click Configure NIS.
9. Enter t002.company.corp.nis as the NIS Domain and leave the NIS Server field empty. Click OK to close the NIS Settings window.

10. Click OK on the Authentication Configuration window to accept the NIS configuration and close the window.
11. Open a Terminal window.
12. Open file /etc/nsswitch.conf with an editor like vi and change the listed lines as follows:

```
Passwd: filesnis
Shadow:filesnis
Group:filesnis
Hosts:files dns
Services:filesnis
```

DHCP Client Hook

To retain all necessary search domains in the `/etc/resolv.conf` file, a custom DHCP client hook is necessary. Therefore, the file `/etc/dhclient-enter-hooks` must be created with the following content.

Copy the function `make_resolv_conf()` from the original `/sbin/dhclient-script` to the file. Locate the `if [ -n "$SEARCH" ];` … `fi` clause, and exchange it by with the following:

```
if [ -z "$SEARCH" ]; then
  make_search $new_domain_name
fi
echo search $SEARCH >> $rscf
```

Add the following function to the file.

```
make_search() {
  domain_name=`dnsdomainname`
  if [ -z "$domain_name" ] ||
      [ "$domain_name" == "localdomain" ]; then
    domain_name=$1
  fi
  echo "using domain $domain_name..."
  old_search=`grep search /etc/resolv.conf`
  old_search="$old_search $1"
  new_search=

  for item in $old_search; do
    match=`echo $item | grep -o $domain_name`
    if [ -n "$match" ]; then
      already_added=
      for added_item in $new_search; do
        if [ "$item" == "$added_item" ]; then
```

```
                already_added=1
              fi
            done
            if [ -z "$already_added" ]; then
              new_search="$new_search $item"
            fi
          fi
        done

        SEARCH=$new_search
      }
```

Network Card Configuration

Add the following line to `/etc/sysconfig/network-scripts/ifcfg-eth1`:

```
DHCP_HOSTNAME=`hostname`
```

Delete the following line from `/etc/sysconfig/network-scripts/ifcfg-eth0` and `/etc/sysconfig/network-scripts/ifcfg-eth1`:

```
HWADDR=….
```

SAP Host Agents Installation

Follow the instructions in section SAP Host Agents Installation.

SnapDrive Installation and Configuration

Follow the instructions in section SnapDrive Installation and Configuration.

SMSAP Installation and Configuration

Follow the instructions in section SMAP Installation and Configuration.

System Boot Configuration

Follow the instructions in section System Boot Configuration.

Converting the Virtual Machine to a Template

Follow the instructions in section Converting the Virtual Machine to a Template.

Bare Metal

ISO Images

Copy ISO images from SLES 11 SP1 and RHEL 5.5 to the central software share on the central software vfiler.

Log onto a server in the Infrastructure tenant with read/write permissions on the central software share. The default mount point on linux operating systems is `/mnt/software`.

Create a new directory for the ISO images.

```
Mkdir /mnt/software/ISO
```

Copy the required ISO images to the new directory

```
Cp /tmp/rhel-server-5.5-x86_64-dvd.iso
/mnt/software/ISO/rhel-server-5.5-x86_64-dvd.iso
```

Kickstart File For Rhel 5.5

Create a new directory on the central software share:

```
Mkdir /mnt/software/RHEL
```

Create a new Kickstart file in the new directory

```
vi /mnt/software/RHEL/rhel55.ks
```

Add the following lines to the new Kickstart file:

```
START OF SAMPLE KICKSTART

# Kickstart file automatically generated by anaconda.


install

nfs --server=192.168.96.10 --dir=/vol/software/ISO

key --skip

lang en_US.UTF-8

keyboard us

network --device eth0 --bootproto dhcp

network --device eth1 --bootproto dhcp --hostname=`hostname`

rootpw --iscrypted $1$BCDPox75$CyI4U56yKfDkd5E/lCQrh.

firewall --enabled --trust eth0 --trust eth1

authconfig --enableshadow --enablemd5 --enablenis
--nisdomain=company.corp.nis


selinux --permissive

reboot

timezone --utc Europe/Berlin

bootloader --location=mbr --driveorder=sda --append="rhgb quiet"
```

```
# The following is the partition information you requested
# Note that any partitions you deleted are not expressed
# here so unless you clear all partitions first, this is
# not guaranteed to work
%include /tmp/part-include

%packages
@base
@core
@development-libs
@development-tools
@editors
@legacy-software-development
@legacy-software-support
@printing
@base-x
@gnome-desktop
iscsi-initiator-utils
fipscheck
device-mapper-multipath
sgpio
python-dmidecode
imake
openssl097a
compat-openldap
xorg-x11-utils
xorg-x11-server-Xvfb
-emacs-leim
-psgml
-emacspeak
%post
#!/bin/bash
. /etc/bashrc
( # for logging purpose
echo "BEGIN:  KICKSTART POST PROCEDURE"
echo "BEGIN:  Prepare eth1 setup"
cat > /etc/sysconfig/network-scripts/ifcfg-eth1 <<EOF
DEVICE=eth1
```

```
BOOTPROTO=dhcp
DHCP_HOSTNAME=`hostname`
ONBOOT=yes
EOF

echo "Bring up eth1"
ifconfig eth1 up
dhclient eth1 -H `hostname`
echo "Start portmap"
/etc/init.d/portmap start
echo "END  :  Prepare eth1 setup"

echo "BEGIN:  MKDIR and MOUNTS"
mkdir /mnt/software
mkdir /mnt/data
mkdir /mnt/backup

sleep 2
echo "Mount"
/bin/mount <<var_software_ip>>:/vol/software /mnt/software
sleep 1
/bin/mount
echo "END  :  MKDIR and MOUNTS"

echo "BEGIN:  NetApp SDU SnapDrive"
rpm -ivh /mnt/software/SMT_Software/SDU/netapp.snapdrive.linux_4_2.rpm
echo "use-https-to-filer=off" >> /opt/NetApp/snapdrive/snapdrive.conf
echo "snapcreate-check-nonpersistent-nfs=off" >>
/opt/NetApp/snapdrive/snapdrive.conf
echo "autosupport-enabled=off" >> /opt/NetApp/snapdrive/snapdrive.conf
echo "END  :  NetApp SDU SnapDrive"

echo "BEGIN:  NetApp SnapManager for SAP"
/mnt/software/SMT_Software/SMSAP/netapp.smsap.linux-x64-3.1.bin <<EOF

root
root
1
```

```
EOF
echo "auto_support.on=off" >>
/opt/NetApp/smsap/properties/smsap.config
cp /mnt/software/SMT_Software/SMSAP/snapmanager /etc/pam.d/snapmanager
cp
/opt/NetApp/smsap/plugins/examples/clone/create/post/*activities.sh
/opt/NetApp/smsap/plugins/clone/create/post/
cp
/opt/NetApp/smsap/plugins/examples/clone/create/post/os_db_auth*.sh
/opt/NetApp/smsap/plugins/clone/create/post/
cp /mnt/software/SMT_Software/SMSAP/ORADBUSR.SQL
/opt/NetApp/smsap/plugins/clone/create/post/
cp /mnt/software/SMT_Software/SMSAP/os_db_authentication.sh
/opt/NetApp/smsap/plugins/clone/create/post/
echo "END  :  NetApp SnapManager for SAP"

echo "BEGIN:  SAP Hostagent "
cd /tmp
tar -xf /mnt/software/ACC/hostagent7.2L.tgz
groupadd sapsys
useradd -g sapsys sapadm
cd /tmp/hostctrl
cp -fp /mnt/software/ACC/installsapinit.sh .
./saphostexec -install
echo "END  :  SAP Hostagent "

echo "BEGIN:  FlexPod bootscript config "
mkdir /opt/NetApp/FlexPod
sleep 1
cp /mnt/software/scripts/flexpod_config /etc/init.d
/sbin/chkconfig --add flexpod_config
cp /mnt/software/scripts/set_sdu_password.sh /opt/NetApp/FlexPod/
echo "END  :  FlexPod bootscript config "

echo "END  :  KICKSTART POST PROCEDURE"

%pre
#!/bin/bash
# VMs may have different device name for 1st hdd
```

```
if [ -b /dev/vda ]; then
        disk=vda
        disk2=vda
elif [ -b /dev/mapper/mpath0 ]; then
        disk=mapper/mpath0
        disk2=dm-0
elif [ -b /dev/sda ]; then
        disk=sda
        disk2=sda
fi


# decide whether to use LVM or not (size < 40gb ==> no LVM)
size=$(grep "$disk2$" /proc/partitions | awk '{ print $3 }')

if [ -z "$size" ]; then
        echo "E: could not get size of installation disk"
        exit 1
fi
if [ "$size" -gt 40000000 ]; then
        # lvm setup, 100m /boot, 2g swap, 10g root
        cat > /tmp/part-include <<-EOF
                bootloader --location=mbr --append=selinux=0
                clearpart --all --initlabel --drives=$disk
                part /boot --fstype ext3 --size 100
                part pv.01 --size 1000 --grow --ondisk=$disk
                volgroup vg0 pv.01
                logvol swap --fstype swap --name=swap --vgname=vg0
--size=40000
                logvol / --fstype ext3 --name=root --vgname=vg0
--size=10000
        EOF
else
        # small disk, use one big plain paritition, no swap
        cat > /tmp/part-include <<-EOF
                bootloader --location=mbr --append=selinux=0
                clearpart --all --initlabel --drives=$disk
                part / --fstype ext3 --size 100 --grow
        EOF
fi
%end

%end
```

Tenant-Specific Services Virtual Machine Template

Tenant-specific services are currently provided by a lightweight Linux virtual machine within each tenant. The tenant-specific services virtual machine template is build based on the SLES VMware image described in section SLES VMware. Some additional packages are installed and configured to form the tenant-specific services virtual machine template. The following packages must be installed on the virtual machine. All of them can be installed through the SLES installer yast.

- dnsmasq—a lightweight DNS and DHCP server
- ypserv—the NIS server package
- yppasswdd—the NIS password change deamon

DNSMASQ

The following are the steps to install dnsmasq:

1. Install the dnsmasq package through yast and make sure the service is configured in the correct runlevel.
2. Manually mount the central software share (no DNS resolution of `software.company.corp` possible at this point) to `/mnt/software`.
3. Copy the dnsmasq configuration template from `/mnt/software/scripts/dnsmasq.conf.template` to `/etc`.
4. Copy the hosts configuration template from `/mnt/software/scripts/hosts.template` to `/etc`.
5. Copy the services configuration template from `/mnt/software/scripts/services.template` to `/etc/services`
6. Add the following groups:
    a. groupadd -g 1000 sapinst
    b. groupadd -g 1001 sapsys
    c. groupadd -g 1002 dba
    d. groupadd -g 1003 oper
7. Copy the dnsmasq configuration script from `/mnt/software/scripts/configure_dnsmasq.sh` to `/flexpod` (create if necessary).

YPSERV

The following are the steps to install ypserv:

1. Install the ypserv package through yast, and make sure the service is configured in the correct runlevel (`chkconfig ypserv`).

2. Edit the Makefile in `/var/yp` and set the following values:
   a. MINUID=1000
   b. MINGID=1000
   c. all: passwd group services
3. Initialize NIS by running /usr/lib/yp/ypinit -m

YPPASSWD

Make sure the yppasswdd service is available (installed through ypserv package) and configured in the correct runlevel (`chkconfig yppasswdd`).

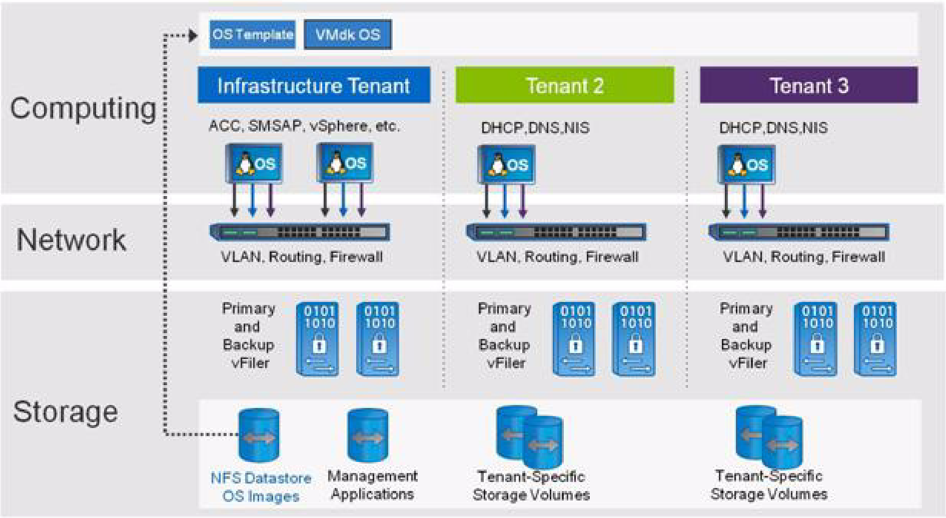
Tenant Provisioning

When a tenant is provisioned, the following resources must be deployed and configured:

- Network resources
  - VLANS
  - Routing and firewall
- Folder within VMware vSphere
- Storage
  - Tenant-specific vFilers
  - Tenant-specific storage volumes
  - Tenant specific services for DHCP, DNS and NIS services
  - Tenant-specific SMSAP repository

Figure 13 shows the network and storage components of each tenant.

Figure 13 Tenant Components Overview



Network

A Managed Tenant is a separate unit with its own vFiler systems, a dedicated Tenant Access VLAN, and a dedicated Tenant Back-end VLAN.

Tenant Access LAN: Dedicated VLAN ID and IP Address range that is accessible for administrators and users through a network router or firewall.

Tenant Back-end LAN: Dedicated VLAN ID and IP Address range for all traffic between the tenant specific vFiler unit and the servers.

Table 6 lists all of the required commands required to configure the access and back-end network for a new tenant.

Table 6 Configuration Steps For Tenant VLANS

Checklist Activity	Process	Verification
Define tenant-specific VLANs on the Cisco Nexus 5548 switches. Duration: 10 minutes	Log on to «var_nexus_A_hostname» and «var_nexus_B_hostname» . Conf t vlan <<var_new_tenant_vlan_id_access>> name «var_new_tenant_name» -access exit interface Vlan <<var_new_tenant_vlan_id_access>> no shtdown exit interface port-channel13 switchport trunk allowed vlan <<Existing VLAN IDs>>, ,<<var_new_tenant_vlan_id_access>> exit vlan «var_new_tenant_vlan_id_backend» name «var_new_tenant_name» -backend exit interface port-channel11 switchport trunk allowed vlan <<Existing VLAN IDs>>, «var_new_tenant_vlan_id_backend» exit interface port-channel12 switchport trunk allowed vlan <<Existing VLAN IDs>> , «var_new_tenant_vlan_id_backend» exit exit copy run start exit	To verify, run the show run command and see whether the VLAN configuration exists.

Configure the tenant VLANs on the Cisco UCS.	Log on to one of the Fabric Interconnects of the UCS through ssh. scope eth-uplink create vlan «var_new_tenant_name» -access <<var_new_tenant_vlan_id_access>> exit create vlan «var_new_tenant_name» -backend «var_new_tenant_vlan_id_backend» exit exit commit-buffer scope org FlexPod scope vnic-templ vNIC_Template_A enter eth-if «var_new_tenant_name» -access set default-net no exit enter eth-if «var_new_tenant_name» -backend set default-net no exit commit-buffer scope vnic-templ vNIC_Template_B enter eth-if «var_new_tenant_name» -access set default-net no exit enter eth-if «var_new_tenant_name» -backend set default-net no exit commit-buffer exit exit	

Define tenant-specific VLANs on the Cisco Nexus 1000v vSwitch	Log on to the Cisco Nexus 1000v VSM.
	`Conf t`
	
	`vlan <<var_new_tenant_vlan_id_access>>`
	`  name «var_new_tenant_name»-access`
	`vlan <<var_new_tenant_vlan_id_backend>>`
	`  name «var_new_tenant_name»-backend`
	`exit`
	
	`port-profile type vethernet «var_new_tenant_name»-access`
	`  vmware port-group`
	`  switchport mode access`
	`  switchport access vlan <<var_new_tenant_vlan_id_access>>`
	`  no shutdown`
	`  system vlan <<var_new_tenant_vlan_id_access>>`
	`  state enabled`
	
	`port-profile type vethernet «var_new_tenant_name»-backend`
	`  vmware port-group`
	`  switchport mode access`
	`  switchport access vlan «var_new_tenant_vlan_id_backend»`
	
	`  no shutdown`
	`  system vlan «var_new_tenant_vlan_id_backend»`
	
	`  state enabled`
	`exit`
	
	`exit`
	`copy run start`	

Configure the inter-VLAN routing function on the Catalyst 4900 switch. Log onto the Catalyst 4900 and execute the following commands:

```
Enable

Conf terminal


vlan <<var_new_tenant_vlan_id_access>>
 name "var_new_tenant_name"-access
exit


ip access-list standard Vlan<<var_new_tenant_vlan_id_access>>
 permit <<var_new_tenant_network>> 0.0.0.255
 permit <<var_software_network>> 0.0.0.255
 permit <<var_global_mgmt_network>> 0.0.0.255
 deny   any
exit



interface Vlan<<var_new_tenant_vlan_id_access>>
 ip address <<var_new_tenant_gw_addr>> <<var_new_tenant_netmask>>
 ip access-group Vlan<<var_new_tenant_vlan_id_access>> in
 ip access-group Vlan<<var_new_tenant_vlan_id_access>> out
 no shutdown
exit

interface TenGigabitEthernet1/2
  switchport trunk allowed vlan , <<EXISTING VLAN
IDs>>,<<var_new_tenant_vlan_id_access>>
exit

interface TenGigabitEthernet1/7
switchport trunk allowed vlan , <<EXISTING VLAN
IDs>>,<<var_new_tenant_vlan_id_access>>
exit

copy run start
exit
```

VMware

Within the VMware vSphere a folder with the tenant name has to be created Execute the following command PowerCLI command after connect to the vCenter server:

```
new-folder -name <<var_new_tenant_name>> -location vm
```

Storage

This section describes the steps necessary to create new vFiler units and new volumes for a new tenant. It also provides information on how to automatically assign protection polices and relationships for the tenant-specific volumes.

The network configuration for the tenant has to done before the storage configuration.

The following information must be provided:

- The name of the primary resource pool for active data defined within PM: `<<var_primary_respool"`
- The name of the resource pool for archive data has been defined within PM: `<<var_secondary_respool>>`
- The name of the provisioning profile defined within PM: `<<var_prim_prov_profile>>` for NAS storage and `<<var_backup_prov_profile>>` for secondary storage
- The name of the vFiler template defined within PM: `<<var_vfiler_template>>`
- Name of the tenant: `<<var_new_tenant_name>>`
- The name of the physical interface or VIF: `vif0`
- The vlan id: `<<var_new_tenant_vlan_id_backend>>`
- The IP address of the primary and secondary vFiler units:`<<var_new_tenant_prim_vfiler_ip>>` and `<<var_new_tenant_sec_vfiler_ip>>`
- The network mask for the vFiler units: `<<var_new_tenant_netmask_vfiler>>`
- The name of the ipspace of the vFiler units is defined as `"ipspace-<<var_new_tenant_name>>`
- Name of the primary vFiler is `<<var_new_tenant_name>>-1-prim"`
- Name of the secondary vFiler is `<<"var_new_tenant_name>>1-bck",`
- Dataset name of the central volume is `<<var_new_tenant_name>>_share"`
- Names of the qtrees are `sap` and `data`
- Dataset name of the backup volume is `<<var_new_tenant_name>>_backup"`
- Qtree name is `data`

vFiler Creation and Configuration

The following are the commands that are executed at the DFM server host:

1. Create the primary vFiler unit with the following DFM command:

```
dfpm vfiler create -d  <<var_new_tenant_prim_vfiler_ip>>  -s
ipspace-<<var_new_tenant_name>>  -a nfs,cifs,iscsi -f
<<var_primary_respool>>   <<var_new_tenant_name>>-1-prim
```

2. Create the secondary vFiler unit with the following DFM command:

```
dfpm vfiler create -d  <<var_new_tenant_sec_vfiler_ip>> -s
ipspace-<<var_new_tenant_name>>  -a nfs,cifs,iscsi -f
<<var_secondary_respool>>  <<var_new_tenant_name>>-1-bck
```

3. Set up the primary vFiler unit with the following DFM command:

```
dfpm vfiler setup  -t <<var_vfiler_template>> -r <<var_vfiler_pw>>
-c -w workgroup -i
<<var_new_tenant_prim_vfiler_ip>>:vif0:<<var_new_tenant_netmask_vf
iler>>:<<var_new_tenant_vlan_id_backend>>:9000:vif0
<<var_new_tenant_name>>-1-prim
```

4. Set up the secondary vFiler unit with the following DFM command:

```
dfpm vfiler setup  -t <<var_vfiler_template>> -r <<var_vfiler_pw>>
-c -w workgroup -i
<<var_new_tenant_sec_vfiler_ip>>:vif0:<<var_new_tenant_netmask_vfi
ler>>:<<var_new_tenant_vlan_id_backend>>:9000:vif0
<<var_new_tenant_name>>-1-bck
```

5. Add the root volume of the primary vFiler unit to the backup_prim_vfilers dataset:

```
dfpm dataset add  backup_prim_vfilers
<<var_new_tenant_name>>-1-prim:/<name of root volume>
```

6. Add the root volume of secondary vFiler unit to the backup_bck_vfilers dataset:

```
dfpm dataset add  backup_bck_vfilers
<<var_new_tenant_name>>-1-prim:/<name of root volume>
```

A network interface might already exist on a controller, if a vFiler of the same tenant exists on this controller or (in case of a clustered system) even when a vFiler of this tenant exists at the other node of the cluster.

If an interface already exists, the setup of the vFiler units in step 3 and step 4 must be replaced with the following ones:

-
  ```
  dfpm vfiler setup  -t <<var_vfiler_template>> -r  <<var_vfiler_pw>>
  -c -w workgroup -i
  <<var_new_tenant_prim_vfiler_ip>>:vif0-<<var_new_tenant_vlan_id_ba
  ckend>>:<<var_new_tenant_netmask_vfiler>>
  <<var_new_tenant_name>>-1-prim
  ```

-
  ```
  dfpm vfiler setup  -t  <<var_vfiler_template>>  -r  <<var_vfiler_pw>>
  -c -w workgroup -i <<var_new_tenant_sec_vfiler_ip>>:
  vif0-<<var_new_tenant_vlan_id_backend>>:<<var_new_tenant_netmask_v
  filer>><<var_new_tenant_name>>-1-bck
  ```

Tenant-Specific Volumes

Table 7 shows the needed volumes for each additional tenant. It includes the to-be-assigned resource pools for source and backup targets. In addition, it lists the recommended Protection Manager policy for backup. The process for creating/provisioning these volumes and assigning the protection policy is described in section Infrastructure Tenant-Specific Services.

Table 7 Tenant-Specific Volumes

Purposes	Volume Name	Qtrees	Source Resource Pool	Backup Policy	Target Resource Pool
Central share /usr/sap/trans Central share	«var_new_tenant_name»_share	sap data	«var_primary_respool»	Backup Backup	«var_secondary_respool»
Backup destination for archive logs	«var_new_tenant_name»_backup	data	«var_secondary_respool»	Local Backups only	n/a

The following are the steps required to provision a volume for central data (for example, /usr/sap/trans at the primary vFiler) and other data, and a volume for backup (for example, archive logs) at the secondary vFiler using the DFM command line.

1. Create a dataset for the central share volume:

```
dfpm dataset create -v <<var_prim_prov_profile>> -r
<<var_new_tenant_name>>-1-prim <<var_new_tenant_name>>_share
```

2. Add the primary resource pool to the central dataset:

```
dfpm dataset respool add <<var_new_tenant_name>>_share
<<var_primary_respool>>
```

Note If desired, protect the central volume by assigning provisioning policies (in this example Back up) and assign the required resource pool.

3. Assign the Back up policy to the central dataset/volume and set the destination to the secondary vFiler:

```
dfpm dataset modify -p "Back up"  -r <<var_new_tenant_name>>-1-bck
<<var_new_tenant_name>>_share  Backup
```

4. Add the secondary resource pool to the backup destination of the central volume/dataset:

```
dfpm dataset respool add -N "Backup" <<var_new_tenant_name>>_share
<<var_secondary_respool>>
```

5. Provision the central dataset (part1):

```
dfpm dataset provision -n data  -s <<var_tenant_share_data_size>> -e
nfs -w all -N no -a 0 -S sys <<var_new_tenant_name>>_share
```

6. Provision the central dataset (part2):

```
dfpm dataset provision -n sap  -s <<var_tenant_share_sap_size>>-e
nfs -w all -N no -a 0 -S sys " <<var_new_tenant_name>>_share
```

7. Create a dataset for the backup volume:

```
dfpm dataset create -v <<var_backup_prov_profile>> -r
<<var_new_tenant_name>>-1-bck <<var_new_tenant_name>>_backup
```

8. Add the secondary resource pool to the backup dataset:

```
dfpm dataset respool add <<var_new_tenant_name>>_backup
<<var_secondary_respool>>
```

Note If desired, protect the backup volume by assigning provisioning policies, in this example Local backups only.

9. Assign the "Local backups only" policy to the central dataset/volume and set the destination to the secondary vFiler:

```
dfpm dataset modify -p "Local backups only" -r
<<var_new_tenant_name>>-1-bck  <<var_new_tenant_name>>_backup
```

10. Provision the backup dataset:

```
dfpm dataset provision -n data  -s <size, e.g. 100g> -e nfs -w all
-N no -a 0 -S " <<var_new_tenant_name>>_backup
```

Script CREATE_NEW_vFILERS.SH

The shell script create_new_vfiler.sh creates the required vFiler unit and provisions the required volumes, including data protection for a new tenant. It must be run at the DFM host with a parameter file as command line argument: `create_vfiler.sh <parameter_file>`. More details about this script are provided in the section Appendix D—Description of Scripts and Configuration Files.

Tenant-Specific Volume Central (TXXX_SHARE)

After the central volume txxx_share is provisioned, several directories have to created and the permission for these directories have to be set:

Mount the txxx_share to a server within the tenant; for example, use the tenant specific DNS/DHCP appliance to execute the following commands:

```
t005-lnx-0:/mnt/software/scripts # mkdir /mnt/tmp

t005-lnx-0:/mnt/software/scripts # mount t005-prim:/vol/t005_share/sap
/mnt/tmp

t005-lnx-0:/mnt/software/scripts # mkdir /mnt/tmp/sap/trans

t005-lnx-0:/mnt/software/scripts # mkdir /mnt/tmp/sap/tmp

t005-lnx-0:/mnt/software/scripts # mkdir /mnt/tmp/sap/ccms

t005-lnx-0:/mnt/software/scripts # chmod 777 /mnt/tmp/sap/trans

t005-lnx-0:/mnt/software/scripts # chmod 777 /mnt/tmp/sap/tmp

t005-lnx-0:/mnt/software/scripts # chmod 777 /mnt/tmp/sap/ccms

t005-lnx-0:/mnt/software/scripts # mkdir /mnt/tmp/data/log

t005-lnx-0:/mnt/software/scripts # chmod 777 /mnt/tmp/data/log

t005-lnx-0:/mnt/software/scripts # umount /mnt/tmp
```

Tenant-Specific Services

Tenant specific services are currently provided by a lightweight Linux virtual machine called Tenant-specific services within each tenant.

The tenant-specific services virtual machine is available as a virtual machine template in the environment and can be provisioned to a new tenant. After the provisioning, a couple of configuration steps must be performed. First, the virtual machine must have static IP address assigned through the config files in /etc/sysconfig/network. Edit ifcfg-eth0 and ifcfg-eth1 and assign IP addresses according the rules provided in Table 8.

Table 8 IP Address Rules for Tenant-Specific Services

Config file	IP Address	Description
`ifcfg-eth0`	192.168.<tenant_id>.50, e.g. 192.168.4.50	User Access LAN
`ifcfg-eth1`	192.168.<tenant_id>+100.50, e.g. 192.168.104.50	Backend LAN

The default gateway setting must be adjusted according to the IP range in `/etc/sysconfig/network/routes`

The DNS settings for Tenant specific services" must be adjusted according to the new network settings in `/etc/resolv.conf`.

The hostname should be set to `<tenant_name>-0-lnx`; for example:

```
hostname t004-0-lnx
```

```
hostname > /etc/HOSTNAME
```

To enable the configuration the network service must be restarted through the command

```
service network restart
```

DNS and DHCP

DNS and DHCP services are provided using DNSmasq. DNSmasq is a standard package of the SuSE distribution and can be installed through yast. The Tenant specific services virtual machine template in the environment has been provided with a template configuration tailored specifically to the needs of a tenant. The template configuration can be found in:

```
/etc/dnsmasq.conf.template
```

```
/etc/hosts.template
```

A script is available to generate a valid DNSmasq configuration file based on the template file. It must be called with the tenant number as the only parameter:

```
/flexpod/configure_dnsmasq.sh <tenant_id>;
```

for example, `/SMT/configure_dnsmasq.sh 4`

To enable the configuration, the `dnsmasq` service must be restarted with the command:

```
service dnsmasq restart
```

Logging information for `DNSmasq` can be found in `/var/log/dnsmasq.log`, and the configuration can be adapted by editing the active config files `/etc/dnsmasq.conf` and `/etc/hosts` or the according template files.

To have access to all required scripts on the tenant share, start the `flexpod_config` service through the command:

```
service flexpod_config start
```

To have the DNS names of this tenant available in the infrastructure tenant as well, a new section must be added in the infrastructure tenant DNS.

Table 9 and Table 10 give an overview of fixed hostnames and IP addresses in an tenant (example: tenant 3).

Table 9 User Access LAN Tenant 3

Hostname	IP Address	Description
t003-0-lnx.t003.company.corp	192.168.3.50	Tenant-Specific Services virtual machine
t003-[11..49]-lnx.t003.company.corp	192.168.3.[61..99]	Dynamic DHCP range

Table 10 Back-End LAN Tenant 3

Hostname	IP Address	Description
t003-1-prim.bknd.t003.company.corp	192.168.103.10	Tenant primary vFiler unit
t003-1-bck.bknd.t003.company.corp	192.168.103.11	Tenant backup vFiler unit
t003-0-lnx.bknd.t003.company.corp	192.168.103.50	Tenant-Specific Services virtual machine
t003-[11..49]-lnx.bknd.t003.company.corp	192.168.103.[61-99]	Static DHCP range

NIS

NIS service is provided using standard NIS packages of the SLES 10 distribution. NIS is configured to offer central user management. The following NIS maps are configured: `passwd, shadow, groups, services`.

The following are the steps to enable NIS:

1. Install the NIS server packages (ypserv); for example, through yast.
2. Set the NIS domain for the host:

   ```
   domainname <tenant_name>.company.corp.nis (for example, domainname t004.company.corp.nis)

   domainname > /etc/defaultdomain
   ```

3. Adapt the file `/var/yp/securenets` according to the IPs defined for the Tenant specific services virtual machine (see above). This is a sample file content for tenant T004:

   ```
   255.0.0.0       127.0.0.0

   255.255.255.0   192.168.4.0

   255.255.255.0   192.168.104.0
   ```

4. Adapt the file /var/yp/ypservers:

   ```
   hostname > /var/yp/ypservers
   ```

5. Go into the folder /var/yp and build the NIS maps:

   ```
   t004-0-lnx:/var/yp # make

   gmake[1]: Entering directory '/var/yp/t004.company.corp.nis'

   Updating group.byname…

   Updating group.bygid…

   Updating passwd.byname…

   Updating passwd.byuid…

   Updating services.byname…

   Updating services.byservicename…

   Updating shadow.byname…

   gmake[1]: Leaving directory '/var/yp/t004.company.corp.nis'
   ```

6. Start/Restart the NIS server:

   ```
   service ypserv restart
   ```

PXE Boot Service

In addition to the DHCP services provided by DNSmasq, a TFTP service must be configured to boot a server through PXE over the network. DNSmasq comes with an integrated TFTP service.

The following are the steps enable the integrated TFTP service:

1. Open /etc/dnsmasq.conf and add the following lines:

```
# Enable dnsmasq built-in tftp server
enable-tftp
tftp-no-blocksize
# Set the root directory of the TFTP service
tftp-root=/var/tftpboot
# An example of dhcp-boot with built-in dhcp server
dhcp-boot=pxelinux.0
```

2. Prepare the required directory structure for the boot environment:

```
mkdir /tftpboot
mkdir /tftpboot/pxelinux.cfg
mkdir /tftpboot/images/rhel55
```

3. Prepare the PXE boot loader:

```
cp /usr/lib/syslinux/pxelinux.0 /tftpboot

Create the file /tftpboot/pxelinux.cfg/default with the following
content:

DEFAULT RHEL55
prompt 0
timeout 300

LABEL RHEL56
  kernel images/rhel56/vmlinuz
  append initrd=images/rhel56/initrd.img mpath ramdisk_size=5939
ks=nfs:<<var_software_ip>>:/vol/software/RHEL/
rhel55_<<var_new_tenant_name>>.ks ksdevice=eth0

LABEL RHEL55
  kernel images/rhel55/vmlinuz
  append initrd=images/rhel55/initrd.img mpath ramdisk_size=5939
ks=nfs:<<var_software_ip>>:/vol/software/RHEL/
rhel55_<<var_new_tenant_name>>.ks ksdevice=eth0
```

4. Prepare the Linux boot image:

```
mkdir  /mnt/rhel55
```

```
mount -o loop,ro
<<var_software_ip>>:/vol/software/ISO/rhel-server-5.5-x86_64-dvd.i
so /mnt/rhel55
cp /mnt/rhel55/images/pxeboot/* /tftpboot/images/rhel55
umount /mnt/rhel55
rmdir /mnt/rhel55


mkdir  /mnt/rhel56
mount -o loop,ro
<<var_software_ip>>:/vol/software/ISO/rhel-server-5.6-x86_64-dvd.i
so /mnt/rhel56
cp /mnt/rhel56/images/pxeboot/* /tftpboot/images/rhel56
umount /mnt/rhel56
rmdir /mnt/rhel56
```

5. Restart the DNSmasq service:

```
/etc/init.d/dnsmasq restart
```

6. Create a tenant-specific Kickstart file for RHEL installation.

   Log on to a server with write access on the software share:

```
cp /mnt/software/RHEL/rhel55.ks
/mnt/software/RHEL/rhel55_<<var_new_tenant_name>>.ks


Open the new file and change the following line:


nisdomain=company.corp.nis


to


nisdomain=<<var_new_tenant_name>>.company.corp.nis
```

Tenant-Specific SMSAP Repository

Within the SMSAP repository database, each tenant has its own repository. At the repository database server, execute the commands as shown in the following example of repository preparation for tenant 2.

```
t001-smrepo:/mnt/software/scripts # su - oracle
oracle@t001-smrepo:~> sqlplus /nolog
SQL*Plus: Release 10.2.0.1.0 - Production on Mon Feb 7 12:24:40 2011
Copyright (c) 1982, 2005, Oracle.  All rights reserved.
SQL> connect / as sysdba
Connected.
```

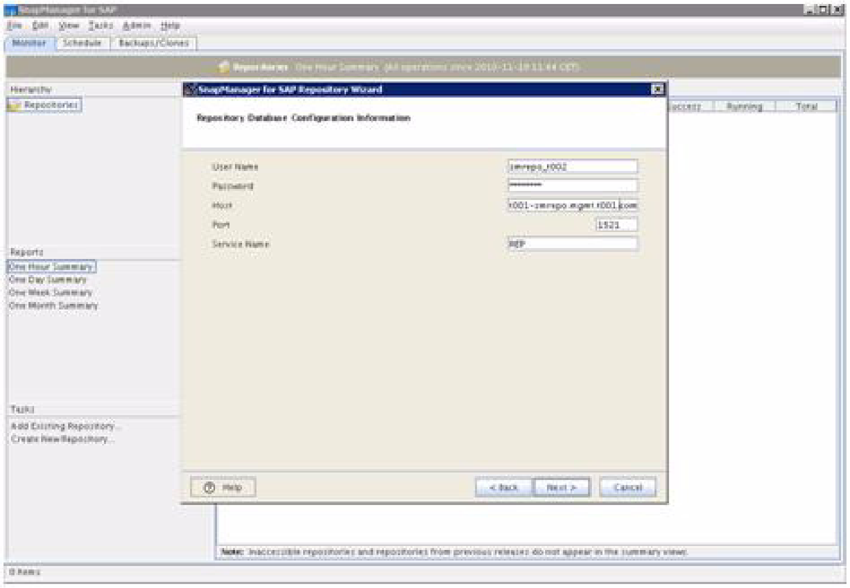
```
SQL>  create tablespace repdata_t002 datafile
'/oracle/REP/oradata/repdata_t002.dbf' size 100m;

Tablespace created.

SQL>  create user smrepo_t002 identified by "ucs4sap!" default
tablespace repdata_t002;

User created.

SQL> grant connect, resource to smrepo_t002;

Grant succeeded.
```

The repository can be created using either the CLI or the SMSAP GUI. The following example shows the creation of a repository for tenant 3 using the CLI.

```
t001-smrepo:/mnt/software/scripts # smsap repository create
-repository -port 1521 -dbname REP -host
t001-smrepo.mgmt.t001.company.corp -login -username smrepo_t003

Enter password for database connection
smrepo_t003@t001-smrepo.mgmt.t001.company.corp:1521/REP: ********

[ INFO] SMSAP-20019: Set password for repository
"smrepo_t003@REP/t001-smrepo.mgmt.t001.company.corp:1521" in user
credentials for "root".

[ INFO] SMSAP-09202: Creating new schema as smrepo_t003 on
jdbc:oracle:thin:@//t001-smrepo.mgmt.t001.company.corp:1521/REP.

[ INFO] SMSAP-09205: Schema generation complete.

[ INFO] SMSAP-09209: Performing repository version INSERT.

[ INFO] SMSAP-09210: Repository created with version: 102

[ INFO] SMSAP-13048: Repository Create Operation Status: SUCCESS

[ INFO] SMSAP-13049: Elapsed Time: 0:00:04.054

t001-smrepo:/mnt/software/scripts #
```

Figure 14 and Figure 15 show the creation of a repository using the GUI. Using tenant 2 as an example, Figure 14 shows the configuration information to enter.

Figure 14 Entering Repository Database Configuration Information


SnapManager for SAP
File Edit View Tasks Admin Help
Monitor Schedule Backups/Clones
Repositories One Hour Summary (All operations since 2010-11-19 11:44 CET)
Hierarchy
Repositories
Reports
One Hour Summary
One Day Summary
One Week Summary
One Month Summary
Tasks
Add Existing Repository...
Create New Repository...
SnapManager for SAP Repository Wizard
Success Running Total
Help
< Back
Next >
Cancel
0 Items

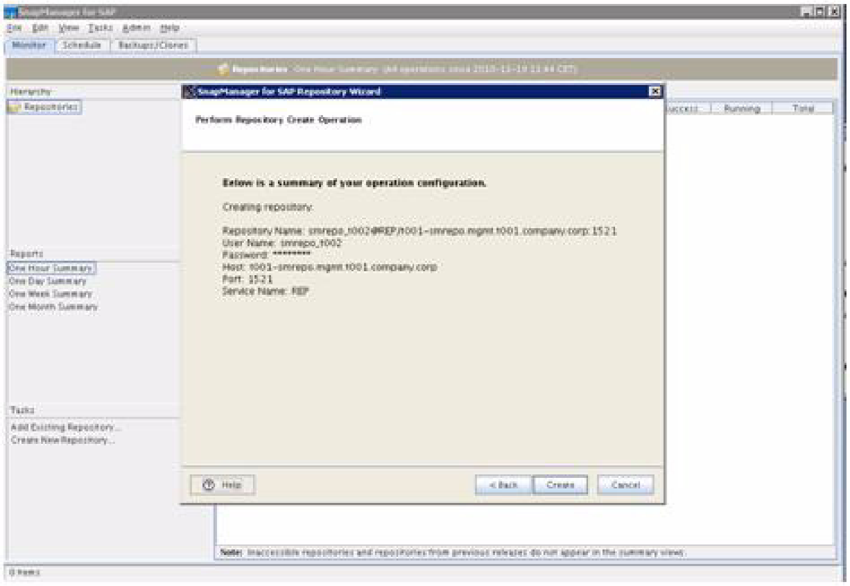
Repository Database Configuration Information

User Name: smrepo_t002
Password: **********
Host: t001-smrepo.mgmt.t001.com
Port: 1521
Service Name: REP

Note: Inaccessible repositories and repositories from previous releases do not appear in the summary views.

Figure 15 displays the resulting summary of the operation configuration.

Figure 15 Summary Of Operation Configuration


SnapManager for SAP
File Edit View Tasks Admin Help
Monitor Schedule Backups/Clones
Repositories One Hour Summary (All operations since 2010-11-19 11:44 CET)
Hierarchy
Repositories
Reports
One Hour Summary
One Day Summary
One Week Summary
One Month Summary
Tasks
Add Existing Repository...
Create New Repository...
SnapManager for SAP Repository Wizard
Success Running Total
Help
< Back
Create
Cancel
0 Items

Perform Repository Create Operation

Below is a summary of your operation configuration.

Creating repository:

Repository Name: smrepo_t002@REP/t001-smrepo.mgmt.t001.company.corp:1521
User Name: smrepo_t002
Password: ********
Host: t001-smrepo.mgmt.t001.company.corp
Port: 1521
Service Name: REP

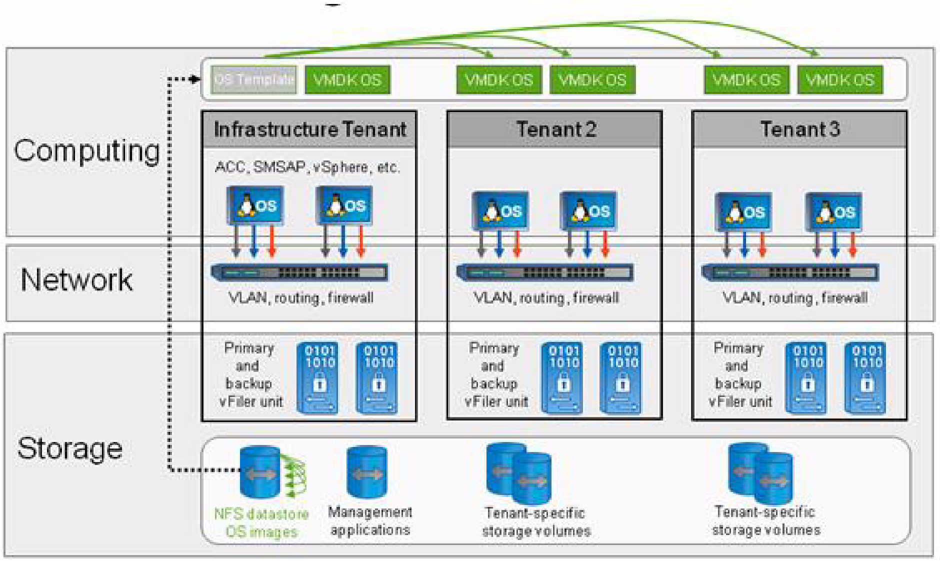
Note: Inaccessible repositories and repositories from previous releases do not appear in the summary views.

Operating System Provisioning

SLES/Redhat on VMware

Figure 16 shows how the operating system is provisioned.

Figure 16 Operating System Provisioning



After the OS template-cloning process is finished, all necessary tenant-specific are configured automatically:

- The new virtual machine is moved to the tenant-specific Virtual Center folder.
- The network adapters are assigned to tenant-specific network ports.
- IP, DNS, and routing are configured during system boot.
- The tenant-specific NFS shares are mounted during system boot.
- The tenant-specific SDU passwords are set during system boot.

There is no need for any further configuration on the OS level, and the OS can be used immediately to run an SAP system.

The PowerShell script DeployNewVm.ps1 uses native VMware-based cloning because RCU/VSC does not currently support command line interaction.

With the current version, the following parameters are hard coded:

- Hostname of VMware Virtual Center
- Hostname of target ESX host

```
DeployNewVm.ps1 <VM Name> <Tenant Name> < Template Name>
```

Where

  – **Virtual Machine Name**. Name of the target virtual machine.

  – **Tenant Name**. Name of the target tenant.

- **Template Name**. Name of the source template to be cloned.

The script executes the following steps:

1. Adds vSphere PowerShell sSnapin to the PowerShell session
2. Connects to VMware Virtual Center
3. Creates a VMware clone of the source template

   (RCU is not used with the scripted version.)
4. Moves the new virtual machine to the tenant-specific Virtual Center folder
5. Assigns network adapters to tenant-specific network ports:
   - `<tenant-name>-access`
   - `<tenant-name>-backend`
6. Starts the new virtual machine

During the boot process, the DHCP server configures the hostname and the interfaces for the user and backend LANs, as well as the default route.

The following example (for a host within tenant 3) shows the configuration that should be available:

```
t003-40-lnx:~ # ifconfig
eth0      Link encap:Ethernet  HWaddr 00:50:56:A6:00:46
        inet addr:192.168.3.90  Bcast:192.168.3.255  Mask:255.255.255.0
          inet6 addr: fe80::250:56ff:fea6:46/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:5265 errors:0 dropped:0 overruns:0 frame:0
          TX packets:6328 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1202537 (1.1 Mb)  TX bytes:1416674 (1.3 Mb)

eth1      Link encap:Ethernet  HWaddr 00:50:56:A6:00:47
          inet addr:192.168.103.90  Bcast:192.168.103.255
Mask:255.255.255.0
          inet6 addr: fe80::250:56ff:fea6:47/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:6235877 errors:0 dropped:0 overruns:0 frame:0
          TX packets:4234493 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
        RX bytes:8355884612 (7968.7 Mb)  TX bytes:1661872038 (1584.8 Mb)

t003-40-lnx:~ # hostname
t003-40-lnx

t003-40-lnx:~ # netstat -nr
```

```
Kernel IP routing table
Destination     Gateway         Genmask         Flags   MSS Window  irtt
Iface
192.168.103.0   0.0.0.0        255.255.255.0   U        0 0          0 eth1
192.168.3.0     0.0.0.0        255.255.255.0   U        0 0          0 eth0
169.254.0.0     0.0.0.0        255.255.0.0     U        0 0          0 eth0
127.0.0.0       0.0.0.0         255.0.0.0       U         0 0          0 lo
0.0.0.0        192.168.3.1     0.0.0.0        UG       0 0          0 eth0
```

In addition, the rc script flexpod config is executed during the boot process. It is part of the Linux OS and performs the following tasks:

- Mounts the software share from

  `software.company.corp:/vol/software to /mnt/software`
- Mounts the backup volume for archive log backups from

  `"$TENANT"-1-bck:/vol/"$TENANT"_backup/data to /mnt/backup`
- Mounts the shared data volume from

  `"$TENANT"-1-prim:/vol/"$TENANT"_share/data to /mnt/data`

After the OS is booted, the following NFS mounts should be available, as this example for a host within tenant 3 shows:

```
software.company.corp:/vol/software
                     167772160  57500096 110272064  35% /mnt/software
t003-1-bck:/vol/t003_backup/data
                      31456896      4224  31452672   1% /mnt/backup
t003-1-prim:/vol/t003_share/data
                      31457280       320  31456960   1% /mnt/data
```

In addition, the script starts the script `/opt/NetApp/FlexPod/set_sdu_password.sh` in the background to set the SDU passwords. The script `set_sdu_password.sh` waits until the SDU daemon is started and executes the following commands:

- Setting SDU password for user root at primary vFiler unit `"$TENANT"-1-prim`
- Setting SDU password for user root at backup vFiler unit `"$TENANT"-1-bck`

After the SDU daemon has been started (5 minutes), the SDU configuration should be available, as shown in the following example for a host within tenant 3:

```
t003-40-lnx:~ # snapdrive config list
username    appliance name                    appliance type
-----------------------------------------------------------
root        t003-1-prim                       StorageSystem
root        t003-1-bck                        StorageSystem
root        smt-dfm.mgmt.t001.company.corp   DFM
```

Operating System Provisioning SLES on Bare Metal

Create a Service Profile From a Service Profile Template

Log onto <<var_ucsm_A_hostname>> or <<var_ucsm_B_hostname>>.

```
create service-profile  t005-lnx-01
 set src-templ-name linux_a
 scope vnic vNIC_A
  create eth-if  t005-access
   set default-net yes
   commit-buffer
   exit
  delete eth-if default
  commit-buffer
  exit
 exit
 scope vnic vNIC_B
  create eth-if  t005-backend
   set default-net yes
   commit-buffer
   exit
  delete eth-if default
  commit-buffer
  exit
 associate server-pool Infa_Pool
 commit-buffer
 exit
commit-buffer
```

Configure SAN Zoning

The following are the steps to configure SAN zoning:

1. Log onto the Cisco Nexus 5548 A - <<var_nexus_A_hostname>>
2. From the global configuration mode, type "device-alias database".
3. Type "device-alias name <<var_new_hostname>>_<<var_ntap_A_hostname>>_A pwwn <vHBA_A WWPN>".
4. Type "device-alias name <<var_new_hostname>>_<<var_ntap_B_hostname>>_A pwwn <vHBA_A WWPN>".
5. After all of the necessary device-alias are created, type "exit".

6. Type "`device-alias commit`".
7. Create the zones for each service profile.
   a. Type "`zone name <<var_new_hostname>>_<<var_ntap_A_hostname>>_A vsan <<var_global_vsan_A_id>>`.
   b. Type "`member device-alias <<var_new_hostname>>_<<var_ntap_A_hostname>>_A>>`.
   c. Type "`member device-alias <<var_ntap_A_hostname>>_0c>>`.
   d. Type "`exit`".
   e. Type "`zone name <<var_new_hostname>>_<<var_ntap_B_hostname>>_A vsan <<var_global_vsan_A_id>>`.
   f. Type "`member device-alias <<var_new_hostname>>_<<var_ntap_B_hostname>>_A>>`.
   g. Type "`member device-alias <<var_ntap_B_hostname>>_0c`".
   h. Type "`exit`".
8. After all of the zones for the Cisco UCS service profiles have been created, create a zoneset to organize and manage them.
9. Create the zoneset and add the necessary members.
   a. Type "`zoneset name flexpod vsan <<var_global_vsan_A_id>>`.
   b. Type "member <<var_new_hostname>>_<<var_ntap_A_hostname>>_A".
   c. Type "`member <<var_new_hostname>>_<<var_ntap_B_hostname>>_A`".
   d. Type "`exit`".
10. Activate the zoneset.
    a. Type "`zoneset activate name flexpod vsan <<var_global_vsan_A_id>>`.
    b. Type "`exit`".
    c. Type "`copy run start`".

Cisco Nexus 5548 B - `<<var_nexus_B_hostname>>`

1. From the global configuration mode, type "`device-alias database`".
2. Type "`device-alias name <<var_new_hostname>>_<<var_ntap_A_hostname>>_B pwwn <vHBA_B WWPN>`".
3. Type "`device-alias name <<var_new_hostname>>_<<var_ntap_B_hostname>>_B pwwn <vHBA_B WWPN>`".
4. After all of the necessary device-alias are created, type "`exit`".
5. Type "`device-alias commit`".
6. Create the zones for each service profile.
   a. Type "`zone name <<var_new_hostname>>_<<var_ntap_B_hostname>>_B vsan <<var_global_vsan_B_id>>`.
   b. Type "`member device-alias <<var_new_hostname>>_<<var_ntap_B_hostname>>_B`".
   c. Type "`member device-alias <<var_ntap_A_hostname>>_0d`".

   d. Type "`exit`".
   e. Type "`zone name <<var_new_hostname>>_<<var_ntap_B_hostname>>_B vsan <<var_global_vsan_B_id>>`.
   f. Type "`member device-alias <<var_new_hostname>>_<<var_ntap_B_hostname>>_B`".
   g. Type "`member device-alias <<var_ntap_B_hostname>>_0d`".
   h. Type "`exit`".

7. After all of the zones for the Cisco UCS service profiles have been created, create a zoneset to organize and manage them.
8. Create the zoneset and add the necessary members.
   a. Type "`zoneset name flexpod vsan <<var_global_vsan_B_id>>`.
   b. Type "`member <<var_new_hostname>>_<<var_ntap_A_hostname>>_B`".
   c. Type "`member <<var_new_hostname>>_<<var_ntap_B_hostname>>_B`".
   d. Type "`exit`".
9. Activate the zoneset.
   a. Type "`zoneset activate name flexpod vsan <<var_global_vsan_B_id>>`.
   b. Type "`exit`".
   c. Type "`copy run start`".

Configure the Storage

The following are the steps to configure the storage:

Controller A - `<<var_ntap_A_hostname>>`

For the service profile containing `<<var_ntap_A_hostname>>` do the following to create igroups for each vHBA:

```
"igroup create -f -t linux
<<var_new_hostname>>_<<var_ntap_A_hostname>>_A<vHBA_A WWPN>".
```

```
"igroup create -f -t linux
<<var_new_hostname>>_<<var_ntap_A_hostname>>._B<vHBA_B WWPN>".
```

Controller B - `<<var_ntap_B_hostname>>`

For the service profile containing `<<var_ntap_B_hostname>>` do the following to create igroups for each vHBA:

```
"igroup create -f -t linux
<<var_new_hostname>>t_<<var_ntap_B_hostname>>._A<vHBA_A WWPN>".
```

```
"igroup create -f -t linux
<<var_new_hostname>>_<<var_ntap_B_hostname>>_B<vHBA_B WWPN>".
```

Controller A - `<<var_ntap_A_hostname>>`

Create a LUN for the service profile booting from `<<var_ntap_A_hostname>>`:

```
"lun create -s 60g -t linux -o no reserve
/vol/boot_A/<<var_new_hostname>>_<<var_ntap_A_hostname>>
```

Controller B - `<<var_ntap_B_hostname>>`

Create a LUN for the service profile booting from `<<var_ntap_B_hostname>>`:

```
"lun create -s 60g -t vmware -o no reserve /vol/boot_B/
<<var_new_hostname>>_<<var_ntap_B_hostname>>
```

Controller A - <<ar_ntap_A_hostname>>

For each LUN created, enter the following command to map the created LUNs to the two initiator groups per service profile:

```
"lun map /vol/boot_A/<<var_new_hostname>>_<<var_ntap_A_hostname>>
<<var_new_hostname>>_<<var_ntap_A_hostname>>_A0"


"lun map /vol/boot_A/<<var_new_hostname>>_<<var_ntap_A_hostname>>
<<var_new_hostname>>_<<var_ntap_A_hostname>>_B 0"
```

Controller B - `<<var_ntap_B_hostname>>`

For each LUN created, enter the following command to map the created LUNs to the two initiator groups per service profile:

```
"lun map /vol/boot_B/<<var_new_hostname>>_<<var_ntap_B_hostname>>
<<var_new_hostname>>_<<var_ntap_B_hostname>>_A 0"


"lun map /vol/boot_B/<<var_new_hostname>>_<<var_ntap_B_hostname>>
<<var_new_hostname>>_<<var_ntap_B_hostname>._B 0"
```

Choose a desired name for the igroups and LUNs and use the WWPNs of the vHBAs of the new server to be assigned to the igroups. Create the LUNs with a size of 60GB instead of 10GB.

Install SLES 11 Sp1

Before the server installation can be started, the NetApp controllers and SAN zoning must be configured completely as a prerequisite.

```
boot iso image is SLES-11-SP1-DVD-x86_64-GM-DVD1.iso.
```

The following are the steps for the initial OS installation:

1. Open the KVM Console of the created Service Profile by clicking on the Service Profile entry. Click KVM Console. A new window appears.
2. Choose English (US) as the language, select your correct keyboard layout, and accept the license terms after reading and agreeing to it.
3. If desired,check the installation medium.
4. Choose New Installation.
5. Define your Time Zone settings.
6. Choose Physical Machine as Server Base Scenario.

7. In the Installations Settings overview, the Partitioning must be adapted and the Multipathing option enabled.
8. Select Hard Disks and then click Configure… and Configure Multipath.
9. Click Yes.
10. Two primary partitions must be created:
    - `SWAP:Partition with disk space 40GB`
    - /:Root Partion based on ext3 filesystem with disk space 20GB
11. Click Booting..
12. Modify the Boot Loader options or select Write generic Boot Code to MBR and click OK
13. Delete all devices excepting the first multipath device and Click OK.
14. Add the following Software components in addition to the standard: SAP Application Server Base, C/C++ Development tools, and your desired desktop. Afterward, click Details.
15. Search for odbc.
16. Choose unixODBC, unixODBC-32bit, unixODBC-devel, and unixODBC-devel-32bit and accept. In addition, search for java and install java-1_4_2-ibm. Check whether Perl 5 is chosen for installation. If not, choose Perl 5, too.
17. Set the Default Runlevel to 3. Full multiuser with network.
18. Click Install.
19. Click Install to start the installation process.
20. After the correct OS installation, the System boots the first time and starts with the specific server host configurations.
21. Set the root password and click Next.
22. Leave the Hostname and Domain Name on the default and select Change Hostname through DHCP and click Next.
23. Open the SSH ports in the firewall and set the Network interfaces (eth0-ethX) to internal networks.
24. The network test is optional.
25. Change the User Authentication Method to NIS.
26. Configure the NIS: Check the boxes Use NIS and Open Ports in Firewall.
27. Read the Release Notes and go to the next step.
28. Use the default hardware configuration.
29. Click Next.
30. Summary and all config information is stored in /root/autoinst.xml.
31. Reboot the system.

DHCP Client Configuration

This section describes the necessary DHCP Client configuration and other network-related configurations.

Adjust the DHCP Client timeout by setting it to 99 seconds. This makes sure that the DHCP client does go in background to get the DHCP lease. This is necessary because otherwise other scripts or services that require network access may fail to start at boot time. Edit /etc/sysconfig/network/dhcp and change the timeout value to 99:

```
DHClient_TIMEOUT='99'
```

Because all interfaces should get the same hostname, insert the line hostname > /etc/HOSTNAME into the section case$state in up into /etc/sysconfig/network/scripts/dhcpd-hook as shown:

```
case $state in
up)
        write_cached_config_data  dhcp4_state up       $INTERFACE
        commit_cached_config_data                      $INTERFACE

        $debug && NC_OPTIONS="-v"
        /sbin/netconfig modify -s "dhcpcd" \
                -i $INTERFACE $NC_OPTIONS  \
                -l $leaseinfo 2>&1 | $log_dbg

        hostname > /etc/HOSTNAME
```

In addition, it is necessary that all other interfaces wait until the first interface (eth0) is up and got the new hostname assigned. Therefore, add the following line into the configuration files (for example, `/etc/sysconfig/network/ifcfg-eth1 for eth1)` of all interfaces except for eth0.

```
PRE_UP_SCRIPT="wait4eth0"
```

`Afterwards create the script "wait4eth0" in directory /etc/sysconfig/network/script was the following content:`

```
#!/bin/bash
ifstatus eth0
eth0up=$?
while [ $eth0up -gt 0 ]; do
        echo "waiting for eth0...";
        sleep 5;
        ifstatus eth0;
        eth0up=$?;
done
```

Disable the use of persistent network device names by clearing the UDEV configuration for network interfaces according to the Novell/SUSE TID 3048119:

```
cat< /dev/null > /etc/udev/rules.d/70-persistent-net.rules
```

This step must be repeated if the template is started or rebooted for other changes.

Check whether the network interfaces are set to internal networks at the firewall.

Open /etc/sysconfig/SuSEfirewall2 and check whether the network interfaces are included into FW_DEV_INT as shown in the following line:

```
FW_DEV_INT="eth0 eth1 eth2"
```

NIS Configuration

The OS template is configured to run an NIS client communicating with a NIS server to provide central user management capabilities. The following maps are provided by the NIS server: passwd, group, services. This section describes the necessary configurations.

NSSWITCH

The file /etc/nsswitch.conf configures where to get data from for the different user configuration files. The OS template should contain the following nsswitch.conf entries:

```
passwd:      compat
shadow:      files
group:       compat

hosts:       dns files
networks:    files dns
services:    nis
```

PASSWD

The following line must be appended to the file /etc/passwd to merge NIS users with local users:

```
+::::::
```

Groups

The following line must be appended to the file /etc/group to merge NIS groups with local groups:

```
+:::
```

Services

The services definition is completely retrieved from the NIS server. No local services are possible.

Linux Kernel Configuration

No special kernel settings are required for the SAP on FlexPod landscape other than the ones mentioned in SAP Note 1310037 for SLES 11 installations. The most important thing is to install the sapconf (fka sapinit) package. This is done automatically when you select the pattern “SAP Application Server Base” during the SLES installation procedure.

SAP Host Agents Installation

The SAPHOSTAGENT package contains all of the required elements for centrally monitoring any host. You can either install the host agent using SAPInst (only the kernel DVD is required) or install the package directly (download SAPHOSTAGENT.SAR from SAP Service Marketplace).

The following are the steps to directly install SAP Host Agents:

1. Login as user root.

2. Make sure the group sapsys exists on the host.
3. Make sure the user sapadm exists and that it is a member of the `sapsys` group.
4. Decompress the `SAPHOSTAGENT.SAR` archive with the `SAPCAR` tool (for example, into `/tmp`):
   ```
   sapcar -xvf SAPHOSTAGENT.SAR
   ```
5. Go to the extracted path `/tmp/hostctrl/exe`.
6. Execute the installation procedure: `./saphostexec -install`.
7. Verify that the centrally mounted `SAPOSCOL` working directory `/usr/sap/tmp` exists (if not, mount it accordingly) or change the working directory by adding the following line to the file `/usr/sap/hostctrl/exe/host_profile`:
   ```
   DIR_PERF = /usr/sap/hostctrl/work
   ```

SnapDrive Installation and Configuration

After SnapDrive is installed, the following changes must be made in the configuration file:

- vFiler units don't support HTTPS, HTTP needs to be configured in the snapdrive config file.
- The SAP systems are installed adaptive computing aware; there won't be any service-specific entries in /etc/fstab.
- Turn off the autosupport option.

```
t002-1-lnx:/opt/NetApp/snapdrive # vi snapdrive.conf

use-https-to-filer=off  # Communication with filer done via HTTPS
instead of HTTP

snapcreate-check-nonpersistent-nfs=off  # Check that entries exist in
/etc/fstab for specified nfs fs.

autosupport-enabled=off
```

Access Configuration to Data Fabric Manager:

```
snapdrive config set -dfm <user_name> <<var_ntap_dfm_ip>>
```

SMSAP Installation and Configuration

During the installation, user and group must be configured to root/root.

```
Please enter the operating system user name and group name that should
be used

to run SnapManager for SAP commands.  Press <ENTER> to accept the
default

values.

   User Name (DEFAULT: oracle): root

   User Group (DEFAULT: dba): root
```

Insert the following option into `/opt/NetApp/smsap/properties/smsap.config`:

```
auto_support.on=off
```

JAVA.SECURITY File

Within the java.security file, `/dev/urandom` must be changed to `/dev/./urandom`.

```
cat /opt/NetApp/smsap/jre/lib/security/java.security | grep
securerandom

# the securerandom.source property. If an exception occurs when

securerandom.source=file:/dev/./urandom

# Specifying this system property will override the securerandom.source
```

Authorization Configuration

Create /etc/pam.d/snapmanager for SMSAP:

```
t002-1-lnx:/etc/pam.d # vi snapmanager

Insert : auth required pam_unix.so

account required pam_unix.so


t002-1-lnx:/etc/pam.d # cat snapmanager

auth required pam_unix.so

account required pam_unix.so

t002-1-lnx:/etc/pam.d #
```

SMSAP Post Cloning Plugin Configuration

The scripts os_db_authentication.sh and sap_follow_up_activities.sh must be copied from /opt/NetApp/smsap/plugins/examples/clone/create/post to /opt/NetApp/smsap/plugins/clone/create/post/.

The function execute in the script os_db_authentication.sh must be adapted.

Original version:

```
function execute {

        EXIT=0

       [ -z "$SCHEMAOWNER" ] && EXIT=4 && echo "parameter [SCHEMAOWNER]
not set"

        [ -z "$ORADBUSR_FILE" ] && EXIT=4 && echo "parameter
[ORADBUSR_FILE] not set"

        [ -z "$SM_TARGET_SID" ] && EXIT=4 && echo "parameter
[SM_TARGET_SID] not set"

        [ -z "$SM_ORIGINAL_SID" ] && EXIT=4 && echo "parameter
[SM_ORIGINAL_SID] not set"

        [ $EXIT -ne 0 ] && echo "processing stopped due to missing
parameters" && _exit $EXIT

       [ ! -f "$ORADBUSR_FILE" ] && echo "file [$ORADBUSR_FILE] is not
a regular file" && _exit 4

        sqlplus /nolog @${ORADBUSR_FILE} $SCHEMAOWNER UNIX
$SM_TARGET_SID x

        sqlplus /nolog <<EOF
        set echo on
        set termout on
        connect / as sysdba
        insert into OPS\$${SM_TARGET_SID}ADM.SAPUSER select *
from OPS\$${SM_ORIGINAL_SID}ADM.SAPUSER;
        commit;
        exit
EOF
```

Correct version:

```
function execute {
    EXIT=0
   [ -z "$SCHEMAOWNER" ] && EXIT=4 && echo "parameter [SCHEMAOWNER]
not set"
    [ -z "$ORADBUSR_FILE" ] && EXIT=4 && echo "parameter
[ORADBUSR_FILE] not set"
    [ -z "$SM_TARGET_SID" ] && EXIT=4 && echo "parameter
[SM_TARGET_SID] not set"
    [ -z "$SM_ORIGINAL_SID" ] && EXIT=4 && echo "parameter
[SM_ORIGINAL_SID] not set"
    [ $EXIT -ne 0 ] && echo "processing stopped due to missing
parameters" && _exit $EXIT
   [ ! -f "$ORADBUSR_FILE" ] && echo "file [$ORADBUSR_FILE] is not
a regular file" && _exit 4
    sqlplus /nolog @${ORADBUSR_FILE} $SCHEMAOWNER UNIX
$SM_TARGET_SID x
    . ${ORACLE_HOME}/../.profile && . ${ORACLE_HOME}/../.dbenv.sh
   ${DIR_LIBRARY}/brconnect -u / -c force -f chpass -o SAPSR3 -p sap
    _exit $?
}
```

Download oradbusr10.zip as described in SAP Note 50088. Extract the zip file and copy `ORADBUSR.SQL` to `/opt/NetApp/smsap/plugins/clone/create/post/`.

System Boot Configuration

The script flexpod_config is used to execute the following tasks during system boot:

- Mounting the read-only software share
- Mounting tenant-specific data share
- Configuring the SDU password for the primary vFiler unit
- Configuring the SDU password for the backup vFiler unit

The mount points `/mnt/software`, `/mnt/data`, and `/mnt/backup` must be created. The permissions of these mount points must be changed to 777.

The script `flexpod_config` must be copied to `/etc/rc.d`

A new directory /opt/NetApp/FlexPod must be created. The script set_sdu_password.sh must be copied to /opt/NetApp/FlexPod.

The system boot configuration is done with the chkconfig command.

```
t003-20-lnx:/etc/rc.d # chkconfig --add flexpod_config
flexpod_config          0:off  1:off  2:off  3:on   4:off  5:on   6:off
```

Prerequisites: The vFiler password is hard coded in the script and must be the same for all tenants.

Operating System Provisioning RHEL on Bare Metal

Create A Service Profile From A Service Profile Template

Log onto `<<var_ucsm_A_hostname>>` or `<<var_ucsm_B_hostname>>`.

```
create service-profile  t005-lnx-02
 set src-templ-name linux_a
 scope vnic vNIC_A
  create eth-if  t005-access
   set default-net yes
   commit-buffer
   exit
  delete eth-if default
  commit-buffer
  exit
 exit
 scope vnic vNIC_B
  create eth-if  t005-backend
   set default-net yes
   commit-buffer
   exit
  delete eth-if default
  commit-buffer
  exit
 associate server-pool Infa_Pool
 commit-buffer
 exit
commit-buffer
```

Configure the SAN Zoning

Configure the Cisco Nexus 5548 switches for the new servers similarly as described in section 3.6 Cisco Nexus 5548 Deployment Procedure: Part II of the FlexPod for VMware Deployment Guide.

Choose a desired name for the zone name and use the WWPNs of the vHBAs of the new server for the configuration (instead of ESXi hosts).

Install RHEL 5 With Kickstart Option

Before the server installation can be started, the NetApp controllers and SAN zoning must be configured completely as shown in the following steps.

The following are the steps to install the initial RHEL:

1. Open the KVM Console of the created Service Profile by clicking on the Service Profile entry. Click KVM Console. A new window appears.
2. Click Tools and then Launch Virtual Media.
3. In the new window add the ISO image rhel-server-5.5-x86_64-dvd.iso
4. From the KVM window click Boot.
5. The server will start booting from the selected RHEL 5.5 DVD.
6. Start the installation process by entering:

```
linux mpath ks=nfs:<location of the kickstart file> ksdevice=eth0
```

7. Click Return.
8. The server will be installed as defined in the Kickstart file including all required components and parameters for SAP.
9. The server is ready to use after a reboot.

SAP System Provisioning

Preparation

The following are the steps to install or migrate an SAP system:

1. Provision the new OS image for the new host (bare metal or virtual machine).
2. Configure DNS and NIS for the new SAP system.
3. Provision the storage for the new SAP system.
4. Create necessary subdirectories within the new storage volumes.
5. Mount the file system and configure the IP alias with script fp_sap_system.sh.
6. Start SAPINST to install the new SAP system or migrate the existing one into the FlexPod landscape.

Provisioning of New Operating System

The new OS image is deployed as described in the section Operating System Provisioning SLES on Bare Metal.

DNS and NIS Configuration

Some information must be added to the DNS and NIS configuration for the new SAP system.

The following are the steps to add information to the DNS and NIS configuration:

1. Create the required SAP OS users on the tenant-specific services virtual machine. The following users must be created:

   ```
   "ora<sid> (group: dba) - Oracle Database Administrator for <SID>
   "<sid>adm (group: sapsys) - SAP System Administrator for <SID>
   ```

   This can be done using the script /mnt/software/scripts/createSAPuser.sh

   ```
   Usage: createSAPuser.sh <user_type> <SID> <user_id> <group>
   [<additional_groups> [<password>]]
     <user_type>       : {adm|ora}, adm = <sid>adm user, ora = ora<sid>
   user
     <SID>               : SAP System ID
     <user_id>           : user ID of the new user
     <group>            : group ID or name of the primary group of the
   new user
     <additional_groups> : (opt.) list of additional groups (comma
   separated list of names)
     <password>          : (opt.) password for the new user
   ```

2. Choose available user IDs (user ID >= 1000) for the new users; for example:

   ```
   /mnt/software/scripts/createSAPuser.sh adm QE6 1001 sapsys
   'sapinst,dba,oper' 'myPassword!'
   /mnt/software/scripts/createSAPuser.sh ora QE6 1002 dba
   'sapinst,oper' 'myPassword!'
   ```

3. Add missing service entries on the tenant-specific services virtual machine. Usually the SAP message server entry is missing. This can be done using the script /mnt/software/scripts/addSAPservice.sh:

   Usage: addSAPservice.sh <SID> <SN>

   ```
    <SID> : SAP System ID
     <SN>  : SAP System number of the CI/SCS
   ```

4. Enter the SID and system number of the new system; for example:

   ```
   /mnt/software/scripts/addSAPservice.sh QE6 00
   ```

5. Add DNS entries for the virtual hostnames of the target SAP system to the DNS configuration on the tenant-specific services virtual machine. This can be done using the script `/mnt/software/scripts/addDNSHostname.sh`:

Usage: addDNSHostname.sh <virtual_hostname>

```
 <virtual_hostname> : the virtual hostname to add (simple or full
name)
```

The following lines show an example for the ABAP central system QE6:

```
/mnt/software/scripts/addDNSHostname.sh dbqe6
```

```
/mnt/software/scripts/addDNSHostname.sh ciqe6
```

6. To activate the changes:
   - Restart the DNS services: service dnsmasq restart.
   - Update the NIS maps: /mnt/software/scripts/update_nis.sh.

Storage Provisioning

To provision storage, run the following commands on the NetApp DFM host in the management tenant:

1. Create a dataset for the data volume:

   ```
   dfpm dataset create -v <provisioning policy> -r  < primary vFiler
   name>  <<tenant>_sapdata_<SID> >
   ```

   ```
   For example: dfpm dataset create -v Default -r t002-1-prim
   t002_sapdata_PA1
   ```

2. Add the primary resource pool to the data dataset:

   ```
   dfpm dataset respool add <<tenant>_sapdata_<SID> > <primary resource
   pool>
   ```

   ```
   For example: dfpm dataset respool add t002_sapdata_PA1 filer14a
   ```

3. Provision the data dataset:

   ```
   dfpm dataset provision -n sapdata_<SID>  -s <size, e.g., 150g> -e
   nfs -w all -N no -a 0 -S sys <<tenant>_sapdata_<SID> >
   ```

   ```
   For example: dfpm dataset provision -n sapdata_PA1 -s 150g -e nfs -w
   all -N no -a 0 -S sys t002_sapdata_PA1
   ```

4. Create a dataset for the log volume:

```
dfpm dataset create -v <provisioning policy> -r  <primary vFiler name>
<<tenant>_saplog_<SID> >
```

```
For example: dfpm dataset create -v Default -r t002-1-prim
t002_saplog_PA1
```

5. Add the primary resource pool to the log dataset:

   ```
   dfpm dataset respool add <<tenant>_saplog_<SID> > <primary resource
   pool>
   ```

   ```
   For example: dfpm dataset respool add t002_saplog_PA1 filer14a
   ```

6. Provision the saplog SID qtree:

   ```
   dfpm dataset provision -n saplog_<SID> -s <size, e.g. 10g> -e nfs -w
   all -N no -a 0 -S sys <<tenant>_saplog_<SID> >
   ```

   ```
   For example: dfpm dataset provision -n saplog_PA1 -s 10g -e nfs -w
   all -N no -a 0 -S sys t002_saplog_PA1
   ```

7. Provision the sapusr _SID qtree:

```
dfpm dataset provision -n sapusr_<SID>  -s <size, e.g. 10g> -e nfs
-w all -N no -a 0 -S sys <<tenant>_saplog_<SID> >
```

```
For example: dfpm dataset provision -n sapusr_PA1 -s 10g -e nfs -w
all -N no -a 0 -S sys t001_saplog_PA1
```

8. Provision the sapusr SMD qtree:

```
dfpm dataset provision -n sapusr_SMD  -s <size, e.g., 10g> -e nfs -w
all -N no -a 0 -S sys <<tenant>_saplog_<SID> >
```

```
For example: dfpm dataset provision -n sapusr_SMD -s 10g -e nfs -w
all -N no -a 0 -S sys t002_saplog_PA1
```

9. Provision the sapmnt SID qtree:

```
dfpm dataset provision -n sapmnt_<SID>  -s <size, e.g., 10g> -e nfs
-w all -N no -a 0 -S sys <<tenant>_saplog_<SID> >
```

```
For example: dfpm dataset provision -n sapmnt_PA1 -s 10g -e nfs -w
all -N no -a 0 -S sys t002_saplog_PA1
```

10. Provision the saphome qtree:

```
dfpm dataset provision -n saphome_<SID>  -s <size, e.g., 10g> -e nfs
-w all -N no -a 0 -S sys <<tenant>_saplog_<SID> >
```

```
For example: dfpm dataset provision -n saphome_PA1 -s 10g -e nfs -w
all -N no -a 0 -S sys t002_saplog_PA1
```

11. Delete the log dataset:

```
dfpm dataset destroy -f <<tenant>_saplog_<SID> >
```

```
For example: dfpm dataset destroy -f t002_saplog_PA1
```

12. Delete the dataset itself:

```
dfpm dataset destroy -f <<tenant>_sapdata_<SID> >
```

```
For example: dfpm dataset destroy -f t002_saplog_PA1
```

After the datasets, the volumes, and the qtrees are provisioned, the dataset itself is deleted in the last step because SDU creates the necessary datasets when data protection is configured within SMSAP.

Creating Subdirectories

To create the remaining subdirectories within the qtrees, call the following script on the tenant-specific services virtual machine:

```
Usage: provision_SAP_storage.sh <tenant number> <SID> <vFiler> [<task>]
  <tenant number> : the number of the tenant, e.g. 4 for T004
  <SID>           : the SAP system ID
  <vFiler>        : the vFiler name, e.g. t004-1-prim
  <task>          : {log|data|all}, provision log volume, data volume
or both; default: log
```

For example: t002-0-lnx:/mnt/software/scripts # ./provision_SAP_storage.sh 2 PA1 t002-1-prim all

Mounting File Systems and Configuring IP Alias

The script fp_sap_system.sh is used to mount the necessary file systems and configure the IP alias. This script is executed at the host where the SAP system will be installed or migrated with the following command:

```
/mnt/software/scripts/fp_sap_system.sh startmountonly <SID> <abap |
java>
```

The script executes the following tasks:

1. Creates a directory for archive log backups (if none exists)
2. Configures virtual interfaces for the SAP and database services
3. Creates mount points (if none exists)
4. Mounts file systems

SAP System Installation With SAPINST

The SAP system is installed using `SAPINST`. To get an installation that uses virtual hostnames (necessary to move systems between hosts and for the SAP ACC integration), the xxxxx must be installed in the following order (choosing the distributed system option):

1. Global Host Preparation using SAPINST parameter `SAPINST_USE_HOSTNAME=<CI_or_SCS_virtual_hostname>`
2. Database Instance using SAPINST parameter `SAPINST_USE_HOSTNAME=<DB_virtual_hostname>`
3. Central Instance using SAPINST parameter `SAPINST_USE_HOSTNAME=<CI_or_JC_virtual_hostname>`

Configuring Backup Services for SAP Systems

Backup services can be configured for newly installed or migrated SAP systems as well as for SAP systems created using a system copy with SMSAP.

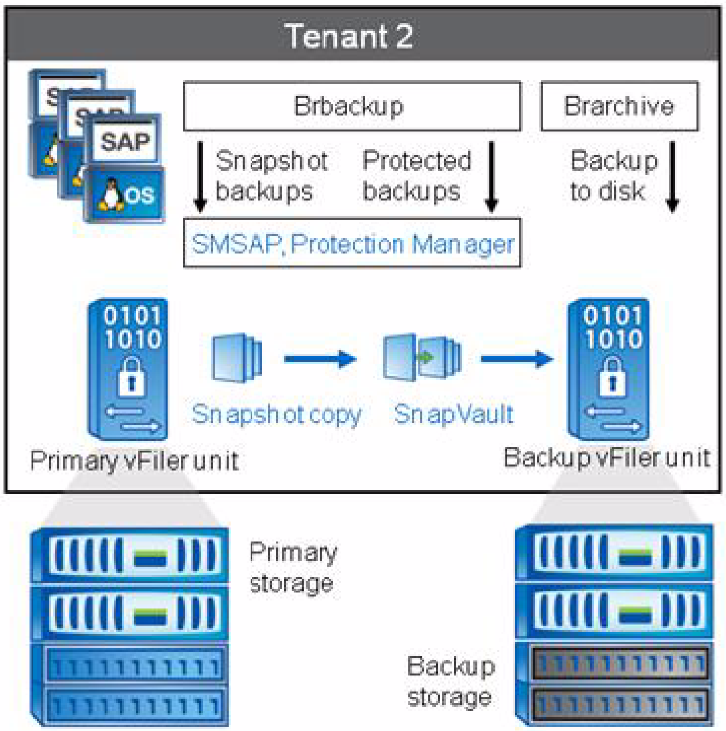
If backup services have been configured for SAP systems based on a SMSAP system copy, several additional steps must be taken before refreshing this SAP system again. More details can be found in section "Cloning based system copy - system refresh."

The SAP Br*tools, in combination with SMSAP and Protection Manager, are used to back up the SAP systems.

- Brbackup, with the retention class set to the hourly option, is used to create local backups based on Snapshot images at the primary storage. With the retention class set to the daily option, Brbackup is used to create local backups, including data protection with Protection Manager.
- Brarchive is used to back up the archive logs directly to a mount point from the secondary storage and to delete the archive logs at the primary storage.
- Brconnect is used to delete the archive logs at the secondary storage based on a configurable retention policy.

Figure 17 shows how SMSAP and Protection Manager work together with the SAP Br*tools.

Figure 17 Overview Of Backup Concept



The following are the steps to configure backup services.

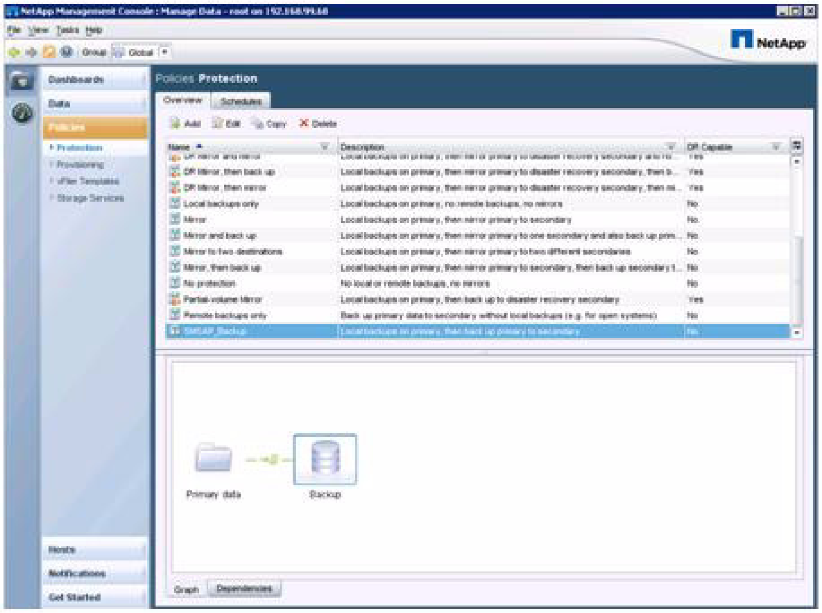
1. In Protection Manager: Define protection policies.
2. In SMSAP: Create the SMSAP profile for the specific SAP system.
3. In SMSAP: Define the retention policy for local backups.
4. In SMSAP: Select one of the protection policies that have been defined in step 1. With this step SDU creates a new dataset for the SAP system within Protection Manager.
5. In Protection Manager: Define the resource pool for the backup node of the new dataset. With this step, the initial transfer for the SnapVault relationship is started.
6. In Br*tools: Adapt the configuration files initSID.sap and initSID.utl for Brbackup and Brachive.
7. In SMSAP: Set credentials for the user oraSID.
8. In SAP database planning calendar: Configure the schedule for database and archive log backups.

Protection Manager Protection Policies

Typically, more than one protection policy is defined to allow different retention policies for different SAP system classes or customer-defined SLAs.

A new protection policy is copied from the backup policy. The new policy defines the retention policy for the secondary storage as well as the schedules for SnapVault software updates to the secondary storage. An example using SMSAP_Backup is shown in Figure 18.

Figure 18 Defining the New Protection Policy



Name	Description	DR Capable
DR Mirror and mirror	Local backups on primary, then mirror primary to disaster recovery secondary and m...	Yes
DR Mirror, then back up	Local backups on primary, then mirror primary to disaster recovery secondary, then b...	Yes
DR Mirror, then mirror	Local backups on primary, then mirror primary to disaster recovery secondary, then mi...	Yes
Local backups only	Local backups on primary, no remote backups, no mirrors	No
Mirror	Local backups on primary, then mirror primary to secondary	No
Mirror and back up	Local backups on primary, then mirror primary to one secondary and also back up prim...	No
Mirror to two destinations	Local backups on primary, then mirror primary to two different secondaries	No
Mirror, then back up	Local backups on primary, then mirror primary to secondary, then back up secondary t...	No
No protection	No local or remote backups, no mirrors	No
Partial-volume Mirror	Local backups on primary, then back up to disaster recovery secondary	Yes
Remote backups only	Back up primary data to secondary without local backups (e.g. for open systems)	No
SMSAP_Backup	Local backups on primary, then back up primary to secondary	No

Because local Snapshot images are created by SMSAP, the local backup schedule is set to None.

The schedule for SnapVault software updates is configured in Primary data to Backup.

The retention policy at the secondary storage is defined in Backup.

SMSAP Profile Creation

The profile for each SAP system within a tenant can be created using either the SMSAP GUI or the CLI.

Profile Creation Using the Command Line

The following example shows the profile creation for the SAP system PP7 in tenant 2:

```
t002-24-lnx:~ # smsap profile create -profile PP7 -profile-password
ucs4sap! -repository -dbname REP -host
t001-smrepo.mgmt.t001.company.corp -port 1521 -login -username
smrepo_t002 -database -dbname PP7 -host dbpp7.t002.company.corp
-osaccount orapp7 -osgroup dba -comment "Portal PP7"

Enter password for database connection
smrepo_t002@t001-smrepo.mgmt.t001.company.corp:1521/REP: ********

[ INFO] SMSAP-20019: Set password for repository
"smrepo_t002@REP/t001-smrepo.mgmt.t001.company.corp:1521" in user
credentials for "root".

[ INFO] SMSAP-20020: Set password for profile "PP7" in user credentials
for "root".

Operation Id [402882ca2e94f8d3012e94f8d6770009] succeeded.
```

The SMSAP CLI must be executed at the host where the database PP7 is running.

Profile Creation Using the SMSAP GUI

The following are the steps to create a profile using the SMSAP GUI:

1. Enter the profile configuration information.
2. Configure the virtual hostname for the database hostname.
3. Enter the host account and host group.
4. Specify the database connection.
5. The response indicates that the profile configuration is complete.

Data Protection Configuration

The following are the steps to configure data protection:

1. Within the profile properties of SMSAP, select the protection policy.
2. SDU automatically creates a dataset within Protection Manager that is linked to the selected protection policy. The new dataset is now visible within Protection Manager.
3. Add a resource pool to the Backup node.
4. Select the resource pool of the secondary storage system.
5. Select the secondary vFiler unit for the specific tenant. For example, the SAP system PE6 is running in tenant 2.
6. The message appears that configuration has successfully been completed.
7. The SnapVault software initial transfer is now started.
8. Protected backups can be scheduled after the initial transfer is finished.

BRBACKUP and BRARCHIVE Configuration

Brbackup is used to create local Snapshot-based backups at the primary storage using the configuration file `initSID_hourly.sap`. These backups are not replicated to the secondary storage as configured in the `initSID_hourly.utl` file. A second configuration file is used to configure daily backups, which are replicated to the secondary storage.

Archive log backups are backed up using brrachive with the backup_device_type disk instead of using SMSAP. The destination for the archive log backups is a mount point at the secondary storage. Brconnect is used to delete the archive logs at the secondary storage based on a configurable retention policy in `initSID.sap`.

Table 11 shows a configuration example for a system with SID=PE6.

*Table 11 Backint and Br*tools Configuration*

Purpose	InitSID.sap file name	Entries in initSID.sap file	initSID.utl file name	Entries in initSID.utl

Brbackup database backups with retention class "hourly" without replication to secondary storage.	initPE6_hourly.sap	backup_dev_type = util_file
		util_par_file = initPE6_hourly.utl
			initPE6_hourly.utl	profile_name = PE6
				fast = require
				protect = no
				retain = HOURLY

Brbackup database backups with retention class "daily" with replication to secondary storage	InitPE6_daily.sap	backup_dev_type = util_file
		util_par_file = initPE6_daily.utl
			InitPE6_daily.utl	profile_name = PE6
				fast = require
				protect = yes
				retain = DAILY

Brarchive archive log backups written directly to a mount point at the secondary storage.	initPE6_brarchive.sap	backup_dev_type = disk
		archive_copy_dir = /mnt/backup/archive_logs_PE6
			N/A	N/A

Brconnect to cleanup archive logs at secondary storage	initPE6.sap	cleanup_brarchive _log = 14	N/A	N/A

SMSAP credentials need to be set for the user orasid. After the credentials are set for user orasid, both users orasid and sidadm can execute Br*tools commands from the command line or the SAP DBA Planning Calendar. (Sticky bits must be set correctly for the Br*tools.)

The following example shows the configuration for:

- SAP system with SID=PE6
- Repository database SID=REP
- Repository database host =t001-smrepo.mgmt.t001.company.corp

```
t002-17-lnx:orape6 51> smsap credential set -repository -dbname REP
-host t001-smrepo.mgmt.t001.company.corp -login -username smrepo_t002
-port 1521
```

```
Enter password for database connection
smrepo_t002@t001-smrepo.mgmt.t001.company.corp:1521/REP: ********
```

```
[ INFO] SMSAP-20019: Set password for repository
"smrepo_t002@REP/t001-smrepo.mgmt.t001.company.corp:1521" in user
credentials for "orape6".

t002-17-lnx:orape6 52> smsap profile sync -repository -dbname REP -host
t001-smrepo.mgmt.t001.company.corp -port 1521 -login -username
smrepo_t002

[ INFO] SMSAP-20010: Synchronizing mapping for profiles in repository
"smrepo_t002@REP/t001-smrepo.mgmt.t001.company.corp:1521".

[ INFO] SMSAP-20011: Loaded mapping for profile "PE6".

t002-17-lnx:orape6 53> smsap credential set -profile -name PE6

Enter password for profile PE6: ********

[ INFO] SMSAP-20020: Set password for profile "PE6" in user credentials
for "orape6".

t002-17-lnx:orape6 54>
```

After the configuration files have been adapted, database and archive log backups can be scheduled using the SAP DBA Planning Calendar (DB13).

Configuring ACC For SAP Systems

To be able to monitor and manage SAP systems with the Adaptive Computing Controller (ACC) the infrastructure components and the SAP systems must be configured in ACC

The following are the steps to start any configuration:

1. Open a browser window and go to the ACC start page; for example, http://t001-acc:50000/acc.
2. Log on as Administrator or as any other user with ACC administrative rights.
3. Go to the Configuration tab.

Configuring Virtualization Managers

Before you can integrate information from the VMware virtualization landscape, you must follow the steps below to configure the VMware Virtualization Manager in ACC.

The following are the steps to configure the VMware Virtualization Manager in ACC:

1. Select Virtualization Managers and click on Add. Select the VMware platform.
2. Enter the required information to connect to the VMware Virtual Center.
3. Save the connection information. At this point, ACC can interact with the Virtual Center.

Configuring Pools, Networks, and Characteristics

The different tenants (called "pools" in ACC), their networks, and their characteristics must be identified in ACC. To configure tenant information in ACC, follow the steps below.

Note These steps must be repeated every time a new tenant is provisioned.

The following are the steps to configure tenance information in ACC:

1. Select Pools, Networks, and Characteristics and click on Edit and then on Add.
2. Enter the information to create a new pool (or tenant).
3. Select the Networks tab and click Add.
4. Enter the required information for the access LAN.
5. Click Add again to enter the required information for the back-end LAN.
6. Click Save to save the pool and network information just entered.

Configuring Resources

All hosts, virtual machines as well as physical servers, that are to be managed by ACC must be configured first. Follow the steps below to register such resources in ACC.

The following are the teps to register resources in ACC:

1. Select Resources and click Add Resources.
2. Click Expert Mode and select Detect Using Host and Instance Agent as source.
3. Enter the hostnames and the network domain of the hosts to be configured, and set the required credentials for the host agents running on these hosts:
4. Click Detect. The new resource should now be discovered by ACC.
5. Assign the corresponding pool (tenant) to the new resources and click Save.
6. Select one of the newly discovered resources from the list and click on Edit to assign networks to the resources.
7. Check all information on the next screen and test the host agent connection. Verify that the connection works and the AC-Managed flag is set. Then click Next.
8. Check the flags AC-Enabled and AC-Operational.
9. Click Retrieve & Add Interfaces from Host Agent.
10. If more than one host has been discovered in step 0, click Next to start the Mass Configuration. Otherwise click Save to end the configuration.
11. Optionally, for mass configuration only, there is another step: Select all remaining hosts from the list of hosts that have been discovered in step 0 and click Save & Apply Mass Configuration.
12. Click Apply.

Configuring Services

All SAP systems that are to be managed by ACC must be configured first. The steps below describe how to register SAP systems in ACC.

The following are the teps to register SAP systems in ACC:

1. Select Services and click Add Services.
2. Click Expert Mode and select Detect Using Host and Instance Agent as source.
3. Enter the virtual hostnames and the network domain of the SAP systems, and set the required credentials for the host agents running on these hosts.

4. Click Detect. The new SAP services should now be discovered by ACC.
5. Select the action Assign to New System and select the correct pool (tenant) for the SAP systems.
6. Click Assign New to create a new representation in ACC for the SAP system. Change the default entries as needed. Then click Assign.
7. Open the new system in the list and select the database instance. Then click Edit.
8. Check all default values and enter the database operator credentials. Then click Next.
9. Set the AC-Enabled flag and select the correct network for the virtual hostname. Then select the OS from the list of Required Resource Type. Click Next.
10. Deselect the flag OS Managed Mounts (Automounter) and click Retrieve Mount List.
11. Click Sort and remove all mount entries that do not belong to the instance. Then click Save to store the information of the database instance.
12. Now select the remaining Central Instance and repeat steps 0 through 0 accordingly. Fill in the information as required.

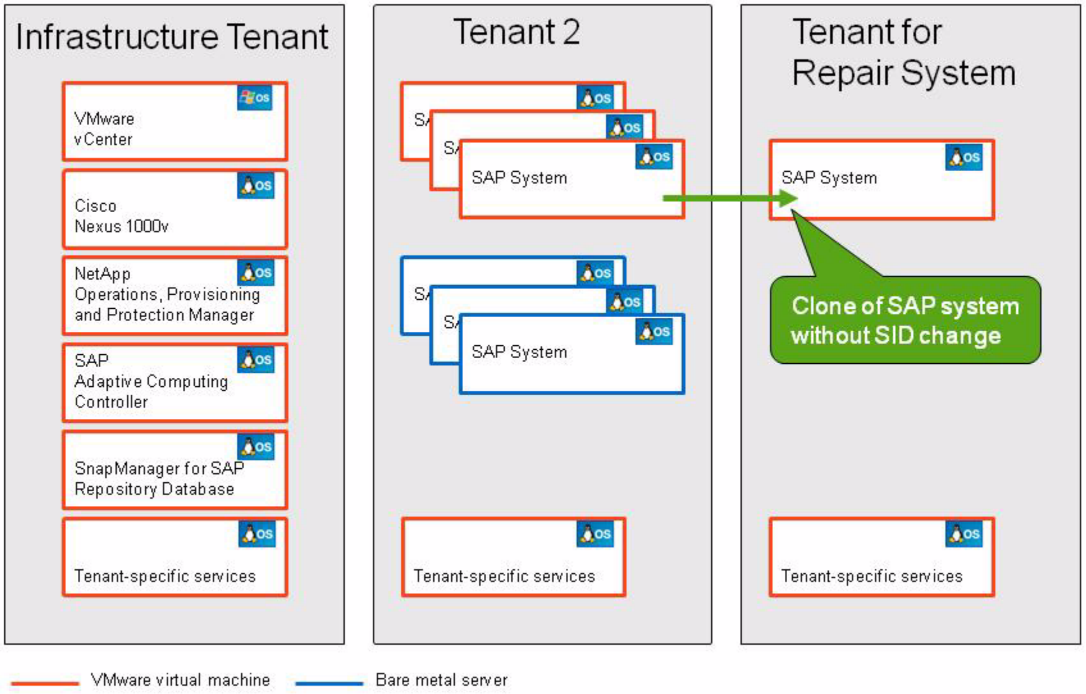
Appendix A—Sample Use Case

Provisioning Fenced SAP Systems

The built-in secure multi-tenancy functionality of FlexPod for SAP Applications is also used to cover specific use cases, which require isolation of an SAP system.

One use case is the creation of a Repair System which can be used to address logical errors.

Figure 19 Example of a Repair System Use Case



FlexPod for SAP Applications includes a fully automated workflow for creating a Repair Systems.

- The time stamp of the Repair System can be chosen very flexible, since any SMSAP backup can be chosen as the source.
- A new OS image will be provisioned into the repair tenant
- The required users and services will be configured within the “tenant specific services” in the repair tenant.
- The source system will be cloned using the chosen SMSAP backup.
- The clone will be moved to the repair tenant.
- The database and SAP system will be started in the repair tenant.

The creation of the Repair System is done in a few minutes and the problem analysis can be started.

Appendix B—Naming Conventions and Prerequisites

SAP Service Names

Naming convention for the SAP services names (virtual hostnames):

- ci<sid>: Central instance service
- db<sid>: Database service
- jc>sid>: Java component
- scs<sid>: SAP central services
- ascs<sid>: ABAP central services (used for HA installations)
- lc<sid>: Live Cache
- trx<sid>: TREX instance
- ers<sid>: Enqueue Replication Server
- app<sn><sid>: ABAP dialog instance
- j<sn><sid>: Java dialog instance
- <sid> = lowercase
- <sn> = two-digit system number

These host names and IP addresses must be available within the DNS service in the tenant.

Table 12 shows the storage layout for ABAP and the JAVA Central system.

Table 12 Storage Layout for ABAP and JAVA Central System

FlexVol® Volume	Qtree	Subdirectory To Be Mounted	Mountpoint at SAP Server
<tenant>_sapdata_<SID>	sapdata_<SID>	sapdata1	/oracle/<SID>/sapdata1
		sapdata2	/oracle/<SID>/sapdata2
		sapdata3	/oracle/<SID>/sapdata3
		sapdata4	/oracle/<SID>/sapdata4
<tenant>_saplog_<SID>	saplog_<SID>		/oracle
	sapusr_<SID>		/usr/sap/<SID>
	sapusr_SMD		/usr/sap/SMD
	sapmnt_<SID>		/sapmnt/<SID>
	saphome_<SID>	<sid>adm	/home/<sid>adm
		smdadm	/home/smdadm
<tenant>_share	sap	trans	/usr/sap/trans
		tmp	/usr/sap/tmp
		ccms	/usr/sap/ccms

<SID>= uppercase, <sid>=lowercase, <tenant>=tenant name

Appendix C-System Variables

Variable Name	Variable Value	Variable Description
<<var_global_nfs_vlan_id>>	<<var_global_nfs_vlan_id>>	Provide the appropriate VLAN ID used for NFS traffic throughout the FlexPod environment.
<<var_global_nfs_net_addr>>	<<var_global_nfs_net_addr>>	Network address for NFS VLAN traffic in CIDR notation (that is, 192.168.30.0/24)
<<var_global_mgmt_vlan_id>>	<<var_global_mgmt_vlan_id>>	Provide the appropriate VLAN ID used for management traffic throughout the FlexPod environment.
<<var_global_vmotion_vlan_id>>	<<var_global_vmotion_vlan_id>>	Provide the appropriate VLAN ID used for VMotion™ traffic throughout the FlexPod environment.
<<var_global_vmotion_net_addr>>	<<var_global_vmotion_net_addr>>	Network address for VMotion VLAN traffic in CIDR notation (that is, 192.168.30.0/24)
<<var_global_packet_control_vlan_id>>	<<var_global_packet_control_vlan_id>>	Provide the appropriate VLAN ID used for the Cisco Nexus 1000v packet and control traffic.
<<var_global_native_vlan_id>>	<<var_global_native_vlan_id>>	Provide the appropriate VLAN ID that will be used for the native VLAN ID throughout the FlexPod environment.
<<var_global_vm_traffic_vlan_id>>	<<var_global_vm_traffic_vlan_id>>	Provide the appropriate VLAN ID that will be used for VM traffic by default.
<<var_global_default_passwd>>	<<var_global_default_passwd>>	Provide the default password that will be used in the initial configuration of the environment **NOTE:** We recommend changing this password as needed on each device after the initial configuration is complete.
<<var_global_nameserver_ip>>	<<var_global_nameserver_ip>>	Provide the IP address of the appropriate nameserver for the environment.
<<var_global_domain_name>>	<<var_global_domain_name>>	Provide the appropriate domain name suffix for the environment.
<<var_global_vsan_A_id>>	<<var_global_vsan_A_id>>	The VSAN ID that will be associated with fabric A. This will be associated with both FC and FCoE traffic for fabric A.
<<var_global_vsan_B_id>>	<<var_global_vsan_B_id>>	The VSAN ID that will be associated with fabric B. This will be associated with both FC and FCoE traffic for fabric B.

<<var_global_fcoe_A_vlan_id>>	<<var_global_fcoe_A_vlan_id>>	Provide the VLAN ID of the VLAN that will be mapped to the FCoE traffic on fabric A.
<<var_global_fcoe_B_vlan_id>>	<<var_global_fcoe_B_vlan_id>>	Provide the VLAN ID of the VLAN that will be mapped to the FCoE traffic on fabric B.
<<var_global_ssl_country>>	<<var_global_ssl_country>>	Provide the appropriate SSL country name code.
<<var_global_ssl_state>>	<<var_global_ssl_state>>	Provide the appropriate SSL state or province name.
<<var_global_ssl_locality>>	<<var_global_ssl_locality>>	Provide the appropriate SSL locality name (city, town, and so on).
<<var_global_ssl_org>>	<<var_global_ssl_org>>	Provide the appropriate SSL organization name (company name).
<<var_global_ssl_org_unit>>	<<var_global_ssl_org_unit>>	Provide the appropriate SSL organization unit (division).
<<var_global_ntp_server_ip>>	<<var_global_ntp_server_ip>>	Provide the NTP server IP address.
<<var_ntap_A_hostname>>	<<var_ntap_A_hostname>>	Provide the hostname for NetApp FAS3210 A.
<<var_ntap_B_hostname>>	<<var_ntap_B_hostname>>	Provide the hostname for NetApp FAS3210 B.
<<var_ntap_netboot_int>>	<<var_ntap_netboot_int>>	Designate the appropriate interface to use for initial netboot of each controller. Interface e0M is the recommended interface.
<<var_ntap_A_netboot_int_IP>>	<<var_ntap_A_netboot_int_IP>>	Provide the IP address for the netboot interface on NetApp FAS3210 A.
<<var_ntap_B_netboot_int_IP>>	<<var_ntap_B_netboot_int_IP>>	Provide the IP address for the netboot interface on NetApp FAS3210 B.
<<var_ntap_A_netboot_int_netmask>>	<<var_ntap_A_netboot_int_netmask>>	Provide the subnet mask for the netboot interface on NetApp FAS3210 A.
<<var_ntap_B_netboot_int_netmask>>	<<var_ntap_B_netboot_int_netmask>>	Provide the subnet mask for the netboot interface on NetApp FAS3210 B.
<<var_ntap_A_netboot_int_gw>>	<<var_ntap_A_netboot_int_gw>>	Provide the gateway IP address for the netboot interface on NetApp FAS3210 A.
<<var_ntap_B_netboot_int_gw>>	<<var_ntap_B_netboot_int_gw>>	Provide the gateway IP address for the netboot interface on NetApp FAS3210 B.
<<var_ntap_netboot_img_address>>	<<var_ntap_netboot_img_address>>	Provide the full TFTP path to the 7.3.5 Data ONTAP® boot image.
<<var_ntap_A_mgmt_int_IP>>	<<var_ntap_A_mgmt_int_IP>>	Provide the IP address for the management interface on NetApp FAS3210 A

<<var_ntap_B_mgmt_int_IP>>	<<var_ntap_B_mgmt_int_IP>>	Provide the IP address for the management interface on NetApp FAS3210 B
<<var_ntap_A_mgmt_int_netmask>>	<<var_ntap_A_mgmt_int_netmask>>	Provide the subnet mask for the management interface on NetApp FAS3210 A
<<var_ntap_B_mgmt_int_netmask>>	<<var_ntap_B_mgmt_int_netmask>>	Provide the subnet mask for the management interface on NetApp FAS3210 B.
<<var_ntap_A_mgmt_int_gw>>	<<var_ntap_A_mgmt_int_gw>>	Provide the gateway IP address for the management interface on NetApp FAS3210 A.
<<var_ntap_B_mgmt_int_gw>>	<<var_ntap_B_mgmt_int_gw>>	Provide the gateway IP address for the service processor interface on NetApp FAS3210 B.
<<var_ntap_admin_host_ip>>	<<var_ntap_admin_host_ip>>	Provide the IP address of the host that will be used for administering the NetApp FAS3210A.
<<var_ntap_location>>	<<var_ntap_location>>	Provide a description of the physical location where the NetApp chassis resides.
<<var_ntap_A_sp_int_ip>>	<<var_ntap_A_sp_int_ip>>	Provide the IP address for the service processor interface on the NetApp FAS3210 A.
<<var_ntap_B_sp_int_ip>>	<<var_ntap_B_sp_int_ip>>	Provide the IP address for the service processor interface on NetApp FAS3210 B.
<<var_ntap_A_sp_int_netmask>>	<<var_ntap_A_sp_int_netmask>>	Provide the subnet mask for the service processor interface on NetApp FAS3210 A.
<<var_ntap_B_sp_int_netmask>>	<<var_ntap_B_sp_int_netmask>>	Provide the subnet mask for the service processor interface on NetApp FAS3210 B.
<<var_ntap_A_sp_int_gw>>	<<var_ntap_A_sp_int_gw>>	Provide the gateway IP address for the service processor interface on NetApp FAS3210 A.
<<var_ntap_B_sp_int_gw>>	<<var_ntap_B_sp_int_gw>>	Provide the gateway IP address for the service processor interface on NetApp FAS3210 B.
<<var_ntap_mailhost_name>>	<<var_ntap_mailhost_name>>	Provide the appropriate mail hostname.
<<var_ntap_mailhost_ip>>	<<var_ntap_mailhost_ip>>	Provide the appropriate mail host IP address.
<<var_ntap_data_ontap_url>>	<<var_ntap_data_ontap_url>>	Provide the “http” or “https” Web address of the NetApp Data ONTAP 7.3.5 flash image to install the image to the onboard flash storage.
<<var_ntap_admin_email_address>>	<<var_ntap_admin_email_address>>	Provide the e-mail address for the NetApp administrator to receive important alerts/messages by e-mail.

<<var_ntapA_infra_vfiler_IP>>	<<var_ntapA_infra_vfiler_IP>>	Provide the IP address for the infrastructure vFiler™ unit on FAS3210A. **Note:** This interface will be used for the export of NFS datastores and possibly iSCSI LUNs to the necessary ESXi hosts.
<<var_ntapA_infra_vfiler_admin_IP>>	<<var_ntapA_infra_vfiler_admin_IP>>	Provide the IP address of the host that will be used to administer the infrastructure vFiler unit on FAS3210A. This variable might have the same IP address as the administration host IP address for the physical controllers as well.
<<var_ntapB_infra_vfiler_IP>>	<<var_ntapB_infra_vfiler_IP>>	Provide the IP address for the infrastructure vFiler unit on FAS3210B. Keep in mind that this interface will be used for the export of NFS datastores and possibly iSCSI LUNs to the necessary ESXi hosts.
<<var_ntapB_infra_vfiler_admin_IP>>	<<var_ntapB_infra_vfiler_admin_IP>>	Provide the IP address of the host that will be used to administer the infrastructure vFiler unit on FAS3210B. This variable might possibly have the same IP address as the administration host IP address for the physical controllers as well.
<<var_ntap_cluster_lic>>	<<var_ntap_cluster_lic>>	Provide the license code to enable cluster mode within the FAS3210 A configuration.
<<var_ntap_fcp_lic>>	<<var_ntap_fcp_lic>>	Provide the license code to enable the Fibre Channel protocol.
<<var_ntap_flash_cache_lic>>	<<var_ntap_flash_cache_lic>>	Provide the license code to enable the installed Flash Cache adapter.
<<var_ntap_nearstore_option_lic>>	<<var_ntap_nearstore_option_lic>>	Provide the license code to enable the NearStore® capability, which is required to enable deduplication.
<<var_ntap_a_sis_lic>>	<<var_ntap_a_sis_lic>>	Provide the license code to enable deduplication.
<<var_ntap_nfs_lic>>	<<var_ntap_nfs_lic>>	Provide the license code to enable the NFS protocol.
<<var_ntap_multistore_lic>>	<<var_ntap_multistore_lic>>	Provide the license code to enable MultiStore®.
<<var_ntap_flexclone_lic>>	<<var_ntap_flexclone_lic>>	Provide the license code to enable FlexClone.

<<var_ntap_A_num_disks>>	<<var_ntap_A_num_disks>>	Number of disks assigned to controller A using software ownership. **Note:** Do not include the three disks used for the root volume in this number.
<<var_ntap_B_num_disks>>	<<var_ntap_B_num_disks>>	Number of disks assigned to controller B using software ownership. **Note:** Do not include the three disks used for the root volume in this number.
<<var_ntap_A_num_disks_aggr1>>	<<var_ntap_A_num_disks_aggr1>>	Number of disks to be assigned to aggr1 on controller A
<<var_ntap_B_num_disks_aggr1>>	<<var_ntap_B_num_disks_aggr1>>	Number of disks to be assigned to aggr1 on controller B
<<var_ntap_esxi_boot_vol_size>>	<<var_ntap_esxi_boot_vol_size>>	Each Cisco UCS server bootsby using the FC protocol. Each FC LUN will be stored in a volume on either controller A or controller B. Choose the appropriate volume size depending on how many ESXi hosts will be in the environment.
<<var_ntap_esxi_swap_vol_size>>	<<var_ntap_esxi_swap_vol_size>>	VMware allows the option to store VM swap files in a different location other than the default location within the specific VM directory itself. Choose the appropriate size for the common VM swap datastore volume.
<<var_ntap_dfm_hostname>>	<<var_ntap_dfm_hostname>>	Provide the hostname for the NetApp DataFabric Manager® server instance.
<<var_ntap_dfm_ip>>	<<var_ntap_dfm_ip>>	Provide the IP address to be assigned to the NetApp DFM server.
<<var_ntap_dfm_nfs_ip>>	<<var_ntap_dfm_nfs_ip>>	Provide the IP address to be assigned to the NetApp DFM server in the NFS VLAN for VSC access to the infrastructure vFiler unit.
<<var_ntap_dfm_license>>	<<var_ntap_dfm_license>>	Provide the license key for the NetApp DFM Server.
<<var_ntap_autosupport_mailhost>>	<<var_ntap_autosupport_mailhost>>	Provide the address of the mailhost that will be used to relay Auto Support™ e-mails.
<<var_ntap_snmp_community>>	<<var_ntap_snmp_community>>	Provide the appropriate SNMP community string.
<<var_ntap_snmp_user>>	<<var_ntap_snmp_user>>	Provide the appropriate SNMP username.
<<var_ntap_snmp_password>>	<<var_ntap_snmp_password>>	Provide the appropriate SNMP password.

<<var_ntap_snmp_traphost>>	<<var_ntap_snmp_traphost>>	Provide the IP address or hostname for the SNMP traphost.
<<var_ntap_snmp_request_role>>	<<var_ntap_snmp_request_role>>	Provides the request role for SNMP.
<<var_ntap_snmp_managers>>	<<var_ntap_snmp_managers>>	Users who have the ability to manage SNMP.
<<var_ntap_snmp_site_name>>	<<var_ntap_snmp_site_name>>	Provides the site name as required by SNMP.
<<var_ntap_ent_snmp_trap_dest>>	<<var_ntap_ent_snmp_trap_dest>>	Provides the appropriate enterprise SNMP trap destination.
<<var_nexus_A_hostname>>	<<var_nexus_A_hostname>>	Provide the hostname for the Cisco Nexus 5548 A.
<<var_nexus_B_hostname>>	<<var_nexus_B_hostname>>	Provide the hostname for the Cisco Nexus 5548 B.
<<var_nexus_A_mgmt0_IP>>	<<var_nexus_A_mgmt0_IP>>	Provide the IP address for the mgmt0 interface on the Cisco Nexus 5548 A.
<<var_nexus_B_mgmt0_IP>>	<<var_nexus_B_mgmt0_IP>>	Provide the IP address for the mgmt0 interface on the Cisco Nexus 5548 B.
<<var_nexus_A_mgmt0_netmask>>	<<var_nexus_A_mgmt0_netmask>>	Provide the subnet mask for the mgmt0 interface on the Cisco Nexus 5548 A.
<<var_nexus_B_mgmt0_netmask>>	<<var_nexus_B_mgmt0_netmask>>	Provide the subnet mask for the mgmt0 interface on the Cisco Nexus 5548 B.
<<var_nexus_A_mgmt0_gw>>	<<var_nexus_A_mgmt0_gw>>	Provide the gateway IP address for the mgmt0 interface on the Cisco Nexus 5548 A.
<<var_nexus_B_mgmt0_gw>>	<<var_nexus_B_mgmt0_gw>>	Provide the gateway IP address for the mgmt0 interface on the Cisco Nexus 5548 B.
<<var_nexus_vpc_domain_id>>	<<var_nexus_vpc_domain_id>>	Provide a unique vPC domain ID for the environment.
<<var_n1010_A_hostname	<<var_n1010_A_hostname	Provide a host name for the Cisco Nexus 1010 A virtual appliance.
<<var_n1010_B_hostname	<<var_n1010_B_hostname	Provide a host name for the Cisco Nexus 1010 B virtual appliance.
<<var_n1010_A_cimc_ip>>	<<var_n1010_A_cimc_ip>>	Provide the IP address for the out-of-band management interface or CIMC on the Cisco Nexus 1010 A appliance.
<<var_n1010_A_cimc_netmask>>	<<var_n1010_A_cimc_netmask>>	Provide the netmask for the out-of-band management interface or CIMC on the Cisco Nexus 1010 A appliance.
<<var_n1010_A_cimc_gw>>	<<var_n1010_A_cimc_gw>>	Provide the gateway for the out-of-band management interface or CIMC on the Cisco Nexus 1010 A appliance.
<<var_n1010_hostname>>	<<var_n1010_hostname>>	Provide the host name for the Cisco Nexus 1010 A virtual appliance.

<<var_n1010_mgmt_ip>>	<<var_n1010_mgmt_ip>>	Provide the IP address for the management interface on the Cisco Nexus 1010 A appliance.
<<var_n1010_mgmt_netmask>>	<<var_n1010_mgmt_netmask>>	Provide the netmask for the management interface on the Cisco Nexus 1010 A appliance.
<<var_n1010_mgmt_gw>>	<<var_n1010_mgmt_gw>>	Provide the gateway for the management interface on the Cisco Nexus 1010 A appliance.
<<var_n1010_B_cimc_ip>>	<<var_n1010_B_cimc_ip>>	Provide the IP address for the out-of-band management interface or CIMC on the Cisco Nexus 1010 B appliance.
<<var_n1010_B_cimc_netmask>>	<<var_n1010_B_cimc_netmask>>	Provide the netmask for the out-of-band management interface or CIMC on the Cisco Nexus 1010 B appliance.
<<var_n1010_B_cimc_gw>>	<<var_n1010_B_cimc_gw>>	Provide the gateway for the out-of-band management interface or CIMC on the Cisco Nexus 1010 B appliance.
<<var_n1010_domain_id>>	<<var_n1010_domain_id>>	Provide a unique domain ID for the Cisco Nexus 1010 virtual appliances in the environment.
<<var_vsm_hostname>>	<<var_vsm_hostname>>	Provide the hostname for the primary VSM.
<<var_vsm_mgmt_ip>>	<<var_vsm_mgmt_ip>>	Provide the IP address for the management interface for the primary Cisco Nexus 1000v virtual supervisor module.
<<var_vsm_mgmt_netmask>>	<<var_vsm_mgmt_netmask>>	Provide the netmask for the management interface for the primary Cisco Nexus 1000v virtual supervisor module.
<<var_vsm_mgmt_gw>>	<<var_vsm_mgmt_gw>>	Provide the gateway for the management interface for the primary Cisco Nexus 1000v virtual supervisor module.
<<var_vsm_domain_id>>	<<var_vsm_domain_id>>	Provide a unique domain ID for the Cisco Nexus 1000v VSMs. This domain ID should be different than the domain ID used for the Cisco Nexus 1010 virtual appliance domain ID.
<<var_ucsm_A_hostname>>	<<var_ucsm_A_hostname>>	Provide the hostname for fabric interconnect A.
<<var_ucsm_B_hostname>>	<<var_ucsm_B_hostname>>	Provide the hostname for fabric interconnect B.

<<var_ucsm_cluster_hostname>>	<<var_ucsm_cluster_hostname>>	Both Cisco UCS fabric interconnects will be clustered together as a single Cisco UCS. Provide the hostname for the clustered system.
<<var_ucsm_cluster_ip>>	<<var_ucsm_cluster_ip>>	Both Cisco UCS fabric interconnects will be clustered together as a single Cisco UCS. Provide the IP address for the clustered system.
<<var_ucsm_A_mgmt_ip>>	<<var_ucsm_A_mgmt_ip>>	Provide the IP address for fabric interconnect A’s management interface.
<<var_ucsm_B_mgmt_ip>>	<<var_ucsm_B_mgmt_ip>>	Provide the IP address for fabric interconnect B’s management interface.
<<var_ucsm_A_mgmt_netmask>>	<<var_ucsm_A_mgmt_netmask>>	Provide the subnet mask for fabric interconnect A’s management interface.
<<var_ucsm_B_mgmt_netmask>>	<<var_ucsm_B_mgmt_netmask>>	Provide the subnet mask for fabric interconnect B’s management interface.
<<var_ucsm_A_mgmt_gw>>	<<var_ucsm_A_mgmt_gw>>	Provide the gateway IP address for fabric interconnect A’s management interface.
<<var_ucsm_B_mgmt_gw>>	<<var_ucsm_B_mgmt_gw>>	Provide the gateway IP address for fabric interconnect B’s management interface.
<<var_ucsm_infra_org_name>>	<<var_ucsm_infra_org_name>>	A Cisco UCS organization will be created for the necessary “infrastructure” resources. Provide a descriptive name for this organization.
<<var_ucsm_mac_pool_A_start>>	<<var_ucsm_mac_pool_A_start>>	A pool of MAC addresses will be created for each fabric.Depending on the environment, certain MAC addresses might already be allocated. Identify a unique MAC address as the starting address in the MAC pool for fabric A. It is recommended, if possible, to use either “0A” or “0B” as the second to last octet to distinguish from MACs on fabric A or fabric B.

<<var_ucsm_mac_pool_B_start>>	<<var_ucsm_mac_pool_B_start>>	A pool of MAC addresses will be created for each fabric. Depending on the environment, certain MAC addresses might already be allocated. Identify a unique MAC address as the starting address in the MAC pool for fabric B. It is recommended, if possible, to use either “0A” or “0B” as the second to last octet to more easily distinguish from MACs on fabric A or fabric B.
<<var_ucsm_wwpn_pool_A_start>>	<<var_ucsm_wwpn_pool_A_start>>	A pool of WWPNs will be created for each fabric. Depending on the environment, certain WWPNsmight already be allocated. Identify a unique WWPN as the starting point in the WWPN pool for fabric A. It is recommended, if possible, to use either “0A” or “0B” as the second to last octet to more easily distinguish from WWPNs on fabric A or fabric B.
<<var_ucsm_wwpn_pool_B_start>>	<<var_ucsm_wwpn_pool_B_start>>	A pool of WWPNs will be created for each fabric. Depending on the environment, certain WWPNs might already be allocated. Identify a unique WWPN as the starting point in the WWPN pool for fabric B. It is recommended, if possible, to use either “0A” or “0B” as the second to last octet to more easily distinguish from WWPNs on fabric A or fabric B.
<<var_vm_host1_hostname>>	<<var_vm_host1_hostname>>	The hostname for the first ESXI host in the infrastructure cluster.
<<var_vm_host1_mgmt_ip>>	<<var_vm_host1_mgmt_ip>>	The IP address for the management VMkernel port on the first host in the infrastructure cluster.
<<var_vm_host1_mgmt_netmask	<<var_vm_host1_mgmt_netmask	The netmask for the management VMkernel port on the first host in the infrastructure cluster.
<<var_vm_host1_mgmt_gw>>	<<var_vm_host1_mgmt_gw>>	The gateway for the management VMkernel port on the first host in the infrastructure cluster.
<<var_vm_host1_vmk_nfs_ip>>	<<var_vm_host1_vmk_nfs_ip>>	The IP address for the nfs VMkernel port on the first host in the cluster.
<<var_vm_host1_vmk_nfs_netmask>>	<<var_vm_host1_vmk_nfs_netmask>>	The netmask for the nfs VMkernel port on the first host in the infrastructure cluster.

<<var_vm_host1_vmk_vmotion_ip>>	<<var_vm_host1_vmk_vmotion_ip>>	The IP address for the VMotion VMkernel port on the first host in the cluster.
<<var_vm_host1_vmk_vmotion_netmask>>	<<var_vm_host1_vmk_vmotion_netmask>>	The netmask for the VMotion VMkernel port on the first host in the infrastructure cluster.
<<var_vm_host2_hostname>>	<<var_vm_host2_hostname>>	The hostname for the second ESXi host in the infrastructure cluster.
<<var_vm_host2_mgmt_ip>>	<<var_vm_host2_mgmt_ip>>	The IP address for the management VMkernel port on the second host in the infrastructure cluster.
<<var_vm_host2_mgmt_netmask>>	<<var_vm_host2_mgmt_netmask>>	The netmask for the management VMkernel port on the second host in the infrastructure cluster.
<<var_vm_host2_mgmt_gw>>	<<var_vm_host2_mgmt_gw>>	The gateway for the management VMkernel port on the second host in the infrastructure cluster.
<<var_vm_host2_vmk_nfs_ip>>	<<var_vm_host2_vmk_nfs_ip>>	The IP address for the nfs VMkernel port on the second host in the cluster.
<<var_vm_host2_vmk_nfs_netmask>>	<<var_vm_host2_vmk_nfs_netmask>>	The netmask for the nfs VMkernel port on the second host in the infrastructure cluster.
<<var_vm_host2_vmk_nfs_ip>>	<<var_vm_host2_vmk_nfs_ip>>	The IP address for the VMotion VMkernel port on the second host in the cluster.
<<var_vm_host2_vmk_vmotion_netmask>>	<<var_vm_host2_vmk_vmotion_netmask>>	The netmask for the VMotion VMkernel port on the second host in the infrastructure cluster.
<<var_vm_sql_hostname>>	<<var_vm_sql_hostname>>	The hostname of the SQL Server®virtual machine that runs the vCenter Server database.
<<var_vm_sql_ip>>	<<var_vm_sql_ip>>	The IP address of the SQL server virtual machine that runs the vCenter server database.
<<var_vm_vcenter_hostname>>	<<var_vm_vcenter_hostname>>	The hostname of the vCenter server virtual machine.
<<var_vm_vcenter_ip>>	<<var_vm_vcenter_ip>>	The IP address of the vCenter server virtual machine.
<<var_vm_vcenter_lic>>	<<var_vm_vcenter_lic>>	The vCenter server license key.
<<var_vsphere_lic>>	<<var_vsphere_lic>>	The vSphere license key.
FlexPod for SAP Variables		
<<var_ndmp_vlan_id>>	<<var_ndmp_vlan_id>>	The VLAN ID for the NDMP LAN
<<var_ndmp_ip_contr_a>>	<<var_ndmp_ip_contr_a>>	The IP address for the NDMP VLAN of controller A
<<var_ndmp_ip_contr_b>>	<<var_ndmp_ip_contr_b>>	The IP address for the NDMP VLAN of controller B
<<var_ndmp_network>>	<<var_ndmp_network>>	The IP Network for the NMDP traffic (sample: 192.168.97.0)
<<var_ndmp_netmask>>	<<var_ndmp_netmask>>	The network mask of the NMDP network

<<var_software_vlan_id>>	<<var_software_vlan_id>>	The VLAN ID for the software vFiler
<<var_software_ip>>	<<var_software_ip>>	The IP address for the software vfiler
<<var_software_netmask>>	<<var_software_netmask>>	The network mask of the software vFiler
<<var_software_size>>	<<var_software_size>>	The size of software volume
<<var_software_gate_ip>>	<<var_software_gate_ip>>	The IP address of the default gateway of the software vFiler
<<var_template_name_suse>>	<<var_template_name_suse>>	Name of the Vmware template of the Suse OS
<<var_template_name_senil>>	<<var_template_name_senil>>	Name of the Vmware template of SeNil
<<var_template_name_redhat>>	<<var_template_name_redhat>>	Name of the Vmware template of the RedHat OS
<<var_new_tenant_name>>	<<var_new_tenant_name>>	Name of the new Tenant to be created
<<var_new_tenant_vlan_id_access>>	<<var_new_tenant_vlan_id_access>>	The VLAN ID of the access network of the new tenant
<<var_new_tenant_vlan_id_backend>>	<<var_new_tenant_vlan_id_backend>>	The VLAN ID of the backend (NFS) network for the new tenant
<<var_new_tenant_prim_vfiler_ip>>	<<var_new_tenant_prim_vfiler_ip>>	The IP address of the primary vFiler for the new Tenant
<<var_new_tenant_sec_vfiler_ip>>	<<var_new_tenant_sec_vfiler_ip>>	The IP address of the secondary vFiler for the new Tenant
<<var_new_tenant_netmask_vfiler>>	<<var_new_tenant_netmask_vfiler>>	The networkmask for the backend network for the new Tenant
<<var_vfiler_pw>>	<<var_vfiler_pw>>	The password for the new Tenant vFilers
<<var_secondary_respool>>	<<var_secondary_respool>>	The name of the secondary DFM ressource pool
<<var_primary_respool>>	<<var_primary_respool>>	The name of the primary DFM ressource pool
<<var_backup_prov_profile>>	<<var_backup_prov_profile>>	The name of the backup storage DFM provisioning profile
<<var_prim_prov_profile>>	<<var_prim_prov_profile>>	The name of primary storage DFM provisioning profile
<<var_vfiler_template>>	<<var_vfiler_template>>	The name of the DFM vFiler template
<<var_infra_share_sap_size>>	<<var_infra_share_sap_size>>	The size of the infrastructure share sap qtree
<<var_infra_share_data_size>>	<<var_infra_share_data_size>>	The size of the infrastructure share data qtree
<<var_infra_backup_size>>	<<var_infra_backup_size>>	The size of the infrastructure backup volume
<<var_tenant_share_sap_size>>	<<var_tenant_share_sap_size>>	The size of the new tenant share sap qtree
<<var_tenant_share_data_size>>	<<var_tenant_share_data_size>>	The size of the new tenant_share data qtree
<<var_tenant_backup_size>>	<<var_tenant_backup_size>>	The size of the new tenant backup volume
<<var_new_vm_name>>	<<var_new_vm_name>>	The name of the new VM to be deployed

<<var_smrepo_host_name>>	<<var_smrepo_host_name>>	The hostname of the SMSAP repository
<<var_smrepo_ip>>	<<var_smrepo_ip>>	The IP address of the SMSAP repository
<<var_smrepo_sid>>	<<var_smrepo_sid>>	The SID of the SMSAP repository
<<var_smrepo_lstnr_port>>	<<var_smrepo_lstnr_port>>	The Oracle listener port of SMSAP repository
<<var_smrepo_data_size>>	<<var_smrepo_data_size>>	The size of the SMSAP repository database volume
<<var_smrepo_log_size>>	<<var_smrepo_log_size>>	The size of the SMSAP repository log volume
<<var_acc_host_name>>	<<var_acc_host_name>>	The hostname of the ACC
<<var_acc_ip>>	<<var_acc_ip>>	The IP address of the ACC
<<var_acc_sid>>	<<var_acc_sid>>	The SID of the ACC
<<var_acc_sys_number>>	<<var_acc_sys_number>>	The system number of the ACC
<<var_physmgmt_vlan_id>>	<<var_physmgmt_vlan_id>>	The VLAN ID for the PhysMGMT LAN (sample 98)
<<var_physmgmt_ip>>	<<var_physmgmt_ip>>	The IP Network for the PhysMGMT LAN (sample 192.168.98.0)
<<var_physmgmt_netmask>>	<<var_physmgmt_netmask>>	The network mask of the PhysMGMT LAN (sample 255.255.255.0)
<<var_infrastructure_network>>	<<var_infrastructure_network>>	The network of the infrastructure management network (sample: 192.168.99.0)
<<var_infrastructure_gw_addr>>	<<var_infrastructure_gw_addr>>	Default Gateway of the Global MGMT LAN (sample 192.168.98.1)
<<var_global_mgmt_netmask>>	<<var_global_mgmt_netmask>>	Netmask of the Global MGMT LAN (sample 255.255.55.0)
<<var_physmgmt_net_addr>>	<<var_physmgmt_net_addr>>	Network address for PhysMGMT LAN (sample 192.168.99.0)
<<var_physmgmt_gw_addr>>	<<var_physmgmt_gw_addr>>	Default Gateway of the PhysMGMT LAN (sample 192.168.98.1)
<<var_physmgmt_netmask>>	<<var_physmgmt_netmask>>	Netmask of the PhysMGMT LAN (sample 255.255.55.0)
<<var_new_bm_host>>	<<var_new_bm_host>>	Name of the new Bare metal host for the service profile and the zoning (sample t002-linux-01)

Appendix D—Description of Scripts and Configuration Files

SCRIPT FP_CLONE4REPAIR.SH

Prerequisites and necessary configuration steps:

- The script is executed at the script execution host within the management tenant.
- Naming convention for tenants (txxx) and vFiler units (Txxx)
- Storage layout (number of volumes) and naming convention for storage volumes

```
Usage: fp_clone4repair.sh  <create|delete>
                           <hostname physical storage controller>
                           <target tenant>
                           <smsap_backup_label>
                           <smsap_backup_profile>
```

Where:

Create. Create the clone volumes and attach them to the target vFiler unit

Delete. Delete the clone volumes and detach them from the target vFiler unit

Hostname physical storage controller. Physical storage controller, where the tenants are hosted

Tenant. Tenant name where the repair or test system should run

s**msap_backup_label.** Label of the backup of the source system as shown with the SMSAP GUI

smsap_backup_profile. Profile name of the source SAP system as configured within SMSAP

With the create parameter, the script executes the following tasks:

1. Identifies parent volume and snapshot names using an SMSAP call with <smsap_backup_label> and <smsap_profile_name>.
2. Creates and executes FlexClone volumes using dfm run cmd at the physical storage controller . with these parent volume and Snapshot copy names.
3. Attaches the FlexClone volumes to the target vFiler unit using dfm run cmd executed at the physical storage controller.
4. Configures the FlexClone volumes for export using dfm run cmd executed at the physical storage controller.
5. With the delete parameter, the script executes the following tasks:
6. Identifies parent volume and snapshot names using an SMSAP call with <smsap_backup_label> and <smsap_profile_name>.
7. Removes the FlexClone volumes from the target vFiler unit using dfm run cmd executed at the physical storage controller.
8. Destroys FlexClone volumes using dfm run cmd executed at the physical storage controller

SCRIPT FP_SAP_SYSTEM.SH

The script is executed on a host within tenant, where the SAP system is running.

These are the prerequisites and limitations:

- The tenant name is extracted from the host name.
- The standardized volume, qtree, and directory structure, including naming convention, is used.
- The naming convention for SAP service names (virtual hostnames) has been followed.
- The SAP system is installed "adaptive enabled"
- The OS image must not contain entries for the SAP system in the /etc/fstab file.
- The script does not support SAP Systems that are based on SMSAP clones.
- The script uses hard coded mount options

```
MOUNT_OPTIONS="rw,bg,hard,nointr,rsize=32768,wsize=32768,vers=3,su
id,tcp,timeo=600"
```

- The current version of the script handles starting and stopping of the following services:
  - Abap: Central instance and database instance running on the same host.
  - Java: SCS, JC and database instance running on the same host.

The current version of the scripts supports only one vFiler <tenant>-1-prim:

```
Usage: fp_sap_system.sh<start|stop

startrepair|stoprepair|

startmountonly|stopmountonly|

startmount_wo_sapdata|stopmount_wo_sapdata>

<SID>

<abap|java>
```

start | stop. This option is used to start or stop a "normal" SAP system. After starting a repair or test system for the first time with “startrepair” the start and stop options are used for all other operations.

startrepair | stoprepair: The “startrepair” option is used to start a test or repair system for the first time. After the first start the system can then be started with the “start” option. The “stoprepair” option is identical to the "stop" option.

startmountonly | stopmountonly: This option is used only to configure the IP alias and mount all the file systems. It is used for preparing an SAP installation or new setup of an SAP system using a system copy.

startmount_wo_sapdata | stopmount_wo_sapdata: This option is used to only configure the IP alias and mount all the file systems except the sapdata file systems. It is typically used when relocating an SAP system that is based on a SMSAP system copy.

SID: SID of the SAP system

SAP stack: Abap-only or Java-only stack

Table 13 shows the tasks that are executed with the different start options.

Table 13 Tasks Executed with Different Start Options

	start	startrepair	startmountonly	startmount_wo_sapdata
1. Directory for archive log backups is created (if not existing).	X	X	X	X
IP alias is configured for the SAP and database service.	X	X	X	X
Mount points are created (if not existing).	X	X	X	X
File systems (except sapdata file systems) are mounted.	X	X	X	X
Sapdata file systems are mounted.	X	X	X	
SMSAP credentials for user oraSID are deleted.		X		
`/etc/oratab` is created or adapted, and SID is included.	X	X		
The Oracle listener is started.	X	X		

The database is recovered.	X	X		
The database is started.	X	X		
The SAP system is started.	X	X		

Table 14 shows the tasks executed with the different stop options.

Table 14 Tasks Executed with Different Stop Options

	stop	stoprepair	stopmountonly	stopmount_wo_sapdata
1. The SAP system is stopped.	X	X		
The database is stopped.	X	X		
The Oracle listener is stopped.	X	X		
Sapdata file systems are unmounted.	X	X	X	
File systems (except Sapdata file systems) are unmounted.	X	X	X	X
IP alias is shut down for the SAP and database service.	X	X	X	X

SCRIPT DEPLOYNEWVM.PS1

The PowerShell script is used to provision a new VMware virtual machine. The VMware PowerCLI, a power shell snapin, needs to be installed at the host where the script is running as well as Power Shell itself. It is recommended to use the Windows system where the Virtual Center server runs.

Prerequisites and limitations: With the current version the following parameters are hard coded:

- Hostname of VMware Virtual Center
- Hostname of target ESX host

```
DeployNewVm.ps1 <VM Name> <Tenant Name> < Template Name>
```

Where:

VM Name. Name of the target virtual machine

Tenant Name. Name of the target tenant

TemplateName. Name of the source template to be cloned

The script executes the following steps:

1. Connects to VMware Virtual Center
2. Creates a VMware clone of the source template
3. Moves the new virtual machine to tenant-specific Virtual Center folder
4. Assigns network adapters to tenant-specific network ports
5. Starts the new virtual machine

RC SCRIPT FLEXPOD_CONFIG

The script `flexpod_config` is part of the Linux OS template. The script is executed during the boot process of the OS and executes the following tasks:

- Mounting the software share from

software.company.corp:/vol/software to /mnt/software

- Mounting the backup volume for archive log backups from

  "$TENANT"-1-bck:/vol/"$TENANT"_backup/data to /mnt/backup

- Mounting the shared data volume from

  "$TENANT"-1-prim:/vol/"$TENANT"_share/data to /mnt/data

In addition, the script starts the script /opt/NetApp/FlexPod/set_sdu_password.sh in the background to set the SDU passwords. The script set_sdu_password.sh waits until the SDU deamon is started and executes the following commands:

- Setting SDU password for user root at primary vFiler unit "$TENANT"-1-prim
- Setting SDU password for user root at backup vFiler unit "$TENANT"-1-bck

SMSAP CLONING SPECIFICATION FILE

Sample cloning specifiaction files are available for SAP system copies.

- New system setup based on SMSAP cloning

  File:Clone_PE6_DE6_new_setup.xml

- Refresh of an SAP system based on SMSAP cloning

  File: Clone_PE6_DE6_refresh.xml

These files can easily be adapted by replacing the source and target SID values.

The sample file for system refresh also includes the necessary configuration for the post-cloning plugins that are used to configure the ops$ authentication as well as to delete batch jobs in the target system.

SCRIPT SET_SMSAP_CREDENTIALS.SH

The script is used to set the necessary SMSAP credentials so that the script fp_clone4repair.sh can execute SMSAP commands.

With the current version, the following parameters are hard coded:

- Same password for repository, root user at target host and SMSAP profile
- Hostname of repository database: t001-smrepo.mgmt.t001.company.corp
- Listener port of repository database

```
Usage: set_smsap_credentials.sh <SID> <TENANT NAME>
  <SID>           : the SAP system ID
  <TENANT NAME>   : tenant name where the SAP system runs
```

The script executes the following tasks:

- Sets credentials for the tenant-specific repository
- Syncs the profiles of the repository
- Sets credentials for the profile
- Sets credentials for the host

SCRIPT CREATE_VFILER.SH

This script simplifies the provisioning of a new Tenant into the existing FlexPod Solution. Typically when provisioning a new Tenant, the storage administrator would have to manually perform a set of tasks: from creating vFiler units for that Tenant, to provisioning FlexVol volumes and shares and protecting those using SnapVault and Protection Manager.

This script can replace those manual steps and automate those tasks by delivering the following results:

Creates two initial vFiler units for a new tenant:

- `tenant-1-prim`
- `tenant-1-bck`

Creates additional vFiler unitss for an existing tenant:

- `tenant-2-prim tenant-3-prim, tenant-4-prim`

Provision Operations Manager datasets:

- `tenant_share (qtree(s) data, sap)`
- `tenant_backup (qtree data)`

Configures Protection Manager to protect the datasets:

- `Tenant_share (Backup)`
- `Tenant_backup (Local backups only)`

The script should be executed with root privileges from the DFM server using the following syntax:

```
# create_vfiler.sh <tenant_parameter_file>
```

Where `<tenant_parameter_file>` is a file containing variables to be parsed by the script, these variables define tenant specific parameters such as tenant name, resource pools to use, network configuration.

For each tenant, a new parameter file should be created and edited accordingly.

Parameter `TENANTNAME` should contain the tenant name for the new tenant; this must be a unique name, as it is used in several objects within the flexpod solution, such as vFiler units and datasets.

As an example, the following could be used as tenant names: `t002, t003, t004, t005`. The recommendation is to keep t001 for the infrastructure tenant.

Parameter `VFILERTEMPLATE` contains the Provisioning Manager vFiler template to use during the setup of the vFiler unit for the new tenant.

Parameter `PROVPFLNAS` and `PROVPFLSEC` contain the protection policies to use with the datasets on primary(`PROVPFLNAS`) and secondary(`PROVPFLSEC`)

Parameter `PRIMRESPOOL` and `SECRESPOOL` contain the name of the resource pools to use for primary(`PRIMRESPOOL`) and secondary(`SECRESPOOLS`) vFiler units.

Parameter `SHAREDATASIZE` contains the size of the primary dataset `tenantname_share/data`.

Parameter `SHARESAPSIZE` contains the size of the primary dataset `tenantname_share/sap`.

Parameter `BACKUPDATASIZE` contains the size of the secondary dataset `tenantname_backup/data`.

Parameter SUFFIXNUMBER allows for scaling of an existing tenant by adding additional primary vFiler units, the create_vfiler.sh script creates tenant vFiler units using the following convention: 'tenantname-suffixnumber-prim' or 'tenantname-1-bck'. If a tenant requires an additional vFiler unit, then the parameter SUFFIXNUMBER can be modified from '1' to '2', and executing this script would create a new vFiler unit 'tenant-2-prim'.

This script won't create any additional secondary vFiler units (tenantname-2-bck). Also, no additional datasets are created on the new vFiler unit. By default, this parameter should be set to 1.

Parameter VFPRIMIP and VFSECIP are the IP addresses for both primary (VFPRIMIP) and secondary (VFSECIP) vFiler units.

Parameter VLANID contains the STORAGE VLAN number to use. This VLAN is the VLAN where the hosts access the NFS exports.

Parameter PW contains the root password for both the primary and the secondary vFiler units.

Parameter NIC contains the vfiler0 VIF interface where the IP aliases for the different VLANs are to be configured.

Parameters MTUSIZE and NETWORKMASK contain the MTU size in bytes and the network mask (for example, 255.255.255.0).

```
#!/bin/sh
#PARAMETER file for tenant t009

#TENANTNAME contains the tenant name
tenantname=t009


#VFILERTEMPLATE contains the vfiler template to use during the initial
#setup of the vfiler
vfilertemplate=Default

#PROVPFLNAS contains the Provisioning Policy to use
#during setup of the datasets in the primary vfiler
provpflnas=Default

#PROVPFLSEC contains the Provisioning Policy to use
#during setup of the datasets in the secondary vfiler
provpflsec=Backup

#SHAREDATASIZE contains the size of the primary dataset
tenantname_share/data
sharedatasize=10g

#SHARESAPSIZE contains the size of the primary dataset
tenantname_share/sap
```

```
sharesapsize=30g

#BACKUPDATASIZE contains the size of the secondary dataset
tenantname_backup/data
Backupdatasize=40g

#PRIMRESPOOL contains the name of the primary resource pool
primrespool=filer14a

#SECRESPOOL contains the name of the secondary resource pool
secrespool=filer14b

#SUFFIXNUMBER is an unique sequential number to use when
#creating additional vfilers for an existing tenant
#the initial vfiler(s) should always use suffixnumber=1
#Additional primary vfilers would use
suffixnumber=2,suffixnumber=3,...
suffixnumber=1

#VLANID contains the storage vlan id to use
vlanid=3009

#VFPRIMIP contains the IP address of the primary vfiler
vfprimip=192.168.109.10

#VFSECIP contains the IP address of the secondary vfiler
vfsecip=192.168.109.11

#PW contains the vfiler(s) root password
pw=ucs4sap!

#NIC contains the name of the vif on the storage controllers
nic=vif0

#MTUSIZE contains the mtu size to use
mtusize=1500

#NETWORKMASK contains the network mask to use
```

```
networkmask=255.255.255.0
```

The script starts by parsing the <parameter-tenant> file to initialize all the variables.

It then executes function `create_vfiler`, which creates two vFiler units (`tenantname-1-prim and tenant-1-sec`) when the parameter `suffixnumber` is set to 1.

The function `create_dataset` creates the DATASETs `'tenant_share'` and `'tenant_backup`', the provisioning of the qtrees 'sap' and 'data' is done by the function `provision_dataset`.

The script then applies the specific Protection Manager Policies Back up and Local Backups Only through function `protect_dataset`.

Finally, the datasets are exported through function `export_flexvol`.

In case the parameter `suffixnumber` is set to any number higher than 1, then only an additional primary vFiler unit is created (for example: `tenantname-2-prim`), and no additional datasets are created within this vFiler unit.

SCRIPT ADDDNSHOSTNAME.SH

The script is used to add host entries to the DNS configuration of the tenant-specific services.

The script must be executed on the tenant-specific services virtual machine.

```
Usage: addDNSHostname.sh <virtual_hostname>
  <virtual_hostname> : the virtual hostname to add (simple or full name)
```

The script executes the following tasks:

- Find valid IP address
- Add entry to local hosts

To activate the changes, the following tasks have to be completed:

- Restart the DNS services: `service dnsmasq restart`.
- Update the NIS maps: `/mnt/software/scripts/update_nis.sh`.

SCRIPT ADDSAPSERVICE.SH

The script is used to add required services entries into the tenant-specific services.

The script must be executed on the tenant-specific services virtual machine.

```
Usage: addSAPservice.sh {<SID> <SN>|-line <service_entry>}
  <SID>            : SAP System ID
  <SN>             : SAP System number of the CI/SCS
```

<service_entry> : the complete service entry as it appears in /etc/services

The script executes the following task:

- Add entry to /etc/services

SCRIPT CONFIGUREDNSMASQ.SH

The script generates a valid DNSmasq configuration file based on the template file. It must be called with the tenant number as the only parameter:

```
Usage: configure_dnsmasq.sh <tenant_id>
  <tenant_id>  : number of the tenant
```

To enable the configuration, the DNSmasq service must be restarted with this command:

```
service dnsmasq restart
```

SCRIPT CREATESAPUSER.SH

This Script create the required SAP OS users on the tenant-specific services virtual machine:

- `ora<sid> (group: dba,oper)`—Oracle Database Administrator for <SID>
- `<sid>adm (group: sapsys,dba,oper)`—SAP System Administrator for <SID>

```
Usage: createSAPuser.sh <user_type> <SID> <user_id> <group>
[<additional_groups> [<password>]]
  <user_type>         : {adm|ora}, adm = <sid>adm user, ora = ora<sid>
user
  <SID>               : SAP System ID
  <user_id>           : user ID of the new user
  <group>             : group ID or name of the primary group of the
new user
  <additional_groups> : (opt.) list of additional groups (comma
separated list of names)
  <password>          : (opt.) password for the new user
```

SCRIPT DELETE_VFILER.SH

This script simplifies the decommissioning of a Tenant from the existing FlexPod Solution. It is the counter part of the crate_vfielr.sh and uses the same parameter file.

The script should be executed with root privileges from the DFM server using the following syntax:

```
Usage: create_vfiler.sh <tenant_parameter_file>
```

Where: `<tenant_parameter_file>` is a file containing variables to be parsed by the script. These variables define tenant-specific parameters such as tenant name, resource pools to use, and network configuration.

SCRIPT PROVISION_SAP_STORAGE.SH

This script creates the required subdirectories for an SAP system, within volumes on the storage system. The script must run on the tenant-specific services virtual machine:

```
Usage: provision_SAP_storage.sh <tenant number> <SID> <vFiler> [<task>]
```

```
  <tenant number> : the number of the tenant, e.g. 4 for T004
  <SID>           : the SAP system ID
  <vFiler>        : the vFiler name, e.g. t004-1-prim
  <task>          : {log|data|all}, provision log volume, data volume
or both; default: log
```

SCRIPT SET_SDU_PASSWORD.SH

The script is used to set up the communication between SnapDrive for Unix and the virtual storage controller.

With the current version, the following parameters are hard coded:

- User for snapdrive communication
- Password for snapdrive users

```
Usage: set_sdu_credentials.sh
```

`The script executes the following tasks:`

- `Sets SDU password for communication with primary vFiler unit`
- `Sets SDU password for communication with backup vFiler unit`

SCRIPT UPDATE_NIS.SH

The script is used to activate NIS Service configurations. It must run on the tenant specific services virtual machine.

```
Usage: update_nis.sh
```

`The script executes the following tasks:`

- `Update passwd.byname`
- `Update passwd.byuid`

SCRIPT BACKUP_REPO.SH

The script is used to create an export from the Repository Database for backup purposes.

It is designated to run on the SMSAP Repository Database Host. It can be run either from cli or scheduled by cron as user oracle.

With the current version the following parameters are hard coded and might be adjusted prior to first use:

- Username and Password of DB User
- Backup and Logfile location
- Specific Oracle DB Environment Values
- Retention for the Backup

```
Usage: backup_repo.sh
```

The script executes the following tasks:

- Exports whole database

- Queries some information about the Repository Database
- Organizes Backup and Logfile Retention

References

- Backup and Recovery Administration Guide
- NetApp FlexPod for VMware Implementation Guide (TR-3892)
- SAP Note 50088
- Novell/SUSE TID 3048119

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