



Technical Report

Integrating NetApp Storage with SAP NetWeaver Landscape Virtualization Management

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April 2012 | TR-4018

Abstract

This document describes a solution on a NetApp® shared storage infrastructure that provides system administrators with the ability to quickly copy, clone, and manage SAP® systems. The goal of this document is to (a) provide IT administrators and operational staff with an understanding of the integration of NetApp shared storage with SAP NetWeaver® Landscape Virtualization Management software, and (b) provide decision makers with an understanding of its complexity by using exemplary use cases to reduce implementation risks.

TABLE OF CONTENTS

1	Introduction	3
2	Use Cases	4
2.1	System Clone with SAP LVM.....	4
2.2	System Copy with SAP LVM.....	4
2.3	Time Analysis for System Copy and Clone with SAP LVM.....	4
2.4	Unique NetApp Values in This Scenario.....	6
2.5	Summary	7
3	Components and Integration	8
3.1	Architecture Overview.....	8
3.2	Registering SAP Systems and Resources	10
3.3	SAP on Different Databases—Best Practices	11
4	Use Cases in Detail	11
4.1	System Clone.....	11
4.2	System Copy.....	16
4.3	Addressing Large and Multisite Environments.....	17
5	Conclusion	18
	References	18

LIST OF TABLES

Table 1)	Challenges and how they can be addressed with NetApp technology.	7
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LIST OF FIGURES

Figure 1)	SAP system clone: NetApp approach with SAP LVM.	5
Figure 2)	SAP system clone: traditional approach.	5
Figure 3)	SAP system copy: NetApp approach with SAP LVM.	5
Figure 4)	SAP system copy: traditional approach.	5
Figure 5)	Architecture overview.	8
Figure 6)	Adding an SAP system into SAP LVM.	10
Figure 7)	Adding an existing SAP system into SAP LVM.	11
Figure 8)	Storage view: cloning an SAP system to the same NetApp storage controller.	12
Figure 9)	Storage view: copying an SAP system to the same NetApp storage controller.	16
Figure 10)	Cloning a SAP system to a remote NetApp storage controller.	17

1 Introduction

This report describes a solution that provides system administrators with the ability to quickly copy, clone, and manage SAP systems by using SAP NetWeaver Landscape Virtualization Management (LVM) software, NetApp shared storage, and NetApp Storage Services Connector (SSC). SAP LVM is deployed as the central management tool to instantiate SAP system copies and clones. SSC is used as the bridge between SAP LVM and the NetApp storage controllers. This solution uses NetApp technologies such as NetApp FlexClone[®] and NetApp SnapMirror[®] technologies to minimize the storage required for SAP systems and shorten the time required to provide SAP system clones and copies.

The goals of this report are to:

- Explain the use cases and challenges of cloning and copying existing SAP systems for production, development, and testing environments.
- Describe the role and setup of the SSC within SAP LVM to create SAP system copies and clones within a fraction of the time that is usually required when using traditional storage systems.
- Give an overview of the architecture and explain the interaction between the individual components.

Data centers currently face a trend of dramatic changes because they are turning into service organizations. While budgets for IT are kept steady or are even decreased, data centers are still expected to offer IT as a service in a flexible, managed, secure, instantaneous, and cost-efficient manner. This means efficient allocation of resources at each layer in the IT stack and coordination of those resources to meet business demands with the ability to rapidly adapt to future changes.

Handling the interaction between multiple technologies (for example, virtualization, storage, and applications on top of the hardware stack) poses a difficult challenge because it is a time-consuming and error-prone task for administrators. Making these costly processes repeatable is inevitable and requires intensive documentation, which is also time consuming and subject to error. In the case of SAP systems and applications, it is important to simplify and automate the effort required to configure, provision, and deploy systems. This is applicable for both physical and virtualized infrastructures.

To achieve cost efficiency, consolidation, and agility, the goal is to have a highly efficient, shared infrastructure with the ability to deliver clones and copies of SAP systems for production, testing, and development, independent of physical boundaries.

SAP LVM helps to achieve these goals by automating and simplifying the efforts required for configuring, provisioning, deploying, monitoring, and managing SAP systems in both physical and virtualized infrastructures. The copy and clone functionality offered by SAP LVM consumes components of the IT stack in a flexible manner rather than being tied to dedicated IT components. As a consequence, this consolidation increases flexibility and efficiency by reclaiming unused capacity and making it reusable.

NetApp shared storage helps to meet the demands that are posed to the underlying storage layer in such a shared infrastructure. NetApp technology such as FlexClone helps generate significant space saving when cloning or copying SAP systems. It enables SAP LVM to provide these clones and copies in a very time-efficient manner. NetApp deduplication can generate enormous storage savings when cloning virtual machines. NetApp SnapMirror is used to address SAP system copying and cloning in large and multisite environments. NetApp Storage Services Connector provides the connection between SAP LVM and the NetApp storage controllers. It helps to hide the complexity that large infrastructures usually exhibit.

This solution is built on the principle of having a shared infrastructure instead of deploying small and separate application silos. On the storage layer this implies heavy usage of large aggregates so that free space and performance in an aggregate can be shared. The server side utilizes virtualization to share its computing resources.

The remainder of this document is structured as follows: section 2 explains the basic use cases of SAP system copying and cloning and gives an overview of the benefits of using NetApp shared storage in such an environment; section 3 introduces the individual components in the setup and outlines the interaction between them; section 4 examines the use cases in greater detail; and section 5 concludes the document.

2 Use Cases

This section gives an overview of two use cases to help you understand why SAP system copying and cloning are important and how they can help meet business demands and rapid adaption to changes. For technical discussion of the use cases, see section 4, “Use Cases in Detail”.

2.1 System Clone with SAP LVM

This use case addresses the problem of providing one or many clones of a running or predefined SAP system. An exact duplicate of a SAP system is referred to as a *SAP system clone*. The data and configuration of this new system are identical to the original system. This includes, for example, the system ID (SID), network connections, clients, and so on. All clones are isolated on the OS level using firewall rules to prevent interference of the parents and clones.

SAP LVM provides the functionality of isolating the cloned system from the rest of the landscape.

The ability to clone SAP systems is of great benefit in development, test, and upgrade scenarios. For example, before applying a new component upgrade to a production system, it can be first tested in a cloned environment to verify its functional expectations without altering the original system. Downtimes can therefore be minimized when applying the changes to the production systems.

2.2 System Copy with SAP LVM

This use case addresses the problem of providing one or many SAP instances with individual configurations and SIDs.

In contrast to a SAP system clone, a *SAP system copy* is a clone of an existing SAP system with the addition of applying further postprocessing (by using SAP LVM) to the clone to change its unique properties. This enables the system to run in an SAP landscape without interfering with the parent system. In this case, no network fence is required.

Copying an existing system, for example, a template system, can be used to instantiate new systems for customers. Usually, the manual postprocessing alone can take several hours or days. Automating this process not only lowers costs significantly, it also is more accurate than applying the changes manually.

2.3 Time Analysis for System Copy and Clone with SAP LVM

In general, the time required to create an SAP system copy or clone can be divided into three parts:

- Time to restore the backup to the target system
- Time to perform OS-specific postprocessing
- Time to perform database-specific and SAP application postprocessing (only required in case of a SAP system copy)

A restore of the backup to the target system, and the OS-specific postprocessing need to be performed in either case. The database-specific and SAP postprocessing depends on the customer’s SAP environment and only needs to be performed in case of a SAP system copy. Some customers can finish the database-specific and SAP postprocessing in a few hours, while others might need several days to accomplish this task.

In a conventional system copy or clone process, the data is first backed up to tape and then restored, which takes a great deal of time. If an online backup is used, there is no downtime for the source system; however, the performance of the source system during the backup may be affected. Because of the large number of logs that need to be applied, the time required to recover the database and make it consistent is greatly increased, possibly adding hours to the system copy or clone process. If an offline backup is used, the source system is shut down, resulting in a loss of productivity.

Figures 1 through 4 show an example of the difference in the time spent creating an SAP system clone or copy with NetApp shared storage and SAP LVM (Figure 1 and Figure 3) versus the time spent when using conventional approaches (Figure 2 and Figure 4).

Figure 1) SAP system clone: NetApp approach with SAP LVM.

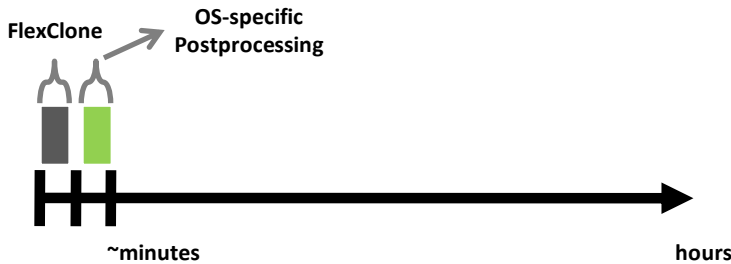


Figure 2) SAP system clone: traditional approach.

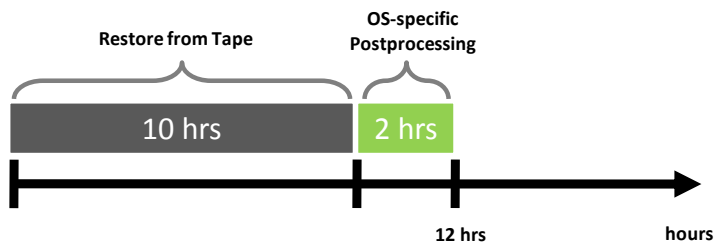


Figure 3) SAP system copy: NetApp approach with SAP LVM.

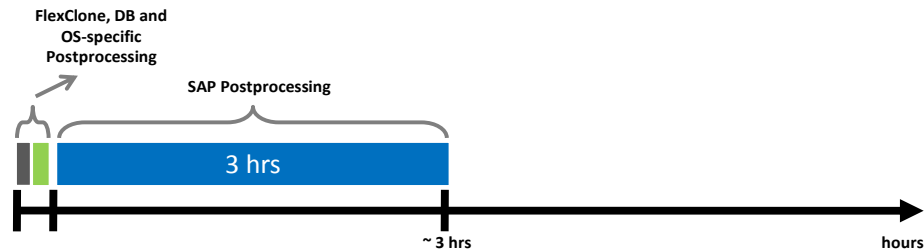
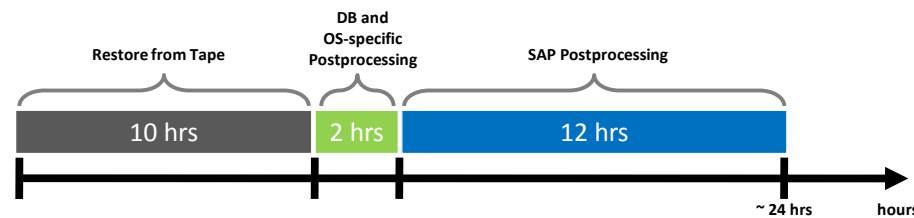


Figure 4) SAP system copy: traditional approach.



All steps up to the point when the SAP system can be started on the target host can be accomplished in a few minutes by using SAP LVM in combination with NetApp shared storage. In comparison, the traditional approaches take significantly longer. In case of a SAP system copy, the SAP postprocessing needs to be performed in the traditional, as well as in the NetApp with SAP LVM approach, but it is fully automated when deploying SAP LVM. For details, refer to [TR-3442: "SAP with Oracle on UNIX and NFS and NetApp Storage"](#)

2.4 Unique NetApp Values in This Scenario

SAP LVM enables automated copying and cloning of SAP systems. It offers IT departments and administrators the possibility to offer IT as a service in a flexible, managed, secure, instantaneous, and cost-efficient manner. However, this creates several challenges at the storage layer, such as increasing space requirements, providing fast data copy/cloning, high I/O loads, and so on. The following sections outline how these challenges can be overcome by using NetApp shared storage to minimize the costs for such infrastructures and the time required to perform these processes.

Managing Growing Storage Demands

SAP production systems can virtually grow to any arbitrary size, with most of the systems exhibiting space requirements in the gigabyte/terabyte range. Production systems in the industry show a trend of growing and therefore requiring additional space. Besides production systems, the test and development systems also tend to take up significant space. In many cases it is required to have multiple test or development systems at the same time. For example, in a production system of 2TB, each test or development system takes up an additional 2TB. Data centers already exhibit large energy consumption for hardware and cooling, lack of floor space, and low budgets. Building or renting additional data centers is often not economically feasible. It is therefore inevitable to store data as space efficiently as possible.

NetApp FlexClone provides space-efficient volume clones directly at the file-system level. It is completely transparent to the user. FlexClone technology uses Snapshot copies that can be created in a few seconds without interrupting the operation on the source system, to create SAP systems copies and clones. Because the data is not copied but referenced in place, the amount of storage required is limited to only data that is changed at the source and the target system and therefore significantly decreases the disk space needed for SAP system copies and clones. Consequently, the already existing storage can be used much more efficiently, thus saving additional hardware and operation costs.

Given the scenario of one production and five development or test systems (created out of the production system), the total space requirement in a traditional sense would be six times the space required by the production system. Since an untouched FlexClone volume comes at negligible cost, the total space consumption for the six systems would still be about the size of the production system. Even if the development or test systems differ from the parent system over time, space savings will still be significant.

A more extensive analysis of the way NetApp achieves significant storage efficiency can be found in [TR-3827: "If You're Doing This, Then Your Storage Could Be Underutilized"](#).

Virtual Storage Tiering

Virtual infrastructures usually run and host many different applications. Since these applications usually exhibit different I/O patterns, it is difficult to predict the sum of all I/O patterns combined. This poses special performance requirements to the underlying storage infrastructure. Obviously, these requirements should be met in an economical fashion.

The NetApp Virtual Storage Tiering architecture supports different drive technologies that can be combined with intelligent flash-based caching (for example, Flash Cache) to increase read and write performance. In contrast to traditional automated storage tiering that is based on the fundamental concept of data migration, NetApp relies on proven existing caching techniques that have been used for a long time, for example, for virtual memory. The NetApp Virtual Storage Tiering architecture minimizes

management overhead and provides greater flexibility and real-time performance to meet the I/O needs of the shared virtual and physical infrastructures. For more information, see [WP-7118: "Tierless Storage."](#)

Efficient Cloning and Point-In-Time Copy of SAP Systems

Clones or copies of SAP systems might be required in testing environments. For example, suppose there is an error in the production system. To test and apply a fix to the production system as rapidly as possible, a clone should be created. Especially in development and test scenarios, in which clones might be required for a short period, it is necessary to be able to quickly create a clone. Creating clones of SAP production systems might be time consuming because of their large size. NetApp FlexClone helps to significantly quicken this process. Instead of first reading and then copying the data, thereby allocating new blocks on the disks, FlexClone references the already existing blocks of the parent as read-only. Therefore, new blocks need to be allocated only when the data is actually changed or written. When using SAP LVM in combination with NetApp shared storage, FlexClone volumes are created whenever possible, minimizing space and time consumption.

Addressing Large and Multisite Environments

NetApp can support data migration between two controllers separated by long distances—for example, to a different NetApp storage controller in the same data center or even to a remote data center at a different site—by using NetApp SnapMirror. SnapMirror in combination with deduplication, transfers only the deduplicated data, which quickens the transfer process. Furthermore, after the initial baseline transfer is completed, only the delta between the data on the source and the destination site needs to be transferred.

One Unified API and Operating System

NetApp provides a single API and operating system, independent of the NetApp controller model. Therefore, only a single integration into SAP LVM is required and needs to be maintained.

2.5 Summary

SAP LVM helps administrators to easily create clones and copies of SAP systems. However, cloning and copying of SAP systems in shared environments also poses challenges to storage vendors. Table 1 summarizes how these challenges can be addressed by using NetApp shared storage.

Table 1) Challenges and how they can be addressed with NetApp technology.

Challenges	NetApp Solution
Managing growing storage demands	NetApp FlexClone NetApp deduplication
Unpredictable I/O patterns	NetApp Flash Cache NetApp Virtual Storage Tiering
Efficient cloning and point-in-time copy	NetApp FlexClone
Balancing load and scaling	NetApp SnapMirror
Large and multisite environments	One single API and operating system

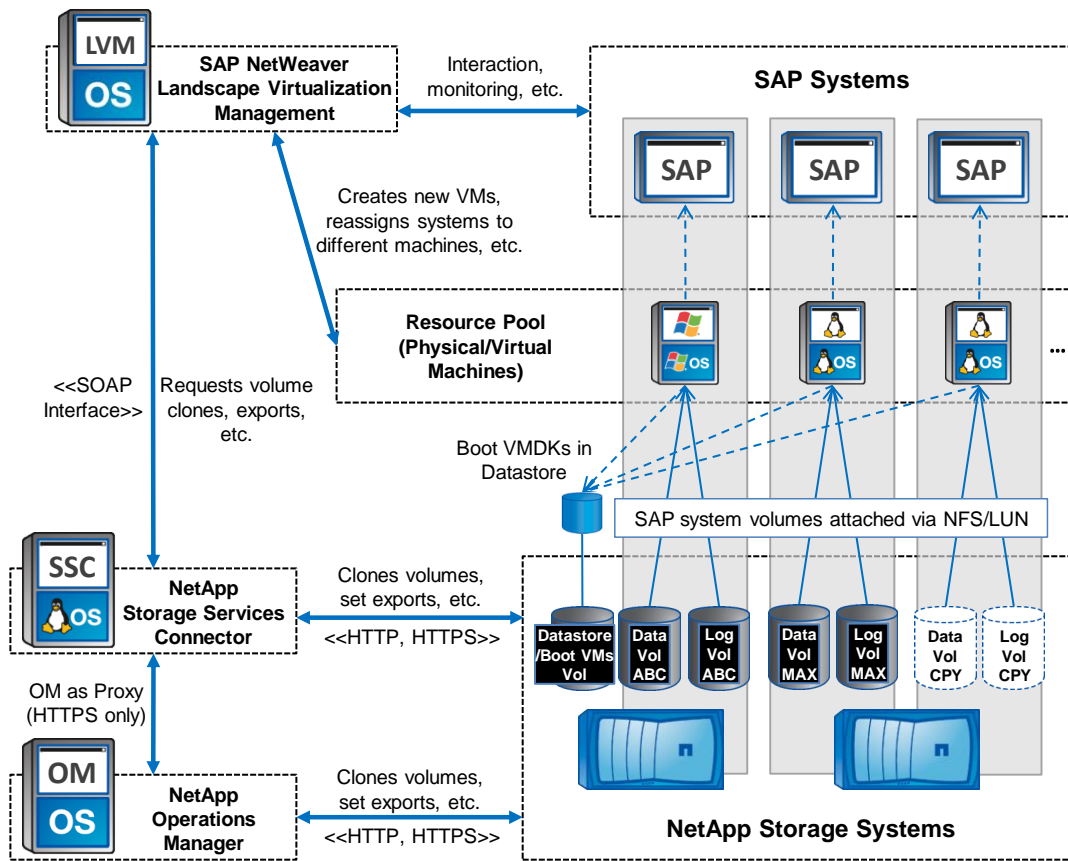
3 Components and Integration

This section gives a general overview of the architecture and an in-depth view of the interaction between SAP NetWeaver Landscape Virtualization Management software and NetApp Storage Services Connector.

3.1 Architecture Overview

Figure 5 shows a high-level overview of the interaction between the different components in the architecture. The functionality and responsibilities of the individual components such as the SAP LVM, the SSC, or the NetApp shared storage are explained in detail below.

Figure 5) Architecture overview.



SAP NetWeaver Landscape Virtualization Management

From an administrator's perspective, SAP LVM is the central tool that communicates with the storage and the virtualization layer. Apart from creating copies and clones, it acts as a management component that provides controls for interaction with SAP systems (start, stop, relocate, and so on) and extensive monitoring capabilities. More information about its features can be found at www.sap.com.

SAP LVM communicates directly with the SAP systems over the common SAP communication channels. Communication capabilities to certain virtualization managers (in case of using virtual machines) are also integrated (for example, into VMware® vCenter™). Communication with the NetApp storage controllers is provided through SSC.

NetApp Storage Services Connector

The NetApp Storage Services Connector is the central technical component that enables communication between SAP LVM and the NetApp storage controllers. SSC controls the storage layer; for example, by creating volume clones or supplying exports. The communication between SAP LVM and SSC is established via a SOAP interface. It uses well-defined XML objects to transmit messages, thereby providing transparency and interoperability.

SSC can communicate with the storage in one of the following ways:

- Directly with the NetApp shared storage
- Through NetApp Operations Manager acting as a proxy

In the first case, the connection can either be unsecured (via HTTP) or secured (via HTTPS). When using Operations Manager as a proxy, all communication between SSC and the storage is tunneled through Operations Manager; that is, SSC does not necessarily need to have access to the storage system(s). However, SSC can only establish secured connections to Operations Manager. In all cases, ports for communication can be configured within SSC.

SSC can easily handle multiple NetApp storage controllers simultaneously.¹ It hides the complexity that administrators face when dealing with multiple storage controllers.

NetApp Operations Manager

NetApp Operations Manager delivers comprehensive monitoring and management for NetApp storage. It provides alerts, reports, performance, and configuration tools to keep the NetApp storage infrastructure in line with business requirements for maximum availability and efficiency.

Operations Manager provides a single human interface and an application programming interface (API) for integration with other management software. The API uses well-defined XML objects for communication for transparency and interoperability. For easy integration, NetApp provides libraries for all major programming languages exploiting the DataFabric[®] Manager API.

In this scenario, Operations Manager acts as a proxy for SSC. It enables SSC to communicate with the NetApp storage controller(s), even if there is no direct connection possible between them. Operations Manager also acts as a repository for NetApp storage controllers, because it has autodiscovery capabilities. This can be useful in scenarios in which multiple NetApp storage controllers are deployed. However, it is not necessary to use Operations Manager; it is an optional component in this setup.

Resource Pool

SAP LVM uses a resource pool to manage compute resources when cloning or copying SAP systems. The resource pool consists of physical and virtual machines on which SAP runs or will run on. In this example, we only consider virtual machines. Those virtual machines reside in one or multiple datastores, which live in a volume that is attached via NFS, iSCSI, or FCP.

SAP LVM integrates with different virtualization managers like VMware vCenter to discover or provision new virtual machines out of templates. This integration provides administrators with a single point of contact and enables further simplification, since administrators no longer need to switch back and forth between different applications (for example, between SAP LVM and virtualization managers).

¹ It is also possible to deploy several instances of NetApp SSC and/or multiple NetApp Operations Manager tools.

Those virtual and physical machines serve as hosts for the SAP systems. SAP systems (such as source, cloned, or copied systems) are attached to these machines and can be relocated from one system to another. This enables the administrator to easily migrate SAP systems, for example, to accommodate their performance requirements. Each SAP system usually resides on two volumes (log and data). Those volumes are attached to the host OS dynamically by SAP LVM. When dealing with Linux[®] as the host OS, SAP LVM creates NFS exports via SSC and then mounts them to the host OS. In Windows[®], LUNs are used (this requires "NetApp Plug-In for SAP NetWeaver Landscape Virtualization Management", which will be made available in the [NetApp Utility ToolChest](#)).

3.2 Registering SAP Systems and Resources

Existing SAP systems can be added to SAP LVM by using the configuration tab in the SAP LVM main screen. SAP systems need to be "adaptive-computing" enabled (for more information, refer to the [SAP NetWeaver Landscape Virtualization Management Software Installation Guide](#)). SAP LVM can discover existing systems, for example, by its hostname entry. However, the administrator has to specify which exports (for example, volumes) belong to a specific system. After adding and configuring these systems within SAP LVM, they can be used as source systems for the copy and clone operations.

An example is shown in Figure 6 and Figure 7. All SAP systems that reside on the host "sapsource" are automatically discovered and can be added into SAP LVM in the subsequent steps.

Figure 6) Adding an SAP system into SAP LVM.

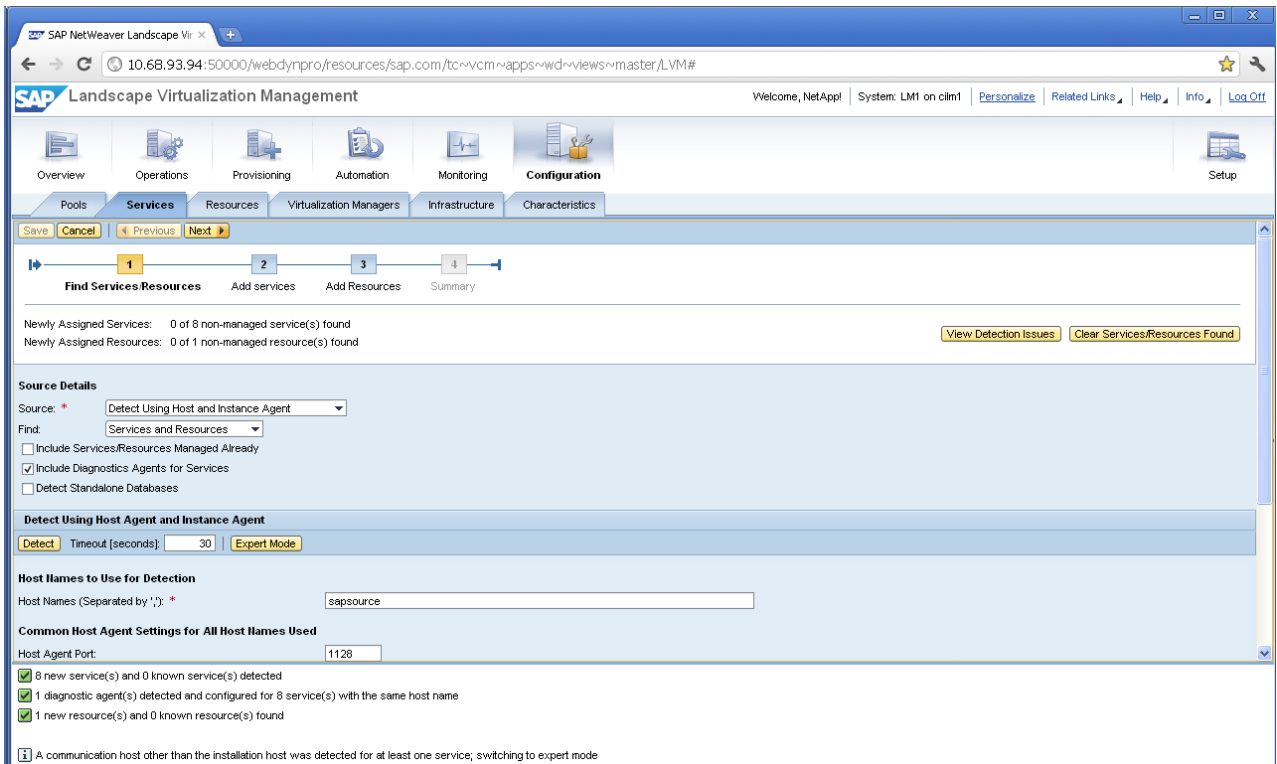
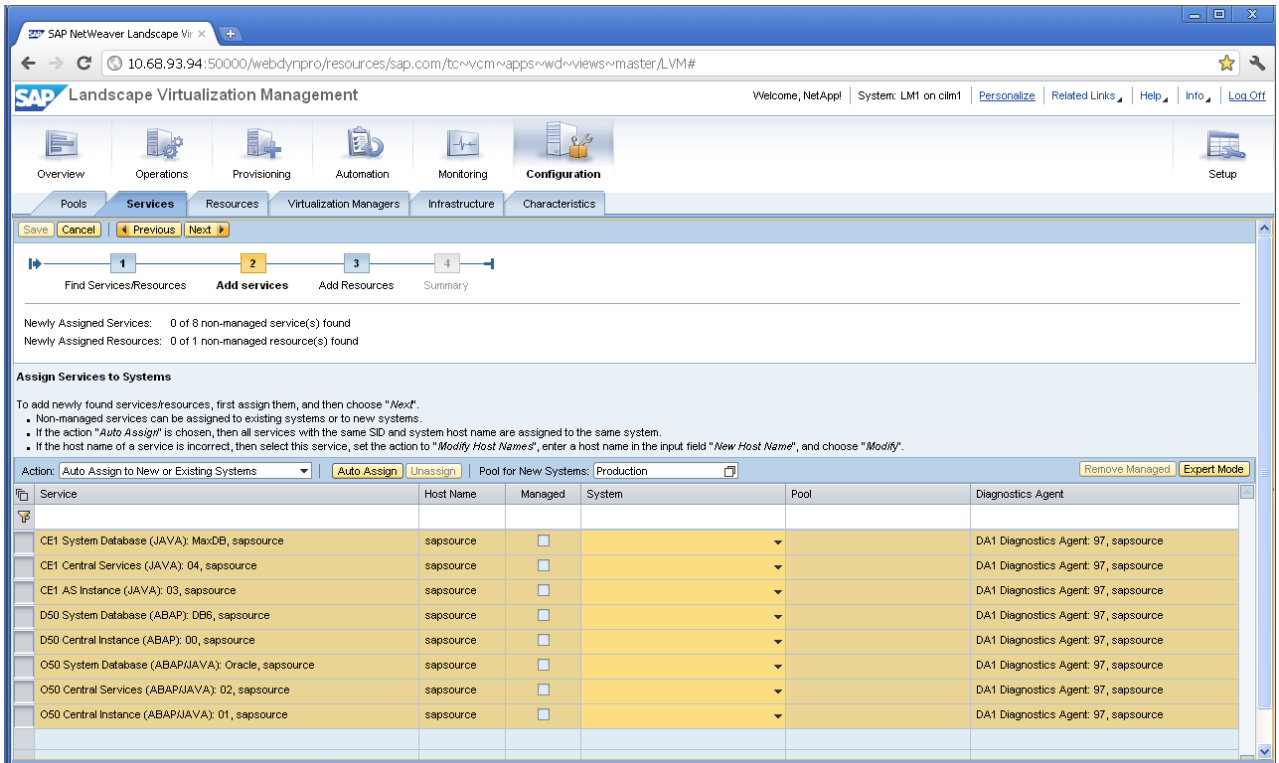


Figure 7) Adding an existing SAP system into SAP LVM.



3.3 SAP on Different Databases—Best Practices

In a typical SAP setup, there are multiple ways to attach the storage to the database/SAP system. SAP LVM supports the copying and cloning of SAP systems on SAP MaxDB, DB2, Oracle®, and Microsoft® SQL Server®. For best performance and repeatability in this infrastructure, it is important to define a standardized layout for each of these databases. For more information, see section “References.”

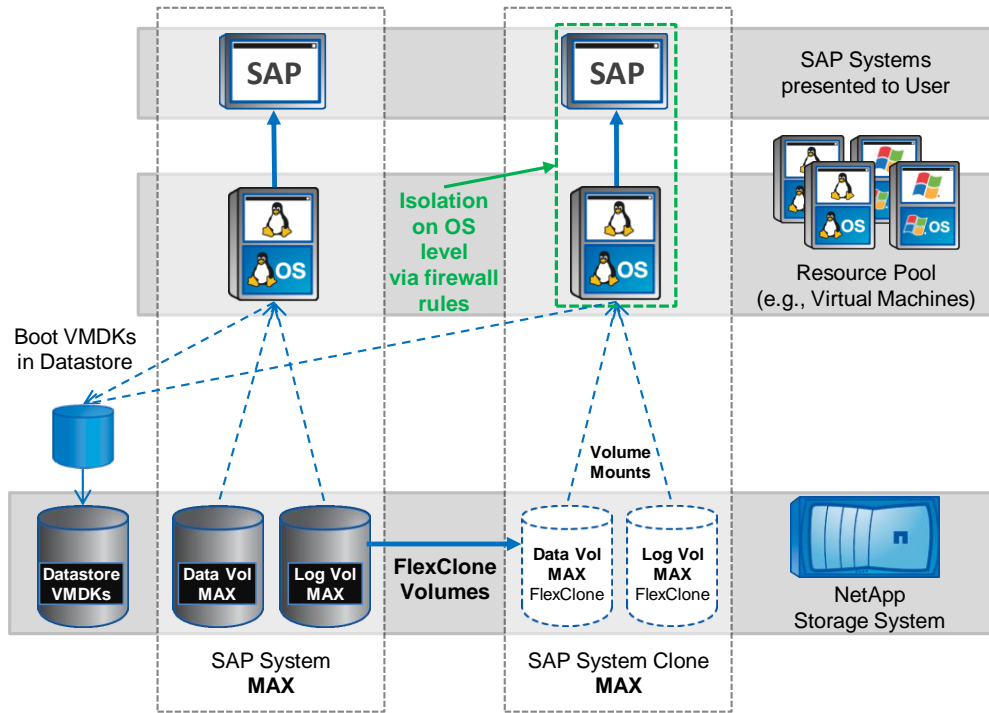
4 Use Cases in Detail

This section describes two use cases (SAP system clone and system copy) and outlines the technical aspects of these operations.

4.1 System Clone

A schematic clone process is illustrated in Figure 8.

Figure 8) Storage view: cloning an SAP system to the same NetApp storage controller.



The following procedure shows how to clone a sample system named "MAX" for test or development purposes. The clone will reside within the same NetApp storage controller and on the same aggregate as the source.

1. In SAP LVM, navigate to the "Provisioning" tab and select the source SAP system with the System ID "MAX". The "Clone System" button will initiate the clone process.

The screenshot shows the SAP Landscape Virtualization Management (LVM) interface. The navigation bar includes tabs for Overview, Operations, Provisioning, Automation, Monitoring, and Configuration. The main content area displays the provisioning details for an ERP System, MaxDB, Linux. The 'Clone System' button is visible. The provisioning information includes:

- System Name: MAX: NetWeaver ABAP 7.00
- System ID: MAX
- System Host: dbmax
- Type: NetWeaver ABAP
- Release: 7.00
- Service ID: SystemID.MAX.SystemHost.db
- Description:
- Pool: Production
- Status: Running

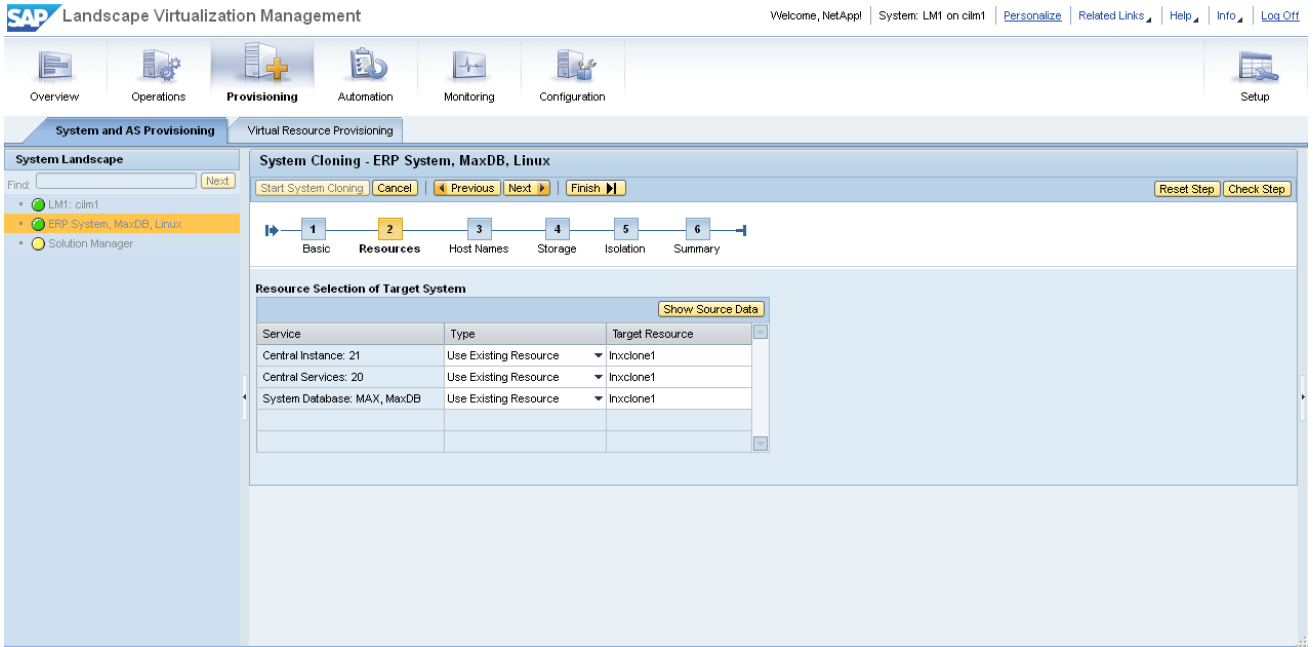
The Provisioning Information section shows:

Provisioned By: Installation

Service	OS	Network	Description	Provisioned By	Provisioning Time (CET)
System Database (ABAP): MAX, MaxDB, dbmax	Linux	10.68.93.0		Installation	Unknown
Central Services (ABAP): 20, scsmax	Linux	10.68.93.0		Installation	Unknown
Central Instance (ABAP): 21, cimax	Linux	10.68.93.0		Installation	Unknown

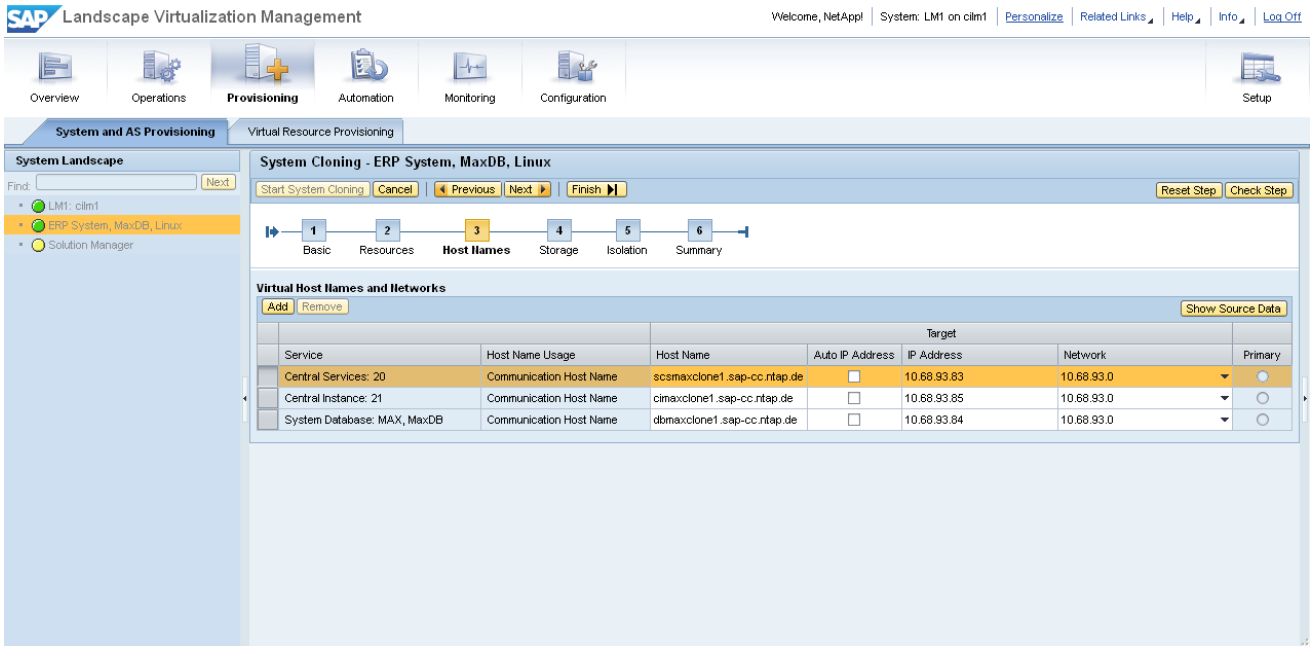
2. Select the resources.

A resource, on which the clone will run on, needs to be selected from the resource pool. In this example, the virtual machine "Inxclone1" is chosen from the resource pool. To recap, the resource pool consists of the physical and/or virtual machines that are used as hosts. SAP LVM allows the user to automatically provision a virtual machine out of a template by integrating itself tightly with, for example, VMware vCenter.



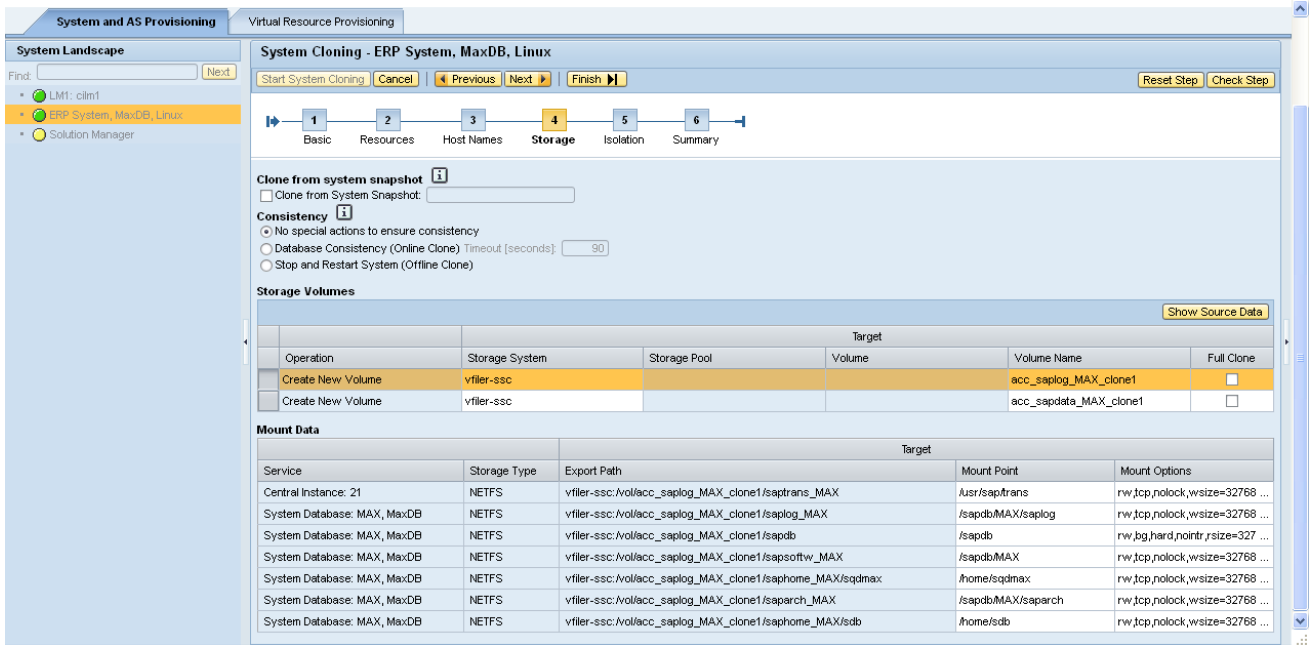
3. Configure the network settings.

In this screen, the hostname of the clone and its network settings are configured.



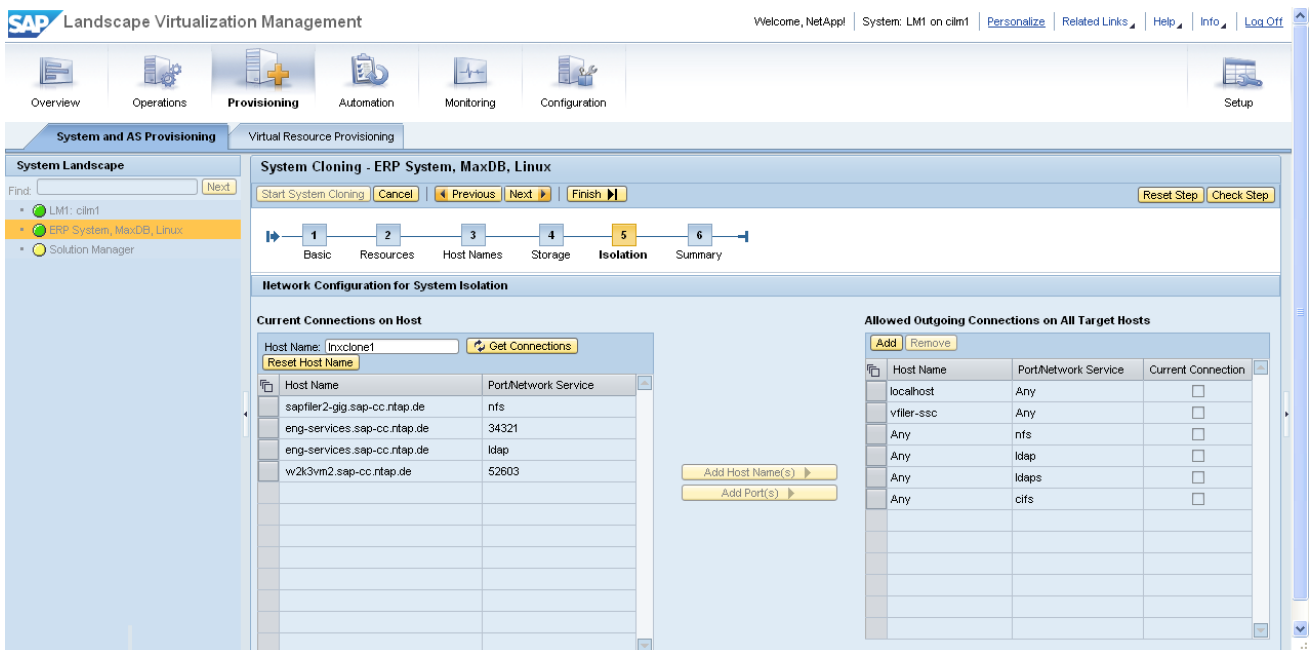
4. Configure the storage settings.

The storage screen allows the user to preview or change the name of the cloned volumes. It also allows defining the target storage controller, on which the cloned system should live on. Furthermore it gives an overview on the new exports that are going to be added. In addition to this, it can be selected if the clone should be created out of a snapshot or if the clone should be split from its parent volume instantly.



5. Isolate the clone.

Since in this example (a SAP system clone) the SID of the clone is not changed, SAP LVM will isolate the clone by blocking the outgoing network connections (except those that are required, for example, communication with the storage layer). This is done by SAP LVM by altering the settings of the firewall in the host OS.



- SAP LVM now performs all the actions that were configured in the previous steps. This includes the creation of the volume clones and exports, mounting them to the host machine, and adding the firewall rules on the OS level. After the process is completed, the cloned SAP system is ready to be started and used, without interfering with the original SAP system.

Activities | Overview | Operations | Provisioning | Automation | **Monitoring** | Configuration | Setup

Overview

Cancel | Suspend | Resume | Retry | Remove | Export

Latest Server Time: 2011-11-07 15:36:30 CET | Auto | Interval[s]: 10

ID	Status	Progress	Description	Note	User	Start Time (CET)	Duration	Retry Of
854	Completed	100%	System Clone		NetApp	2011-11-07 15:31:11	4:45	

Rows: 29 total, 29 unfiltered, 1 selected | Selected: Activity ID - 854

Summary | Steps

Continue Step

ID	Successor IDs	Predecessor IDs	Status	Step Time	Duration	Operation	Service/Virtual Resource	Resource/Virtual Resource Provider
3	5	2	Completed	0:29	0:02	Change Profile	MAX Central Services (ABAP): 20_scsmaxclone1.sap-cc.ntap.de	Inxclone1
4	5	2	Completed	0:29	0:04	Change Profile	MAX Central Instance (ABAP): 21_cimaxclone1.sap-cc.ntap.de	Inxclone1
5	6,7	3,4	Completed	0:34	0:00	Enable system	MAX: NetWeaver ABAP 7.00_dbmaxclone1.sap-cc.ntap.de	
6	8	5	Completed	0:34	1:10	Register Instance Agent via HostAgent	MAX Central Services (ABAP): 20_scsmaxclone1.sap-cc.ntap.de	Inxclone1
7	8	5	Completed	0:34	0:51	Register Instance Agent via HostAgent	MAX Central Instance (ABAP): 21_cimaxclone1.sap-cc.ntap.de	Inxclone1
8	10,11,12,9	6,7	Completed	1:44	0:39	OS firewall fencing	MAX Central Instance (ABAP): 21_cimaxclone1.sap-cc.ntap.de	Inxclone1
9	10,11,12	8	Completed	2:24	0:04	Change local host name lookup	MAX Central Instance (ABAP): 21_cimaxclone1.sap-cc.ntap.de	Inxclone1
10	12	8,9	Completed	2:40	0:46	Start	MAX Central Services (ABAP): 20_scsmaxclone1.sap-cc.ntap.de	Inxclone1

Rows: 12 total, 12 unfiltered, 1 selected

- Finally, the cloned system of "MAX" can be found in the "Operations" menu, under the "Services" tab. It is indicated that it is a clone of the SAP system "MAX" and runs on the virtual host "Inxclone1".

Operations | Overview | Provisioning | Automation | Monitoring | Configuration | Setup

System Landscape

Find: | Next

Services (2)

- Production (2)
 - ERP System, MaxDB, Linux
 - Solution Manager
- Test (2)
 - LM1: cilml
 - MAX: dbmaxclone1.sap-cc.ntap.de**

Overview

Grouping & Filtering | Export

Auto | Interval[s]: 10

Service	System	Pool	Description	Operation	Assigned Resource	Virtualized
MAX: NetWeaver ABAP 7.00, dbmaxclone1.sap-cc.ntap.de (3)		Test	Clone of System 'MAX'			
MAX System Database (ABAP): MaxDB, dbmaxclone1.sap-cc.ntap.de	MAX: dbmaxclone1.sap-cc.ntap.de	Test	Clone of System MAX		Inxclone1	<input checked="" type="checkbox"/>
MAX Central Services (ABAP): 20_scsmaxclone1.sap-cc.ntap.de	MAX: dbmaxclone1.sap-cc.ntap.de	Test	Clone of System MAX		Inxclone1	<input checked="" type="checkbox"/>
MAX Central Instance (ABAP): 21_cimaxclone1.sap-cc.ntap.de	MAX: dbmaxclone1.sap-cc.ntap.de	Test	Clone of System MAX		Inxclone1	<input checked="" type="checkbox"/>

Pools: 0, Systems: 1, Services: 3 | Selected: MAX: NetWeaver ABAP 7.00, dbmaxclone1.sap-cc.ntap.de

Mass Operations | System Details | Log | Validation

Operation Type: Normal | Operation: Mass Stop (including unprepare if possible) | Execute

Executable Services (3)

Resource Check: Enabled | Auto Assign | Clear Resources | User Exits: Enabled | Note: Disabled | Intersystem Dependency: Enabled

NetApp shared storage enables quick cloning of the system irrespective of its size. The clone of the original SAP system will be very lightweight, since initially only the blocks of the parent volumes are referenced.

This significantly saves space and time since only a few new blocks of data need to be written during the clone process. New blocks will only be written as soon as the cloned or parent volumes are actually changed; e.g. when the cloned SAP system is modified.

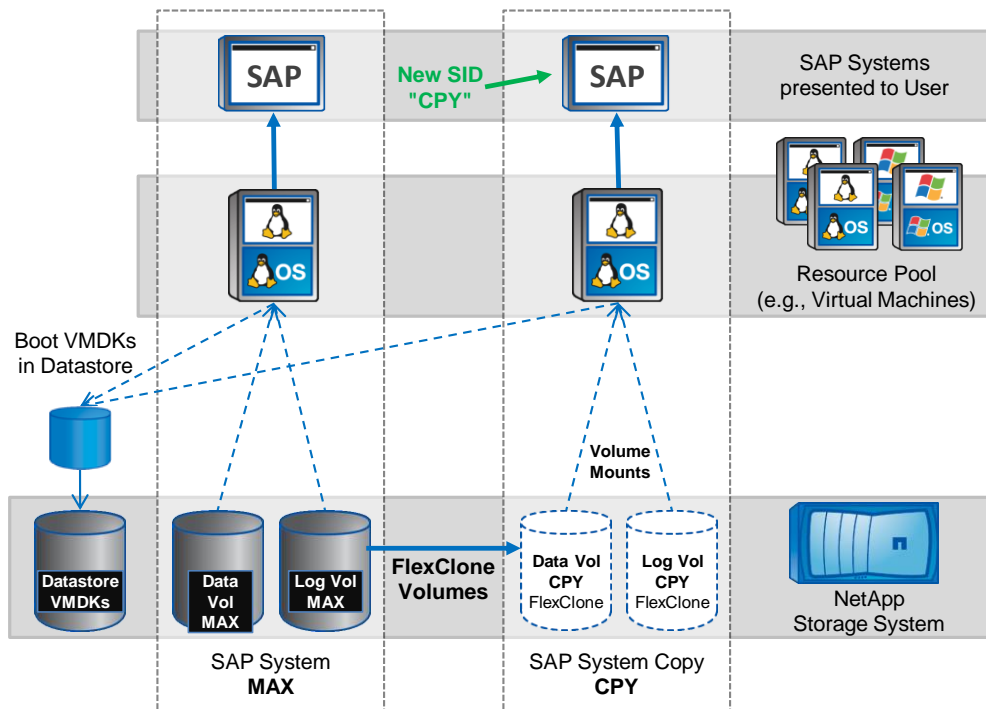
The resource pool of SAP LVM can consist of physical and virtual machines. Either way, NetApp shared storage can help obtain significant savings in the disk space at this layer. In particular, virtual machines exhibit large space savings when cloned or deduplicated. Since their operating systems are nearly identical when provisioned out of templates, the data that resides on the storage is consequently also very similar. Unaffected by that fact, virtual machines can still exhibit different settings (memory, clock speed, number of CPUs, and so on). This results in significant savings on the storage site when using deduplication, because most of the blocks of the space used by the machines will be identical. Thus, cloning a virtual machine, for example, 10 times, only requires a little additional space. In contrast, doing this by creating traditional copies would require 10 times the space of the original virtual machine.

Not only does system cloning provide significant space savings, but it also enhances read performance significantly. Since NetApp provides extensive caching algorithms, for example, with Flash Cache, the blocks of the virtual machines that are accessed frequently are likely to reside in the cache. Since those blocks are likely to be deduplicated blocks, the performance increases for all virtual machines that share these blocks. Therefore a cache can easily exhibit caching effects as if it was multiple times its actual size. Since in this case no user interaction is required, the best performance is provided by the system itself.

4.2 System Copy

Figure 9 shows an overview of a typical copy process. The user interaction that needs to be performed is similar to the SAP system clone process; that is, you have to select the resource on which the copied SAP system will run. However, in this case the SID will be changed from "MAX" to "CPY" by SAP LVM. Therefore, it is not necessary to network fence the copied SAP system. It can coexist with the parent SAP system without interfering with it.

Figure 9) Storage view: copying an SAP system to the same NetApp storage controller.



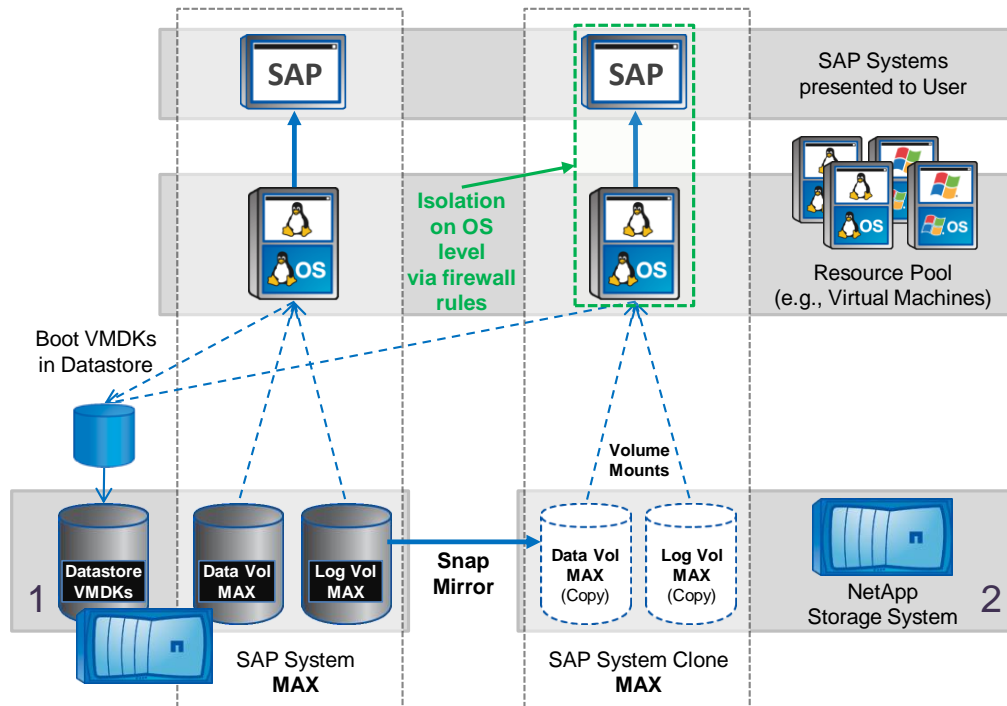
4.3 Addressing Large and Multisite Environments

Whenever a space-efficient NetApp FlexClone volume can be created, SAP LVM software and NetApp SSC enable it to be used. However, there are cases in which it is not possible to share common data by using FlexClone; for example, when going beyond the aggregate limits, such as copying or cloning SAP systems from one aggregate to another, probably even between different NetApp storage controllers at remote locations. SAP LVM and NetApp SSC leverage the triggering of FlexClone and SnapMirror transparently.

SnapMirror makes it possible to transfer data between NetApp storage controllers. This accounts for data transfer between aggregates within the same NetApp storage controller, between controllers in the same building, or even between NetApp storage controllers further apart. Whenever those transfers are incremental (for example, after finishing the initial baseline transfer), SnapMirror only transfers the delta between the source and the destination version of the file system.

Figure 10 illustrates the process of cloning an SAP system to a different/remote NetApp storage controller.

Figure 10) Cloning a SAP system to a remote NetApp storage controller.



You can see that the overall process is very similar to the clone process within an aggregate, except that SnapMirror is used to make a remote copy of the volume instead of FlexClone. The process is similar when creating SAP system copies.

5 Conclusion

SAP NetWeaver Landscape Virtualization Management software enables you to efficiently copy or clone existing SAP systems in physical or virtual environments by using NetApp FlexClone and other NetApp technologies. It also gives administrators the ability to quickly move existing, cloned, or copied SAP systems from one host to a different machine. Basic virtual machine provisioning from templates is enabled by integration with different virtualization managers.

NetApp Storage Services Connector enables SAP NetWeaver Landscape Virtualization Management software to communicate with NetApp storage controllers. FlexClone and SnapMirror enable space- and time-efficient SAP system copy and clone processes within or between NetApp storage controllers. NetApp deduplication helps to lower the space requirements, especially for virtual machines. NetApp Virtual Storage Tiering provides efficient caching to meet the I/O requirements in physical and virtualized infrastructures.

References

The following documents were used as references, and can provide additional detail on the topics discussed in this report:

- TR-3442: “SAP with Oracle on UNIX and NFS and NetApp Storage”
media.netapp.com/documents/tr-3442.pdf
- TR-3533: “SAP with Oracle on UNIX and FCP and NetApp Storage”
media.netapp.com/documents/tr-3533.pdf
- TR-3444: “SAP with Oracle on Windows and NetApp Storage”
media.netapp.com/documents/tr-3444.pdf
- TR-3485: “SAP on UNIX and DB2 with NFS and Network Appliance Storage”
media.netapp.com/documents/tr-3485.pdf
- TR-3689: “SAP on UNIX and SAP MaxDB with NFS and NetApp Storage”
media.netapp.com/documents/tr-3689.pdf
- TR-3175: “SAP R/3 SAP DB/Windows/MSCS: Integrating with a NetApp Filer”
media.netapp.com/documents/tr-3689.pdf
- TR-3585: “SAP on Windows and Microsoft SQL Server with NetApp Storage”
media.netapp.com/documents/tr-3585.pdf
- TR-3734: “SAP on Windows and Microsoft SQL Server with NetApp Storage and VMware”
media.netapp.com/documents/tr-3734.pdf
- TR-3827: “If You're Doing This, Then Your Storage Could Be Underutilized”
media.netapp.com/documents/tr-3827.pdf
- WP-7118: “Tierless Storage”
www.netapp.com/us/library/white-papers/wp-7118.html

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

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TR-4018-0412