



# **NetApp SAP Landscape Management Integration using Ansible**

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# NetApp SAP Landscape Management Integration using Ansible

## TR-4953: NetApp SAP Landscape Management Integration using Ansible

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SAP Landscape Management (LaMa) enables SAP system administrators to automate SAP system operations, including end-to-end SAP system clone, copy, and refresh operations.

NetApp offers a rich set of Ansible modules that allows SAP LaMa to access technologies such as NetApp Snapshot and FlexClone through SAP LaMa Automation Studio. These technologies help to simplify and accelerate SAP system clone, copy, and refresh operations.

The integration can be used by customers who run NetApp storage solutions on-premises or by customers using NetApp storage services at public cloud providers such as Amazon Web Services, Microsoft Azure, or Google Cloud Platform.

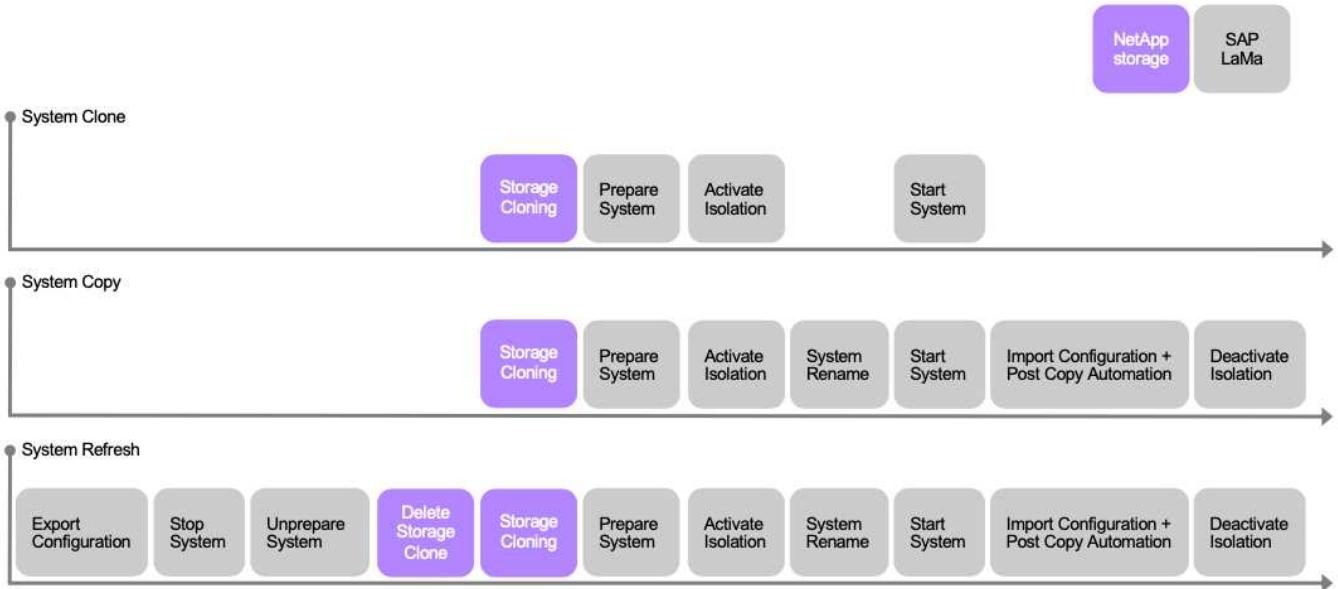
This document describes the configuration of SAP LaMa with NetApp storage features for SAP system copy, clone, and refresh operations using Ansible automation.

## SAP system clone, copy, and refresh scenarios

The term SAP system copy is often used as a synonym for three different processes: SAP system clone, SAP system copy, or SAP system refresh. It is important to distinguish between the different operations because the workflows and use cases differ for each one.

- **SAP system clone.** An SAP system clone is an identical clone of a source SAP system. SAP system clones are typically used to address logical corruption or to test disaster recovery scenarios. With a system clone operation, the hostname, instance number, and SID remain the same. It is therefore important to establish proper network fencing for the target system to make sure that there is no communication with the production environment.
- **SAP system copy.** An SAP system copy is a setup of a new target SAP system with data from a source SAP system. The new target system could be, for example, an additional test system with data from the production system. The hostname, instance number, and SID are different for the source and target systems.
- **SAP system refresh.** An SAP system refresh is a refresh of an existing target SAP system with data from a source SAP system. The target system is typically part of an SAP transport landscape, for example a quality assurance system, that is refreshed with data from the production system. The hostname, instance number, and SID are different for the source and target systems.

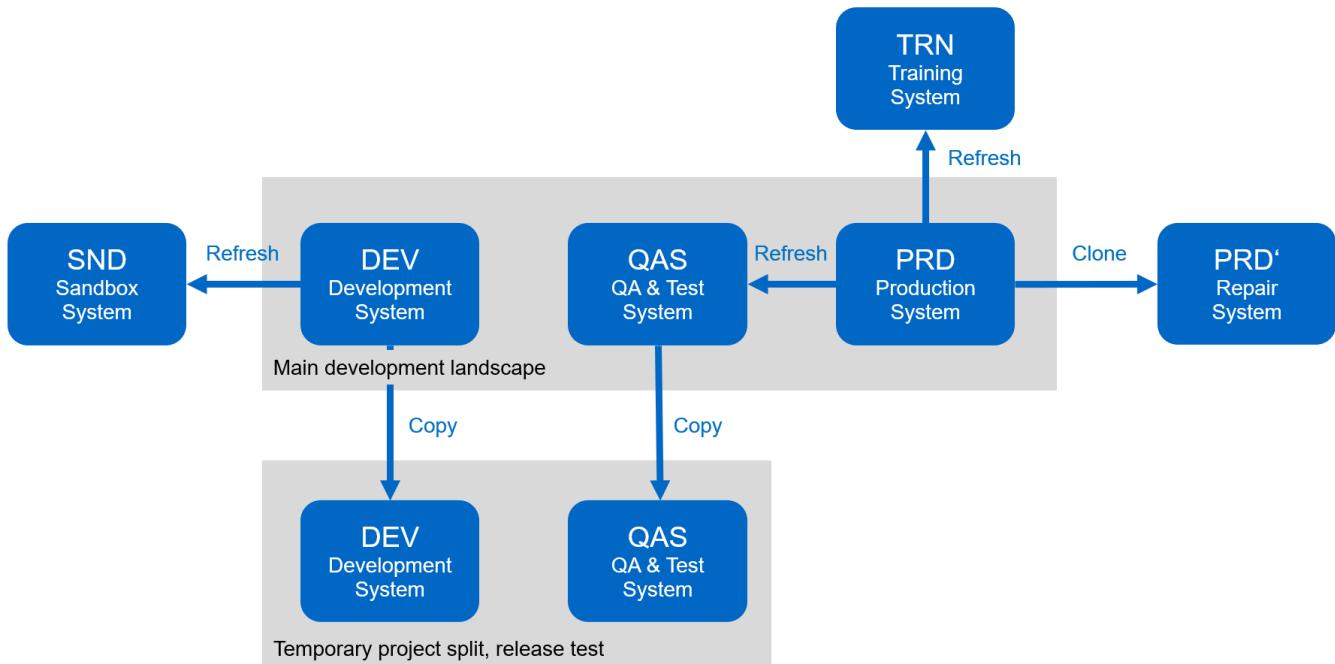
The following figure illustrates the main steps that must be performed during a system clone, system copy, or system refresh operation. The purple boxes indicate steps where NetApp storage features can be integrated. All three operations can be fully automated by using SAP LaMa.



## Use cases for system refresh, copy, and cloning

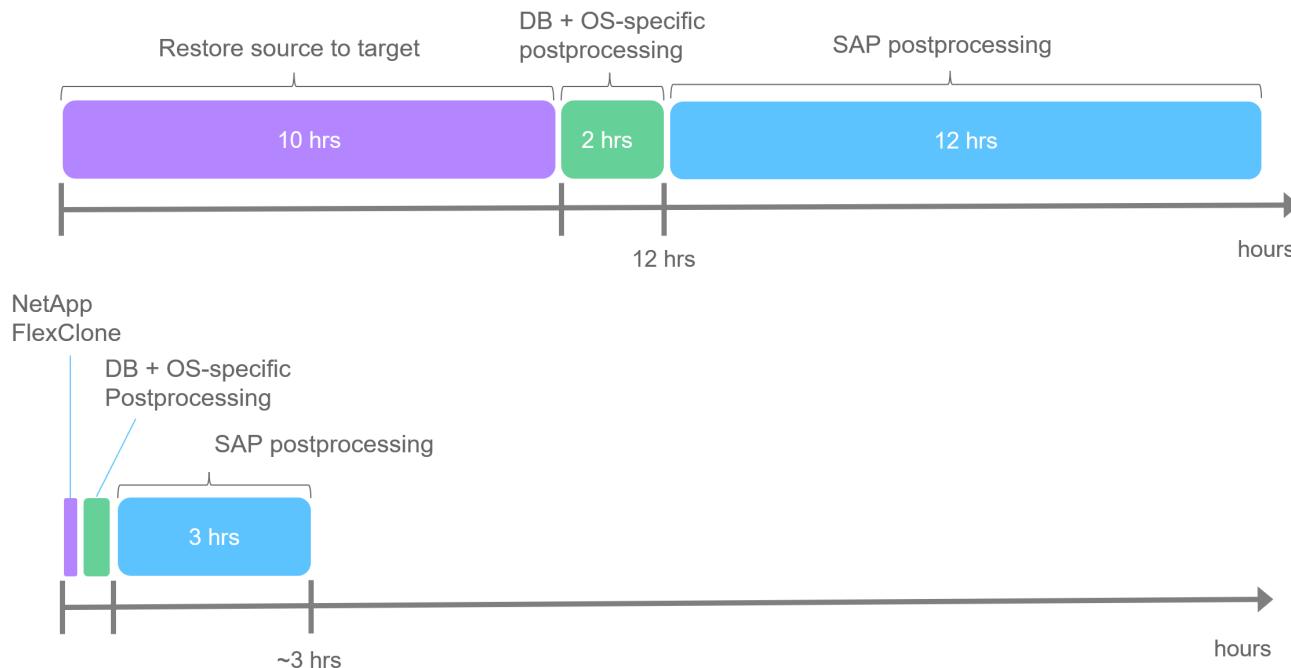
There are multiple scenarios in which data from a source system must be made available to a target system for testing or training purposes. These test and training systems must be updated with data from the source system on a regular basis to make sure that testing and training is performed with the current data set.

These system refresh operations consist of multiple tasks on the infrastructure, database, and application layers, and they can take multiple days depending on the level of automation.



SAP LaMa and NetApp cloning workflows can be used to accelerate and automate the required tasks at the

infrastructure and database layers. Instead of restoring a backup from the source system to the target system, SAP LaMa uses NetApp Snapshot copy and NetApp FlexClone technology so that required tasks up to a started HANA database can be performed in minutes instead of hours as shown in the following figure. The time needed for the cloning process is independent from the size of the database; therefore even very large systems can be created in a couple of minutes. Further reduction of the runtime is accomplished by automating tasks on the operating system and database layer as well as on the SAP post processing side.



## Address logical corruption

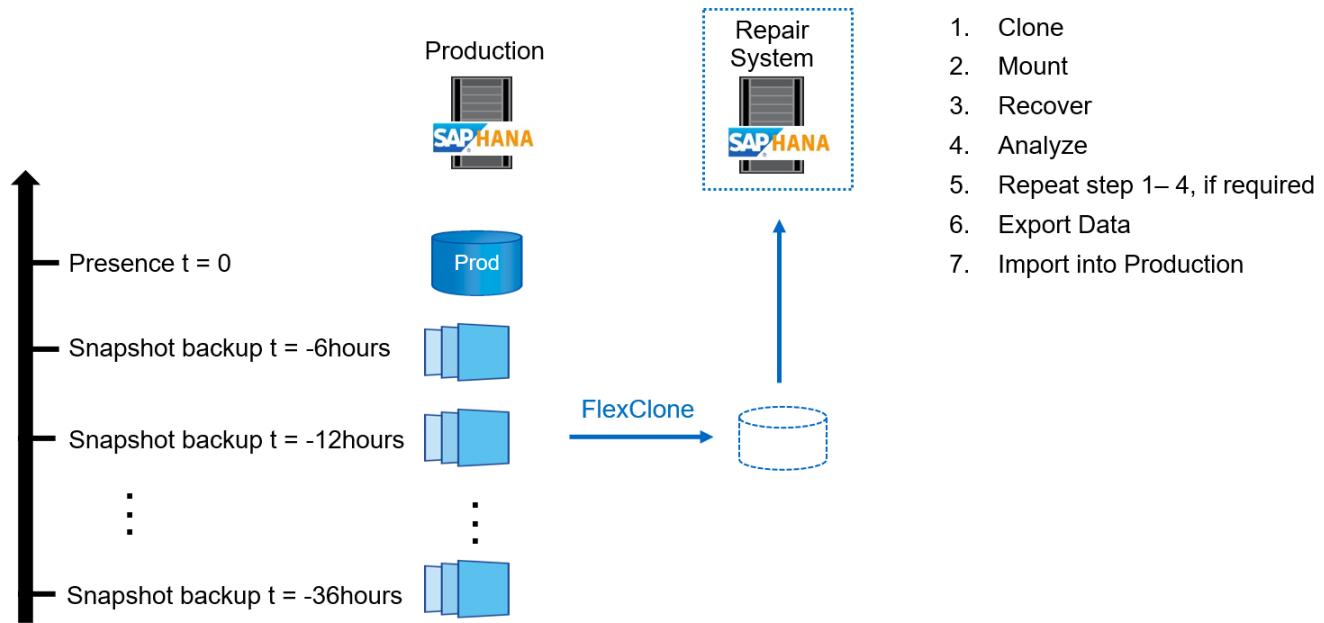
Logical corruption can be caused by software errors, human errors, or sabotage. Unfortunately, logical corruption often cannot be addressed with standard high-availability and disaster recovery solutions. As a result, depending on the layer, application, file system, or storage where the logical corruption occurred, minimal downtime and acceptable data loss requirements can sometimes not be fulfilled.

The worst case is logical corruption in an SAP application. SAP applications often operate in a landscape in which different applications communicate with each other and exchange data. Therefore, restoring and recovering an SAP system in which a logical corruption has occurred is not the recommended approach. Restoring the system to a point in time before the corruption occurred results in data loss. Also, the SAP landscape would no longer be in sync and would require additional postprocessing.

Instead of restoring the SAP system, the better approach is to try to fix the logical error within the system by analyzing the problem in a separate repair system. Root cause analysis requires the involvement of the business process and application owner. For this scenario, you create a repair system (a clone of the production system) based on data stored before the logical corruption occurred. Within the repair system, the required data can be exported and imported into the production system. With this approach, the production system does not need to be stopped, and, in the best-case scenario, no data or only a small fraction of data is lost.

When setting up the repair system, flexibility and speed are crucial. With NetApp storage-based Snapshot backups, multiple consistent database images are available to create a clone of the production system by using NetApp FlexClone technology. FlexClone volumes can be created in a matter of seconds rather than

multiple hours if a redirected restore from a file-based backup is used to set up the repair system.

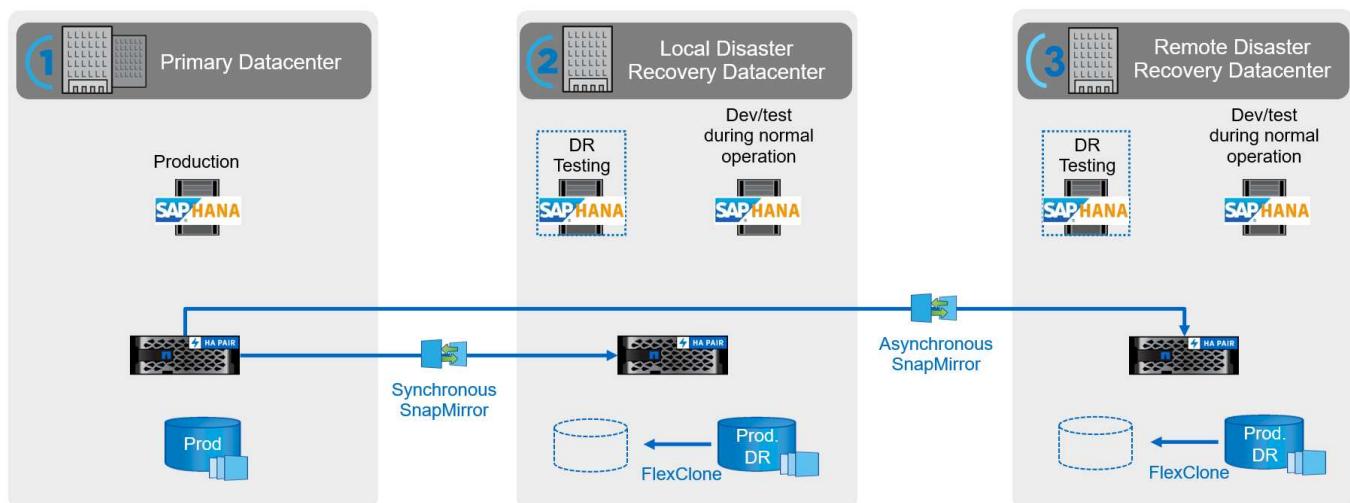


## Disaster recovery testing

An effective disaster recovery strategy requires testing the required workflow. Testing demonstrates whether the strategy works and whether the internal documentation is sufficient. It also allows administrators to train on the required procedures.

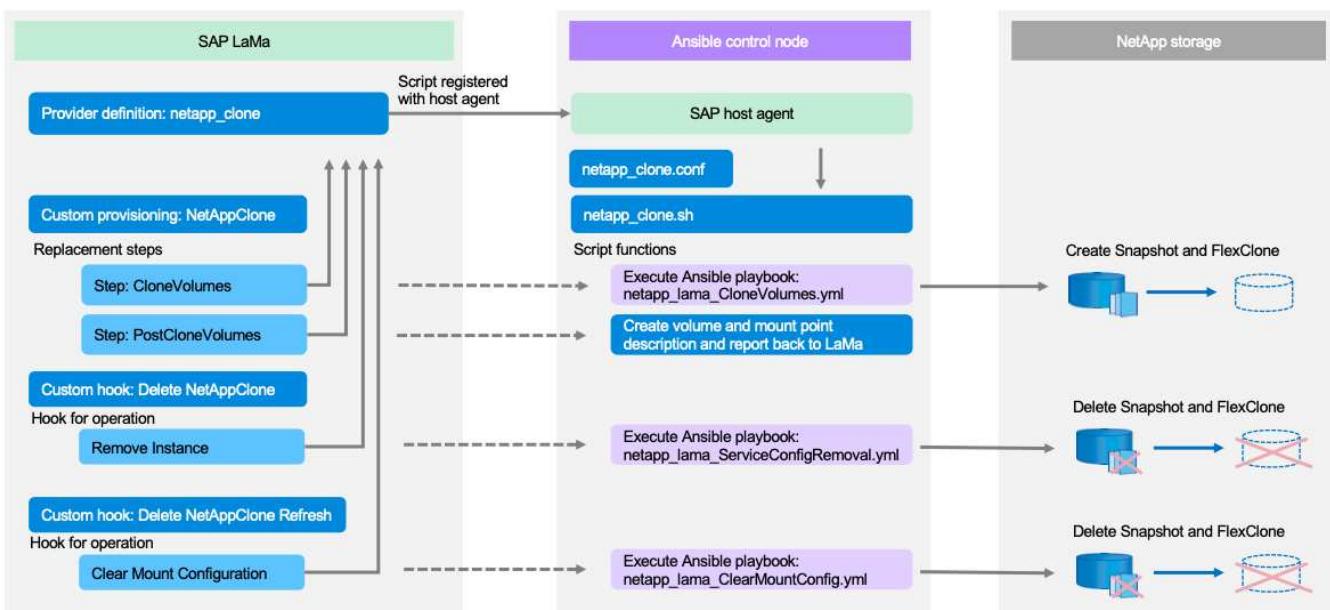
Storage replication with SnapMirror makes it possible to execute disaster recovery testing without putting RTO and RPO at risk. Disaster recovery testing can be performed without interrupting data replication. Disaster recovery testing for both asynchronous and synchronous SnapMirror uses Snapshot backups and FlexClone volumes at the disaster recovery target.

SAP LaMa can be used to orchestrate the entire testing procedure, and it also takes care of network fencing, target host maintenance, and so on.



# NetApp SAP LaMa integration using Ansible

The integration approach uses SAP LaMa custom provisioning and operation hooks combined with Ansible playbooks for NetApp storage management. The following figure shows a high-level overview of the configuration on the LaMa side as well as the corresponding components of the example implementation.



A central host acting as an Ansible control node is used to execute the requests from SAP LaMa and to trigger the NetApp storage operations using Ansible playbooks. The SAP host agent components must be installed on this host so that the host can be used as a communication gateway to SAP LaMa.

Within LaMa Automation Studio, a provider is defined that is registered at the Ansible host's SAP host agent. A host agent configuration file points to a shell script that is called by SAP LaMa with a set of command line parameters, depending on the requested operation.

Within LaMa Automation Studio, custom provisioning and a custom hook is defined to execute storage cloning operations during provisioning and also during clean-up operations when the system is deprovisioned. The shell script on the Ansible control node then executes the corresponding Ansible playbooks, which trigger the Snapshot and FlexClone operations as well as the deletion of the clones with the deprovisioning workflow.

More information on NetApp Ansible modules and the LaMa provider definitions can be found at:

- [NetApp Ansible modules](#)
- [SAP LaMa documentation – provider definitions](#)

## Example implementation

Due to the large number of options available for system and storage setups, the example implementation should be used as a template your individual system setup and configuration requirements.



The example scripts are provided as is and are not supported by NetApp. You can request the current version of the scripts via email to [ng-sapcc@netapp.com](mailto:ng-sapcc@netapp.com).

## Validated configurations and limitations

The following principles were applied to the example implementation and might need to be adapted to meet customer needs:

- Managed SAP systems used NFS to access NetApp storage volumes and were set up based on the adaptive design principle.
- You can use all ONTAP releases supported by NetApp Ansible modules (ZAPI and REST API).
- Credentials for a single NetApp cluster and SVM were hard coded as variables in the provider script.
- Storage cloning was performed on the same storage system that was used by the source SAP system.
- Storage volumes for the target SAP system had the same names as the source with an appendix.
- No cloning at secondary storage (SV/SM) was implemented.
- FlexClone split was not implemented.
- Instance numbers were identical for the source and target SAP systems.

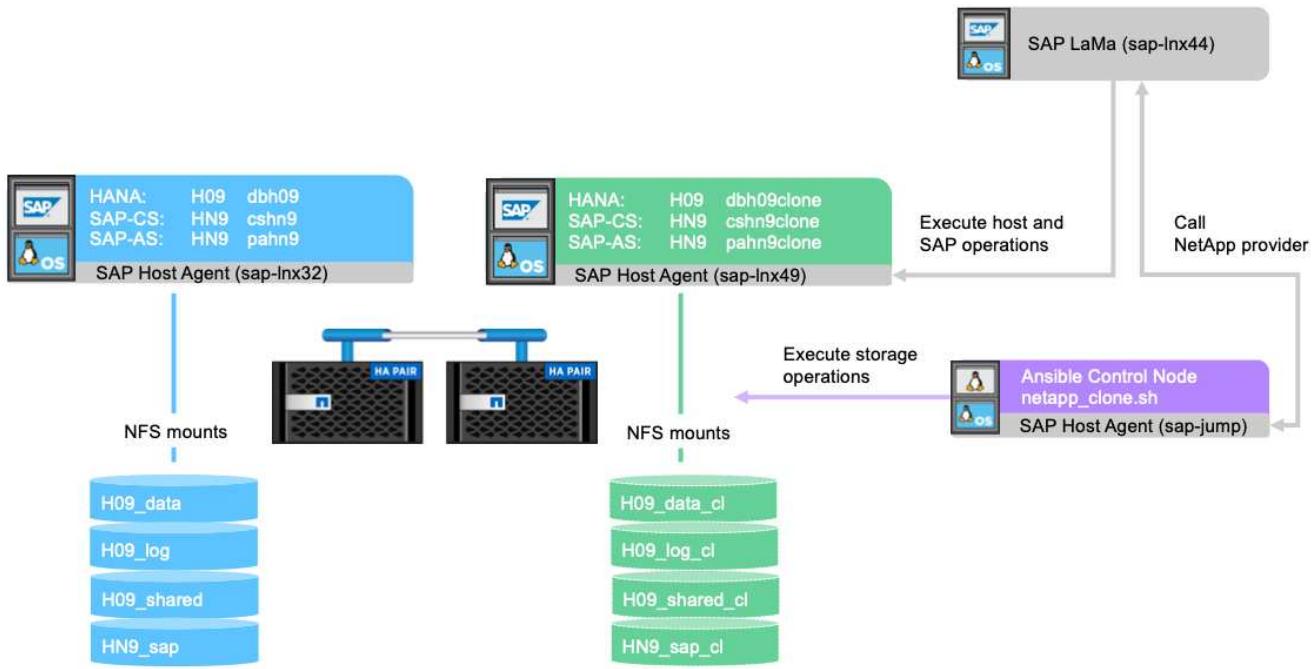
## Lab setup

The following figure shows the lab setup we used. The source SAP system HN9 used for the system clone operation consisted of the database H09, the SAP CS, and the SAP AS services running on the same host (sap-Inx32) with installed [adaptive design](#) enabled. An Ansible control node was prepared according to the [Ansible Playbooks for NetApp ONTAP](#) documentation.

The SAP host agent was installed on this host as well. The NetApp provider script as well as the Ansible playbooks were configured on the Ansible control node as described in the [“Appendix: Provider Script Configuration.”](#)

The host sap-Inx49 was used as the target for the SAP LaMa cloning operations, and the isolation-ready feature was configured there.

Different SAP systems (HNA as source and HN2 as target) were used for system copy and refresh operations, because Post Copy Automation (PCA) was enabled there.



The following software releases were used in the lab setup:

- SAP LaMa Enterprise Edition 3.00 SP23\_2
- SAP HANA 2.00.052.00.1599235305
- SAP 7.77 Patch 27 (S/4 HANA 1909)
- SAP Host Agent 7.22 Patch 56
- SAPACEXT 7.22 Patch 69
- Linux SLES 15 SP2
- Ansible 2. 13.7
- NetApp ONTAP 9.8P8

## SAP LaMa configuration

### SAP LaMa provider definition

The provider definition is performed within Automation Studio of SAP LaMa as shown in the following screenshot. The example implementation uses a single provider definition that is used for different custom provisioning steps and operation hooks as explained before.

The provider `netapp_clone` is defined as the script `netapp_clone.sh` registered at the SAP host agent. The SAP host agent runs on the central host `sap-jump`, which also acts as the Ansible control node.

The **Used in** tab shows which custom operations the provider is used for. The configuration for the custom provisioning **NetAppClone** and the custom hooks **Delete NetAppClone** and **Delete NetAppClone Refresh** are shown in the next chapters.

The parameters **ClonePostFix** and **SnapPostFix** are requested during the execution of the provisioning workflow and are used for the Snapshot and FlexClone volume names.

Name	Label	Type	Value	Mandatory	Secure	Multivalue
ClonePostFix	ClonePostFix	String		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SnapPostFix	SnapPostFix	String		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## SAP LaMa custom provisioning

In the SAP LaMa custom provisioning configuration, the customer provider described before is used to replace the provisioning workflow steps **Clone Volumes** and **PostCloneVolumes**.

Name	Provider Parameters	Instance Type
CloneVolumes	netapp_clone	Default (all unused instance types)
FinalizeCloneVolumes	netapp_clone	Default (all unused instance types)

## SAP LaMa custom hook

If a system is deleted with the system destroy workflow, the hook **Delete NetAppClone** is used to call the provider definition `netapp_clone`. The **Delete NetApp Clone Refresh** hook is used during the system refresh workflow because the instance is preserved during the execution.

Name	Entity Type	Provider	Type
Delete NetAppClone Refresh	Instance	netapp_clone	Pre hook for 'Clear Mount Configuration'
Delete NetAppClone	Instance	netapp_clone	Pre hook for 'Remove Instance'

It is important to configure **Use Mount Data XML** for the custom hook, so that SAP LaMa provides the information of the mount point configuration to the provider.

To ensure that the custom hook is only used and executed when the system was created with a custom provisioning workflow, the following constraint is added to it.

Custom Hooks /  
Delete NetAppClone

Instance

General Parameters Constraints

Constraints (1) i

Name	Operator	Value
Custom clone process name (Static)	=	NetAppClone

Copy Edit Delete

More information about the use of custom hooks can be found in the [SAP LaMa Documentation](#).

## Enable custom provisioning workflow for SAP source system

To enable the custom provisioning workflow for the source system, it must be adapted in the configuration. The **Use Custom Provisioning Process** checkbox with the corresponding custom provisioning definition must be selected.

Working Set: [All] Search: [ ] Go LN1 on sap-linx4

Automation Studio Configuration Infrastructure

Pools Systems Hosts Characteristics

Overview of Systems and Instances

Discover Remove Instance and System Reassign Instances Mass Configuration Filtering Export Import

Name	Managed	AC-Enabled	Operational	Pool	Network	Description
HN9: NetWeaver ABAP 7.77_cshn9	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	MUCCBC		
• System database: MASTER (configured): H09, SAP HANA 02, dbh09	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	MUCCBC	MUCCBC-SAP-Front	
• Central services: 01_cshn9	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	MUCCBC	MUCCBC-SAP-Front	
• AS instance: 00_pahn9	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	MUCCBC	MUCCBC-SAP-Front	
▶ HNA: NetWeaver ABAP 7.77_cshn9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MUCCBC		

Systems: 2 Selected: HN9: NetWeaver ABAP 7.77\_cshn9

System Details Log

Edit

General  
System Name: HN9: NetWeaver ABAP 7.77\_cshn9  
SID: HN9  
Instance ID: SystemID.HN9.SystemHost.cshn9

Solution Manager settings  
Assign Solution Manager System:

Focused Run Settings  
Assign Focused Run System:  
Disable Workmode Management:

System and AS Provisioning  
This system was provided by:  
This system can be used for:

Installation	
<input checked="" type="checkbox"/> Cloning	<input type="checkbox"/> Application Server (Un-)Installation
<input type="checkbox"/> Copying	<input type="checkbox"/> Diagnostic Agent (Un-)Installation
<input type="checkbox"/> Renaming	<input type="checkbox"/> z/OS Java
<input type="checkbox"/> Standalone PCA	<input type="checkbox"/> Replication Configuration

Use Custom Provisioning Process:  NetAppClone

Intersystem Dependencies  
From Instance To Instance  
•  Outgoing (0)  
•  Incoming (0)

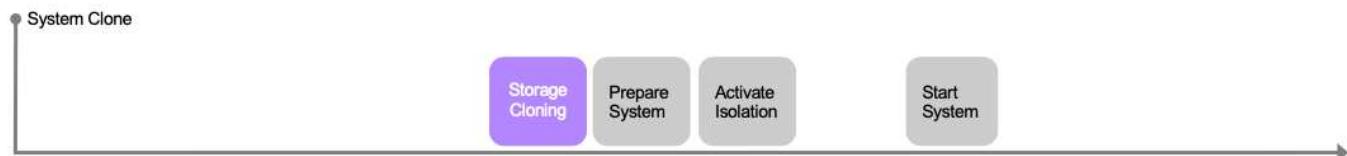
Entity Relations  
Custom Relation Type Target Entity Type Target Entity  
Table is empty

E-Mail Notification  
Enable Email Notification:

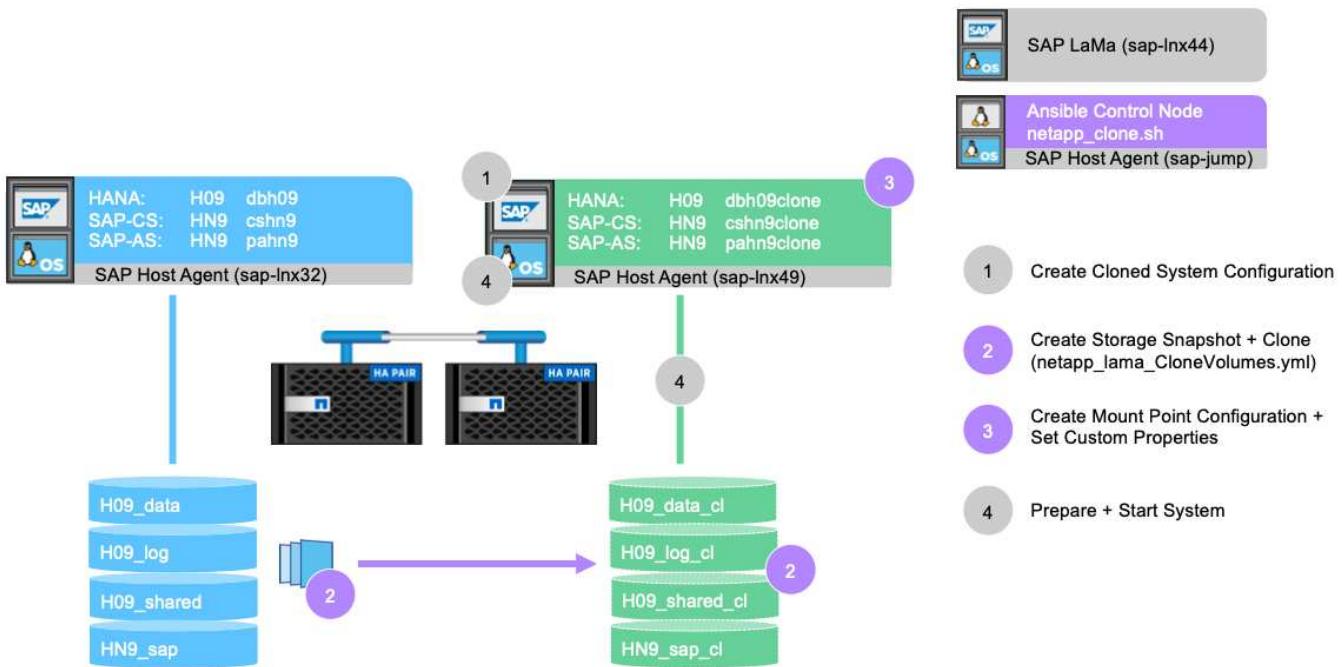
Custom Notification  
Enable Custom Notification:   
ACM Settings  
ACM Managed:

## SAP LaMa provisioning workflow - clone system

The following figure highlights the main steps executed with the system clone workflow.



In this section, we go through the complete SAP LaMa system cloning workflow based on the source SAP system HN9 with HANA database H09. The following picture gives an overview of the steps executed during the workflow.



1. To start the cloning workflow, open **Provisioning** in the menu tree and select the source system (in our example HN9). Then start the **Clone System** wizard.

The screenshot shows the SAP Landscape Management interface under the 'Provisioning' section. The 'Systems' tab is selected, displaying a list of systems. The source system, HN9, is listed with its instances: SAP HANA 02, dbh09; SAP HANA 01, cshn9; SAP Central services (ABAP); 01, cshn9; and HN9 AS instance (ABAP); 00, pahn9. The 'Provisioning' column for HN9 is highlighted, indicating it is selected for cloning. The interface includes a search bar, filter options, and a toolbar at the top.

2. Enter the requested values. Screen 1 of the wizard asks for the pool name for the cloned system. This step specifies the instances (virtual or physical) on which the cloned system will be started. The default is to clone the system into the same pool as the target system.

SAP Landscape Management

Clone System [i]

HN9: NetWeaver ABAP 7.77, cshn9

Basic Hosts Host Names Custom Clone Consistency Revert To DB Snapshot Isolation Summary

Provide Basic Data for Target System

\*Pool: MUCCBC

\*Short Name: clone

Description: Clone of System 'HN9'

Ignore Warnings for This Step Validate Step Reset Step < Previous Next > Finish Execute Cancel

3. Screen 2 of the wizard asks for the target hosts that the new SAP instances are started on. The target hosts for this instance(s) can be selected out of the host pool specified in the previous screen. Each instance or service can be started on a different host. In our example, all three services run on the same host.

SAP Landscape Management

Clone System [i]

HN9: NetWeaver ABAP 7.77, cshn9

Basic Hosts Host Names Custom Clone Consistency Revert To DB Snapshot Isolation Summary

Host Selection of Target System

Instance	Target Host/Virtual Host
System database: MASTER (configured) : SAP HANA 02	sap-inx49
AS instance: 00	sap-inx49
Central services: 01	sap-inx49

Provisioned/Cloned Virtual Hosts

Target Virtual Host	Source Virtual Host
No data	

Add

Ignore Warnings for This Step Validate Step Reset Step < Previous Next > Finish Execute Cancel

4. Provide the information requested in screen 3, which asks for virtual host names and networks. Typically, the host names are maintained in DNS, so the IP addresses are prepopulated accordingly.

SAP Landscape Management

Clone System HNB: NetWeaver ABAP 7.77, cshn9

Basic >> Hosts >> **Host Names** >> Custom Clone >> Consistency >> Revert To DB Snapshot >> Isolation >> Summary

Virtual Host Names and Networks

Host Name	Auto IP Address	IP Address	Target Network	Instance/Virtual Host	Host Name Usage	Add
dbh09clone.muccbc.hq.netap...	<input type="checkbox"/>	172.30.15.157	MUCCBC-SAP-Front	System database: MASTER (co...	Communication Host Name	<input type="checkbox"/>
pahn9clone.muccbc.hq.netap...	<input type="checkbox"/>	172.30.15.159	MUCCBC-SAP-Front	AS instance: 00	Communication Host Name	<input type="checkbox"/>
cshn9clone.muccbc.hq.netap...	<input type="checkbox"/>	172.30.15.158	MUCCBC-SAP-Front	Central services: 01	Communication Host Name	<input type="checkbox"/>

Ignore Warnings for This Step Validate Step Reset Step < Previous Next > Finish Execute Cancel

5. In screen 4, the custom clone operations are listed. A clone and a **SnapPostfix** name are provided, which are used during the storage clone operation for the FlexClone volume and Snapshot name, respectively. If you leave these fields empty, the default value configured in the variable section of the provider script `netapp_clone.sh` is used.

SAP Landscape Management

Clone System HNB: NetWeaver ABAP 7.77, cshn9

Basic >> Hosts >> Host Names >> **Custom Clone** >> Consistency >> Revert To DB Snapshot >> Isolation >> Summary

Custom Clone

Operation	Hook	Selected Instances
Clone Volumes	Clone Volumes	Central services (ABAP): 01, cshn9, AS instance (ABAP): 00, pahn9, System database (ABAP): MASTER : H09, SAP HANA 02, dbh09
Finalize Clone Volumes	Modify Mountpoints and add Custom Properties	Central services (ABAP): 01, cshn9, AS instance (ABAP): 00, pahn9, System database (ABAP): MASTER : HN9, SAP HANA 02, dbh09

Operation Parameters

Show All Parameters
ClonePostFix: <code>_clone_20221115</code>
SnapPostFix: <code>_snap_20221115</code>

Ignore Warnings for This Step Validate Step Reset Step < Previous Next > Finish Execute Cancel

6. In screen 5, the database consistency option is selected. In our example, we selected **Online: Clone running DB**.

SAP Landscape Management - Clone System

HN9: NetWeaver ABAP 7.77, cshn9

Basic Hosts Host Names Custom Clone Consistency Revert To DB Snapshot Isolation Summary

Database Consistency

- No Consistency
- Online: Clone Running DB
- Online: Backup/Suspend IO Mode
- Offline: Stop and Restart System
- Offline: Database already stopped
- Database was stopped during system snapshot

Scheduled Execution of Cloning Step

Schedule execution of cloning step

Ignore Warnings for This Step Validate Step Reset Step < Previous Next > Finish Execute Cancel

7. In screen 6, input is only required if you perform a tenant clone.

SAP Landscape Management - Clone System

HN9: NetWeaver ABAP 7.77, cshn9

Basic Hosts Host Names Custom Clone Consistency Revert To DB Snapshot Isolation Summary

This step is required only for HANA single tenant database clone, using a database snapshot. For any other scenarios you can proceed without entering any credentials.

Provide Username and Password

Source SystemDB Administrator User

Source SystemDB Administrator Password

Ignore Warnings for This Step Validate Step Reset Step < Previous Next > Finish Execute Cancel

8. In screen 7, system isolation can be configured.

Clone System HN9: NetWeaver ABAP 7.77, cshn9

Basic >> Hosts >> Host Names >> Custom Clone >> Consistency >> Revert To DB Snapshot >> Isolation >> Summary

Define Allowed Outgoing Connections for System Isolation

Rule Type	Target Host	Target Port	Predefined	Explanation
Host	localhost	Any port	<input checked="" type="checkbox"/>	<input type="checkbox"/> Allow communication to host (localhost) on all ports
Port	Any host name	nfs	<input checked="" type="checkbox"/>	<input type="checkbox"/> Allow communication to all hosts on port/service (nfs)
Port	Any host name	ldap	<input checked="" type="checkbox"/>	<input type="checkbox"/> Allow communication to all hosts on port/service (ldap)
Port	Any host name	idaps	<input checked="" type="checkbox"/>	<input type="checkbox"/> Allow communication to all hosts on port/service (idaps)
Port	Any host name	cifs	<input checked="" type="checkbox"/>	<input type="checkbox"/> Allow communication to all hosts on port/service (cifs)
Port	Any host name	microsoft-ds	<input checked="" type="checkbox"/>	<input type="checkbox"/> Allow communication to all hosts on port/service (microsoft-ds)

Read Connections Of: Source Host Host Name: sap-lnx49 Get Connections Add

Ignore Warnings for This Step Validate Step Reset Step < Previous Next > Finish Execute Cancel

9. In screen 8, a summary page contains all the settings for final confirmation before the workflow is started. Click **Execute** to start the workflow.

Clone System HN9: NetWeaver ABAP 7.77, cshn9

Basic >> Hosts >> Host Names >> Custom Clone >> Consistency >> Revert To DB Snapshot >> Isolation >> Summary

Host Names

Virtual Host Names and Networks

Host Name	Auto IP Address	IP Address	Target Network	Instance/Virtual Host	Host Name Usage
dbh09clone.muccbc.hq.netapp.com	<input type="checkbox"/>	172.30.15.157	MUCCBC-SAP-Front	System database: MASTER (config...)	Communication Host Name
pahn9clone.muccbc.hq.netapp.com	<input type="checkbox"/>	172.30.15.159	MUCCBC-SAP-Front	AS instance: 00	Communication Host Name
cshn9clone.muccbc.hq.netapp.com	<input type="checkbox"/>	172.30.15.158	MUCCBC-SAP-Front	Central services: 01	Communication Host Name

Custom Clone

Custom Clone

Operation	Hook	Selected Instances
Clone Volumes	Clone Volumes	Central services (ABAP): 01, cshn9, AS instance (ABAP): 00, pahn9, System database (ABAP): MASTER : H09, SAP HANA 02, dbh09
Finalize Clone Volumes	Modify Mountpoints and add Custom Properties	Central services (ABAP): 01, cshn9, AS instance (ABAP): 00, pahn9, System database (ABAP): MASTER : HN9, SAP HANA 02, dbh09

Operation Parameters

ClonePostFix: \_clone\_20221115  
SnapPostFix: \_snap\_20221115

Show All Parameters

Ignore Warnings for This Step Validate Step Reset Step < Previous Next > Finish Execute Cancel

SAP LaMa now performs all the actions indicated in the configuration. These actions include creating the storage volume clones and exports, mounting them to the target host, adding the firewall rules for isolation, and starting the HANA database and SAP services.

10. You can monitor the progress of the clone workflow under the **Monitoring** menu.

The screenshot shows the SAP Landscape Management interface. On the left, there's a navigation sidebar with sections like Overview, Operations, Provisioning, Automation Studio, UI Customizations, and Monitoring. The Monitoring section is currently selected. In the main area, a 'New view' dialog is open for an activity named 'System Clone' with activity number 1854. The progress bar indicates 0%. There are tabs for Activities (1) and Steps (1). The Step details show a single step named 'String'.

Within the detailed log, the operations **Clone Volume** and **Modify Mountpoints and add Custom Properties** are executed at the Ansible node, the `sap-jump` host. These steps are executed for each service, the HANA database, the SAP central services, and the SAP AS service.

This screenshot shows the detailed log for the 'System Clone' activity (Activity Number 1854). The 'Steps' tab is selected, displaying 29 steps. The steps include various operations such as 'Create Target System', 'Clone Volumes', 'Prepare DB copy', 'Finalize Source DB', 'Clone Volumes', 'Clear Local Cache', and several 'Modify Mountpoints and add Custom Properties' steps. Each step provides details like the operation name, ID, next/previous steps, hook for ID, instance/virtual element, host/parent virtual element, step time, and duration. The 'Clone Volumes' steps are specifically highlighted, showing they are executed for each HANA database volume, data, log, and shared.

- By selecting the **Clone Volumes** task the detailed log for that step is displayed and the execution of the Ansible Playbook is shown here. You can see, that the Ansible playbook `netapp_lama_CloneVolumes.yml` is executed for each HANA database volume, data, log, and shared.

The screenshot shows the SAP Landscape Management interface. On the left, the navigation bar includes 'Overview', 'Dashboard', 'Visualization', 'SAP Database Administration', 'Search', 'Operations', 'Provisioning', 'Automation Studio', 'Provider Definitions', 'Custom Operations', 'Custom Hooks', 'Custom Notifications', 'Custom Provisioning', 'Provisioning Blueprints', 'Custom Processes', 'UI Customizations', and 'Monitoring'. The 'Monitoring' section is currently selected.

In the center, the 'System Clone' activity details are displayed. The 'Steps' tab is selected, showing the following steps:

- Step 7: Prepare DB copy (ID: 4)
- Step 8: Finalize Source DB (ID: 5)
- Step 9: Clone Volumes (ID: 6)
- Step 10: Clear Local Cache (ID: 7)
- Step 11: Modify Mountpoints and add Custom Properties (ID: 8)
- Step 12: Modify Mountpoints and add Custom Properties (ID: 9)
- Step 13: Clear Local Cache (ID: 10)

The 'Activities (1)' section shows a single entry: 'System Clone' (Activity Number: 1854, Progress: 4%).

On the right, the 'Clone Volumes' log is shown, with several messages highlighted in red:

- ID: 39 | Message Code: OSP-0200 | Operation succeeded
- ID: 56 | Message Code: HALOG | No valid sapacext found. Request will be handled by sapacosprep. See log for further details
- ID: 57 | Message Code: FWD-0003 | No valid sapacext found. Request will be handled by sapacosprep. See log for further details
- ID: 58 | Message Code: TMP-1001 | Temp File /tmp/VM/sapling9MDYH removed
- ID: 59 | Message Code: OSP-0200 | Operation succeeded
- ID: 60 | Message Code: LVM | Download logfile /usr/sap/hostctrl/work/ASUI.log from host sap-jump
- ID: 61 | Message Code: NetApp Clone for Custom Provis | Running ansible playbook netapp\_1ama\_CloneVolumes.yml on Volume H09\_shared
- ID: 62 | Message Code: NetApp Clone for Custom Provis | Running ansible playbook netapp\_1ama\_CloneVolumes.yml on Volume H09\_log
- ID: 63 | Message Code: NetApp Clone for Custom Provis | Running ansible playbook netapp\_1ama\_CloneVolumes.yml on Volume H09\_data
- ID: 64 | Message Code: NetApp Clone for Custom Provis | Running ansible playbook netapp\_1ama\_CloneVolumes.yml on Volume H09\_data
- ID: 65 | Message Code: NetApp Clone for Custom Provis | Saving mount config...
- ID: 66 | Message Code: NetApp Clone for Custom Provis | netapp\_clone.sh --HookOperationName=CloneVolumes --SAPSYSTEMNAME=H09 --SAPSYSTEM=02 -- MOUNT\_XML\_PATH=/tmp/VM/sapling9MDYH --PARAM\_ClonePostFix=\_clone\_20221115 -- PARAM\_SnapPostFix=\_snap\_20221115 --PROP\_ClonePostFix= --PROP\_SnapPostFix= --SAP\_LVM\_SRC\_SID=H09 --SAP\_LVM\_TARGET\_SID=H09
- ID: 67 | Message Code: NetApp Clone for Custom Provis | Running Script netapp\_clone.sh Version 0.9
- ID: 68 | Message Code: NetApp Clone for Custom Provis | Got new property SnapPostFix=\_snap\_20221115
- ID: 69 | Message Code: NetApp Clone for Custom Provis | Got new property ClonePostFix=\_clone\_20221115
- ID: 70 | Message Code: NetApp Clone for Custom Provis | netapp\_clone.sh --HookOperationName=FinalizeCloneVolumes --SAPSYSTEMNAME=H09 --SAPSYSTEM=01 -- MOUNT\_XML\_PATH=/tmp/VM/sapling9MDYH --PARAM\_ClonePostFix=\_snap\_20221115 --PROP\_ClonePostFix= --PROP\_SnapPostFix= --SAP\_LVM\_SRC\_SID=H09 --SAP\_LVM\_TARGET\_SID=H09
- ID: 71 | Message Code: NetApp Clone for Custom Provis | Running Script netapp\_clone.sh Version 0.9
- ID: 72 | Message Code: LVM | Retrieved the following parameters from hostagent [name: ClonePostFix, is a CustomProperty, name: ClonePostFix, is a CustomParameter, name: SnapPostFix, is a CustomProperty, name: MOUNT\_XML\_PATH, name: SAPSYSTEMNAME, name: HookOperationName, name: SnapPostFix, is a CustomParameter, name: SAP\_LVM\_SRC\_SID, name: SAP\_LVM\_TARGET\_SID, name: SAP\_SYSTEM]
- ID: 73 | Message Code: LVM | Generic Transferred Parameters: CustomOpId: w0c689cc-6017-11ed-c90e-00000007e967' HookOperationName: 'FinalizeCloneVolumes'
- ID: 74 | Message Code: LVM | Previous Service ID: SystemID:H09.Number:01.InstanceHost:cshn9done.muccbc.hq.netapp.com'
- ID: 75 | Message Code: LVM | ServiceId: 'SystemID:H09.Number:01.InstanceHost:cshn9done.muccbc.hq.netapp.com'
- ID: 76 | Message Code: LVM | srcServiceId: 'SystemID:H09.Number:01.InstanceHost:cshn9'

12. In the details view of the step **Modify Mountpoints and add Custom Properties**, you can find information about the mount points and the custom properties handed over by the execution script.

The screenshot shows the SAP Landscape Management interface, similar to the previous one but with different log entries.

The 'System Clone' activity details show the same steps and progress as before.

The 'Modify Mountpoints and add Custom Properties' log is shown, with several messages highlighted in red:

- ID: 40 | Message Code: LVM | Updates Persisted
- ID: 41 | Message Code: LVM | netapp\_clone.sh --HookOperationName=CloneVolumes --SAPSYSTEMNAME=H09 --SAPSYSTEM=02 -- MOUNT\_XML\_PATH=/tmp/VM/sapling9MDYH --PARAM\_ClonePostFix=\_clone\_20221115 -- PARAM\_SnapPostFix=\_snap\_20221115 --PROP\_ClonePostFix= --PROP\_SnapPostFix= --SAP\_LVM\_SRC\_SID=H09 --SAP\_LVM\_TARGET\_SID=H09
- ID: 42 | Message Code: NetApp Clone for Custom Provis | Running Script netapp\_clone.sh Version 0.9
- ID: 43 | Message Code: NetApp Clone for Custom Provis | Got new property SnapPostFix=\_snap\_20221115
- ID: 44 | Message Code: NetApp Clone for Custom Provis | Got new property ClonePostFix=\_clone\_20221115
- ID: 45 | Message Code: NetApp Clone for Custom Provis | netapp\_clone.sh --HookOperationName=FinalizeCloneVolumes --SAPSYSTEMNAME=H09 --SAPSYSTEM=01 -- MOUNT\_XML\_PATH=/tmp/VM/sapling9MDYH --PARAM\_ClonePostFix=\_snap\_20221115 --PROP\_ClonePostFix= --PROP\_SnapPostFix= --SAP\_LVM\_SRC\_SID=H09 --SAP\_LVM\_TARGET\_SID=H09
- ID: 46 | Message Code: NetApp Clone for Custom Provis | Running Script netapp\_clone.sh Version 0.9
- ID: 47 | Message Code: LVM | Retrieved the following parameters from hostagent [name: ClonePostFix, is a CustomProperty, name: ClonePostFix, is a CustomParameter, name: SnapPostFix, is a CustomProperty, name: MOUNT\_XML\_PATH, name: SAPSYSTEMNAME, name: HookOperationName, name: SnapPostFix, is a CustomParameter, name: SAP\_LVM\_SRC\_SID, name: SAP\_LVM\_TARGET\_SID, name: SAP\_SYSTEM]
- ID: 48 | Message Code: LVM | Generic Transferred Parameters: CustomOpId: w0c689cc-6017-11ed-c90e-00000007e967' HookOperationName: 'FinalizeCloneVolumes'
- ID: 49 | Message Code: LVM | Previous Service ID: SystemID:H09.Number:01.InstanceHost:cshn9done.muccbc.hq.netapp.com'
- ID: 50 | Message Code: LVM | ServiceId: 'SystemID:H09.Number:01.InstanceHost:cshn9done.muccbc.hq.netapp.com'
- ID: 51 | Message Code: LVM | srcServiceId: 'SystemID:H09.Number:01.InstanceHost:cshn9'

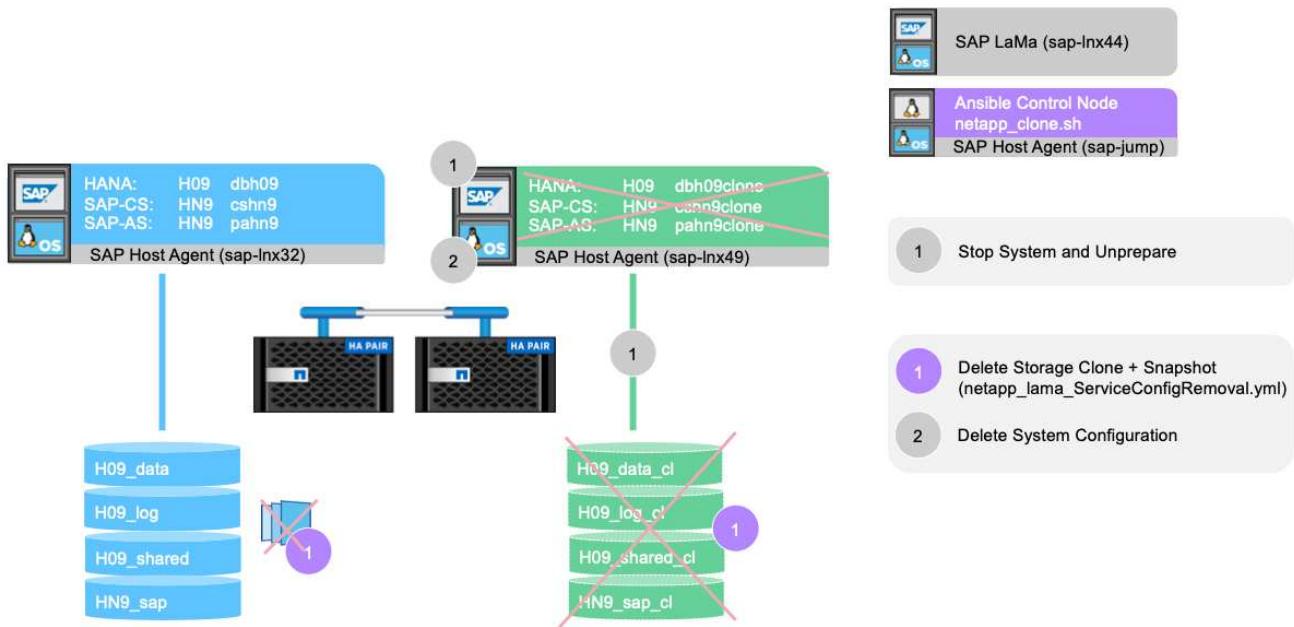
After the workflow has been completed, the cloned SAP system is prepared, started, and ready for use.

# SAP LaMa deprovisioning workflow - system destroy

The following figure highlights the main steps executed with the system destroy workflow.



1. To decommission a cloned system, it must be stopped and prepared in advance. Afterwards the system destroy workflow can be started.



2. In this example, we run the system destroy workflow for the system created before. We select the system in the **System View** screen and start the system destroy workflow under **Destroy Processes**.
3. All the mount points maintained during the provisioning phase are shown here and are deleted during the system destroy workflow process.

SAP Landscape Management

### Destroy System !!

HN9: NetWeaver ABAP 7.77, dbh09clone.muccbc.hq.netapp.com

[Show Source Data](#) [Create Provisioning Blueprint](#) [Remote Execution](#)

[Delete Storage Volumes](#) [Delete Host Names](#) [Summary](#)

**Storage Volumes**

Delete	Volume	Storage Manager	Storage System	Storage Pool	Volume Group	Latest Monitoring Time
No data						

**Mount Data Without Corresponding Storage Volume**

Instance	Storage Type	Export Path	Mount Point	Mount Options
AS instance: 00	NETFS	192.168.10.14:/HN9_sap_clone_20221115/hn9...	/home/hn9adm	rw,noatime,vers=3,rsize=65536,wsize=65536,na...
AS instance: 00	NETFS	192.168.10.14:/HN9_sap_clone_20221115/sapmnt	/sapmnt/HN9	rw,noatime,vers=3,rsize=65536,wsize=65536,na...
AS instance: 00	NETFS	192.168.10.14:/HN9_sap_clone_20221115/HN9	/usr/sap/HN9	rw,noatime,vers=3,rsize=65536,wsize=65536,na...
AS instance: 00	NETFS	192.168.10.14:/HN9_sap_clone_20221115/ccms	/usr/sap/ccms/HN9_00	rw,noatime,vers=3,rsize=65536,wsize=65536,na...
AS instance: 00	NETFS	192.168.10.14:/HN9_sap_clone_20221115/saptr...	/usr/sap/trans	rw,noatime,vers=3,rsize=65536,wsize=65536,na...
System database: MASTER : H09, SAP HANA 02	NETFS	192.168.10.14:/H09_data_clone_20221115/data	/hana/data/H09	rw,noatime,vers=3,rsize=65536,wsize=65536,na...
System database: MASTER : H09, SAP HANA 02	NETFS	192.168.10.14:/H09_log_clone_20221115/log	/hana/log/H09	rw,noatime,vers=3,rsize=65536,wsize=65536,na...
System database: MASTER : H09, SAP HANA 02	NETFS	192.168.10.14:/H09_shared_clone_20221115/sh...	/hana/shared/H09	rw,noatime,vers=3,rsize=65536,wsize=65536,na...
Central services: 01	NETFS	192.168.10.14:/HN9_sap_clone_20221115/hn9a...	/home/hn9adm	rw,noatime,vers=3,rsize=65536,wsize=65536,na...
Central services: 01	NETFS	192.168.10.14:/HN9_sap_clone_20221115/sapmnt	/sapmnt/HN9	rw,noatime,vers=3,rsize=65536,wsize=65536,na...
Central services: 01	NETFS	192.168.10.14:/HN9_sap_clone_20221115/HN9	/usr/sap/HN9	rw,noatime,vers=3,rsize=65536,wsize=65536,na...
Central services: 01	NETFS	192.168.10.14:/HN9_sap_clone_20221115/ccms	/usr/sap/ccms/HN9_00	rw,noatime,vers=3,rsize=65536,wsize=65536,na...
Central services: 01	NETFS	192.168.10.14:/HN9_sap_clone_20221115/saptr...	/usr/sap/trans	rw,noatime,vers=3,rsize=65536,wsize=65536,na...

Monitoring Time:  Monitoring Data:

[Ignore Warnings for This Step](#) [Validate Step](#) [Reset Step](#) [Next >](#) [Finish](#) [Execute](#) [Cancel](#)

No virtual hostnames are deleted because they are maintained through DNS and have been assigned automatically.

SAP Landscape Management

### Destroy System !!

HN9: NetWeaver ABAP 7.77, dbh09clone.muccbc.hq.netapp.com

[Show Source Data](#) [Create Provisioning Blueprint](#) [Remote Execution](#)

[Delete Storage Volumes](#) [Delete Host Names](#) [Summary](#)

**Host Names**

Delete	DNS Server	Host Name	IP Address
No data			

[Ignore Warnings for This Step](#) [Validate Step](#) [Reset Step](#) [Previous](#) [Next >](#) [Finish](#) [Execute](#) [Cancel](#)

- The operation is started by clicking the execute button.

Destroy System [ ]

HN9: NetWeaver ABAP 7.77, dbh09clone.muccbc.hq.netapp.com

Show Source Data Create Provisioning Blueprint Remote Execution

Delete Storage Volumes >> Delete Host Names >> Summary

[ ] SAP advises that it is the customer's responsibility to ensure that no data is lost when the selected volumes/virtual hosts are deleted by SAP Landscape Management.

▼ Delete Storage Volumes

**Storage Volumes**

Delete	Volume	Storage Manager	Storage System	Storage Pool	Volume Group	Latest Monitoring Time
No data						

**Mount Data Without Corresponding Storage Volume**

Instance	Storage Type	Export Path	Mount Point	Mount Options
AS instance: 00	NETFS	192.168.10.14:/HN9_sap_clone_20221115/hn9...	/home/hn9adm	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...
AS instance: 00	NETFS	192.168.10.14:/HN9_sap_clone_20221115/sap...	/sapmnt/HN9	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...
AS instance: 00	NETFS	192.168.10.14:/HN9_sap_clone_20221115/HN9	/usr/sap/HN9	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...
AS instance: 00	NETFS	192.168.10.14:/HN9_sap_clone_20221115/ccms	/usr/sap/ccms/HN9_00	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...
AS instance: 00	NETFS	192.168.10.14:/HN9_sap_clone_20221115/sapt...	/usr/sap/trans	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...
System database: MASTER : H09, SAP HANA 02	NETFS	192.168.10.14:/H09_data_clone_20221115/data	/hana/data/H09	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...
System database: MASTER : H09, SAP HANA 02	NETFS	192.168.10.14:/H09_log_clone_20221115/log	/hana/log/H09	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...
System database: MASTER : H09, SAP HANA 02	NETFS	192.168.10.14:/H09_shared_clone_20221115/s...	/hana/shared/H09	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...
Central services: 01	NETFS	192.168.10.14:/HN9_sap_clone_20221115/hn9...	/home/hn9adm	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...
Central services: 01	NETFS	192.168.10.14:/HN9_sap_clone_20221115/sap...	/sapmnt/HN9	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...
Central services: 01	NETFS	192.168.10.14:/HN9_sap_clone_20221115/HN9	/usr/sap/HN9	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...
Central services: 01	NETFS	192.168.10.14:/HN9_sap_clone_20221115/ccms	/usr/sap/ccms/HN9_00	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...
Central services: 01	NETFS	192.168.10.14:/HN9_sap_clone_20221115/sapt...	/usr/sap/trans	rw,noatime,vers=3,rsize=65536,wsIZE=65536,n...

Monitoring Time:  Monitoring Data:

[ ] 0 Ignore Warnings for This Step Validate Step Reset Step < Previous Next > Finish Execute Cancel

SAP LaMa now performs the deletion of the volume clones and deletes the configuration of the cloned system.

## 5. You can monitor the progress of the clone workflow under the **Monitoring** menu.

**New view \* [ ]**

Latest Server Time: 2022-11-15 17:52:54 (CET)

**Mass Actions [ ] \*\*\***

**Support Information [ ] X**

**System destroy**  
Activity | Activity Number 1861

**General Steps**

**Steps (4)**

Operation	ID	Next	Previous	Hook for ID	Instance/Virtual Element	Host/Parent Virtual Element	Step Time	Duration
Delete NetAppClone	1	2, 3, 4		4	HN9 Central services (ABAP): 01, cshn9clone.muccbc.hq.netapp.com	sap-jump	0:00	0:11 >
Delete NetAppClone	2	3, 4	1	4	HN9 AS instance (ABAP): 00, pahn9clone.muccbc.hq.netapp.com	sap-jump		>
Delete NetAppClone	3	4	1, 2	4	HN9 System database (ABAP): MASTER : SAP HANA 02, dbh09clone.muccbc.hq.netapp.com	sap-jump		>
Remove Instance	4		1, 2, 3		HN9: NetWeaver ABAP 7.77, dbh09clone.muccbc.hq.netapp.com			>

6. By selecting the **Delete NetAppClone** task, the detailed log for that step is displayed. The execution of the Ansible Playbook is shown here. As you can see, the Ansible playbook `netapp_lama_ServiceConfigRemoval.yml` is executed for each HANA database volume, data, log, and shared.

The screenshot shows the SAP Landscape Management interface. On the left, the navigation tree is expanded under 'Activities'. In the center, a 'System destroy' step is selected, showing its configuration and history. The 'Logs' tab is active, displaying a list of 19 messages. A red box highlights a DEBUG message at ID 39, which reads:

```

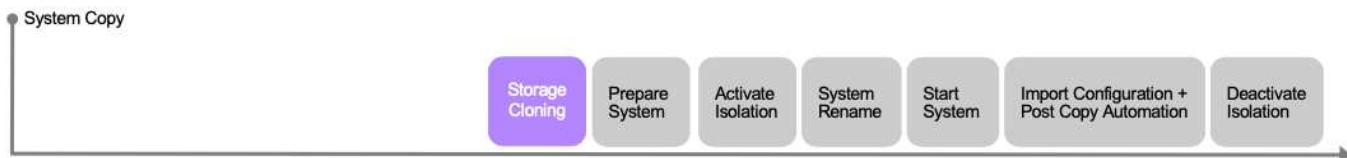
DEBUG | ID: 39 | Message Code: NetApp Clone for Custom Provis
Time: 2022-11-15 17:56:23 | Entry Time: 0:14
Running ansible playbook netapp_lama_ServiceConfigRemoval.yml on Volume H09_shared

```

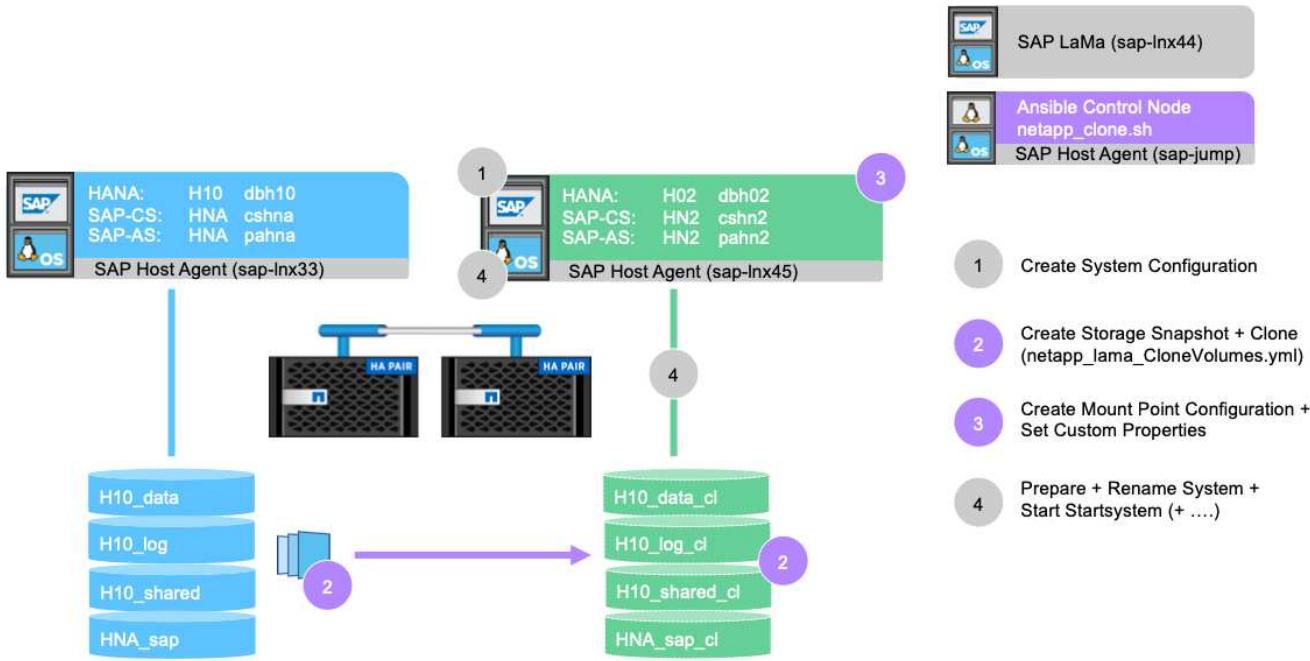
This message is part of a larger sequence of logs related to the removal of a NetApp clone.

## SAP LaMa provisioning workflow - copy system

The following figure highlights the primary steps executed with the system copy workflow.



In this chapter, we briefly discuss the differences for the system clone workflow and input screens. As you can see in the following image, nothing changes in the storage workflow.



1. The system copy workflow can be started when the system is prepared accordingly. This is not a specific task for this configuration, and we do not explain it in detail. If you need further information, review the SAP LaMa documentation.

The screenshot shows the SAP Landscape Management interface under the 'Provisioning Systems View' section. The 'Systems' table lists two systems: HN9: NetWeaver ABAP 7.77, cshn9 and HNA: NetWeaver ABAP 7.77, cshna. In the top right corner of the table, there is a context menu with several options. The 'Copy System' option is highlighted with a red rectangle.

2. During the copy workflow, the system is renamed, as must be specified in the first screen.

The screenshot shows the SAP Landscape Management interface for copying a system. The left sidebar has 'Copy System' selected under 'Basic'. The main area is titled 'Provide Basic Data for Target System'. It contains fields for 'System ID' (HN2), 'Pool' (MUCCBC), 'Description' ('Copy of System HNA'), and 'HANA SID' (H02). Below these are sections for 'Set Master Password for OS and DB Users' with 'Password' and 'Confirm Password' fields. At the bottom are buttons for 'Ignore Warnings for This Step', 'Validate Step', 'Reset Step', and navigation links like '< Previous', 'Next >', 'Finish', 'Execute', and 'Cancel'.

### 3. During the workflow, you can change the instance numbers.

The screenshot shows the SAP Landscape Management interface for copying a system. The left sidebar has 'Copy System' selected under 'Basic'. The main area is titled 'SAP Instance Numbers'. It contains fields for 'System database: MASTER (configured) : SAP HANA 02', 'AS instance: 00', and 'Central services: 01'. At the bottom are buttons for 'Ignore Warnings for This Step', 'Validate Step', 'Reset Step', and navigation links like '< Previous', 'Next >', 'Finish', 'Execute', and 'Cancel'.



Changing instance numbers has not been tested and might require changes in the provider script.

### 4. As described, the **Custom Clone** screen does not differ from the cloning workflow, as is shown here.

SAP Landscape Management

**Copy System**

HNA: NetWeaver ABAP 7.77, cshna

Basic Hosts Host Names Instance Number Custom Clone Consistency Users Rename Isolation ABAP PCA Summary

**Custom Clone**

**Operation** Hook **Selected Instances**

Clone Volumes Clone Volumes System database (ABAP): MASTER : H10, SAP HANA 02, dbh10, Central services (ABAP): 01, cshna, AS instance (ABAP): 00, paha

Post Clone Volumes Modify Mountpoints and add Custom Properties System database (ABAP): MASTER : HN2, SAP HANA 02, dbh10, Central services (ABAP): 01, cshna, AS instance (ABAP): 00, paha

**Operation Parameters**

ClonePostFix String  
SnapPostFix String

Show All Parameters

Ignore Warnings for This Step Validate Step Reset Step < Previous Next > Finish Execute Cancel

5. As we already described, the remaining input masks do not deviate from the standard, and we do not go into them any further here. The final screen shows a summary, and execution can now be started.

SAP Landscape Management

**Copy System**

HNA: NetWeaver ABAP 7.77, cshna

Basic Hosts Host Names Instance Number Custom Clone Consistency Users Rename Isolation ABAP PCA Summary

**Basic**

Provide Basic Data for Target System

\*System ID: HN2 \*Pool: MUCCBC  
 Use different Database Name  
 +HANA SID: H02 Description: Copy of System 'HNA'

Set Master Password for OS and DB Users

\*Password: \*\*\*\*\* \*Confirm Password: \*\*\*\*\*

**Hosts**

Host Selection of Target System

Instance: Target Host/Virtual Host: sap-inx45

System database: MASTER (configured) : SAP HANA 02

Ignore Warnings for This Step Validate Step Reset Step < Previous Next > Finish Execute Cancel

After the copy process, the target instance is not enabled for the custom cloning process.

SAP Landscape Management

Automation Studio Configuration Infrastructure

Pools Systems Hosts Characteristics

Overview of Systems and Instances

Discover Remove Instance and System Reassign Instances Mass Configuration Filtering Export Import

Name	Managed	AC-Enabled	Operational	Pool	Network	Description
HN2 NetWeaver ABAP 7.77, dbh02.muccbc.hq.netapp.com	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MUCCBC		Copy of System 'HNA'
HN9 NetWeaver ABAP 7.77, csh9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MUCCBC		
HNA NetWeaver ABAP 7.77, cshna	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MUCCBC		

Systems: 3 Selected: HN2: NetWeaver ABAP 7.77, dbh02.muccbc.hq.netapp.com

System Details Log

Edit

General

System Name: HN2: NetWeaver ABAP 7.77, dbh02.muccbc.hq.netapp.com  
SID: HN2  
Instance ID: SystemID.HN2.SystemHost.dbh02.muccbc.hq.netapp.com

Solution Manager settings

Assign Solution Manager System:

Focused Run Settings

Assign Focused Run System:  
Disable Workmode Management:

System and AS Provisioning

This system was provided by: Copy  
Source System: HNA: NetWeaver ABAP 7.77, cshna  
This system can be used for:  
Cloning Copying Diagnostic Agent (Un-)Installation Renaming nZDM Java Standalone PCA Replication Configuration

Use Custom Provisioning Process:  
Use as TDMS Control System:  
Is BW Source System:  
Use Replication for Single Tenant Database Refresh:

Network Isolation - Allowed Outgoing Connections  
Enable Network Fencing:

Intersystem Dependencies

From Instance	To Instance
• [o] Outgoing (0)	
• [e] Incoming (0)	

Entity Relations

Custom Relation Type	Target Entity Type	Target Entity
[Table is empty]		

E-Mail Notification  
Enable Email Notification:   
Custom Notification  
Enable Custom Notification:   
ACM Settings  
ACM-Managed:

It must be adopted manually to run the pre-hook step during the system destroy process because a constraint is set and would prevent execution.

SAP Landscape Management

Automation Studio Configuration Infrastructure

Pools Systems Hosts Characteristics

Overview of Systems and Instances

Discover Remove Instance and System Reassign Instances Mass Configuration Filtering Export Import

Name	Managed	AC-Enabled	Operational	Pool	Network	Description
HN2 NetWeaver ABAP 7.77, dbh02.muccbc.hq.netapp.com	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MUCCBC		Copy of System 'HNA'
HN9 NetWeaver ABAP 7.77, csh9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MUCCBC		
HNA NetWeaver ABAP 7.77, cshna	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MUCCBC		

Systems: 3 Selected: HN2: NetWeaver ABAP 7.77, dbh02.muccbc.hq.netapp.com

System Details Log

Edit

General

System Name: HN2: NetWeaver ABAP 7.77, dbh02.muccbc.hq.netapp.com  
SID: HN2  
Instance ID: SystemID.HN2.SystemHost.dbh02.muccbc.hq.netapp.com

Solution Manager settings

Assign Solution Manager System:

Focused Run Settings

Assign Focused Run System:  
Disable Workmode Management:

System and AS Provisioning

This system was provided by: Copy  
Source System: HNA: NetWeaver ABAP 7.77, cshna  
This system can be used for:  
Cloning Copying Diagnostic Agent (Un-)Installation Renaming nZDM Java Standalone PCA Replication Configuration

Use Custom Provisioning Process:  
Use as TDMS Control System:  
Is BW Source System:  
Use Replication for Single Tenant Database Refresh:

Network Isolation - Allowed Outgoing Connections  
Enable Network Fencing:

Intersystem Dependencies

From Instance	To Instance
• [o] Outgoing (0)	
• [e] Incoming (0)	

Entity Relations

Custom Relation Type	Target Entity Type	Target Entity
[Table is empty]		

E-Mail Notification  
Enable Email Notification:   
Custom Notification  
Enable Custom Notification:   
ACM Settings  
ACM-Managed:

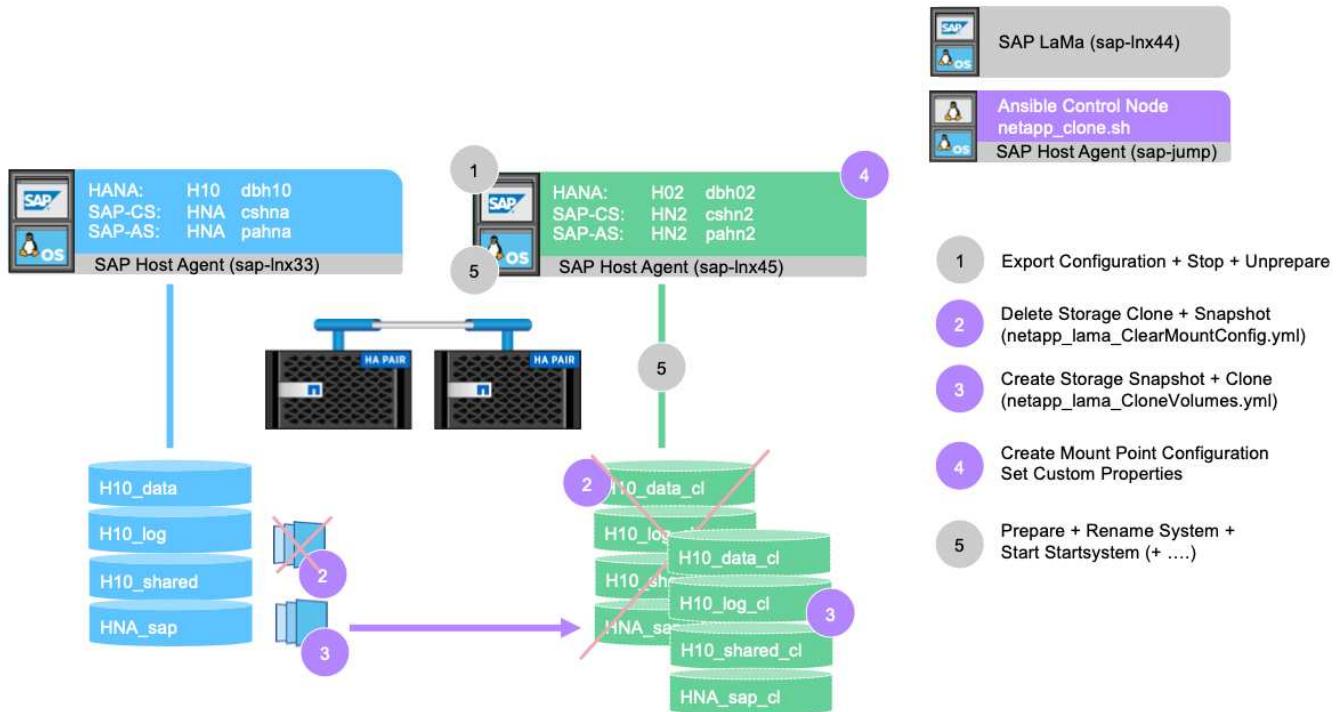
The checkbox 'NetAppClone' is highlighted with a red box.

## SAP LaMa provisioning workflow - system refresh

The following figure highlights the main steps executed with the system refresh workflow.



During the refresh workflow, the storage clone must be deleted. You can use the same Ansible playbook as for the system destroy workflow. However, the custom hook is defined to a different step, so the playbook is named accordingly. The process step for the clone doesn't differ.



The refresh workflow can be triggered through the provisioning screen for a copied system.

The screenshot shows the SAP Landscape Management interface. On the left, there's a navigation sidebar with various tabs like Overview, Systems, Virtualization, Cloud, and several under Operations. The main area is titled "Provisioning Systems View". It lists three systems: "HN2: NetWeaver ABAP 7.77, dbh02.muccbc.hq.netapp.com", "HN9: NetWeaver ABAP 7.77, cshn9", and "HNA: NetWeaver ABAP 7.77, cshna". Each system has columns for Name, Status, Pool, Description, Assigned Host, and Virtualized. A context menu is open for the HNA system, showing options such as "Search", "Destroy Processes", "Refresh Processes", "Manage System Snapshots", and "Restore-Based Refresh".

Again, nothing differs in the input screens from the standard, and the workflow execution can be started from the summary screen.

The screenshot shows the "Refresh System" dialog in SAP Landscape Management. The dialog is divided into sections: "Basic Data of System to Be Refreshed", "Export of System Configuration Data", and "Set Master Password for OS and DB Users". There's also a "Hosts" section for selecting target hosts. At the bottom, there are buttons for "Ignore Warnings for This Step", "Validate Step", "Reset Step", "Previous", "Next", "Finish", "Execute", and "Cancel". A note in the dialog states: "SAP advises that it is the customer's responsibility to ensure that it has all necessary third party license rights required to clone and/or copy an environment using this software, and the customer has obtained and will maintain all such license rights necessary to use the functionality described herein, including, without limitation, the license right to operate the target system landscape after cloning and/or copying."

## Provider script configuration and Ansible playbooks

The following provider configuration file, execution script, and Ansible playbooks are used

during the sample deployment and workflow execution in this documentation.



The example scripts are provided as is and are not supported by NetApp. You can request the current version of the scripts via email to [ng-sapcc@netapp.com](mailto:ng-sapcc@netapp.com).

## Provider configuration file netapp\_clone.conf

The configuration file is created as described in the [SAP LaMa Documentation - Configuring SAP Host Agent Registered Scripts](#). This configuration file must be located on the Ansible control node where the SAP host agent is installed.

The configured os-user `sapuser` must have the appropriate permissions to execute the script and the called Ansible playbooks. You can place the script in a common script directory. SAP LaMa can provide multiple parameters when calling the script.

In addition to the custom parameters, `PARAM_ClonePostFix`, `PROP_ClonePostFix`, `PARAM_ClonePostFix`, and `PROP_ClonePostFix`, many others can be handed over, as is shown in the [SAP LaMa Documentation](#).

```
root@sap-jump:~# cat /usr/sap/hostctrl/exe/operations.d/netapp_clone.conf
Name: netapp_clone
Username: sapuser
Description: NetApp Clone for Custom Provisioning
Command: /usr/sap/scripts/netapp_clone.sh
--HookOperationName=${HookOperationName} --SAPSYSTEMNAME=${SAPSYSTEMNAME}
--SAPSYSTEM=${SAPSYSTEM} --MOUNT_XML_PATH=${MOUNT_XML_PATH}
--PARAM_ClonePostFix=${PARAM-ClonePostFix} --PARAM_SnapPostFix=${PARAM-SnapPostFix}
--PROP_ClonePostFix=${PROP-ClonePostFix}
--PROP_SnapPostFix=${PROP-SnapPostFix}
--SAP_LVM_SRC_SID=${SAP_LVM_SRC_SID}
--SAP_LVM_TARGET_SID=${SAP_LVM_TARGET_SID}
ResultConverter: hook
Platform: Unix
```

## Provider script netapp\_clone.sh

The provider script must be stored in `/usr/sap/scripts` as configured in the provider configuration file.

### Variables

The following variables are hard coded in the script and must be adapted accordingly.

- `PRIMARY_CLUSTER=<hostname of netapp cluster>`
- `PRIMARY_SVM=<SVM name where source system volumes are stored>`

The certificate files `PRIMARY_KEYFILE=/usr/sap/scripts/ansible/certs/ontap.key` and `PRIMARY_CERTFILE=/usr/sap/scripts/ansible/certs/ontap.pem` must be provided as described in [NetApp Ansible modules - Prepare ONTAP](#).



If different clusters or SVMs are required for different SAP systems, these variables can be added as parameters in the SAP LaMa provider definition.

### Function: create inventory file

To make Ansible playbook execution more dynamic, an `inventory.yml` file is created on the fly. Some static values are configured in the variable section and some are dynamically created during execution.

### Function: run Ansible playbook

This function is used to execute the Ansible playbook together with the dynamically created `inventory.yml` file. The naming convention for the playbooks is `netapp_lama_${HookOperationName}.yml`. The values for `${HookOperationName}` is dependent on the LaMa operation and handed over by LaMa as a command line parameter.

### Section Main

This section contains the main execution plan. The variable `${HookOperationName}` contains the name of the LaMa replacement step and is provided by LaMa when the script is called.

- Values with the system clone and system copy provisioning workflow:
  - `CloneVolumes`
  - `PostCloneVolumes`
- Value with the system destroy workflow:
  - `ServiceConfigRemoval`
- Value with the system refresh workflow:
  - `ClearMountConfig`

#### **HookOperationName = CloneVolumes**

With this step, the Ansible playbook is executed, which triggers the Snapshot copy and cloning operation. The volume names and mount configuration are handed over by SAP LaMa through an XML file defined in the variable `$MOUNT_XML_PATH`. This file is saved because it is used later in the step `FinalizeCloneVolumes` to create the new mount-point configuration. The volume names are extracted from the XML file and the Ansible cloning playbook is executed for each volume.



In this example, the AS instance and the central services share the same volume. Therefore, volume cloning is only executed when the SAP instance number (`$_SAPSYSTEM`) is not 01. This might differ in other environments and must be changed accordingly.

#### **HookOperationName = PostCloneVolumes**

During this step, the custom properties `ClonePostFix` and `SnapPostFix` and the mount point configuration for the target system are maintained.

The custom properties are used later as input when the system is decommissioned during the `ServiceConfigRemoval` or `ClearMountConfig` phase. The system is designed to preserve the settings of the custom parameters that were specified during the system provisioning workflow.

The values used in this example are `ClonePostFix=_clone_20221115` and

SnapPostFix=\_snap\_20221115.

For the volume HN9\_sap, the dynamically created Ansible file includes the following values:

datavolumename: HN9\_sap, snapshotpostfix: \_snap\_20221115, and clonepostfix: \_clone\_20221115.

Which leads into the snapshot name on the volume HN9\_sap HN9\_sap\_snap\_20221115 and the created volume clone name HN9\_sap\_clone\_20221115.



Custom properties could be used in any way to preserve parameters used during the provisioning process.

The mount point configuration is extracted from the XML file that has been handed over by LaMa in the CloneVolume step. The ClonePostFix is added to the volume names and send back to LaMa through the default script output. The functionality is described in [SAP Note 1889590](#).



In this example, qtrees on the storage system are used as a common way to place different data on a single volume. For example, HN9\_sap holds the mount points for /usr/sap/HN9, /sapmnt/HN9, and /home/hn9adm. Subdirectories work in the same way. This might differ in other environments and must be changed accordingly.

## **HookOperationName = ServiceConfigRemoval**

In this step, the Ansible playbook that is responsible for the deletion of the volume clones is running.

The volume names are handed over by SAP LaMa through the mount configuration file, and the custom properties ClonePostFix and SnapPostFix are used to hand over the values of the parameters originally specified during the system provisioning workflow (see the note at HookOperationName = PostCloneVolumes).

The volume names are extracted from the xml file, and the Ansible cloning playbook is executed for each volume.



In this example, the AS instance and the central services share the same volume. Therefore, the volume deletion is only executed when the SAP instance number (\$SAPSYSTEM) is not 01. This might differ in other environments and must be changed accordingly.

## **HookOperationName = ClearMountConfig**

In this step, the Ansible playbook that is responsible for the deletion of the volume clones during a system refresh workflow is running.

The volume names are handed over by SAP LaMa through the mount configuration file, and the custom properties ClonePostFix and SnapPostFix are used to hand over the values of the parameters originally specified during the system provisioning workflow.

The volume names are extracted from the XML file and the Ansible cloning playbook is executed for each volume.



In this example, the AS instance and the central services share the same volume. Therefore, volume deletion is only executed when the SAP instance number (\$SAPSYSTEM) is not 01. This might differ in other environments and must be changed accordingly.

```

root@sap-jump:~# cat /usr/sap/scripts/netapp_clone.sh
#!/bin/bash
#Section - Variables
#####
VERSION="Version 0.9"
#Path for ansible play-books
ANSIBLE_PATH=/usr/sap/scripts/ansible
#Values for Ansible Inventory File
PRIMARY_CLUSTER=grenada
PRIMARY_SVM=svm-sap01
PRIMARY_KEYFILE=/usr/sap/scripts/ansible/certs/ontap.key
PRIMARY_CERTFILE=/usr/sap/scripts/ansible/certs/ontap.pem
#Default Variable if PARAM_ClonePostFix / SnapPostFix is not maintained in
LaMa
DefaultPostFix=_clone_1
#TMP Files - used during execution
YAML_TMP=/tmp/inventory_ansible_clone_tmp_$$ .yml
TMPFILE=/tmp/tmpfile.$$
MY_NAME=`basename $0`
BASE_SCRIPT_DIR=`dirname $0`
#Sendig Script Version and run options to LaMa Log
echo "[DEBUG]: Running Script $MY_NAME $VERSION"
echo "[DEBUG]: $MY_NAME $@"
#Command declared in the netapp_clone.conf Provider definition
#Command: /usr/sap/scripts/netapp_clone.sh
--HookOperationName=${HookOperationName} --SAPSYSTEMNAME=${SAPSYSTEMNAME}
--SAPSYSTEM=${SAPSYSTEM} --MOUNT_XML_PATH=${MOUNT_XML_PATH}
--PARAM_ClonePostFix=${PARAM-ClonePostFix} --PARAM_SnapPostFix=${PARAM-SnapPostFix} --PROP_ClonePostFix=${PROP-ClonePostFix}
--PROP_SnapPostFix=${PROP-SnapPostFix}
--SAP_LVM_SRC_SID=${SAP_LVM_SRC_SID}
--SAP_LVM_TARGET_SID=${SAP_LVM_TARGET_SID}
#Reading Input Variables hand over by LaMa
for i in "$@"
do
case $i in
--HookOperationName=*)
HookOperationName="${i#*=}";shift;;
--SAPSYSTEMNAME=*)
SAPSYSTEMNAME="${i#*=}";shift;;
--SAPSYSTEM=*)
SAPSYSTEM="${i#*=}";shift;;
--MOUNT_XML_PATH=*)
MOUNT_XML_PATH="${i#*=}";shift;;
--PARAM_ClonePostFix=*)

```

```

PARAM_ClonePostFix="${i#*=}";shift;;
--PARAM_SnapPostFix=*)
PARAM_SnapPostFix="${i#*=}";shift;;
--PROP_ClonePostFix=*)
PROP_ClonePostFix="${i#*=}";shift;;
--PROP_SnapPostFix=*)
PROP_SnapPostFix="${i#*=}";shift;;
--SAP_LVM_SRC_SID=*)
SAP_LVM_SRC_SID="${i#*=}";shift;;
--SAP_LVM_TARGET_SID=*)
SAP_LVM_TARGET_SID="${i#*=}";shift;;
*)
# unknown option
;;
esac
done

#If Parameters not provided by the User - defaulting to DefaultPostFix
if [ -z $PARAM_ClonePostFix ]; then PARAM_ClonePostFix=$DefaultPostFix;fi
if [ -z $PARAM_SnapPostFix ]; then PARAM_SnapPostFix=$DefaultPostFix;fi
#Section - Functions
#####
#Function Create (Inventory) YML File
#####
create_yml_file()
{
echo "ontapservers:>$YAML_TMP
echo " hosts:>>$YAML_TMP
echo " ${PRIMARY_CLUSTER}:>>$YAML_TMP
echo "   ansible_host: \"${PRIMARY_CLUSTER}\">>>$YAML_TMP
echo "   keyfile: \"${PRIMARY_KEYFILE}\">>>$YAML_TMP
echo "   certfile: \"${PRIMARY_CERTFILE}\">>>$YAML_TMP
echo "   svmname: \"${PRIMARY_SVM}\">>>$YAML_TMP
echo "   datavolumename: \"${datavolumename}\">>>$YAML_TMP
echo "   snapshotpostfix: \"${snapshotpostfix}\">>>$YAML_TMP
echo "   clonepostfix: \"${clonepostfix}\">>>$YAML_TMP
}
#Function run ansible-playbook
#####
run_ansible_playbook()
{
echo "[DEBUG]: Running ansible playbook
netapp_lama_${HookOperationName}.yml on Volume ${datavolumename}"
ansible-playbook -i ${YAML_TMP}
$ANSIBLE_PATH/netapp_lama_${HookOperationName}.yml
}
#Section - Main

```

```

#####
#HookOperationName - CloneVolumes
#####
if [ $HookOperationName = CloneVolumes ] ;then
#save mount xml for later usage - used in Section FinalizeCloneVolues to
generate the mountpoints
echo "[DEBUG]: saving mount config...."
cp $MOUNT_XML_PATH /tmp/mount_config_${SAPSYSTEMNAME}_${SAPSYSTEM}.xml
#Instance 00 + 01 share the same volumes - clone needs to be done once
if [ $SAPSYSTEM != 01 ]; then
#generating Volume List - assuming usage of qtrees - "IP-
Adress:/VolumeName/qtree"
xmlFile=/tmp/mount_config_${SAPSYSTEMNAME}_${SAPSYSTEM}.xml
if [ -e $TMPFILE ];then rm $TMPFILE;fi
numMounts=`xml_grep --count "/mountconfig/mount" $xmlFile | grep "total: "
| awk '{ print $2 }'`
i=1
while [ $i -le $numMounts ]; do
    xmllint --xpath "/mountconfig/mount[$i]/exportpath/text()" $xmlFile
    |awk -F"/" '{print $2}' >>$TMPFILE
    i=$((i + 1))
done
DATAVOLUMES=`cat $TMPFILE |sort -u`
#Create yml file and rund playbook for each volume
for I in $DATAVOLUMES; do
datavolumename="$I"
snapshotpostfix="$PARAM_SnapPostFix"
clonepostfix="$PARAM_ClonePostFix"
create_yml_file
run_ansible_playbook
done
else
echo "[DEBUG]: Doing nothing .... Volume cloned in different Task"
fi
fi
#####
#HookOperationName - PostCloneVolumes
#####
if [ $HookOperationName = PostCloneVolumes] ;then
#Reporting Properties back to LaMa Config for Cloned System
echo "[RESULT]:Property:ClonePostFix=$PARAM_ClonePostFix"
echo "[RESULT]:Property:SnapPostFix=$PARAM_SnapPostFix"
#Create MountPoint Config for Cloned Instances and report back to LaMa
according to SAP Note: https://launchpad.support.sap.com/#/notes/1889590
echo "MountDataBegin"
echo '<?xml version="1.0" encoding="UTF-8"?>'
echo "<mountconfig>"
```

```

xmlFile=/tmp/mount_config_${SAPSYSTEMNAME}_${SAPSYSTEM}.xml
numMounts=`xml_grep --count "/mountconfig/mount" $xmlFile | grep "total: "
| awk '{ print $2 }'`
i=1
while [ $i -le $numMounts ]; do
MOUNTPOINT=`xmllint --xpath "/mountconfig/mount[$i]/mountpoint/text()" $xmlFile`;
EXPORTPATH=`xmllint --xpath
"/mountconfig/mount[$i]/exportpath/text()" $xmlFile`;
OPTIONS=`xmllint --xpath "/mountconfig/mount[$i]/options/text()" $xmlFile`;
#Adopt Exportpath and add Clonepostfix - assuming usage of qtrees - "IP-
Adress:/VolumeName/qtree"
TMPFIELD1=`echo $EXPORTPATH|awk -F":/" '{print $1}'` 
TMPFIELD2=`echo $EXPORTPATH|awk -F"/" '{print $2}'` 
TMPFIELD3=`echo $EXPORTPATH|awk -F"/" '{print $3}'` 
EXPORTPATH=$TMPFIELD1":/"${TMPFIELD2}$PARAM_ClonePostFix"/"${TMPFIELD3}
echo -e '\t<mount fstype="nfs" storagetype="NETFS">' 
echo -e "\t\t<mountpoint>${MOUNTPOINT}</mountpoint>" 
echo -e "\t\t<exportpath>${EXPORTPATH}</exportpath>" 
echo -e "\t\t<options>${OPTIONS}</options>" 
echo -e "\t</mount>" 
i=$((i + 1))
done
echo "</mountconfig>" 
echo "MountDataEnd" 
#Finished MountPoint Config 
#Cleanup Temporary Files 
rm $xmlFile
fi
#HookOperationName - ServiceConfigRemoval
#####
if [ $HookOperationName = ServiceConfigRemoval ] ;then
#Assure that Properties ClonePostFix and SnapPostfix has been configured
through the provisioning process
if [ -z $PROP_ClonePostFix ] ; then echo "[ERROR]: Propertiy ClonePostFix
is not handed over - please investigate";exit 5;fi
if [ -z $PROP_SnapPostFix ] ; then echo "[ERROR]: Propertiy SnapPostFix is
not handed over - please investigate";exit 5;fi
#Instance 00 + 01 share the same volumes - clone delete needs to be done
once
if [ $SAPSYSTEM != 01 ] ; then
#generating Volume List - assuming usage of qtrees - "IP-
Adress:/VolumeName/qtree"
xmlFile=$MOUNT_XML_PATH
if [ -e $TMPFILE ] ;then rm $TMPFILE;fi

```

```

numMounts=`xml_grep --count "/mountconfig/mount" $xmlFile | grep "total: "
| awk '{ print $2 }'`
i=1
while [ $i -le $numMounts ]; do
    xmllint --xpath "/mountconfig/mount[$i]/exportpath/text()" $xmlFile
|awk -F"/" '{print $2}' >>$TMPFILE
i=$((i + 1))
done
DATAVOLUMES=`cat $TMPFILE |sort -u| awk -F $PROP_ClonePostFix '{ print $1
}'`#
#Create yml file and run playbook for each volume
for I in $DATAVOLUMES; do
datavolumename="$I"
snapshotpostfix="$PROP_SnapPostFix"
clonepostfix="$PROP_ClonePostFix"
create_yml_file
run_ansible_playbook
done
else
echo "[DEBUG]: Doing nothing .... Volume deleted in different Task"
fi
#Cleanup Temporary Files
rm $xmlFile
fi
#HookOperationName - ClearMountConfig
#####
if [ $HookOperationName = ClearMountConfig ] ;then
    #Assure that Properties ClonePostFix and SnapPostfix has been
configured through the provisioning process
    if [ -z $PROP_ClonePostFix ]; then echo "[ERROR]: Propertiy
ClonePostFix is not handed over - please investigate";exit 5;fi
    if [ -z $PROP_SnapPostFix ]; then echo "[ERROR]: Propertiy
SnapPostFix is not handed over - please investigate";exit 5;fi
    #Instance 00 + 01 share the same volumes - clone delete needs to
be done once
    if [ $SAPSYSTEM != 01 ]; then
        #generating Volume List - assuming usage of qtrees - "IP-
Adress:/VolumeName/qtree"
        xmlFile=$MOUNT_XML_PATH
        if [ -e $TMPFILE ];then rm $TMPFILE;fi
        numMounts=`xml_grep --count "/mountconfig/mount" $xmlFile
| grep "total: " | awk '{ print $2 }'`#
        i=1
        while [ $i -le $numMounts ]; do
            xmllint --xpath
"/mountconfig/mount[$i]/exportpath/text()" $xmlFile |awk -F"/" '{print

```

```

$2}' >>$TMPFILE
        i=$((i + 1))
    done
    DATAVOLUMES=`cat $TMPFILE |sort -u| awk -F
$PROP_ClonePostFix '{ print $1 }'`#
        #Create yml file and run playbook for each volume
        for I in $DATAVOLUMES; do
            datavolumename="$I"
            snapshotpostfix="$PROP_SnapPostFix"
            clonepostfix="$PROP_ClonePostFix"
            create_yml_file
            run_ansible_playbook
        done
    else
        echo "[DEBUG]: Doing nothing .... Volume deleted in
different Task"
    fi
    #Cleanup Temporary Files
    rm $xmlFile
fi
#Cleanup
#####
#Cleanup Temporary Files
if [ -e $TMPFILE ];then rm $TMPFILE;fi
if [ -e $YAML_TMP ];then rm $YAML_TMP;fi
exit 0

```

## Ansible Playbook netapp\_lama\_CloneVolumes.yml

The playbook that is executed during the CloneVolumes step of the LaMa system clone workflow is a combination of `create_snapshot.yml` and `create_clone.yml` (see [NetApp Ansible modules - YAML files](#)). This playbook can be easily extended to cover additional use cases like cloning from secondary and clone split operations.

```

root@sap-jump:~# cat /usr/sap/scripts/ansible/netapp_lama_CloneVolumes.yml
---
- hosts: ontapservers
  connection: local
  collections:
    - netapp.ontap
  gather_facts: false
  name: netapp_lama_CloneVolumes
  tasks:
    - name: Create SnapShot
      na_ontap_snapshot:
        state: present
        snapshot: "{{ datavolumename }}{{ snapshotpostfix }}"
        use_rest: always
        volume: "{{ datavolumename }}"
        vserver: "{{ svmname }}"
        hostname: "{{ inventory_hostname }}"
        cert_filepath: "{{ certfile }}"
        key_filepath: "{{ keyfile }}"
        https: true
        validate_certs: false
    - name: Clone Volume
      na_ontap_volume_clone:
        state: present
        name: "{{ datavolumename }}{{ clonepostfix }}"
        use_rest: always
        vserver: "{{ svmname }}"
        junction_path: '/{{ datavolumename }}{{ clonepostfix }}'
        parent_volume: "{{ datavolumename }}"
        parent_snapshot: "{{ datavolumename }}{{ snapshotpostfix }}"
        hostname: "{{ inventory_hostname }}"
        cert_filepath: "{{ certfile }}"
        key_filepath: "{{ keyfile }}"
        https: true
        validate_certs: false

```

## Ansible Playbook netapp\_lama\_ServiceConfigRemoval.yml

The playbook that is executed during the ServiceConfigRemoval phase of the LaMa system destroy workflow is combination of `delete_clone.yml` and `delete_snapshot.yml` (see [NetApp Ansible modules - YAML files](#)). It must be aligned to the execution steps of the `netapp_lama_CloneVolumes` playbook.

```

root@sap-jump:~# cat
/usr/sap/scripts/ansible/netapp_lama_ServiceConfigRemoval.yml
---
- hosts: ontapservers
  connection: local
  collections:
    - netapp.ontap
  gather_facts: false
  name: netapp_lama_ServiceConfigRemoval
  tasks:
    - name: Delete Clone
      na_ontap_volume:
        state: absent
        name: "{{ datavolumename }}{{ clonepostfix }}"
        use_rest: always
        vserver: "{{ svmname }}"
        wait_for_completion: True
        hostname: "{{ inventory_hostname }}"
        cert_filepath: "{{ certfile }}"
        key_filepath: "{{ keyfile }}"
        https: true
        validate_certs: false
    - name: Delete SnapShot
      na_ontap_snapshot:
        state: absent
        snapshot: "{{ datavolumename }}{{ snapshotpostfix }}"
        use_rest: always
        volume: "{{ datavolumename }}"
        vserver: "{{ svmname }}"
        hostname: "{{ inventory_hostname }}"
        cert_filepath: "{{ certfile }}"
        key_filepath: "{{ keyfile }}"
        https: true
        validate_certs: false
root@sap-jump:~#

```

## Ansible Playbook netapp\_lama\_ClearMountConfig.yml

The playbook, which is executed during the `netapp_lama_ClearMountConfig` phase of the LaMa system refresh workflow is combination of `delete_clone.yml` and `delete_snapshot.yml` (see [NetApp Ansible modules - YAML files](#)). It must be aligned to the execution steps of the `netapp_lama_CloneVolumes` playbook.

```

root@sap-jump:~# cat
/usr/sap/scripts/ansible/netapp_lama_ServiceConfigRemoval.yml
---
- hosts: ontapservers
  connection: local
  collections:
    - netapp.ontap
  gather_facts: false
  name: netapp_lama_ServiceConfigRemoval
  tasks:
    - name: Delete Clone
      na_ontap_volume:
        state: absent
        name: "{{ datavolumename }}{{ clonepostfix }}"
        use_rest: always
        vserver: "{{ svmname }}"
        wait_for_completion: True
        hostname: "{{ inventory_hostname }}"
        cert_filepath: "{{ certfile }}"
        key_filepath: "{{ keyfile }}"
        https: true
        validate_certs: false
    - name: Delete SnapShot
      na_ontap_snapshot:
        state: absent
        snapshot: "{{ datavolumename }}{{ snapshotpostfix }}"
        use_rest: always
        volume: "{{ datavolumename }}"
        vserver: "{{ svmname }}"
        hostname: "{{ inventory_hostname }}"
        cert_filepath: "{{ certfile }}"
        key_filepath: "{{ keyfile }}"
        https: true
        validate_certs: false
root@sap-jump:~#

```

## Sample Ansible inventory.yml

This inventory file is dynamically built during workflow execution, and it is only shown here for illustration.

```

ontapservers:
  hosts:
    grenada:
      ansible_host: "grenada"
      keyfile: "/usr/sap/scripts/ansible/certs/ontap.key"
      certfile: "/usr/sap/scripts/ansible/certs/ontap.pem"
      svmname: "svm-sap01"
      datavolumename: "HN9_sap"
      snapshotpostfix: " _snap_20221115"
      clonepostfix: " _clone_20221115"

```

## Conclusion

The integration of a modern automation framework like Ansible into SAP LaMa provisioning workflows gives customers a flexible solution to address standard or more complex infrastructure requirements.

### Where to find additional information

To learn more about the information that is described in this document, review the following documents and/or websites:

- Collections in the NetApp Namespace

<https://docs.ansible.com/ansible/latest/collections/netapp/index.html>

- Documentation about Ansible Integration and Sample Ansible Playbooks

[https://github.com/sap-linuxlab/demo.netapp\\_ontap](https://github.com/sap-linuxlab/demo.netapp_ontap)

- General Ansible and NetApp Integration

<https://www.ansible.com/integrations/infrastructure/netapp>

- Blog on integrating SAP LaMa with Ansible

<https://blogs.sap.com/2020/06/08/outgoing-api-calls-from-sap-landscape-management-lama-with-automation-studio/>

- SAP Landscape Management 3.0, Enterprise Edition Documentation

<https://help.sap.com/doc/700f9a7e52c7497cad37f7c46023b7ff/3.0.11.0/en-US/4df88a8f418c5059e1000000a42189c.html#loio4df88a8f418c5059e1000000a42189c>

- SAP LaMa Documentation – Provider Definitions

<https://help.sap.com/doc/700f9a7e52c7497cad37f7c46023b7ff/3.0.11.0/en-US/bf6b3e43340a4cbc0c0f3089715c068.html>

- SAP LaMa Documentation - Custom Hooks

<https://help.sap.com/doc/700f9a7e52c7497cad37f7c46023b7ff/3.0.11.0/en-US/139eca2f925e48738a20dbf0b56674c5.html>

- SAP LaMa Documentation - Configuring SAP Host Agent Registered Scripts

<https://help.sap.com/doc/700f9a7e52c7497cad37f7c46023b7ff/3.0.11.0/en-US/250dfc5eef4047a38bab466c295d3a49.html>

- SAP LaMa Documentation - Parameters for Custom Operations and Custom Hooks

<https://help.sap.com/doc/700f9a7e52c7497cad37f7c46023b7ff/3.0.11.0/en-US/0148e495174943de8c1c3ee1b7c9cc65.html>

- SAP LaMa Documentation - Adaptive Design

<https://help.sap.com/doc/700f9a7e52c7497cad37f7c46023b7ff/3.0.11.0/en-US/737a99e86f8743bdb8d1f6cf4b862c79.html>

- NetApp Product Documentation

<https://www.netapp.com/support-and-training/documentation/>

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