VMware vSphere®
Storage Appliance 5.1.x
Brownfield Deployments

TECHNICAL MARKETING DOCUMENTATION
V 1.0
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Introduction

In the version 1.0 release of VMware vSphere® Storage Appliance, a brand-new, unmodified installation of vSphere 5.x infrastructure, also known as a greenfield infrastructure, was required for deployment. This requirement was identified as a significant constraint to the usability of the solution. The latest release of vSphere Storage Appliance, version 5.1.x, addresses this limitation in deployment options.

vSphere Storage Appliance version 5.1.x can be deployed into a VMware vSphere 5.x infrastructure that is already in production, with configured virtual networks and operating virtual machines. This type of vSphere Storage Appliance 5.1.x deployment is known as a brownfield deployment.

This white paper will discuss the procedure and requirements for vSphere Storage Appliance 5.1.x deployments into existing vSphere infrastructures.

vSphere Storage Appliance 5.1.x Brownfield Deployment

In the previous release, it was required that vSphere Storage Appliance 1.0 be installed into a brand-new vSphere 5.0 infrastructure with a minimum of two and a maximum of three vSphere 5.0 hosts. This installation requirement was typically referred to as a greenfield infrastructure.

The greenfield infrastructure requirement presented some challenges. It made it difficult to introduce the vSphere Storage Appliance solution in scenarios with existing and operating vSphere 5.0 infrastructures. To use and deploy vSphere Storage Appliance, the user had to either procure new hardware or rebuild the existing operating environment.

Figure 1. Supported vSphere Storage Appliance Deployment Scenarios
Rebuilding production environments and procuring new equipment can be a costly enterprise, making it undesirable if not unfeasible for businesses. The release of vSphere Storage Appliance 5.1.x delivers an attractive option that avoids such costs.

A new vSphere Storage Appliance 5.1.x feature called automatic brownfield installation provides support for deployments into existing vSphere infrastructures with virtual machines running on the vSphere hosts’ local VMware vSphere VMFS datastores.

This new feature enables deployment of the vSphere Storage Appliance 5.1.x solution into any existing production environment. By default, however, it does not guarantee 100 percent uptime of the vSphere infrastructure during the deployment and configuration.

This is because the vSphere Storage Appliance manager makes vSphere host and virtual machine modifications that require rebooting the vSphere hosts and shutting down virtual machines.

Rebooting presents challenges for businesses because they often cannot afford unplanned downtime and want to minimize the amount of required downtime associated with the introduction of technology solutions.

The new deployment feature in vSphere Storage Appliance 5.1.x presents two options that take these challenges into account:

• vSphere Storage Appliance 5.1.x deployment with downtime
• vSphere Storage Appliance 5.1.x deployment with zero downtime

**NOTE:** Though the scenario having automatic deployment with zero downtime still requires a reboot at some point, this reboot can be avoided during the initial deployment and performed during a maintenance period.

This creates room for scheduling a planned outage to reboot the vSphere hosts, to apply and save the changes made during the vSphere Storage Appliance installation.

**vSphere Storage Appliance 5.1.x Deployment Requirements**

Deploying vSphere Storage Appliance 5.1.x into both greenfield and brownfield environments follows a set of specific configurations and vSphere infrastructure requirements that are validated during the deployment process.

The vSphere Storage Appliance installer performs a series of vSphere infrastructure compatibility checkpoints before starting the installation and configuration procedures.

These checkpoints enable the vSphere Storage Appliance installer to determine the type of environment vSphere Storage Appliance 5.1.x is being deployed into and the actions that must be taken during the configuration process.

**vSphere Storage Appliance 5.1.x Compatibility Validation Checkpoints**

The following vSphere Storage Appliance 5.1.x compatibility validation checkpoints are executed to verify that the vSphere infrastructure components have been configured correctly:

• **Hosts** – The installed vSphere hosts are version 5.x or later.
• **Deployment type** – The vSphere Storage Appliance deployment type is identified by the existence of the default management network and virtual machine network port groups.
• **Network interface cards** – The appropriate number of physical adapter ports. It requires four ports in total, either two dual-port or four single-port network adapters.
- **Virtual networks** – The existence and configuration of physical switch connectivity, virtual switches, and port group configuration. It requires five port groups:
  - vSphere Storage Appliance front end – Virtual machine port group
  - vSphere Storage Appliance back end – Virtual machine port group
  - vSphere Storage Appliance VMware vSphere vMotion® VMkernel port group
  - Virtual machine network – Virtual machine port group
  - Management network – VMkernel port group

- **NIC binding policy** – The port group NIC policy bindings for NIC teaming and failover capabilities. All port groups require an active and standby interface configuration. The vSphere Storage Appliance back end and vSphere Storage Appliance vMotion port groups cannot share the same active NICs; the vSphere Storage Appliance front end port group can’t share the same active NIC as the virtual machine network or management network port groups, although the virtual machine network and management network port groups can have the same active NIC.

- **Management gateway** – All vSphere hosts are located on the same network segment.

- **Cluster configuration** – vSphere hosts are not members of a VMware vSphere High Availability (HA) cluster. The vSphere Storage Appliance manager adds the vSphere hosts to a vSphere Storage Appliance HA cluster that is created during the deployment.

- **CPU compatibility** – vSphere host CPU compatibility. The members of the cluster are configured with Enhanced vMotion Compatibility (EVC).

- **CPU resource requirements** – vSphere host CPUs run at a clock speed of 2GHz or better.

- **Virtual machines** – vSphere hosts do not have any running virtual machines, with the exception of the zero-downtime deployments. Depending on the type of deployment, the EVC settings might or might not have to be adjusted.

The vSphere Storage Appliance installer will prevent the selection of any vSphere hosts that do not meet the compatibility validation checkpoint requirements.

There are other requirement dependencies that are not part of the validation process of the vSphere Storage Appliance installer but must be implemented to be in compliance with requirements of vSphere Storage Appliance and VMware® support.

- **RAID configurations** – RAID 5, RAID 6 or RAID 10
- **Physical disk configurations** – Four disks, six disks or eight disks
- **RAID controllers** – Check the VMware Hardware Compatibility List (HCL) for supported models.

Check the HCL regularly for information on the latest supported models, disk configurations and RAID controllers supported by vSphere Storage Appliance. To access the HCL, visit: http://www.vmware.com/resources/compatibility/search.php
vSphere Storage Appliance 5.1.x Brownfield Deployment with Downtime

Standard vSphere Storage Appliance deployments require some downtime due to the changes being effected on the vSphere hosts by the vSphere Storage Appliance installer.

There are two configuration changes in particular—VMFS heap size and EVC baseline—that are responsible for imposing downtime on the deployment process.

**VMFS Heap Size**

The heap size of vSphere hosts is increased to support the larger VMFS-5 volume size supported by vSphere Storage Appliance 5.1. This change is automatically implemented by the vSphere Storage Appliance installer and requires a reboot of all vSphere hosts. The default VMFS-5 heap size is 80MB.

VMFS heap size determines the maximum amount of addressable space that can be accessed by a file or, in this case, a virtual machine disk (VMDK). The default VMFS-5 heap configuration is sized in a conservative manner, and any vSphere host should have a large enough heap size to address a default maximum of an estimated 10TB.

The change effected by the vSphere Storage Appliance installer to support larger VMFS-5 volumes boosts the heap size to its maximum supported value of 256MB. This change increases the amount of open file or VMDK addressable space to a new maximum of 32TB.

**EVC Baseline**

In a brownfield environment, it is very likely that there are virtual machines running and using CPU features on vSphere hosts as well as on their local storage.

![Host Audit Details](image)

**Figure 2. Audit Message - vSphere Storage Appliance Installer Running Virtual Machines**

vSphere Storage Appliance installer default EVC settings for greenfield deployments assume no running virtual machines on vSphere hosts. All running virtual machines must be shut down for the vSphere Storage Appliance installer to proceed with the installation.
Network

In brownfield scenarios, vSphere hosts should have their networks and vSphere standard virtual switches already created and configured. If this is the case, the vSphere Storage Appliance installer executes its compatibility checkpoints and validates the configuration to confirm the existence of the required port groups and their configuration.

If the vSphere Storage Appliance installer is unable to validate the required configuration, based on the required port groups, port group naming conventions, vSphere standard switch NIC binding policies and physical switch connectivity requirements, the end user must apply the correct and recommended configuration.

In the event that the vSphere Storage Appliance network configuration is to be applied manually, users must know the port group configurations and vSphere standard switch NIC binding policies recommendation as previously covered in the “vSphere Storage Appliance 5.1.x Compatibility Validation Checkpoints” section of this document.

In the event that the brownfield environment is using the default vSphere network configuration without any custom or preconfigured settings, the vSphere Storage Appliance installer will automatically add the appropriate configuration.

vSphere standard switch configuration requirements for vSphere Storage Appliance are based on a redundant and high-availability concept, which is designed for the mitigation of network single points of failure.

Figure 3. vSphere Storage Appliance Recommended Network Design
Storage

The vSphere Storage Appliance installer analyzes the vSphere hosts’ local VMFS datastores to identify the remaining free space. The available capacity is then handed off to vSphere Storage Appliances for use as part of the NFS shared storage capacity.

When vSphere Storage Appliances have control of the storage capacity, they automatically configure the capacity for the NFS shared storage. After the shared storage has been configured, the virtual machines on local storage can be migrated to the newly presented NFS shared storage.

Using VMware vSphere Storage vMotion®, virtual machines can now be migrated off the local VMFS-5 datastores into the newly mounted NFS shared storage.

The local VMFS-5 capacity can be reclaimed online by vSphere Storage Appliances and then added to the NFS shared storage as the capacity becomes available using the Increase Storage feature located in the vSphere Storage Appliance manager tab in vSphere Web Client.
vSphere Storage Appliance 5.1.x Brownfield Deployment with Zero Downtime

The ability to deploy vSphere Storage Appliance into an existing vSphere environment with zero downtime is a critical addition to the solution. This deployment scenario is much like the one previously discussed and is subject to the same specific configurations, infrastructure requirements and compatibility validation checkpoint process performed by the vSphere Storage Appliance installer.

The difference between this deployment scenario and the one previously discussed is that this approach avoids configuration-setting changes that would require a reboot and shutdown of virtual machines.

In this deployment scenario, the configuration items are manually configured prior to the launch of the vSphere Storage Appliance installer wizard. The vSphere hosts’ VMFS heap size and EVC settings are manually changed to match the vSphere Storage Appliance requirements before the vSphere Storage Appliance installer compatibility validation checkpoints process is performed.

With this manual configuration complete, the vSphere Storage Appliance installer no longer requires the shutdown of running virtual machines or a reboot of the vSphere hosts.

VMFS Heap Size

To modify the VMFS heap size, locate the MaxHeapSizeMB attribute in the vSphere hosts’ advanced systems settings and change it to 256MB, as illustrated in Figure 5.

![Figure 5. VMFS Heap Size Setting](image)

Omitting the requirement to shut down running virtual machines does not impact any future virtual machine operational capabilities. However, omitting the reboot of vSphere hosts impacts the overall storage capacity and the number of open files or VMDKs that vSphere Storage Appliance 5.1.x can support until the hosts are rebooted.

As was previously mentioned, the vSphere hosts’ default VMFS-5 heap size is set at 80MB, which is large enough to address a default maximum of 10TB. For the vSphere hosts to address the vSphere Storage Appliance 5.1.x supported maximum of 32TB, the heap size must be changed to 256MB. After that change has been made, the vSphere hosts must be rebooted to commit the change.
EVC Baseline

EVC is designed to set a homogenous CPU operating baseline to maintain and guarantee vMotion CPU compatibility within the vSphere Storage Appliance HA cluster that will be created as part of the deployment.

In brownfield deployments, virtual machines—such as VMware vCenter Server™ as well as others—might be present and running on the vSphere hosts that will be used for the vSphere Storage Appliance 5.1.x cluster. Because of this, all running virtual machines utilize the vSphere hosts’ CPU features. The EVC CPU operating baseline in the vSphere Storage Appliance installer is set for greenfield by default. This means that the vSphere Storage Appliance installer compatibility validation checkpoint validates that all virtual machines are powered off.

Making virtual machine CPU-related changes, such as use of EVC, requires that all virtual machines be powered off, because the CPU features are applied only after a reboot cycle. In this case, the goal is to prevent the powering-off of virtual machines.

The vSphere Storage Appliance installer’s EVC operating baseline settings provide two options:

- EVC baseline highest
- EVC baseline lowest (default)

The goal for this deployment scenario is to omit the virtual machine “power off” requirement by changing the default setting from lowest to highest. Applying the recommended setting guarantees that the lowest common denominator of EVC baselines is used, which in this case is the highest possible.

To make the necessary configuration changes, a file called `dev.properties` must be modified with the recommended configuration. The file is located on the system where the vSphere Storage Appliance manager application is installed. In most cases, this is the same system where vCenter Server is installed. The file is found under the following directory:

```
C:\Program Files\VMware\Infrastructure\tomcat\webapps\vSphere Storage ApplianceManager\WEB-INF\classes
```

![Dev.properties File](image)

NOTE: Do not modify this file or make any changes other than those recommended in this white paper. Doing so can cause problems with the performance and stability of the vSphere Storage Appliance 5.1.x solution and might not be supported.
In the event the `dev.properties` file is not modified and saved correctly, the vSphere Storage Appliance installer will generate an error message, which will prevent the configuration process from completing.

![Image](image.png)

**Figure 7. vSphere Storage Appliance Installer EVC Mode Message**

**NOTE:** There are two possible scenarios in which the modification of the vSphere Storage Appliance manager’s `dev.properties` file will require downtime to configure EVC and support running virtual machines:

- Hosts do not have the same CPUs.
- Running virtual machines are on hosts with the smallest CPU feature set.

The feature set of the CPUs of all participating vSphere hosts should be a superset of the feature set of any CPU being used by any running virtual machines.

**Network**

vSphere Storage Appliance 5.1.x network requirements are very strict, with almost zero flexibility in reference to the vSphere Storage Appliance installer compatibility validation checkpoints.

vSphere Storage Appliance installer network compatibility validation checkpoints are based on a set of items with very specific configuration requirements. These items were defined in detail in the “vSphere Storage Appliance 5.1.x Deployment Requirements” section. For the most part, the focus of the validation is based on the following items:

- Number of vSphere standard switches or VMware vSphere Distributed Switch™ instances – Minimum of one
- NIC binding policy – A total of four NICs, two NICs per vSphere switch; port groups configured with active and standby interfaces
- Number of port groups – Five port groups in total: two vSphere standard port groups and three vSphere Storage Appliance required port groups
- Port group naming convention – Must match vSphere Storage Appliance naming convention
- Physical switch connectivity – Two different physical switches

Modifying the configuration of any of the network-related items defined here does not impose any vSphere host reboot or require virtual machines to be powered off, but failing to meet all of these requirements will halt the vSphere Storage Appliance 5.1.x deployment.

The brownfield network environment must be modified to match all vSphere Storage Appliance 5.1.x networking requirements.
In the event that any of the configuration items fail the vSphere Storage Appliance installer compatibility validation checkpoint, the vSphere Storage Appliance installer will generate individual error messages similar to the following ones:

![Figure 8. vSphere Storage Appliance Port Group Name Configuration Errors](image1)

![Figure 9. vSphere Storage Appliance NIC Teaming Configuration Errors](image2)

![Figure 10. vSphere Storage Appliance Physical Switch Configuration Error](image3)

The error message in Figure 10 is based on the audit for the redundant connectivity to physical switches. It is presented as a warning, and continuation of the deployment will be allowed even if connectivity is not set as recommended.
Storage

After vSphere Storage Appliance 5.1.x shared storage is configured, all virtual machines running on the vSphere hosts’ local VMFS datastores can be migrated into the new NFS shared volumes provided by vSphere Storage Appliance 5.1.x.

The online storage migration of running virtual machines requires the use of vSphere Storage vMotion.

NOTE: vCenter Server should not be migrated to vSphere Storage Appliance 5.1.x shared storage in two-node cluster configuration scenarios because it is not recommended or supported. Unless the vSphere Storage Appliance Cluster Service (VSACS) is present and deployed into a separate node, vCenter Server must remain on a vSphere local VMFS datastore of one of the cluster members.

After the running virtual machines have been migrated off the vSphere hosts' local VMFS datastores, the new vSphere Storage Appliance 5.1.x Increase Storage feature can be used to reclaim the available local space online and dynamically add that storage capacity to vSphere Storage Appliance cluster NFS shared volumes.

Figure 11. Increase Storage Capacity Online

The Increase Storage wizard is located on the top banner of vSphere Storage Appliance Cluster Properties of the vSphere Storage Appliance manager interface. The vSphere Storage Appliance manager is accessible in vSphere Web Client under the Classic Solutions tab, as illustrated in Figure 11.
Conclusion

The new brownfield automatic deployment feature in vSphere Storage Appliance 5.1.x addresses the limitation introduced in the previous version. With the options provided in this new release, vSphere Storage Appliance 5.1.x can easily be deployed with minimal to zero downtime into any existing vSphere infrastructure.

The vSphere Storage vMotion feature is required to successfully deploy vSphere Storage Appliance 5.1.x into an existing vSphere infrastructure. Knowing and understanding the requirements for the supported deployment scenarios as well as the resources required are instrumental for a successful implementation of the solution.

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