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- This presentation may contain product features that are currently under development.
- This overview of new technology represents no commitment from VMware to deliver these features in any generally available product.
- Features are subject to change, and must not be included in contracts, purchase orders, or sales agreements of any kind.
- Technical feasibility and market demand will affect final delivery.
- Pricing and packaging for any new technologies or features discussed or presented have not been determined.
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Goals of Virtual Volumes

• Ability to express application (VM/VMDK) granular data services
• Provide easy on-demand Capacity provisioning
• Compliance Monitoring
• Ability to get most out of the storage system

• Easy Capacity management
• Meet VM SLOs
• Access Control and Security
High Level Architecture

Storage Policy-Based Mgmt.

Virtual Volumes

Storage Policy
- Capacity
- Performance
- Availability
- Data Protection
- Security

Overview

- No FileSystem
- ESX manages Array through VASA (vSphere APIs for Storage Awareness) APIs.
- Arrays are logically partitioned into containers, called Storage Containers
- VM disks, called Virtual Volumes, stored natively on the Storage Containers.
- IO from ESX to array is addressed through an access point called, Protocol Endpoint (PE)
- Data Services are offloaded to the array
- Managed through storage policy-based management framework
VASA Provider (VP)

Characteristics

- Software component developed by Storage Array Vendors
- ESX and vCenter Server connect to VASA Provider
- Provides Storage awareness services
- Single VASA Provider can manage multiple arrays
- Supports VASA APIs exported by ESX
- VASA Provider can be implemented within the array’s management server or firmware
- Responsible for creating Virtual Volumes
Data Path
Protocol Endpoints (PE)

Why Protocol Endpoints?
- Separate the access points from the storage itself
- Can have fewer access points

What are Protocol Endpoints?
- Access points that enables communication between ESXi hosts and storage array systems.
- Part of the physical storage fabric
- Created by Storage administrators
Protocol Endpoints (PE)

Scope of Protocol Endpoints

- Compatible with all SAN and NAS Protocols:
  - iSCSI
  - NFS v3
  - FC
  - FCoE

- A Protocol Endpoint can support any one of the protocols at a given time

- Existing multi-path policies and NFS topology requirements can be applied to the PE
Protocol Endpoints (PE)

Protocol Endpoint discovery process

- SCSI PEs are discovered during an ESX rescan
- NFS PEs are maintained as IP addresses or file paths
- ESX will identify PE and maintain all discovered PEs in a database.
Managing Storage Capacity
Storage Container (SC)

What are Storage Containers?

• Logical storage constructs for grouping of virtual volumes.
• Setup by Storage administrators
• Capacity is based on physical storage capacity
• Logically partition or isolate VMs with diverse storage needs and requirement
• Minimum one storage container per array
• Maximum depends on the array
• A single Storage Container can be simultaneously accessed via multiple Protocol Endpoints
Storage Container Discovery Process

- Storage admin sets up Storage Container with desired capacity
- Desired Capabilities are applied to the Storage Containers
- VASA Provider discovers Storage Container and reports to vCenter
- Any new VMs that are created will subsequently be provisioned in the Storage Container
Differences between Storage Containers and LUNs

**Storage Containers**
- Size based on array capacity
- Max number of SCs depend only on the array ability
- Size of SC can be extended
- Can distinguish heterogeneous capabilities for different VMs (Virtual Volumes) provisioned in that SC
- Managed by VASA APIs

**LUN**
- Fixed size
- Fixed size mandates more number of LUNs
- Needs a FileSystem
- Can only apply homogeneous capability on all VMs (VMDKs) provisioned in that LUN.
- Managed by In-band FileSystem commands
Storage Container (SC)

Do I still need to create Datastores?

vSphere Datastore

Storage Container
Storage Container (SC)

What do the Admins see?
Ensuring SLOs through Policies
Storage Policy Based Management (SPBM) – Array Capabilities

Publish Capabilities

- Array based features and data services
- Defines what an Array can offer
- Advertised to ESX through VASA APIs
Storage Policy Based Management (SPBM) – Array Capabilities

Sample Default Profile for (6090a058-cd89-ffe3-87763007db37) - capabilities

- Disk Types
- Disk Encryption
- Dedupe
- Replication
- Snapshot
Storage Policy Based Management (SPBM) – VM Policies
Storage Policy Based Management (SPBM)
VM Objects - Virtual Volumes
Virtual Volumes – An Introduction

- **Virtual Volumes**
  - Virtual machine objects stored natively on the array storage containers.
  - No Filesystem on-disk formatting required

- There are **five** different types of recognized Virtual Volumes:
  - **Config-VVol** – Metadata
  - **Data-VVol** – VMDKs
  - **Mem-VVol** – Snapshots
  - **Swap-VVol** – Swap files
  - **Other-VVol** – Vendor solution specific
Virtual Volumes

What do the admins need to get familiar with?
Virtual Volumes – Bind requests

- IO path is established through a VASA Bind request
- VASA Provider does two things upon receiving a Bind request
  - Returns a PE ID to which the VVol is bound
  - A unique secondary ID to be used for IO between the bound VVol and PE
- For SCSI, the secondary ID is the secondary LUN ID
- For NAS, the secondary ID is the file path
- M:M Relationship between VVol and PE
Data Services
Snapshots

• Offloaded to Array
• Copy on write image of a Virtual Volume
• Two type of snapshots supported:
  – Managed Snapshot – Managed by ESX.
    • A maximum of 32 snapshot are supported for fast clones
  – Unmanaged Snapshot – Managed by the storage array.
Piecing It All Together
Virtual Volumes – The New De-facto Storage Paradigm
Making the Transition to Virtual Volumes
Support by Broad Ecosystem Makes Transition Smooth

More than 20 VVOL Partners

Partners Announcing GA

Virtual Volumes in Beta

And Many More…
Learn More.....
VVVols and SPBM in Nimble – Architecture Overview

vCenter

ESXi

ESXi

Nimble Storage Array Group
Learn More……

**Breakout Sessions**
- STO1963 – Virtual Volumes Business Overview
- STO 3163 – Virtual Volumes and Scalable Data Protection in a Software Defined Enterprise
- STO3162 – Satisfy requirements of your application at the granularity of VVols (Nimble)
- STO3246 – Scalable Virtual Volumes Storage Management with IBM XIV storage
- STO3161 – What can Virtual Volumes do for you? (EMC)
- STO2142 – Hypervisor & Storage QOS; Two Great Tastes that Taste Great Together (SolidFire)
- STO3247 – VVol Technical Preview with DELL storage
- STO2554 – How Virtual Volumes will provide Shared Storage with X-ray vision (HP)
- STO2752 – Deploying VVol with Hitachi Data Systems

**Misc**
- HOL-SPL-1429 VVol Tech Preview

**Focused Sessions**
- Engage with VMware
- Engage with Vendors
- Attend NDA sessions

**Demos at Booth**
- VMware
- HP
- Netapp
- Dell
- EMC
- IBM
- HDS
- Nimble
- Tintri
- SolidFire
- Atlantis Computing
- SANBlaze

★ Participate in Virtual Volumes Beta
Q&A
Thank You
Fill out a survey

Every completed survey is entered into a drawing for a $25 VMware company store gift certificate
BACKUP
Snapshots

- Snapshots are a point in time copy on write image of a Virtual Volume with a different ID from the original.
- Virtual Volumes snapshots are useful in the contexts of creating:
  - a quiesced copy for backup or archival purposes, creating a test and rollback environment for applications, instantly provisioning application images, and so on.
- Two type of snapshots supported:
  - Managed Snapshot – Managed by ESX
    - A maximum of 32 snapshot are supported for fast clones
  - Unmanaged Snapshot – Manage by the storage array
    - Maximum snapshot dictated by the storage array.
**Fast Clone**

- **Fast-clones** are an out-of-band space efficient cloning operations, performed exclusively on VMDKs
  - performed on the same storage container using the storage profile of the original virtual volume, or the profile specified
- ESXi hosts guarantee not to issue any I/O to the source or destination virtual volumes during fast clone operations
- **Fast-clones** are similar to the snapshot operation with a few differences:
  - There are no revert operations
  - Space-efficient

---

**Fast clone Snapshot Workflow**

- prepared for snap
- progress update 1
- progress update N
- ready
- create
- acknowledge
- Read only to based VVol allowed
### Capability sets

#### Default Profiles

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<th>Description</th>
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<td>Sample_Default_Profile for (6090a058-cd89-ffe3-87763007db37 - capabilities)</td>
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#### Connectivity with Hosts

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clone VM from VVol container to different VVol container

vSphere

always attempt default operation with VASA API primitives

1 default

fail back 2

If default operations fails VAAI API primitives are used

VMkernel data mover uses VAAI primitives for cloning operation

Fully VAAI & VASA APIs Compatible Array

vSphere Admins

1

2

offload to array

cloning operation

3

vendor native clone utilized with VASA primitives

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