What’s New for Storage in vSphere 4.0
- VMware Data Recovery

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What’s New for Storage in vSphere 4.0
Technical Overview Webcast
Agenda/Objective

- Provide an overview of vSphere benefits
- Explain where the new vStorage capabilities fit
- Address details of each specific feature
- Show which vStorage APIs exist today
VMware vSphere™ – The Industry’s First Cloud Operating System

**Application Services**

- Clustering
- Data Protection
- Firewall
- Anti-virus
- Intrusion Prevention
- Intrusion Detection
- Dynamic Resource Sizing

**Infrastructure Services**

- vCompute
  - Hardware Assist
  - Enhanced Live Migration Compatibility
- vStorage
  - Storage Management & Replication
  - Storage Virtual Appliances
- vNetwork
  - Network Management
Infrastructure Services Deliver CapEx and OpEx Savings

- Hardware assist
- Extended Live
- Migration Compatibility

- Storage Management
- Replication
- Migration Compatibility

- Network Management

- Storage/Virtual Appliances

- vNetwork

- vStorage Thin Provisioning
- Volume Grow

- vNetwork Distributed Switch
- Third party distributed virtual switches

- vNetwork Standard Switch

- vCompute

- Storage/network optimizations
- Power Management
- VMDirectPath I/O

- CPU/Memory optimization
- DRS

- vStorage VMFS
- Storage vMotion

Highest consolidation ratios in the industry
Most efficient use of hardware resources
Low operational overhead
vSphere 4.0 Infrastructure Services: vStorage

**VMware vSphere™ 4.0**

**Infrastructure Services**
- vCompute
- vStorage
- vNetwork

**NEW**
- Enhanced vCenter Storage Capabilities
- iSCSI enhancements
- Thin Provisioning for virtual disks
- VMFS volume grow
- Pluggable Storage Architecture
- vStorage APIs for Data Protection

**CURRENT**
- VMFS
- Storage VMotion
- Consolidated Backup
Benefits of vSphere New Storage Features

- **Improved efficiency**
  - Virtual Disk Thin Provisioning
  - New iSCSI Software Initiator

- **More control**
  - New vCenter Storage Capabilities
  - Dynamic Expansion of VMFS Volumes

- **Increased Choices**
  - Enhanced Storage vMotion
  - Storage vendor plug-ins for MPIO
  - API for Data Protection
  - PVSCSI and VMDirectPath IO
Increased Storage Efficiency
vStorage Thin Provisioning

- Virtual machine disks consume only the amount of physical space in use
  - Virtual machine sees full logical disk size at all times
  - Full reporting and alerting on allocation and consumption

- Benefits
  - Significantly improve storage utilization
  - Eliminate need to over-provision virtual disks
  - Reduce storage costs by up to 50%
Thin Provisioning Options

Virtual Disk Provisioned for VM
Thin Virtual Disk

VMFS Volume/Datastore
Provisioned for ESX

LUN Provisioned at Array
Thin Provisioned LUN
within the Array
Thin Disk Provisioning Operations

A thin-disk option is available when you:
- Create a virtual machine
- Clone to a template
- Clone a virtual machine
- Migrate virtual machine storage (Storage VMotion)
- Deploy from template

Create New Virtual Machine Wizard

Clone and Migrate Virtual Machine Wizards
Key Improvements

- New scalable S/W iSCSI implementation
- Optimized and tuned with new ESX TCP/IP2 stack
- Minimized use of atomics and pre-fetching of locks
- Optimized affinity setting for better cache affinity
- Various histograms to monitor the usage of TCP/IP and per-CPU activities
Updated SW iSCSI Stack

- Significant performance improvements
- No longer requires service console connection to communicate with an iSCSI target
- New iSCSI initiator features

Host Configuration > Storage Adapters > Properties
New iSCSI Initiator Configuration Options

- Improved security
- Performance fine-tuning

For details, see the iSCSI SAN Configuration Guide
iSCSI Performance Improvements

S/W iSCSI performance
(ESX 4 compared to ESX 3.5)

Significant improvement in CPU Cost:

- Read (+10% to 25%)
- Write (+20% to 50%)
Improved Storage Resource Control
vSphere Storage Management

- Provide new monitoring, reporting and alarms features
  - Alerts for thin provisioning and storage connectivity failures
  - Gauge for capacity utilization
  - Manage threshold VMs storage
  - Configuration and management of datastores from a single point
- Security for your datastores
- Simplified troubleshooting with end-to-end view from virtual machine to storage
- Easy migration of virtual disk with Storage vMotion – between FC, NAS, and iSCSI
New Datastore Views

Datastore Views

- Manage Datastores independent of hosts
- Comprehensive usage reports
- See storage resources in Maps

New Management capabilities:

- Group datastores to folders
- Set Alerts/Alarms on capacity
- Set and control Permissions
## Datastore Summary and details

<table>
<thead>
<tr>
<th>Datastore</th>
<th>File system type</th>
<th>Connectivity Status</th>
<th>Multipathing Status</th>
<th>Capacity</th>
<th>Free Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC_Set01_05</td>
<td>VMFS</td>
<td>Up</td>
<td>Full Redundancy</td>
<td>149.75 GB</td>
<td>51.08 GB</td>
</tr>
<tr>
<td>Templates</td>
<td>VMFS</td>
<td>Up</td>
<td>Full Redundancy</td>
<td>323.25 GB</td>
<td>288.42 GB</td>
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<tr>
<td>FC_Set02_06</td>
<td>VMFS</td>
<td>Up</td>
<td>Full Redundancy</td>
<td>149.75 GB</td>
<td>149.20 GB</td>
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<td>FC_Set02_05</td>
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<td>104.92 GB</td>
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<td>esx01a_Local</td>
<td>VMFS</td>
<td>Up</td>
<td>Full Redundancy</td>
<td>14.50 GB</td>
<td>6.64 GB</td>
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<tr>
<td>FC_Set01_06</td>
<td>VMFS</td>
<td>Up</td>
<td>Full Redundancy</td>
<td>149.75 GB</td>
<td>105.19 GB</td>
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<tr>
<td>Storage1</td>
<td>VMFS</td>
<td>Up</td>
<td>Full Redundancy</td>
<td>14.50 GB</td>
<td>6.64 GB</td>
</tr>
</tbody>
</table>

### Datastore Details

**Path Selection**
- Most Recently Used:

**Properties**
- Volume Label: FC_set11_06
- Datastore Name: FC_set11_06

**Extents**
- DGCH Fibre Channel Disk (na... 10.00 GB

**Formatting**
- File System: VMFS 3.33
- Block Size: 1 MB

**Path Details**
- Total: 4
- Broken: 0
- Disabled: 0

**Capacity**
- Total: 9.75 GB
- Used: 9.38 GB
- Free: 375.00 MB
Thin Provisioning Management

Handling running out of space

- Alarms help in notification
  - datastore over-allocation
  - VM total size
- Use reporting to view space usage

Solving an Over Allocation Issue

- Increase datastore capacity using volume grow/add extent
- Use storage vmotion to mitigate space usage on a particular datastore
Options to Alleviate Over Subscription

1) Increase the datastore/VMFS Volume
   - Add Extend/spanning
   - VMFS Volume Grow

2) Move some VM homes to a different datastore with Storage VMotion

3) Cold Migrate of active VM homes to another datastore
Volume Grow expands an extent so that it fills the available adjacent capacity.

- Single partition provides improved virtual machine availability
- Can grow a volume any number of times up to size for a VMFS volume
- Must grow LUN backing VMFS datastore first
- Extent immediately after must have free space in LUN
VMFS Volume Grow

Virtual Disk Provisioned for VM

VMFS Volume/Datastore Provisioned for ESX

VMFS Volume Grow

LUN Provisioned at Array

Dynamic LUN Expansion
## Comparison: Grow Extent and Add Extent

<table>
<thead>
<tr>
<th></th>
<th>Grow Extent</th>
<th>Add Extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Must power-off VMs</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Can be done on newly-provisioned LUN</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Can be done on existing array-expanded LUN</td>
<td>Yes</td>
<td>Yes (but not allowed through GUI)</td>
</tr>
<tr>
<td>Limits</td>
<td>An extent can be grown any number of times, up to 2TB.</td>
<td>A datastore can have up to 32 extents, each up to 2TB.</td>
</tr>
<tr>
<td>Results in creation of new partition</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>VM availability impact</td>
<td>None</td>
<td>Introduces dependency on first extent.</td>
</tr>
<tr>
<td>Introduced in version</td>
<td>ESX 4.0</td>
<td>ESX 3.0</td>
</tr>
</tbody>
</table>
More Storage
Access
Choices
vStorage Storage VMotion

- Information Lifecycle management of virtual machine disk files across storage arrays
  - Set policies to relocate virtual machine disk files across tiered storage
  - Full GUI administration
  - Supports NFS, FC and iSCSI

- Customer Benefits
  - Reduce footprint from high end storage
  - React to changing requirements to Service Level Agreements
  - Reduce backup time, by backing up only active data
Enhanced Storage VMotion

Enhanced mobility of VMs without downtime

1. Copy VM home to new location
2. Start changed block tracking
3. Pre-copy disk to destination (multiple iterations)
4. Copy all remaining disk blocks
5. Delete original VM home and disks

“Fast suspend/resume" VM to start running on new home and disks
New Capabilities for Storage VMotion in vSphere

- No longer requires 2x memory
- Leverages fast suspend/resume and change block tracking to speed up migration
- Supports moving VMDKs from thick to thin formats
- Can migrate RDMs to VMDKs
- Can migrate RDMs to RDMs

Select a format in which to store the virtual machine’s virtual disks

- Same format as source
  - Use the same format as the original disks.
- Thin provisioned format
  - Allocate full size now and commit on demand. This is only supported on VMFS-3 and newer datastores. Other types of datastores may create thick disks.
- Thick format
  - Allocate and commit the full size now.
vStorage Native Multi-Path (NMP)

- Feature within VMFS
  - Enables concurrent fast access to the same virtual machine
  - Support FC, iSCSI
  - Basic failover support

- Benefits
  - Ideal for SMB and Remote office
  - Increase the systems uptime
  - Helps in performance management
Enhanced Multipathing with Pluggable Storage Architecture (PSA)

- **Storage Array Type Plugins (SATPs)** handle path failover, monitors path health, and reports changes to NMP.
- **Path Selection Plugins (PSPs)** choose the best path.
vStorage APIs for Multipathing

Pluggable Storage Architecture (PSA)

- VMware NMP
- VMware SATP
- VMware PSP
- Third-Party PSP
- Third-Party SATP
- Third-Party MPP

For unique performance and fault-tolerance behavior
To accommodate specific storage arrays
For more complex I/O load balancing algorithms
vStorage API for Multipathing

Virtual Machines

ESX Server

HBAs

Storage Array

Storage Vendors provide Plug-ins to

- Leverage multiple connections from storage to ESX server
- Intelligence path selection for performance
- Maximize availability with automatic failover and failback if channel fails

Coordinated Path Management
vStorage APIs for Data Protection

Backup software partners have indicated strong support for the vStorage APIs for Data Protection: CA, Commvault, EMC, HP, IBM, Symantec, Vizioncore ...
Features in vStorage APIs for Data Protection

Includes All VCB features

Also supports:

- All storage architectures for backup and restore, LAN and SAN
- Full, incremental, and differential file-level backup options
- File-level backup and restore
- Windows and Linux guests
- Snapshots and Volume Shadow-Copy Service Quiescing
**Para virtualized SCSI Adapters**

**Serial-Attached SCSI (SAS) paravirtualized PCIe storage adapter**

- A virtual adapter with the hardware specification written by VMware
- Provides functionality similar to BusLogic, LSI Logic and LSI Logic SAS
- Supports MSI-X, PME, MSI capabilities in the device
- Drivers available for Windows Server 2003, 2008 and RHEL 5

**Key benefits:**

- Lower overhead and higher CPU efficiency in I/O processing means:
  - Higher throughput and lower latency
  - Better performance under high I/O conditions
  - Better VM scalability (more VMs/VCPUs per host)

**Proofpoints:**

- +92% IOPS, -45% latency, -6% CPU compared with LSI Logic running GSBlast micro-benchmark (MS SQLIOSIM) on an 8 PCPU system on a 4-VCPU Win2K8 VM

**Caveat:**

- Does not support boot disks with ESX 4.0
Optimization for the Highest Consolidation Ratios

### Virtual Machines
- **VM Scale Up**
  - 8-way vSMP and 255 GB of RAM per VM
- **Hardware Scale Up**
  - 64 cores and 512 GB of physical RAM
- **Hardware Assist**
  - Purpose Built Scheduler
  - Lowest CPU overhead
  - Maximum memory efficiency
- **Page Sharing**
  - Ballooning
  - Wirespeed network access
- **Memory**
  - VMXNET3
  - VMDirectPath I/O
  - Greater than 200k iops per second
  - Lower than 20 microsecond latency
- **Networking**
  - Storage stack optimization
  - VMDirectPath I/O
- **Storage**
  - Current
  - NEW
VMDirectPath I/O for Storage

Enhances CPU efficiency for workloads that require constant and frequent access to I/O devices.

Enabling virtual machines to directly access the underlying hardware devices.

Experimental support for the following storage I/O devices:

- QLogic QLA25xx 8Gb Fibre Channel
- Emulex LPe12000 8Gb Fibre Channel
- LSI 3442e-R and 3801e (1068 chip based) 3Gb SAS adapters

- Use of this feature maps a single HBA to a single VM and will not enable sharing of the HBA by more than a single Virtual Machine.
- Other virtualization features, such as VMotion, hardware independence and sharing of physical I/O devices will not be available to the virtual machines using VMDirectPath.
Additional New vStorage Features

Optimized Storage Capabilities

- SCSI-3 Compliant
- Native SATA support
- Supports for up to 64 NFS datastores per ESX Server
- Support for Jumbo Frames with both NFS and iSCSI on 1Gb and 10Gb NICs
- MS Server 2008 Failover Clustering support
  - Persistent reservations in VMkernel
  - LSI Logic SAS (virtual SAS controller)
- New storage virtual devices
  - Paravirtual SCSI adapter
  - IDE virtual device
    - for supporting older operating systems that lack SCSI drivers.
VMware Data Recovery: A Technical Introduction
“Data protection is a big part of storage budgets among SMBs”

In general, what are your organization’s greatest challenges with respect to its storage environment?

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Percent of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need to improve backup and recovery processes</td>
<td>38%</td>
</tr>
<tr>
<td>Storage system costs</td>
<td>33%</td>
</tr>
<tr>
<td>Keeping pace with overall data growth</td>
<td>31%</td>
</tr>
<tr>
<td>Running out of physical space</td>
<td>30%</td>
</tr>
<tr>
<td>Insufficient capital budget</td>
<td>26%</td>
</tr>
<tr>
<td>General increase in complexity of IT environment, number of servers, etc.</td>
<td>26%</td>
</tr>
<tr>
<td>Storage requirements/complexity related to specific applications</td>
<td>24%</td>
</tr>
<tr>
<td>Rapid growth in unstructured, file-based content</td>
<td>22%</td>
</tr>
<tr>
<td>Supporting storage and data protection requirements at remote/branch offices</td>
<td>18%</td>
</tr>
<tr>
<td>Lack of qualified IT staff and/or skills</td>
<td>17%</td>
</tr>
<tr>
<td>Poor storage utilization</td>
<td>17%</td>
</tr>
<tr>
<td>Meeting regulatory compliance requirements</td>
<td>15%</td>
</tr>
<tr>
<td>Power and cooling costs</td>
<td>14%</td>
</tr>
<tr>
<td>General complexity of managing external storage systems</td>
<td>13%</td>
</tr>
<tr>
<td>Poor search tools/general difficulty finding relevant content across the enterprise</td>
<td>13%</td>
</tr>
<tr>
<td>Meeting e-discovery demands (i.e., litigation support)</td>
<td>9%</td>
</tr>
<tr>
<td>Poor service and support from vendor(s)</td>
<td>9%</td>
</tr>
<tr>
<td>Supporting storage and data protection requirements</td>
<td>7%</td>
</tr>
</tbody>
</table>

ESG, 2008 Medium-Size Business Server & Storage Priorities
Main Factors Influencing Decision to Use Backup to Disk in SMBs

- Fast data recovery/restore
- High reliability of disk drive media
- Previous negative experience with tape
- High reliability of the restore/recovery process
- Shorten time between backups
- Reduced backup window
- Reduce data protection/admin overhead costs

(% of Respondents)

- Small Businesses (n=137)
- Medium-sized Businesses (n=266)

Yankee
Protecting Against All Types Of Downtime
vStorage APIs for Data Protection

Next Evolution of VCB shipping with vSphere
- Improved API enables native integration with partner backup application
- Deployable on Windows and Linux platforms
- Supports all storage architectures

Enhanced Functionality
- Supports incremental, differential and full VM image backup options
- Supports file level backup and restore
- Supports Windows and Linux guests

Customer Benefits
- Easy backup Integration with VI
- Efficient backups
- Easy restore
VMware’s data protection approach is to provide a broad range of solutions for customers through our technology partners and the VMware Data Recovery product.
1. **Backup**
   - **vCenter**
     1. Schedule backups via VC
     2. Snapshots taken
     3. Data de-duped and stored
   - Agent-less, disk-based backup and recovery of VMs on ESX and ESXi hosts
   - Backups occur independent of power state and location of VM
   - VM or file level restore
   - Data de-deduplication and compressed to save disk space

2. **Restore**
   - **vCenter**
     1. VM goes down
     2. Select VM images/files to recover
     3. Fast restore of VM...downtime minimized
   - Quick, simple and complete data protection for your VMs
   - Ease of deployment
   - Centralized Management through vCenter Server
   - Cost Effective Storage Management
Target user is VI Administrator

- Uses vCenter Server to manage VI
- Wants simple agentless VM backup and restore
- Smaller environment <100 VMs
- “Set and Forget” : Wants simple UI with minimal options
- Wants to leverage disk (esp. shared storage) as target
- “Always on” de-duplication to optimize storage
- Non-VM backups solved via other products

One backup every 24 hours

- More aggressive RPO workloads protected by other means
**VMware Data Recovery Key Components**

**Backup and Recovery Appliance**
- Linux appliance in OVF format - leverages vStorage API for Data Protection to discover, manage backup and restore
- First backup is full VM, then incremental forever
- VM or file level restore

**VMware vSphere**
- VSS support via VMware Tools
- Changed block tracking functionality allows backups to be more efficient

**Destination Storage**
- Any VMFS storage: DAS, NFS, iSCSI or Fibre Channel storage, RDM plus CIFS shares as target
- All backed up virtual machines are stored on disk in a deduplicated datastore

**vCenter integration**
- vSphere Client Plugin
- Wizard driven backup and restore job creation
- Automatically import virtual machine inventory
- Awareness of HA/VMotion/DRS
VMware Data Recovery: Under The Hood

vStorage API for Data Protection

VMware Specific Technologies

VDDK

VI API

Policy Engine

Data Deduplication

Incoming Data Stream

Slab File "S1"

Index Tree

Indirect Data Stream

A->S1/1
B->S1/2
C->S1/3
D->S1/4
E->S1/5

S1/1 S1/2 S1/1 S1/3 S1/1 S1/2 S1/1 S1/2 S1/1 S1/4 S1/5 S1/1 S1/2
### Data Deduplication Details

- Included standard with VMware Data Recovery
- Destination based in-line deduplication
  - Variable length chunking using fingerprinting
  - SHA1 hashes for identifying chunks
- Up to two deduplicated destination disks per backup appliance
- In addition to VMDK, can also be RDM and CIFS share (target)
- Application agnostic deduplication (i.e. all data is deduplicated)
- No built-in replication of deduplicate datastore or integration with tape
- Detects incomplete backups and rolls forward after unclean shutdown/crash
- Offline “grooming” of deduplication store
1. Quiesced snapshot is taken
2. Snapshot is hot added to backup appliance (when using shared storage)
3. Change block tracking list determines which blocks have changed. Otherwise scan disk to determine changed blocks
4. Changed blocks are transferred
5. Deduplication engine breaks stream into data chunks and compares to see if chunks match to stored chunks
6. If unique chunk, store chunk (compressed) and update indexes. If redundant chunk, just update indexes
7. Snapshot is dismounted
Implementation Considerations

- Not compatible with ESX/ESXi 3.x/VC2.5 and older
- ESX host resources for snapshots (compute and storage)
  - Does not backup snapshot tree
- Destination disk – “you get what you pay for”
- Incremental backups only after first full backup
  - Product will automatically synthesize multiple restore points when a point in time restore is performed (file or VM)
- Upgrade VMs to HW version 7 to leverage changed blocked tracking for faster generation of changes to be transferred
- Use of shared storage allows off-LAN backups leading to faster data transfer/minimize LAN load
- Update VMware Tools for Windows VMs to enable VSS which properly quiesces VM prior to snapshot
Backup Job Details

- Identify VMs To Backup
- Select Destination Disk
- Select Backup Window
- Select Retention Policy

- First backup is a full backup and then incremental forever
- Each backup runs once every 24 hours
- Maximum of 8 concurrent backup jobs per backup appliance
- Each job can only have one destination
- **ALL** backup jobs are deduplicated and compressed prior to storage on target disk
Backup: Virtual Machine Selection

- Automatically import all hosts and VMs
- Backups can be attached different levels of tree
- Can include or exclude child objects
Backup: Supported Destinations and Storage Types

- Backup to
  - Another virtual disk on VMFS (DAS, NFS, iSCSI, Fibre Channel)
  - CIFS Share
  - Raw Device Mapping (RDM) attached to backup appliance
- Multiple destinations per backup appliance are supported, but each back job can have only one destination
- Supports the ability to grow target disk when full

<table>
<thead>
<tr>
<th>Destinations:</th>
<th>Type</th>
<th>Status</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>/10.17.149.113/amy/</td>
<td>Network Share</td>
<td></td>
<td>1.34 TB</td>
</tr>
<tr>
<td>/SCSI-0:1/</td>
<td>Local Volume</td>
<td></td>
<td>59.0 GB</td>
</tr>
<tr>
<td>/SCSI-0:2/</td>
<td>Local Volume</td>
<td></td>
<td>19.6 GB</td>
</tr>
</tbody>
</table>
> Defines a “backup window” when a job can run
> By default, every backup job runs once every 24 hours and does not run during typical business hours
> Once window is selected, the policy engine will take care of scheduling based on
  - Which jobs should run in windows and which run first
  - VMs out of compliance get backed up first within the job
  - ESX server load and free space available for snapshots
Backup: Data Retention Policy

- Pre-defined per-job retention policies based on # of restore points
- Or customize the retention policy

![Data Retention Policy Options](image)

**Data Retention Policy:**
- Few
- Medium
- Many
- Custom

**Policy Description:** You have chosen to use a custom Data Retention policy.

**Details:** The minimum number of most recent backup images preserved: 50

This policy also preserves...
- ... the last 18 weekly backup(s)
- ... and the last 16 monthly backup(s)
- ... and the last 11 quarterly backup(s)
- ... and the last 7 yearly backup(s)
Complete Virtual Machine Restore

- Backups and restores can run simultaneously – 8 of either
- Highly customizable image level restore
  - Replace a lost VM
  - Restore to a different location/datastore
  - Select disks to restore
- Fast “roll back”:
  - Use change tracking to roll back a virtual disk/Virtual Machine to an earlier state.
  - Only transfers modified blocks for fast restore.
- Restore Rehearsal:
  - Run a restore of a VM to a different datastore and disable networking
Single File Restore

- Download restore client (Windows/Linux only) from backup appliance
  - Run restore client from inside guest
  - Select restore point
  - Restore point will be mounted in Virtual Machine
  - Browse file system and copy back what you need.

- Backup administrator can perform redirected restore
  - No need to restore a deleted VM when just a single file is needed.
<table>
<thead>
<tr>
<th>Feature</th>
<th>VMware Data Recovery</th>
<th>vStorage Enabled Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>VirtualCenter instance required</td>
<td>Required</td>
<td>N/A</td>
</tr>
<tr>
<td>Scale per backup appliance</td>
<td>Target of 100 VMs</td>
<td>Check with vendor</td>
</tr>
<tr>
<td>Tape or Removable Media Support</td>
<td>No</td>
<td>Yes, check with vendor</td>
</tr>
<tr>
<td>Legacy ESX host support</td>
<td>No</td>
<td>Yes, check with vendor</td>
</tr>
<tr>
<td>File by File backup</td>
<td>No</td>
<td>Yes, check with vendor</td>
</tr>
<tr>
<td>Always Perform Full Backups</td>
<td>No</td>
<td>Yes, check with vendor</td>
</tr>
<tr>
<td>VMotion/DRS/HA awareness</td>
<td>Yes</td>
<td>Yes, check with vendor</td>
</tr>
<tr>
<td>Scheduling</td>
<td>Yes, time range</td>
<td>Yes, check with vendor</td>
</tr>
<tr>
<td>Data Retention Policies</td>
<td>Yes, # of restore points</td>
<td>Yes, check with vendor</td>
</tr>
<tr>
<td>Logging &amp; Reporting</td>
<td>Yes</td>
<td>Yes, check with vendor</td>
</tr>
<tr>
<td>Non-deduplicated Backups</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>VMware Fault Tolerance VMs</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>vCenter Linked Mode Compatibility</td>
<td>No</td>
<td>Check with vendor</td>
</tr>
<tr>
<td>Agents</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Full VM backup</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Full VM Restore</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>File by File restore</td>
<td>Yes, experimental support</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Protecting Against All Types of Downtime

VDC-OS Application vServices Capabilities
- Full suite of products to protect more workloads against planned and unplanned outage
  - Planned: Server Maintenance, Backup Window
  - Unplanned: Data Corruption, Server Failure, Power Failure, OS Fault
- Simple deployment and management – all managed via VMware vCenter
- Application & OS Independence
More Information, visit