



Education

SERVER VIRTUALIZATION AND STORAGE DISASTER RECOVERY

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- **Server Virtualization (SV) and Storage Disaster Recovery (DR)**
 - ◆ Server virtualization demands increasingly sophisticated storage subsystems. To support disaster recovery (DR) in virtual server environments storage admins need to understand how I/O and storage layouts in these environments differ from non-virtualized server storage. In addition, some server virtualization systems in order to automate DR can make use of special storage subsystem capabilities unique to these environments.

Server Virt. (SV) DR advantages

- Testability
- Hardware independence
 - ◆ P2V, V2V, & V2P
- Performance optimization
- Data encapsulation

DR testability

- DR can be tested at VM level at local site on other SV servers
- DR can be tested at VM level at remote site with data replicas
- Virtual machine (VM) DR can be easily tested on other servers
 - ◆ Image copies needed
 - ◆ Configuration changes needed to run VM

Hardware (HW) independence

- Primary <> DR site HW
- SV hypervisor/kernel (HV/K) isolates and virtualizes all CPU, networking and storage HW interaction
 - ◆ Except physical/raw device mode (PDM)
- DR site can use re-purposed HW

P2V, V2V, & V2P

- **P2V** - physical server hosted as a VM at DR site via converter or 3rd party tools
- **V2V** - DR site server HW different than primary site HW
- **V2P** - VM hosted as a physical server at DR site, requires compatible HW, 3rd party tools

Performance optimization

- VMs can easily be migrated to other SV servers at DR site to optimize performance or to balance resource utilization
- SV VM migration services supported
- Data migration services may also be used

Data encapsulation

- SV encapsulates all VM data in few files under one directory
 - ◆ Except PDM data
- File data can be restored to re-start a VM on a remote site virtualized server

SV Data Mapping

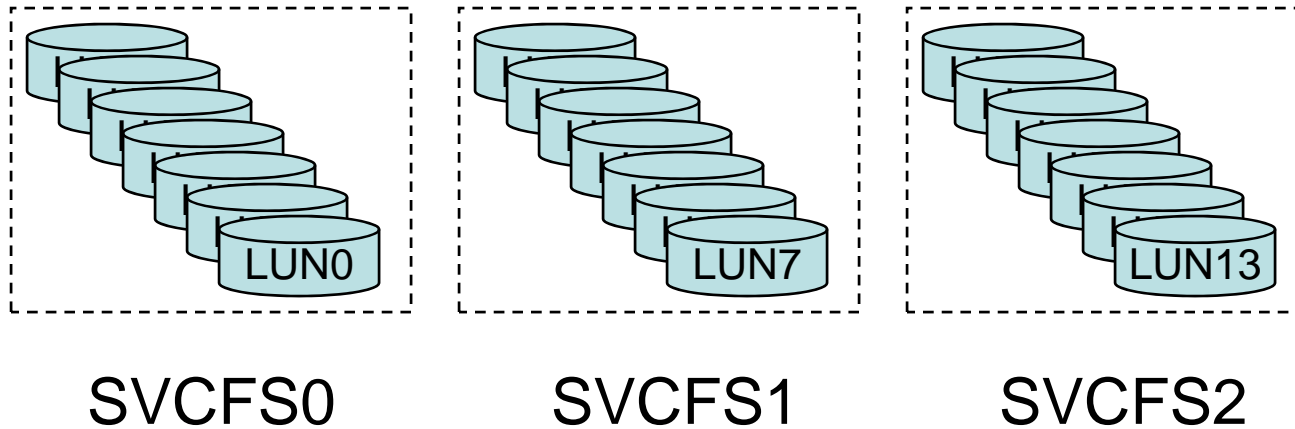
- Most but not all SV products support clustered file systems for data storage (CFS) using
 - ◆ iSCSI
 - ◆ FC storage
- Can also use NAS/NFS volumes
- Some SV products only need shared LUN access
- Most SV products also support physical disk access bypassing IO virtualization

SV CFS capabilities

- Most CFS's support distributed,, high performance, scaleable, sharable file system
- Some CFS's support flexible block sizing, flexible file system/volume sizing, snapshots, and file system change journals

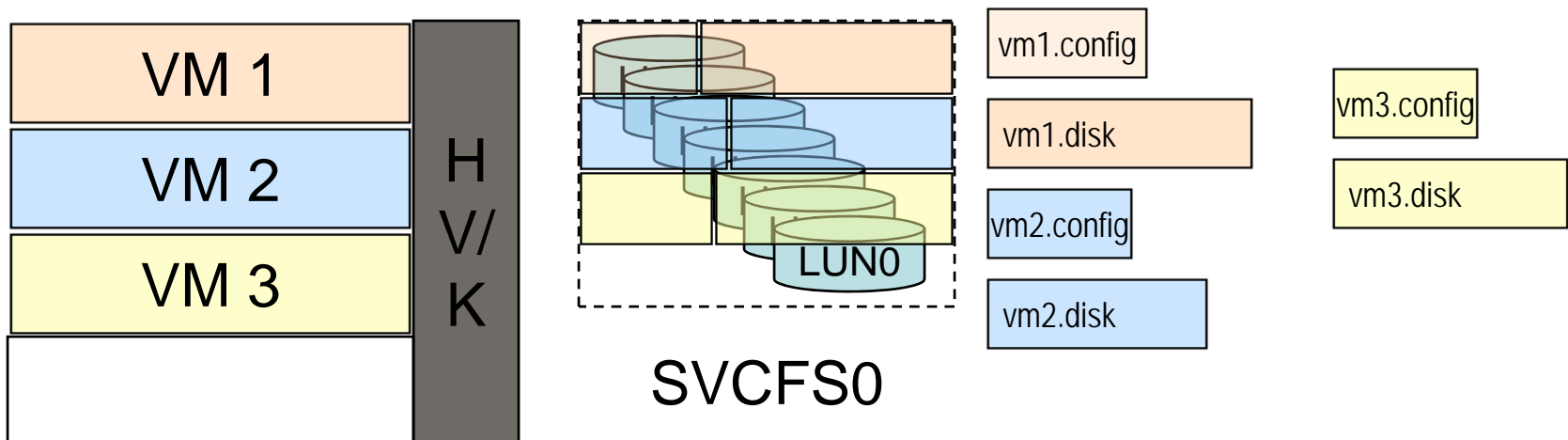
SV CFS data stores

➤ SV CFS data stores



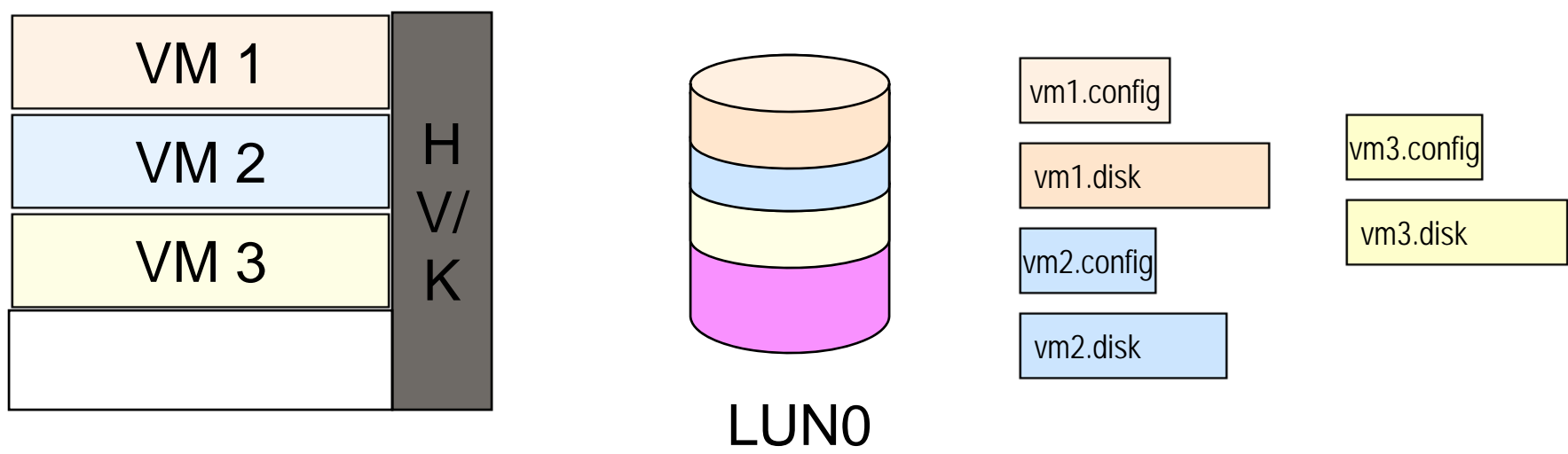
Files for each VM

- File(s) that encapsulate the config, O/S, application, and data for a VM
 - ◆ Typically a .config file and at least a .disk file that corresponds to all physical disks needed by the VM



Shared LUN data stores

➤ Shared LUNs are partitioned to support VMs



Physical Device Mapping (PDM)

Two modes

➤ Virtual compatibility mode

- ◆ Simulates physical device I/O

➤ Physical access mode,

- ◆ I/O directly to physical device bypassing HV/K I/O virtualization
- ◆ SV CFS level snapshots not supported

Recap SV DR advantages

- Provides easy DR testability
- Removes H/W dependencies at DR site
- Performance optimization at DR site
- Encapsulates all VM data
 - ◆ PDM data lone exception

SV backup alternatives

- Backup SW agents on VMs
 - ◆ File level backup & restores
- Backup SW agents at HV/K service manager (HV/K-SM)
 - ◆ Disk image level backup & restores
- Specialized backup services
- Continuous data protection (CDP)

VM backup agents

- No change to current backup procedures
- Backup agents on VM read files
- VM backup agent transfers file data to backup server over LAN
- Backup server writes data to backup target
 - No .disk or .config images for DR
 - Ability to do file level restores
 - Performance considerations

- Backup agents on HV/K-SM reads .disk and .config files
- HV/K-SM backup agent transfers file data to backup server over LAN
- Backup server writes data to backup target
- Backups all VMs on SV server
- No file level restore
- Performance considerations

Specialized backup

- “LAN-free” backup of VMs
 - ◆ Suspend VM
 - ◆ Uses snapshots to replicate data stores
 - ◆ Catalog’s VM state on snapshot
 - ◆ Resume VM
 - ◆ Snapshots mounted or streamed to backup server
 - ◆ Snapshots backed up to target media via other backup SW
 - ◆ Releases snapshots after backup
- Requires shared access to data stores

SV-CFS level snapshots

- Copy of disk, memory, CPU state taken point-in-time
- Parent-child relationship
- Change journal logs
- Activity state of VM?

Specialized backup services

Works well for

- Offloading HV/K-SM backup cycles
- Image copies of VMs
- File level backups for some operating systems

Specialized backup services

Works poorly for

- VMs with large .disk files - need file level backups
- OLTP or always on VMs
- PDM storage

- VM based write splitters protect VM files
- Network and storage array write splitters protect disk images
- Some CDPs support HV/K write splitters
- Depending on splitter location can have file or disk level rollback

SV backup recap

- How you backup VMs impacts DR
- Specialized backup services can help DR
 - ◆ For the right VMs
- Disk image files similar to bare metal restore files

SV local clustering

- For performance optimization
- For fault tolerance/high availability (FT/HA)
- Both depend on
 - ◆ Active VM migration to migrate VMs between SV servers
 - ◆ Shared access to datastores

SV performance clustering

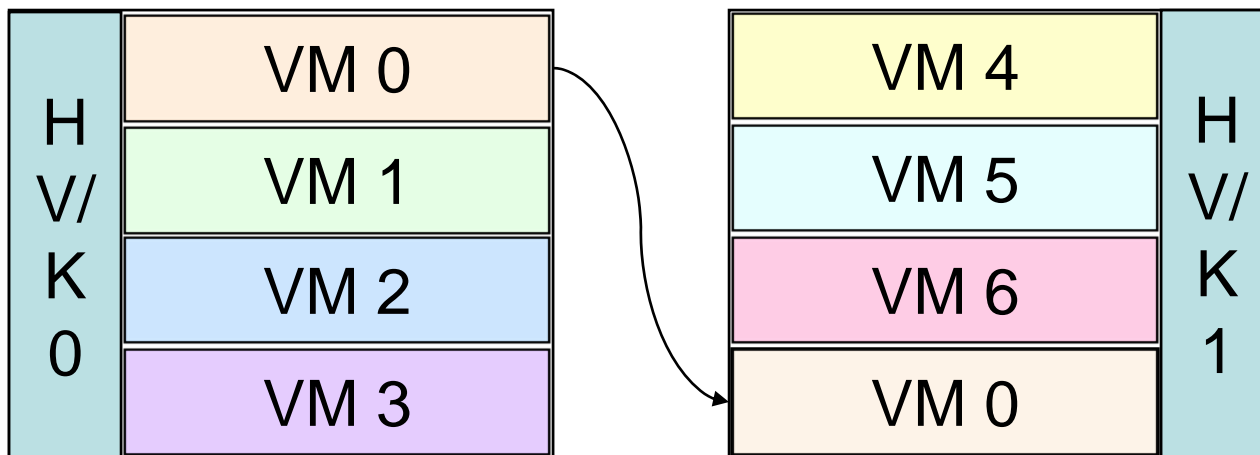
- User defined pools of resources and VM prioritization
- Automatic or manually balances VM load across defined resource pools
- Also used for service outages
- Also supports power management

SV FT/HA clustering

- Local fault tolerant cluster of SV servers using heartbeat to detect failed server
- Reserves resources for fail over
- In combination with performance clustering selects optimal placement for restart

Active VM migration

- Running VM quiesced, snapped and terminated
- Activates new VM on another SV sever
- Requires
 - ◆ Shared access to data stores
 - ◆ Compatible H/W
- VM data stays in place



Why clustering and migration

DR requires similar processes

- Can operate both at local and remote site to optimize performance
- Resource pool definitions and VM prioritization also needed for DR

SV DR alternatives

- Non-PDM DR
- PDM DR
- Specialized DR software/services

Non-PDM VM DR

VM data is .config, .disk(s), & other files

- Disk image copies available at remote site
- H/W & S/W to run SV server
- Configure SV server to run VM
- Configure data store(s)
- Restore VM files
- Re-IP network
- Start SV server
- Restart VM

PDM VM DR

Same as Non-PDM VM DR but

- PDM configuration files needed
- Physical copy of PDM LUN(s) required to be backed up and restored at DR site before VM restart
- Storage HW configuration matches primary site

Specialized DR services 1

- Maps LUNs to data stores to (.disk & .config) files
- Can support HW asynch and/or synchronous disk mirroring
- Can take advantage of HW storage snapshots
- Automates
 - ◆ Procedures to invoke SAN/IPSAN-LUN replication
 - ◆ Processes to failover to hotsite
 - ◆ Procedures to re-IP networking at hotsite

Specialized DR services II

- Software packages that support geographically distributed clustering
- Software packages that support disk data replication using WAN
- Specific to SV solution

Other cluster software

Operate at VM level and only at local/single site

- Specific to VM O/S
- Available for SVs and VMs at one site alone
- Features specific to each product and each SV solution

Remote data replication

- SAN and IPSAN data mirroring
- Storage Virtualization
- Replication appliances
- Remote CDP
- Software replication

SAN and IPSAN mirroring

- Dedicated networking for SAN, WAN used for IPSAN
- Active storage at remote DR site
- Types of SAN mirroring
 - ◆ Synch
 - ◆ Semi-synch
 - ◆ Asynch
- Requires matching vendor storage HW

SV SAN and IPSAN mirroring

- Insure all LUNs for data stores are single consistency group
- Data store mirrored LUNs/volumes must contain all .disk and .config files for VM needed for DR
- PDM LUNs also need to be mirrored
 - ◆ Should be included in consistency group

Storage virtualization

Storage HW independence

- Heterogeneous data mirroring
 - ◆ Primary <> DR site storage hardware
- Also provides storage tiering and pooling across subsystems

Replication appliances

- Usually network attached dedicated HW providing remote replication
- Can use TCP/IP over WAN for data transfer
- Support for Asynch mirroring
- Considerations same as SAN mirroring

CDP replication appliances

- Similar to replication appliances but
- Provide any point-in-time recovery
 - Requires write-splitter at VM, at HV/K, network, or storage HW

Software Replication

- Often specific to VM O/S being used
- Uses WAN for replicating data
- Typically tied in at the HV/K level
- Can be tied to software clustering products specific to each SV solution

- Please send any questions or comments on this presentation to SNIA: trackvirtualization@snia.org

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