Design, Configure and Manage Storage for Virtual Environments

Chicago, IL | June 19, 2014

Brought to you by TechTarget Data Center and Virtualization

#MiStorageVirt14
Event Sponsor

Insight

Partner Sponsors

CA Technologies, DELL, EMC², HP, IBM, Intel, NetApp, Symantec

Gold Sponsor

Tintri

Exhibiting Sponsor

maxta
Design, Configure and Manage Storage for Virtual Environments

Server virtualization has proven to be a boon to the server side of the house, but often the bane of the IT storage team. Virtualized servers put new demands on storage systems and fabrics—in terms of performance, bandwidth and capacity—that were unusual and rarely expected in traditional physical server environments. While the shared and networked storage model is perfect for virtualized servers, the way that storage is configured and made available often fell short. But storage system vendors have helped change that paradigm to put storage more in sync with virtual servers and responded with new and updated products to meet the special requirements of virtualized environments. Today, you'll learn where storage problems are most likely to crop up and how to address them—by adjusting existing systems or taking advantage of some newer storage technologies available now.

—Rich Castagna, Editorial Director, Storage Media Group

Keynote Speaker

Howard Marks
Founder & Chief Scientist, DeepStorage.net

As Founder and Chief Scientist at DeepStorage, LLC, Howard Marks provides the kind of practical, hands-on analysis that can only come from spending 30 years in the trenches. As a consultant, he helped organizations large and small—including American Express, JP Morgan, BBDO Worldwide and Foxwoods Resort Casino—solve real world storage and network problems.

Now at DeepStorage, he runs an independent test lab evaluating the latest in storage products in beautiful Santa Fe, NM and writes about them for multiple websites such as TechTarget and NetworkComputing.com. An entertaining and energetic speaker, Howard speaks regularly at industry events including Storage Decisions, Interop and Microsoft’s TechEd. He has written three books and hundreds of articles on networking and storage technologies.

Howard is co-host of the monthly Greybeards on Storage podcast. He has been recognized as a member of the vExpert, PernixPro and EMC Elect programs. Howard Marks has also been a member of the TechTarget Speaker Bureau since its formation in 2012 and has spoken at numerous TechTarget events in previous years.

Today’s Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00–8:55 AM</td>
<td>Registration/Welcome Refreshments</td>
</tr>
<tr>
<td></td>
<td><em>Exhibit area is open</em></td>
</tr>
<tr>
<td>8:55–9:00 AM</td>
<td>Opening Remarks</td>
</tr>
<tr>
<td>9:00–10:00 AM</td>
<td>Independent Expert Session 1: Why Virtualization is Hard for Storage</td>
</tr>
<tr>
<td>10:00–10:15 AM</td>
<td>Peer Networking and Refreshment Break</td>
</tr>
<tr>
<td>10:15–10:45 AM</td>
<td>Solution Presentations</td>
</tr>
<tr>
<td>10:45 AM–11:15 AM</td>
<td>Peer Networking and Refreshment Break</td>
</tr>
<tr>
<td>12:15–12:30 PM</td>
<td>Q&amp;A with Howard Marks</td>
</tr>
</tbody>
</table>

Lunch and Afternoon Session Sponsored by Insight

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:30–1:30 PM</td>
<td>Lunch and Presentation by Insight</td>
</tr>
<tr>
<td>1:30 PM</td>
<td>Raffle/Seminar Adjourns</td>
</tr>
</tbody>
</table>

Connect with Howard Marks!

Email: HMarks@deepstorage.net
Website: www.DeepStorage.net
Twitter: @DeepStorageNet

#MiStorageVirt14
Session Descriptions

Session 1 – Why Virtualization is Hard for Storage

In the morning session, we’ll explore the challenges that virtual environments present to traditional storage systems. This will begin with how hypervisors both use shared storage and devalue those storage systems data management features. We’ll then move on to how the combined workloads create noisy neighbor problems. The first session will conclude with a discussion of how hypervisors can revolutionize the process of backup and disaster recovery (DR).

Topics covered will also include:

- Virtualization is driving the storage market
  - Before virtualization
    - Arrays tuned for online transaction processing (OLTP)
    - Performance managed by dedicated spindles
  - How virtualization changes storage
    - Shared storage for feature support
    - Combined workloads
      - The IO blender
      - The noisy neighbor problem
      - Array features devalued
  - The storage challenge of VDI
    - Complex workload

- Achieving shared storage
  - Managing VMs over SANs and NAS
  - Storage hypervisor integration via VAAI and ODX

- How virtualization effects backup and DR
  - Backup via the vStorage API data plane
  - Per VM snap and replicate
  - Host based replication and failover
  - Cloud DR

Session 2 – How Modern Storage Addresses Virtualization

In the second session, we will examine how storage solutions have evolved over the past few years to better support virtual environments. Of course, the key to the discussion of modern storage is flash memory. We will talk about the performance flash can provide, how flash works and how that presents challenges to storage system designers. We’ll then look at the myriad ways flash can be integrated into a storage solution from in server memory channels to hybrid storage arrays.

Modern storage isn’t all about flash, however. New storage and hypervisor features like storage quality of service (QOS), data reduction and per-VM data management all vastly improve the integration of storage and the hypervisor. We’ll look at software defined storage solutions like the Server SAN that leverage the hypervisor itself to create a shared storage solution.

#MiStorageVirt14
We’ll conclude the final session exploring solutions to the unique challenges of supporting a VDI environment. We’ll also discuss how storage features like data deduplication can simplify VDI management while non-persistent storage solutions can provide the IOPs VDI demands.

Topics covered will also include:

- Modern storage solutions
  - SSDs, flash and spinning disks
    - How flash works
      - Write endurance
    - Anatomy of an SSD
    - Choosing SSDs
    - Flash deployment models
      - All flash array
      - Hybrid array
      - Local Flash
        - DAS and cache
  - Modern storage is more than flash
    - Addressing the noisy neighbor problem
      - Storage QOS and storage IO control
    - From blocks to files to VMs
      - VM-centric storage advantages
    - Software defined storage
      - Evolution of the Server SAN
        - VSAs
        - VSAN
        - Hyperconverged solutions
      - Choosing a Server SAN solution
- VDI, the last frontier
  - Storage deduplication and VDI
  - Non-persistent storage and VDI
Or How to Make Your Storage and Hypervisor Get Along

By Howard Marks, Founder & Chief Scientist, DeepStorage, LLC.

Designing and Managing Storage for Virtual Environments

Your not so Humble Speaker

• 25+ years of consulting and writing for trade press
• Columnist/blogger at NetworkComputing.com
• Chief Scientist DeepStorage, LLC.
  • Independent test lab and analysts
• @DeepStorageNet on Twitter
• Hmarks@DeepStorage.Net

Today’s Agenda: Session 1

• The Virtual System Storage Syndrome
  - How VMs and storage interact
    - Combined workloads create issues
    - The IO blender effect
    - The noisy neighbor
    - The challenges of VDI
  - Hypervisors and shared storage
    - VMs over SAN and NAS
    - Hypervisor integration via VAAI and ODX
  - How virtualization affects backup and DR
Today’s Agenda: Session 2

- Integrating storage and VMs
  - Of flash, SSDs and spinning disks
    - Anatomy of an SSD
    - Choosing SSDs
    - Flash deployment models
      - All Flash and hybrid arrays
      - Server-side flash
  - Addressing the noisy neighbor
    - Storage QoS and Storage IO control
  - Moving management to the VM w/VM centric storage
  - Evolution of the ServerSAN
- VDI the final frontier

Before Virtualization

- Storage arrays tuned for OLTP
  - Many 4 or 8K IOPS
  - Small working set
- Storage performance managed by spindles
  - 1 HDD=70-200 IOPS
  - App needs 2000 IOPS give it 10 15K RPM drives
  - RAID 1/10 for random IO
  - RAID 6 for sequential (like logs)
- Each application has its own LUN and spindles
  - Array can manage cache other resources per workload
"The I/O Blender" Strains Storage

- Multiple VMs share a datastore
- Virtualization throws I/O into a blender... all I/O is now random I/O!
  - Multiple servers doing sequential I/O multiplexed together
  - Storage array can't tell which is which
  - Breaking read-ahead, other cache management

Will Your I/O Blend?

- Dedicated spindles are like solid walls
  - Applications have limited effect on each other
  - Backups excepted – Same data
- Shared datastores provide no protection
  - 1 application demanding 10,000 IOPS will slow the others.
  - Addressed by Storage QoS, Storage IO Control and more flash
**VDI Presents Unique Workloads**

- Highly variable but coincident (boot/login in morning)
- Steady state 50+% write
- 40+% of projects fail due to storage performance

![Chart showing boot storm and steady state](storage-decisions-seminar.png)

**Why Is VDI so Hard on Storage?**

- The $50 disk in a desktop = 100 IOPS
  - 200 desktops = 20,000 IOPS
  - 100+ 15K RPM drives RAID 10
- Windows 7 with AV 2x IOPS of WinXP
- VDI user steady state IOPS
  - Light 6-12
  - Power 5-40
- But you need to plan for peak

**Hypervisors Want Shared Storage**

- Hypervisors have required shared storage
  - vMotion/Live Migration
    - Now supported with DAS
    - High Availability- Fault Tolerance/Windows Clusters
    - Backup via and VSAPl DP
- Shared storage can offload tasks via VAAI and ODX
- Direct-attached storage advantages
  - Cheaper to buy
  - No special storage skills
- New software-defined solutions can be best of both
Storage vMotion/Live Migration

- Migrates virtual server disk transparently
- Data migration was a big problem
  - Now a few mouse clicks
- Can be offloaded for VAAI-Block
  - Really only to 2nd volume on same array
  - Not NFS
- Enterprise or E+ license only!
- Up to 4 disks in motion at a time
- Both now support local disks

Remedial Shared Storage

- SAN
  - SCSI block addressing
  - Transport over iSCSI or Fibre Channel/FCoE
  - Raw access to disk/virtual disk
  - Host(s) manage clustered file system
    - VMware VMFS
    - Hyper-V NTFS via CSV (Cluster Shared Volumes)
- NAS
  - Storage system manages file system
  - NFS for VMware
  - SMB 3 for Hyper-V 3.0 (Windows 2012)

Choosing a Storage Protocol

Block:
- Some features supported on Fibre Channel first
- Explicit multipathing
  - For load balancing and fail over
- Wide array support

File:
- Easier to manage
  - But relies on NIC teaming for multipath
- More VMs per datastore
- More context for storage to provide services
  - Snapshots, dedupe Etc.
Enter the ServerSAN

- Scale-out where VSAs are fail-over clusters
  - Storage across n hypervisor hosts to form one pool
  - Maximum cluster sizes 8-32 nodes
- Use SSD as cache or tier
- Can be software or hyperconverged servers

Don't Choose a Protocol on Performance

- Worst case NFS 145%, iSCSI 140% of FC
  - That's still basically half of one core
- Nehalem processors offload digests so lower for TCP

Or CPU Utilization

- Worst case NFS 145%, iSCSI 140% of FC
  - That's still basically half of one core
The LUN Must Die

- When a SAN volume (LUN) held data for 1 application the array could:
  - Separate I/Os per LUN to identify sequentiality
  - Provide data services
    - Snapshots
    - Especially application consistent snapshots
    - Clones
    - Replication
  - Timing of application quiescing make datastore snapshots “Crash Consistent”
    - At best 1 VM app consistent per volume
- Storage for virtualization should be VM aware

Why Not vSphere Snapshots?

- Use “log” files like linked clones
- Writes go to log file while snapshot exists
- Reads must walk snapshot tree to find current data
- Can have substantial performance impact
  - That extends to the snapshot unwind

Vmware Snapshot Overhead:

- Log-based snapshots cause IOP multiplication on reads
  - Must check each snap to see who has latest
- Graph is IOMeter running 4K OLTP workload
vStorage API for Array Integration (VAAI)
The first step to VM-Aware Storage

- SCSI extensions to offload tasks to storage
  - Modern storage can unload to metadata operations
- Microsoft ODX leverages same extensions

<table>
<thead>
<tr>
<th>Name</th>
<th>Function</th>
<th>Benefit</th>
<th>MS ODX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atomic Test and Set</td>
<td>Lock block range (file lock for SAN)</td>
<td>No SCSI reservation, More VMs/LUN</td>
<td></td>
</tr>
<tr>
<td>Clone Blocks</td>
<td>Copies data in array</td>
<td>Faster cloning, vMotion YES</td>
<td></td>
</tr>
<tr>
<td>Block Zeroing</td>
<td>Fills space w/zero</td>
<td>Space reallocation</td>
<td></td>
</tr>
<tr>
<td>Out of space</td>
<td>Suspend VMs when out of space</td>
<td>Allows more graceful recovery</td>
<td></td>
</tr>
<tr>
<td>Thin provision</td>
<td>Reclaim space when out of space</td>
<td>Returns free space to array</td>
<td></td>
</tr>
<tr>
<td>Unmap</td>
<td>Releases &amp; zeros blocks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Backup in the Virtual World

- Virtualization changes the whole backup universe
- Virtual disk files enable image backups
  - VSAPI-DP changed block tracking adds incremental images
- All VMs are the same hardware
  - No more bare metal restore to different hardware
- Harder because:
  - They sprawl
  - They share bandwidth and CPU
  - Backing up one effects others
- New VM-only applications
  - That frequently lead in features

vStorage API for Data Protection

- Allows backup server to mount vSphere snap
- Image backup or items
- Tracks changed blocks for incremenitals
- App support/VSS via VMware Tools
What’s Next:

- Solution Showcase

What’s Next:

- Networking Break

Session 2

Curing The Conundrum: Optimizing Storage for Virtualization
Integrating Storage and Virtualization

- vCenter plug-in for monitoring not enough
- Must have VAAI support
  - Should use metadata snapshot technology to implement
- NFS and ServerSAN solutions have per-VM data visibility
  - Can enable per-VM snapshots, replication, cloning
- Storage performance comes from flash
  - Many deployment models
  - Many vendor claims

Data Access Performance

- L1 processor cache ~1ns (3 s)
- L2 processor cache ~4ns (12 s)
- Main memory ~100ns (6 min)
- PCIe SSD read 16-60µs (2 days)
- SAS/SATA SSD read 50-200µs (8 days)
- Disk read 4-50ms (4 mo-3 years)
- All Flash Array .5-1ms (10-30 days)

- Moral of the story: keep IOPS away from the disk

What Is Flash Memory?

- Solid State, Non-volatile memory
  - Stored charge device
  - Not as fast as DRAM but retains
- Read/Write blocks but must erase 256KB-1MB pages
  - Erase takes 2ms or more
  - Erase wears out cells
- Writes always slower than reads
The Three, and a half, Types of Flash

- **Single Level Cell (SLC) (1bit/cell)**
  - Fastest
  - 100,000 program/erase cycle lifetime

- **Multi Level Cell (MLC) (2 bits/cell)**
  - Slower
  - 10,000 program/erase cycle lifetime

- **eMLC or HET MLC (2 bits/cell)**
  - Slightly slower writes
  - 30,000 cycles

- **Triple Level Cell (TLC) (3 bits/cell)**
  - Not ready for data center use
  - Phones, tablets, maybe laptops

Flash’s Future

- Today’s state of the art flash 1x nm cells (17-19nm)
- Most shipping SSDs still 24nm
- Smaller cells are denser, cheaper, crappier
- Samsung now shipping 3d
  - Because they couldn’t get Hi-k to work
- Other foundries have 1-2 more shrinks
- Other technologies post 2020
  - PCM, Memristors, Spin Torque, Etc.

Anatomy of an SSD

- **Flash Controller**
  - Provides external interface
    - SATA
    - SAS
    - PCIe
  - Wear leveling
  - Error correction

- **DRAM**
  - Write buffer
  - Metadata

- **Ultra or other capacitor**
  - Power failure DRAM dump
  - Enterprise SSDs only
Flash/SSD Form Factors

- SATA 2.5"
  - The standard for laptops, good for servers
- SAS 2.5"
  - Dual ports for dual controller arrays
- PCIe
  - Lower latency, higher bandwidth
  - Blades require special form factors
- SATA Express
  - 2.5" PCIe frequently with NVMe

Selecting SSDs

- Trust your OEM’s qualification
  - They really do test
- Most applications won’t need 100k IOPS
- Endurance ≠ reliability
  - SSDs more reliable than HDDs
    - 2 million hr MTBF
    - $10^{17}$ BER vs $10^{15}$ for near line HDD
  - Wear out is predictable
  - Consider treating SSDs as consumables
  - However don’t use read optimized drive in write heavy environment

Basic Deployment Models

- SSDs in server as disk
- All solid state array
- Hybrid arrays
  - Sub LUN tiering
  - Caching
- Server side caching
- Others
All Flash Array Vendors Want You to Think of This

But Some Are This

Or Worse, This
What You Really Want

Rackmount SSDs

- Our drag racers
  - They go fast but that’s all they do
- The first generation of solid state
- Not arrays because:
  - Single Controller
  - Limited to no data services
  - IBM’s Texas Memory
  - Astute Networks
  - Historically Violin Memory though that’s changing

All Flash Arrays

- Minimum dual controllers w/failover
- Some are legacy architectures with SSD replacing HDD
  - Limited performance
    - 50-300,000 IOPS
  - Wrong architecture/data layout for flash
    - Traditional RAID causes write amplification
- Modern designs
  - Higher performance (1 megaIOP or better)
  - Some scale-out for better scalability (100s of TB)
  - Flash optimized metadata based data placement
    - Snapshots, replication, thin provisioning
  - Should include data deduplication, compression
Hybrid Arrays

- Combine flash and spinning disk in one system
  - Usually 7200RPM
- Legacy designs with SSDs added
- Next-Gen Hybrids
  - Tegile
  - Nimble
  - Fusion-I/O control
  - Tinti
- High performance
  - 20,000 IOPS or more from 3-4u
  - 10% flash usually provides 2-4x performance boost
- May include deduplication, compression, virtualization features

Sub-LUN Tiering

- Moves “hot” data from slow to fast storage
- Only 1 copy of data
- Must collect access frequency metadata
- Usually on legacy arrays
- Ask about granularity, frequency
  - Up to 1GB, once a day
- Can give unpredictable performance

Flash Caching

- Data copied to flash on read and/or write
- Real time
- Write around
  - Reads cached
- Write-through cache
  - All writes to disk and flash synchronously
  - Acknowledgment from disk
- Write back cache
  - Write to flash, spool to disk asynchronously
Flash in the Server

- Minimizes latency and maximizes bandwidth
  - No SAN latency/congestion
  - Dedicated controller
- But servers are unreliable
  - Data on server SSD is captive
  - Good where applications are resilient
    - Web 2.0
    - SQL Server Always On
  - Software cross-server mirroring

Server Flash Caching Advantages

- Take advantage of lower latency
  - Especially w/PCIe flash card/SSD
- Data written to back end array
  - So not captive in failure scenario
- Works with any array
  - Or DAS for that matter
- Allows focused use of flash
  - Put your dollars just where needed
  - Match SSD performance to application
  - Politics: Server team not storage team solution

Caching Boosts Performance!

Published TPC-C results
**Distributed Cache**

- Duplicate cached writes across \( n \) servers
- Eliminates imprisoned data
- Allows cache for servers w/o SSD
- Products:
  - PernixData
  - Virident
  - Others soon
- Qlogic FabricCache caching
  - HBA acts as target & initiator

**Live Migration Issues**

- Does cache allow migration
  - Through standard workflow
    - To allow automation like DRS? Is cache cold after migration?
- Cache coherency issues
- Guest cache
  - Cache LUN locks VM to server
    - Can automate but breaks workflow
- Hypervisor cache
  - Must prepare, warm cache at destination

**Copy Cache During Migration**

- Migration includes cache contents
- More data
- Extends migration time
- Requires new workflow or hypervisor support
- Now available from ProximalData
Quieting the Noisy Neighbor:

- **Storage Quality of Service**
  - Emerging technology with varying forms
  - Throttles – Limit workload to x IOPS
    - Keeps neighbors from getting too noisy
    - But apply when performance is available
    - Latency triggers reduce this impact
- **Prioritization**
  - Bronze, silver, gold
  - Bronze workloads get starved when system stressed
- **Minimum, maximum, burst**
  - Most sophisticated and therefore complex
- **Direct allocation**

Storage I/O Control (SIOC):

- **SIOC** is all about fairness:
  - Prioritization and QoS for VMFS
  - Re-distributes unused I/O resources
  - Minimizes “noisy neighbor” issues
- **ESX** can provide quality of service for storage access to virtual machines:
  - Enabled per-datastore
  - When a pre-defined latency level is exceeded on a VM, it begins to throttle I/O (default 30 ms)
  - Monitors queues on storage arrays and per-VM I/O latency

Storage I/O Control in Action:

- **SIOC** is a Quality of Service mechanism for storage
- **2 VMs battle for storage**
- **Set IOP limit on one**
Storage IO Control the Bad

- Disabled by default but highly recommended!
- Enterprise Plus only!
- Block storage only (FC or iSCSI)
  - So won’t work with the cool storage
- VMFS whole-LUN only
  - No extents
  - No RDMs

Storage DRS

- Makes policy-driven storage worthwhile
- Multiple datastores aggregated into cluster
  - Similar performance, protection
- vSphere relocates VMDK based on:
  - Capacity (default 80% full)
  - Performance (I/O latency >15ms)
- Affinity rules
  - Keep a VM’s VMDKs together (VMDK affinity)
  - Separate a VM’s VMDKs (VMDK anti-affinity)
  - Keep VM A and VM B separate (VM anti-affinity)

The Evolution of the ServerSAN

Virtual Storage Appliances

- Run as VM
- Present storage via NFS/iSCSI
- Rely on local RAID
- Synchronous mirror with failover

ServerSAN

- Scale-out, consolidated datastore
- Hybrid, leverages SSD
- N-way replication
- Can be kernel process
ServerSAN Architecture Differentiators

- Data protection model
  - Per node RAID?
  - N-way replication
  - Network RAID?
- Flash usage:
  - Write through or write back cache
  - SubLUN tiering
- Prioritization/storage QoS
- Data locality
- Data reduction
- Snapshots and cloning

Hyperconverged Systems

- Nutanix
  - Derived from Google File System
  - 4 nodes/block
  - Multi-hypervisor
  - Storage for cluster only
- Simplivity
  - Dedupe and backup to the cloud
  - Storage available to other servers
  - 2u Servers
- Both have compute and storage heavy models
- Pivot3 for VDI only
- ScaleComputing KVM based for SMBs

Software Only ServerSANs

- HP StoreVirtual (Lefthand)
  - Sub-LUN tiering for SSDs
  - iSCSI system scales to 10 nodes
  - Data Protection
    - Per Node RAID
    - 2-4 way replication or network RAID 5 or 6
- Maxta Storage Platform
  - Data deduplication and compression
  - Metadata-based snapshots
  - Data integrity via hashes/scrubbing
  - Data locality
More Software ServerSANs

- EMC ScaleIO
  - Extreme scale-out to 100s of nodes
  - Multi-hypervisor
    - Kernel modules for KVM, XEN, Hyper-V
  - Multiple storage pools
  - Some QoS
  - Metadata snaps and clones
- Sanbolic Melio
  - Evolved from clustered file system
  - Perhaps the most mature

VDI the Final Frontier

- VDI cannot be done at scale from spinning disks
  - IOPS will have to be provided by flash or RAM
- VDI datasets, even linked clones are duplicate rich
  - Data deduplication can expand effective size of RAM or SSD layer
- Non-Persistent images are low hanging fruit
  - The nightly reset reduces capacity consumption
    - VMware’s linked clone infrastructure grows 1GB/user/week
  - Can use less persistent storage
    - Write back cache in server
    - RAM caches
    - Rackmount SSDs

RAM Caching for Storage Acceleration

- View Storage Accelerator
  - Up to 2GB RAM as a read cache
    - Cache is deduped
    - Most effective at boot
- Atlantis ILIO
  - Dedupes data into ILIO format virtual disks
    - Accumulates writes to 64KB
    - Larger read and write RAM Cache
- Infinio Accelerator
  - Distributed cache accelerator for NFS datastores
  - Dedupes across all nodes in cluster
The VDI Bottom Line

- Use local solid state storage for transient data
  - Swapfiles, temp files, internet cache etc.
- Pin the root image files for linked clone sets to flash
- Local caching, RAM or SSD strongly suggested
- Persistence options:
  - Full clones on deduplicating flash first storage
  - Semi-Persistent linked clones
    - Masters on flash
    - If not on deduping storage will need periodic recompose

That's All Folks!

Thank You! Questions?

Howard Marks
Founder & Chief Scientist

Follow me on Twitter: @DeepStorageNet
My Blog: www.deepstorage.net
Interested in hearing more from our Modern Infrastructure experts?

Here at Modern Infrastructure our team of editors (the same ones who brought you today’s event) compile the Modern Infrastructure e-zine, a monthly publication penned by leading editors, IT experts, and computing experts like Brian Madden to weigh in on what IT needs to do to meet the needs of today’s end users.

Scan the QR code to download this issue of Modern Infrastructure e-zine – covering how new building designs and energy-efficient techniques could transform tomorrow’s computing facilities – to supplement what you’re learning today:

FREE DOWNLOAD

OTHER RESOURCES FROM SEARCHCONSUMERIZATION AND TECHTARGET MEDIA

Today’s speakers, our magazine contributors, and countless other industry experts all regularly contribute to our storage-network of sites including:

> SearchVirtualDesktop
> SearchConsumerization
> SearchEnterpriseDesktop
> SearchVMware

© 2014 TechTarget
275 Grove Street
Newton, MA 02466
About Our Sponsors

Along with the top technology experts in the field, we strive to bring IT professionals like you face to face with the vendors you most want to meet. Between the rapid-fire Solution Presentations and designated networking time, our vendors aim to provide you with a thorough understanding of their latest technologies and how they can address your IT challenges. Without our sponsors, these events would not be possible, so we encourage you to stop by their booths to thank them and learn more about their solutions.

Event Sponsor

Insight 6820 South Harl Avenue, Tempe, Arizona 85283
www.insight.com

Insight Enterprises, Inc. is a leading technology provider of hardware, software and service solutions to clients all over the world. Insight is focused on helping organizations move technology goals forward. Insight has sold over three million business and public sector client cloud seats across the globe. For more information, please call 1.800.INSI GHT.

Featured Partners:

Gold Sponsor

Tintri 201 Ravendale Drive, Mountain View, CA 94043
www.tintri.com

With smart storage that sees, learns and adapts, Tintri enables IT to focus on virtualized apps instead of managing storage infrastructure. Tintri application-aware storage provides VM-level visibility, control, insight and agility, moving IT from reactive to strategic. Tintri storage powers global enterprises such as AMD, F5 Networks, GE, NEC, NTT, MillerCoors and Time Warner.
Exhibiting Sponsor

Maxta 100 Mathilda Place, #170, Sunnyvale, CA 94086
www.maxta.com

Maxta’s groundbreaking software-defined, VM-centric storage platform dramatically simplifies IT, while delivering significant cost savings. It enables the convergence of compute and storage on standard servers, leveraging server-side flash and disk drives to optimize performance and capacity. Maxta enables shared storage with enterprise-class data services and full scale-out without performance degradation.
Transforming the Data Center

Jack Skelton Practice Leader
Insight Data Center Practice Group

2013 IT BUDGET PRIORITIES

IT IS RIPE FOR TRANSFORMATION
72% ONGOING MAINTENANCE
28% INVEST IN NEW PROJECTS

NEW PROJECTS
OPERATIONS & MAINTENANCE
REPLACE OR EXPAND IT CAPACITY

28% 72%
24% 48%

2013 IT BUDGET PRIORITIES

IT IS BECOMING IRRELEVANT TO THE BUSINESS
ONLY 43% CONSIDER IT INTEGRAL TO THE BUSINESS
Source: InformationWeek Report, How IT’s Perceived by Business, October, 2012

EXPLOSIVE INFORMATION GROWTH IS OUTPACING IT RESOURCES

54% 59%

CONSIDER IT A SUPPORT OR MAINTENANCE ORGANIZATION AND NOT AN INNOVATOR
SAY TECHNOLOGY’S BECOMING MORE CRITICAL TO THE BUSINESS
Solution Presentations

LACK OF RIGHT SKILLS & CAPABILITIES IN HOUSE

WHY TURN TO OUTSIDE SERVICE PROVIDERS?

84% 14%

Source: IDG Research Services/CIO Custom Solutions Group, Big Picture Global Survey: Dual Perspective of ITaaS, A survey of IT and business executives, June 10, 2013

84% 14%

LACK OF RIGHT SKILLS & CAPABILITIES IN HOUSE

THE SAME MANAGER: 84% WORKING 100% OF THE TIME

TODAY’S IT

70% 20% 10%

Technology evolution

75% of time and budget spent "keeping the lights on"
Solution Presentations

**TECHNOLOGY SOLUTIONS**

**OF ENTERPRISE COMPANIES ARE USING OR CONSIDERING CLOUD**

Source: IDC's 2012 North American Global Technology and Industry Research Organization IT Study

**ITaaS DELIVERS**

- **BUSINESS AGILITY**
- **LOWER COST**

**MAIN ATTRIBUTES**

- **ITaaS**

- **Service Oriented**
  - Standardized planning, design delivery and operation of services. IT partners with LOBs.

- **Self-Service**
  - Self-service catalog through user portal.
  - Automated, traceable service requests & fulfillment.

- **Consumerized**
  - Deliver services at convenience and SLAs of commercial SPs.
  - Access to services through device of choice.

- **Chargeback**
  - To LOBs.
  - Tiered services with different SLAs and costs.

- **Financial**
  - Transparency
  - Service consumption measured and reported back to consumer (end user) and customer (LOB).

**PERCEPTIONS OF ITaaS**

- **BETTER ALIGNMENT BETWEEN IT AND LINES OF BUSINESS**
- **MORE RAPID EXECUTION OF BUSINESS PROCESSES**
- **INCREASED BUSINESS EFFICIENCY**
- **IMPROVED CUSTOMER SATISFACTION**
- **INCREASED BUSINESS INNOVATION**
- **COST SAVINGS – MORE OPEX, LESS CAPEX**

Source: IDG Research Services/CIO Custom Solutions Group, Big Picture Global Survey: Dual Perspective of ITaaS, A survey of IT and business executives, June 10, 2013

**PRIVATE CLOUD MAKES ENTERPRISE IT AGILE**

- **INSTANTLY provision of IT resources**
- **QUICKLY REDEPLOY**
- **PROVISON IT RESOURCES**
- **DYNAMICALLY SCALE UP/DOWN**
- **SIMPLE, FLEXIBLE CONSUMPTION MODEL**
- **SERVICE CATALOG**
- **CHARGEBACK/METERING**
- **SELF-SERVICE PORTAL**
- **AUTOMATION**

**RESPONSIVENESS**

- **AVAILABILITY**
- **OPEX SAVINGS**
- **CAPEX SAVINGS**
Solution Presentations

Converged Infrastructure Provisioning Benefits

Traditional
- Many weeks or months
- Precise deployment
- Shared pool meets most requirements

With Converged Infrastructure
- Rapid deployment of applications
- Shared pools meet most requirements

Pre-provisioned Converged Infrastructure
- 50% faster

Benefits
- Agile service delivery
- Higher productivity
- Faster deployment
- Simplifier planning

THE 3RD PLATFORM OF IT

3rd Platform
- Web, Big Data, Social
- Mobile Devices

2nd Platform
- LAN/Visage Cloud
- PC

1st Platform
- Mainframe, all Computer
- Terminals

THE 3RD PLATFORM REDEFINES EVERYTHING

3rd Platform
- Object/DB
- Software Defined Storage
- Converged Infrastructure
- Policy Based Automation
- Data Governance
- On-premise & Off-premise

2nd Platform
- File & Block
- Storage Arrays
- Technology Sلا
- Project Based IT
- Perimeter Based Security
- DR Premise
Solution Presentations

Bridging the Gap

Today's Data Center

Software-Defined Data Center

Reduce Operating Expenses

Invest in New Models

Software Defined Storage Bridges the Gap

Storage Redefined

Block

File

Object

Flash

Storage Redefined

Private Cloud

Public Cloud

Storage Arrays

Commodity Hardware/DAS

Block

File

Object

Flash

Storage Redefined

Commodity Hardware/DAS

Block

File

Object

Flash
Where Does Backup and Recovery Fit In?

1. B&R Requires Planning – Each organization’s needs are unique
2. Critical Data Remains Local for Quick Recovery – How much needs to stay?
3. Archiving Makes B&R Efficient – The cloud can reduce archive costs
Solution Presentations

ACTIVITIES UNDER THE NEW MODEL

THINGS THAT CHANGE

STOP

- Manual Service Requests
- Manual Provisioning
- Writing and Updating Scripts
- System Integration and Configuration

NEW ACTIVITY

- Workload Analysis
- Service Catalog
- Self-Processing
- Programmable Redeployment of Assets
- Continuous Monitoring
- Fast & Agile Service Delivery
- Virtualize Everything

NEW ROLES AND SKILLS

- Cloud Brokers
- Cloud Admins
- Service Management & Marketing

NEW PROCESSES

- Tighter Business Alignment
- Horizontal Planning & Design

IT SERVICE CATALOG

- Horizontal Service Definitions
- Self-Service Portal

ITaaS OPERATIONS INFRASTRUCTURE APPLICATIONS NEXT STEPS

TRANSFORM YOUR WORKLOAD STRATEGY

- Sustainability Evaluation
- Economic, Trust, Functionality

ALL WORKLOADS

- CRM
- ERP
- COLLABORATION PORTAL
- APPLICATION DEVELOPMENT
- SUPPLY CHAIN
- EMAIL APPLICATIONS

APPLICATIONS SUITED FOR CLOUD

APPLICATIONS SUITED FOR PRIVATE CLOUD

APPLICATIONS SUITED FOR PUBLIC CLOUD

WORKLOADS TO PUBLIC CLOUD PROVIDER A

WORKLOADS TO PUBLIC CLOUD PROVIDER B

WORKLOADS FOR PRIVATE CLOUD
How do we think about the data center?

- Skills & Capabilities
- Processes & Tools
- People
- Operational Processes & Tools
- Technology
- Automation / Orchestration
- Business Administration

• Do I have the right organizational structure?
• Do I have the right mix of skills to operate the data center?
• Do I have enough people to deliver on projects and operations?
• Do I have the right processes and tools?
• Do I deliver services efficiently and effectively?
• Do I follow industry best practices?
• Have I automated where possible?
• Do I have the right technologies?
• Do I have the right architectures?
• What is my plan for new technologies?
• Is my current infrastructure reliable and resilient?
• How will I recover costs?
• What metrics should I track?
• How do I compare with the industry?
• How do I plan and budget?
Solution Presentations

GOVERNANCE AND TECHNOLOGY ROADMAP

DIFFERENTIATING INSIGHT

OUR FOCUS

• Leading with Solutions
• Full Project Lifecycle Approach
• Local Presence – Global Reach

DATA CENTER & VIRTUALIZATION

Insight Advantage:
• Multi-vendor capabilities and experience to support real-world heterogeneous solutions
• Highly certified and experienced professionals on all key Data Center and Virtualization Partners
• Service offerings designed with key Partner technologies to solve our clients’ business challenges

The Data Center & Virtualization Imperative:
• Standardization is driving a need for reduced complexity
• Virtualization of mission-critical applications requires agile infrastructures
• Hybrid Cloud Computing
• Reduce time-to-market for applications

Insight's Key Solutions Partners
Solution Presentations

PUBLIC CLOUD

The Cloud Imperative:
- Strategy
- Flexibility
- Scalability
- Availability
- Security
- Reduce IT spend

Insight Advantage:
- InsightCloud Solutions Center
- Best-in-Class cloud solutions
- Integration services
- Single Sign On | Migration | Technical Support
- Pre-architected solutions through industry leading partners

Insight's Key Solutions Partners

INSIGHT AND CISCO – WHY WE'RE UNIQUE!

Cisco Awards and Recognition
- 2012 Cisco Partner Summit Theater Award – Cloud Partner of the Year – U.S./Canada
- 2011 National Technology Excellence Partner of the Year – Advanced Technologies; U.S./Canada
- 2011 Cloud Builder Partner of the Year – Advanced Technologies; U.S./Canada
- 2011 Public Sector Higher Education Partner of the Year; U.S. Canada
- 2011 Collaboration Partner of the Year – West Region, U.S./Canada
- 2011 Cisco Capital Partner of the Year – West Region, U.S. Canada
- 2010 TelePresence Video Master
- 2010 Unified Contact Center Enterprise
- 2010 Customer Voice Portal
- 2010 Identity Services Engine
- 2010 Physical Security

Advanced Technology Providers
- TelePresence Video Master
- Unified Contact Center Enterprise
- Customer Voice Portal
- Identity Services Engine
- Physical Security

Gold Certified
- TelePresence Video Master
- Unified Contact Center Enterprise
- Customer Voice Portal
- Identity Services Engine
- Physical Security

Specializations
- Cisco Certified Cloud
- Cisco Certified Managed Services
- Cisco Certified Contact Center Specialization
- Cisco Certified Security Specialization
- Cisco Certified Borderless Network Specialization
- Cisco Certified Integrated Architecture Specialization

INTEGRATED SYSTEMS PARTNERS

EMC
- Signature Partner
- Premier Partner
- Gold Partner

vmware
Solution Presentations
DID YOU KNOW?

Virtualization and Private Cloud are not the same thing. Without workflow, process orchestration, metering, and self-service portals you’re simply virtualizing your Data Center.

Thank You
Solution Presentations

Application-Aware Smart Storage for Virtualization and Cloud

4 Challenges of adapting Conventional Storage for Virtualized Enterprise...

1. Lack of End-to-End Troubleshooting Visibility inside Virtual Infrastructure
   Conventional storage lacking intelligence to understand a .vmdk file...
   just another file to be stored

2. Matching Performance to each Virtual Application/Workload (Design for IOPS, Throughput, Both?)
   Requires re-configuring, re-tuning when initial need changes.
   BUT ...dependent upon time it takes highly skilled storage admin-experts to adapt conventional storage;
   provision LUNs, Volumes, RAID Groups, Performance Tuning, Reconfiguration, Troubleshooting (SAN or NAS)

3. Simplistic ESX Server creation and Administration...

4. Bean Counters & Tight Budgets!!

"Application-Aware" vs. Conventional Storage

<table>
<thead>
<tr>
<th>Traditional</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC</td>
<td>Violin</td>
</tr>
<tr>
<td>NetApp</td>
<td>Pure Storage</td>
</tr>
<tr>
<td>HDS</td>
<td>Nimble</td>
</tr>
<tr>
<td>HP</td>
<td>XtremIO (EMC)</td>
</tr>
<tr>
<td>IBM</td>
<td>Whiptail (Cisco)</td>
</tr>
</tbody>
</table>

Adapting to analogs, etc...
...high degree of hands-on may be needed with some intelligence to understand VM's or vDisks...
...it's just another file in a LUN or Volume
Solution Presentations

Adapting Conventional ("Application-blind") Storage for Virtualized Applications & Workloads

ESX Admins
Manage VMs
AND Storage

Tier 1
Tier 2
Tier 3

Interchangeable

Adapted Only = guarantees fair service even with most contentious I/O
Troubleshoot Host + Network + Storage in seconds vs. hours/days

Empirical Evidence on a per-VM basis

VDI Reference Architecture for 1,000 Users

* Validated reference architecture with VMware
  * Efficiently deliver cost-effective virtual desktops without a large upfront investment
  * Lower risk of deployments and improve probability of success
  * Scale to its VDI needs by scaling performance and capacity independently
Solution Presentations

Why we stand out in a crowded room

- We manage VMs ONLY
- VM visibility and granularity

Product Setup:
10 minutes, Auto-Tuning, no knobs & dials

3 Simple Clicks:
Find root cause to latency issues.
(from ESX host, network, thru to Tintri)

- We manage VMs ONLY
- VM visibility and granularity

3 Simple Clicks:
Find root cause to latency issues.
(from ESX host, network, thru to Tintri)
Where IT pros go to solve today’s most pressing storage challenges

Enjoying today's event? TechTarget has more conferences, seminars and online classrooms on the schedule for 2014. We continue to travel the globe for the remainder of the year with our Storage Decisions events covering a wide array of storage and data center topics—so make plans now to join us when we return to a city near you.

- **Storage Decisions New York conference:** This 2-day conference delivers 30+ unique educational sessions led by the top independent experts in the world, as well as innovative vendor showcases from 50+ of today’s leading storage technology and solution providers.

- **A Toolkit for Comprehensive Data Protection:** Visiting 13 cities throughout the year, George Crump’s seminar & workshop draws on his 25-years of experience designing storage solutions for data centers to help attendees build a best of breed backup & DR plan.

- **Business Continuity and Disaster Recovery in the Era of Software-Defined Data Centers:** Led by expert Jon Toigo, this 3-part seminar focuses on the latest IT meme—the software-defined data center—and it promises and pitfalls.

Visit [www.StorageDecisions.com](http://www.StorageDecisions.com), or simply scan the QR code to learn more!

[@StorageEvents](https://twitter.com/StorageEvents)  [Join our Storage Decisions Group](https://www.linkedin.com/groups)
Meet and learn from the top independent analysts

TechTarget Speaker Bureau members are renowned independent experts that speak at our live events. They are dedicated to helping IT professionals understand and solve their specific IT-related problems, large and small. Learn more about these industry experts at: events.techtarget.com/speakerbureau

Visit events.techtarget.com to see when our experts and events are coming to a city near you!
Get Smart About Backup & Recovery

Burgeoning data, thin budgets, and multiple acquisitions have created complex infrastructures with fragmented or non-existent backup processes. Insight builds best of breed solutions that can help control your infrastructure chaos.