

Evaluator Group

IOmark Suite



Benchmarking Storage with Application Workloads

August, 2013



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- Introduction to IOmark Suite
- Overview IOmark – VDI
- Overview IOmark - VM



What is IOmark Suite?

- A storage specific benchmark for application workloads
 - Tests storage only
 - Supports VDI and Virtual Machine application Workloads
 - Additional workloads to be added in the future
- Storage Agnostic
 - Supports any storage that application supports
- Based on a set of standard set of application workloads
 - Uses “I/O replay” to simulate storage I/O patterns
 - Benchmark drivers use real-world workloads
 - VDI uses VMware View Planner workloads
 - VM uses VMmark workloads
- Reduces server hardware requirements by 10X
 - Lower capital requirements by 10x
 - Reduced test time 10x less setup
 - EX: each server can generate workload equivalent to 1,000 VM's
 - 12 CPU, 96 GB RAM, with multiple I/O ports



Why an Application Workload Specific Benchmark?

➤ Existing tools have issues

- Storage focused tools do not have valid workloads for VDI or VM environments
- Tools with accurate workloads don't test storage
- No standard metrics, or ways to apply existing tools
- Time and expense of environment setup may be costly

➤ No storage focused tools

- Most existing VM tools and benchmarks are server focused
- Tools focus on testing CPU, Memory and Hypervisor, not Storage



VM Storage Performance Testing Comparison

	IOmark-VM	VM-Mark	IOmeter	SPC
What it tests	Storage	Entire System Focus on CPU	Storage	Storage
Workload	VM Server Workloads	VM Server Workloads	Synthetic	Generic Application
Standardized	Yes	Yes	No	Yes
Server Equipment Required	Low	Very High	Low	Low
Setup Time	Low	High	Low	Low

Lots of tests for servers.
Great if you have time and
equipment to set up

Most popular, but
difficult to predict
real results



VDI Performance Benchmark Options



	IOmark-VDI	Login VSI	View Planner	SPC
Component Measurement	Storage	Entire System	Entire System	Storage
Workload	100% real VDI	100% real VDI	100% real VDI	Non VDI
Cost of tool	Cost to license & publish	Cost to license	VMware partners only	Cost to license & publish
Equipment Required	Low	High	High	Low
Setup Time	Low	High	High	Low





IOmark-VDI Workload

...



Running IOmark-VDI

- Results directly comparable to actual use cases
 - Real workloads, able to dial in Heavy or Light workloads
- Set up and run in 1 day
 - Plan for two weeks of tuning to maximize results
- Equipment needed for typical 5000 User benchmark
 - Server equipment - 12 cores, 96GB, multiple I/O ports
 - Storage and connectivity (most likely FC)

VDI Performance Benchmark Options



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What IOmark-VDI Measures

➤ What it not measure

- Does not measure efficiency of hypervisor
- Does not measure capacity of Server
- Does not measure CPU or memory
- Does not measure network
- Does not measure CPU, memory, network or hypervisor for VDI

➤ What it does test

- The storage system performance for VDI environments
- VMware View specific for version 1.x



I/O Trace Details

› Windows I/O Trace

- When used:

- › Use when Guest OS is running
- › Examples include: RAWC Workload, Virus Scan

- Details:

- › Used windows tracing facilities to create I/O traces from Windows guest

› VMware I/O Trace

- When used:

- › Use when Guest OS is not running
- › Examples include: Clone, Boot, Login
- › Note: Login requires ESX tracing since Guest tool cannot run as a service

- Details:

- › Use VMware tools to create I/O traces from ESX

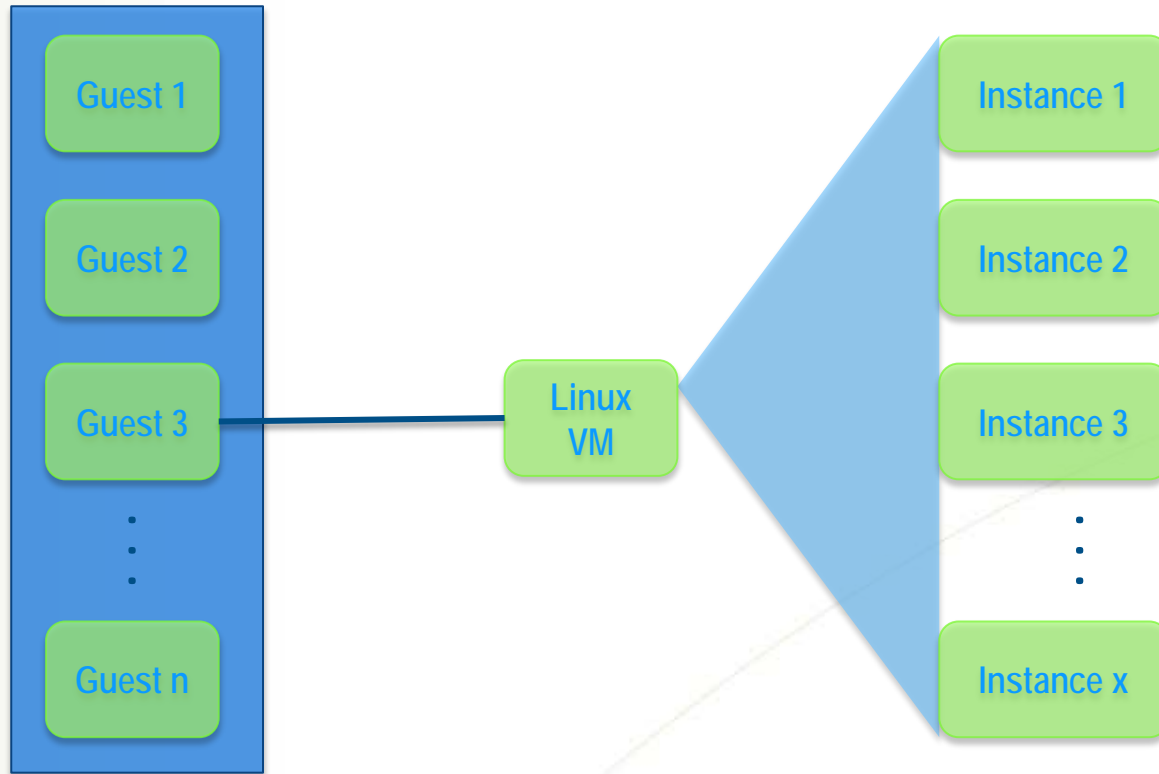


IOMark-VDI Details

- Several Workloads
 - Heavy
 - Standard
 - Office
 - Boot
- Run multiple guests per ESX host
- Run multiple instances of test driver within each guest OS
- Example for 512 replicated users
 - P-host * VM-Guests * Benchmark-instances
 - Example: $1 * 8 * 64 = 512$
- Diagram on following slide



Example Measurement



ESX Host

Guest OS

Test Instances

Total Users

*

n = 16

*

x = 32

= 512



Benchmark Specifications

- The workloads run coincide with the user profiles outlined in the View best practices guide
- The workloads simulate typical usage, including:
 - View booting (for provisioned and non-provisioned users)
 - View steady state operation
 - Workload = Heavy user - office worker (avg. 12 iops)
- Successful Benchmark Criteria:
 - Maximum write response time for steady state must not exceed 50ms
 - All storage utilized must reside on/within the storage system under test
 - Report must include the amount of time to boot all users



Reporting Results

- Benchmark run and results audited by Evaluator Group
 - Purpose is to ensure consistency in configuration and reporting
- All benchmarking methods, setup, configuration and other items are be reported
- All required items must be included in the report

Sample Report

- Number of VMware View Clients Simulated
 - Example: “Vendor storage product Y, supported 10,000 VMware View clients”
- Amount of time required to clone, boot and virus scan
 - Example: “Product Y, took 567 minutes to clone and 35 minutes to boot 10,000 clients”
- Amount of storage capacity per View Client
- View workload, as described by RAWC and View sizing guidelines
- Maximum read and write response times for all View clients during benchmark
- Detailed Test configuration
- VDI Storage Cost per User
 - Cost (including all licenses for tested storage capacity and 3 year maintenance)
 - # VDI Instances Supported
 - Calculation = (\$ Cost / # VDI Instances)



VDI Options Reported

- Options reported for View environment:
 - Version of VMware Hypervisor and VMware View
 - Guest OS for View environment
 - Number of View Virtual Desktops
 - Number of desktops in persistent mode, and number in non-persistent mode
 - Size of virtual disk for each user
 - User data disk size, per user, and protocol used
 - Using VMware View linked clones (or use of storage system based writeable clones)
 - Number of total I/O's per user
 - Capacity of each View user
 - View user workload Profile
 - Size of I/O's (i.e. 512, 4k, etc.)
 - Read / write ratio of I/O's
 - Random vs. sequential I/O mix



Configuration Reporting

- The number of interfaces to the storage system
- The speed and type of connectivity to the storage system
- The protocol used for storage capacity (FCP, iSCSI or NFS)
- Use of thin provisioning
- Use of wide striping and RAID levels used
- The use of storage system based clones, or equivalent (golden image clones, etc.)
- The total amount of RAM and other cache in the system
 - Description of caching technology
 - Description of caching process (read cache, write cache, etc.)
- The number and type of each disk drive (HDD, SSD, etc.)
- The use of point-in-time copies
 - The type of PIT copy,
 - Either a full copy (aka mirror or clone)
 - Or a bit-map copy (aka copy-on-write, redirect-on-write)
 - Cascaded PIT copies (snapshots of snapshots)
- Whether VAAI is supported and used during testing
- Total raw capacity of system
- Total capacity of system allocated to VMware View instances (thick or thinly provisioned)
- Automated tiering usage within the storage system
- Deduplication or compression of data usage





IOmark-VM Workload



Details



IOMark-VM Methodology

➤ Benchmark creation

- Real world VM workload used for data capture
- Actual I/O captured based on application interactions

➤ Benchmark run

- Utilize driver to replay workloads (I/O replay)
- Benchmark driver (the test harness) does not require applications
- Benchmark driver runs under multiple guest OS
 - Linux supported initially, Windows TBD

➤ Result reporting

- Results indicate number of VM's supported by storage system
- Benchmark runs and results audited by Evaluator Group for consistency
- Storage configuration options are included in report

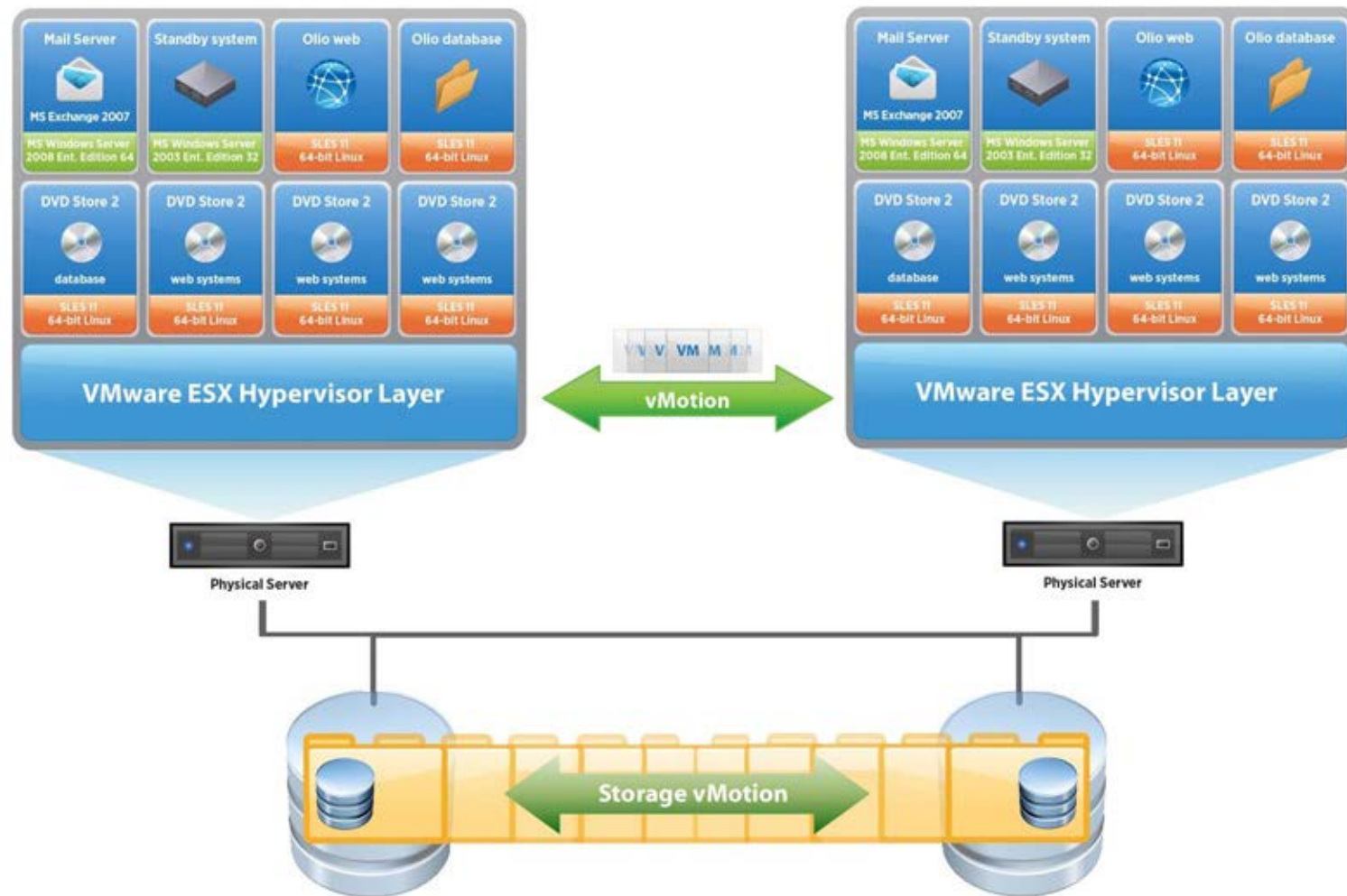


IOMark-VM : Design & Use

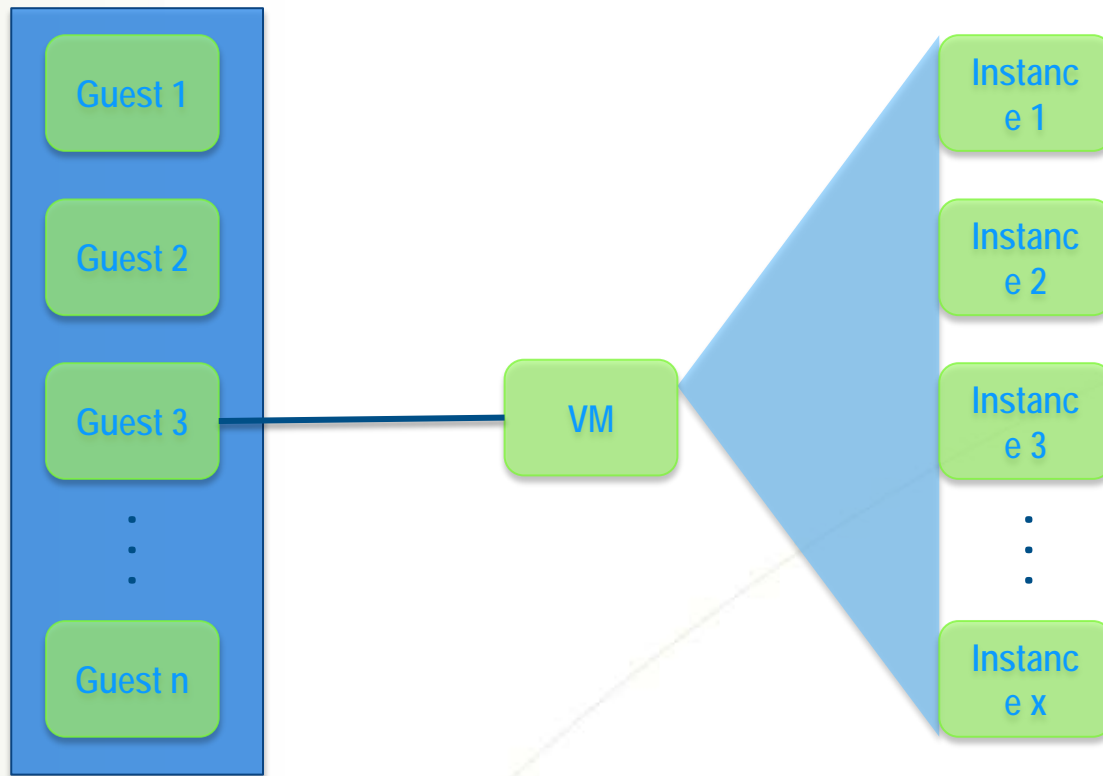
- Application mix, based on VMmark 2.5
 - Uses DVD Store DB, plus DVD web app servers
 - Olio DB, plus web app servers
 - Exchange DB application, plus standby Windows VM
 - Includes VMware vCenter operations – vMotion, clone & deploy
- Based on a known and reference set of application servers
- Creates first storage measurement for VM workload
- Storage agnostic, may test any storage supported by VMware
- Ability to provide price / performance / capacity metrics
- Reduces server hardware requirements (by 10X)
 - Each server can generate workload equivalent to 1,000 VM's
 - 12 CPU, 96 GB RAM, with multiple I/O ports
- Faster time to test with 10x less set-up than VMmark



VM Workload Capture



IOMark-VM - Replay Example



ESX Host

*

Guest OS

*

Test Instances

Total VM's

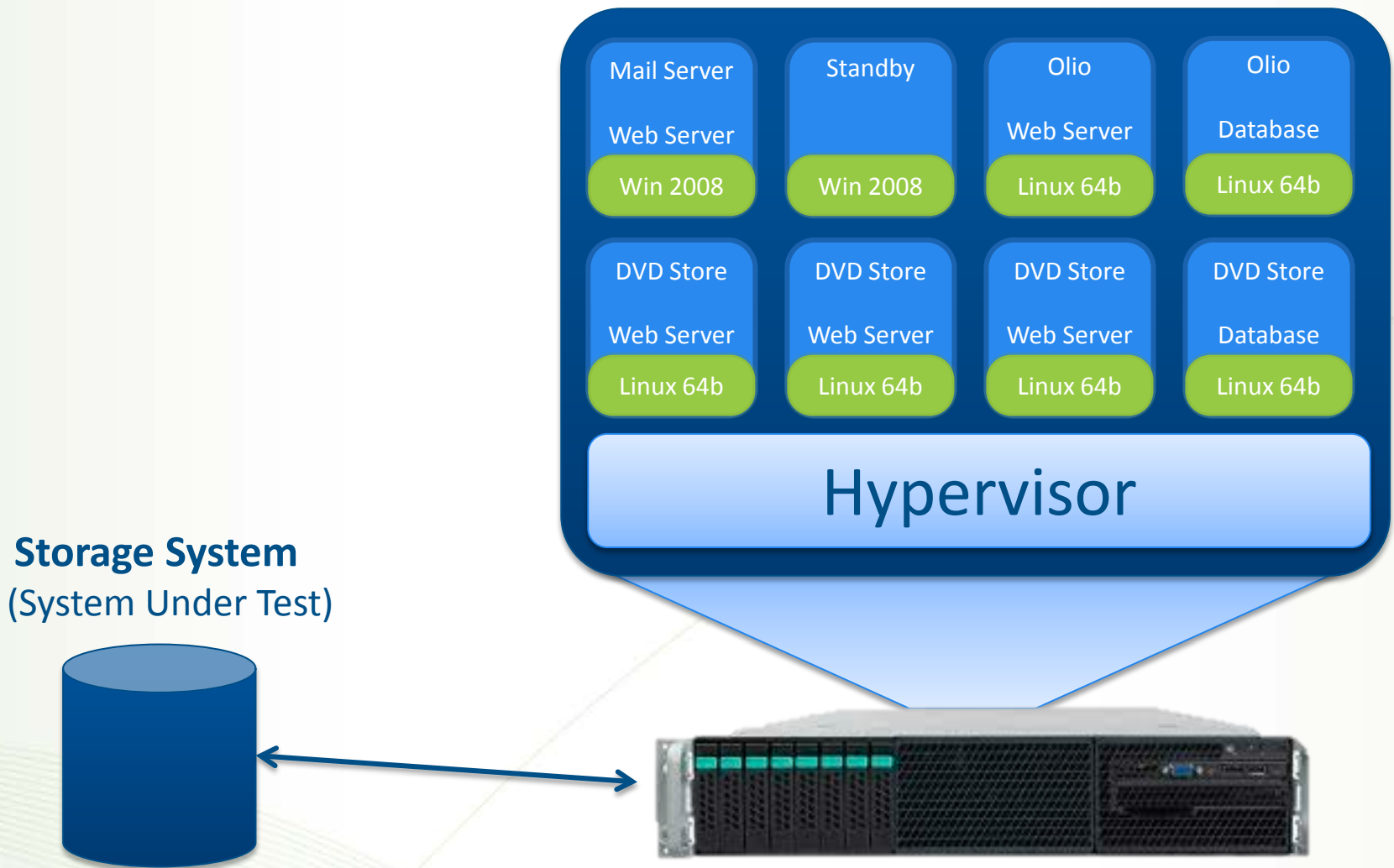
n = 32

x = 32

= 1,024



Example VM Workload Set



Benchmark Specifications

- IOmark-VM workloads match hypervisor workload guidelines
- Workloads simulate typical virtual machines, including:
 - Steady state operation
 - MB/s and IO/s are TBD
- Successful Benchmark Criteria:
 - Maximum response time must not exceed `_xx_` ms (TBD)
 - All workloads must reside on the storage system under test
- Published Results:
 - All published results will be audited, reviewed and approved prior to publication





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