VDBENCH Overview

http://www.oracle.com/technetwork/server-storage/vdbench-downloads-1901681.html

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SNIA Emerald™ Training

SNIA Emerald Power Efficiency Measurement Specification, for use in EPA ENERGY STAR®

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SNIA Emerald™

Agenda

- Introduction to VDBENCH – iodriver
- Purpose of VDBENCH for EPA program
- Performance 101
  - Overview of things that effect performance
- Overview of VDBENCH scripts format
  - SD, WD and RD parameters
- Detailed discussion of SD, WD, and RD parameters
- Discussion of the output of VDBENCH

Quick overview of performance terms

- Scale-ability – able to increase in throughput or performance with increasing application demands
- Utilization – How busy a resource is during a period of time. Generally expressed as a percent from 0 – 100
- Service time – Generally the actual time something take for a specific task
- Response time – Usually considered Service time plus queueing time for resource
- Latency – the period of time one component in a system is waiting for another component
- Data transfer time – The latency required to transfer the requested data from a resource
- Queueing – The natural process of things lining up to be services
- Queueing Theory – The Mathematical study of Queueing systems
- Queue depth – Frequently associated with number of outstanding IOs to a Storage System
- Cache – Placing frequently used things in an easily accessible place. For computers, placing data in a place that has much faster access time.

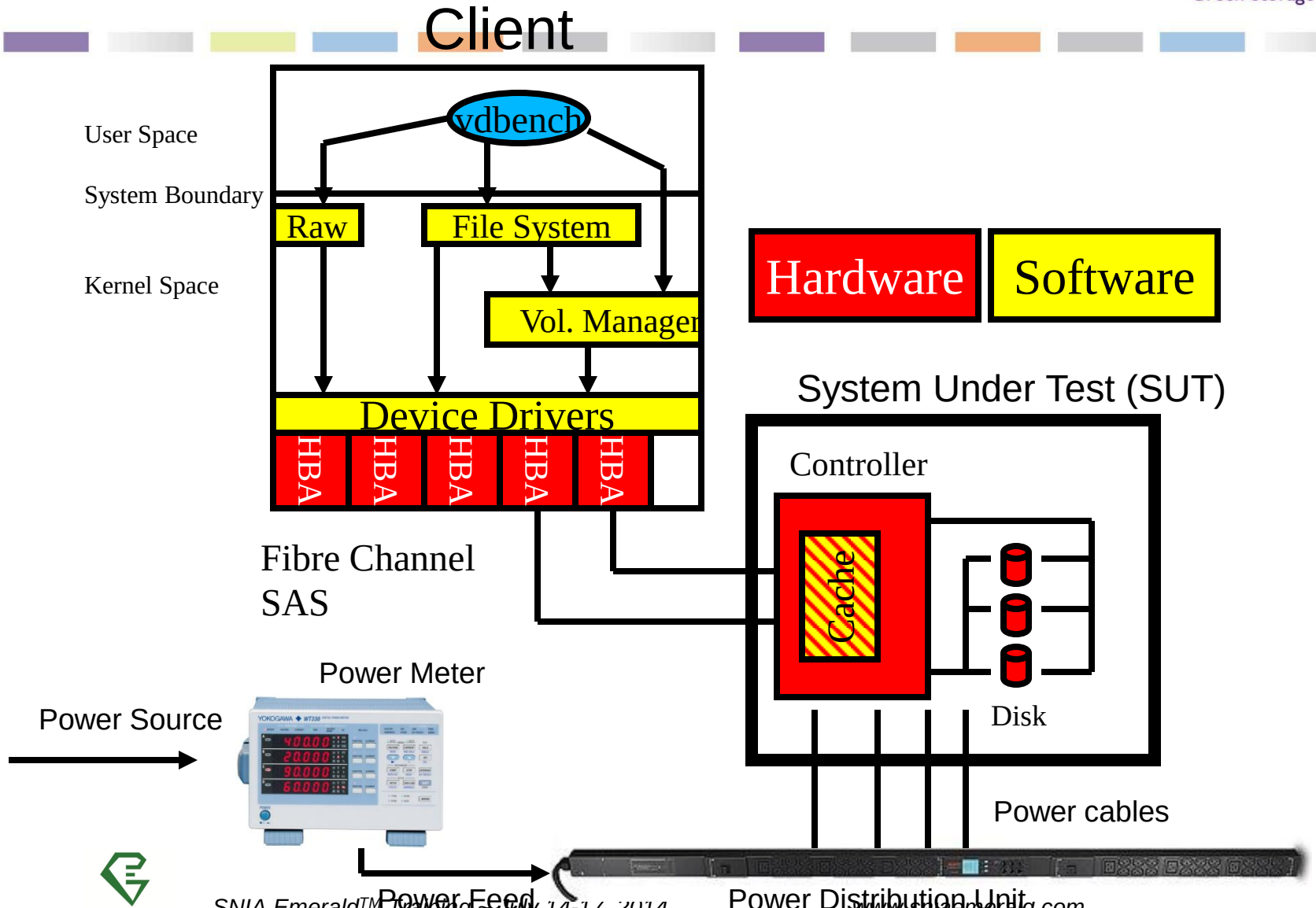
Performance terms (cont)

- Cache hit – Information the system is looking for is located in high-speed memory
- Cache miss – Information was not in high-speed memory and had to be found on a slower device
- Sequential – Type of workload that can read or write something one block after another.
- Logically sequential – An application may read or write a file from beginning to end
- Physically sequential – While while an application may think it is reading physically sequential, generally this is not the case. Dd at the raw level can create physically. Seq workloads
- Random – Access pattern moves around a file or physical device
- Locality of Reference – Accesses are concentrated in a particular area (i.e. head of indexes of a data base)
- Solid State Disk (SSD) – Storage device with no moving parts. A disk drive whose storage capability is provided by solid state storage

Performance terms (cont)

- RAID – Redundant Array Independent (Inexpensive) Disks
- RAID 0 – No Redundancy – maybe striped across many drives (rarely used)
- RAID 1 – Also know as mirroring. Data is mirrored to two drives
- RAID 10 – A variation of RAID 1. Will stripe across more than two drives.
- RAID 5 – A complex scheme of storing Parity blocks to recreate data if one device fails
- RAID 6 – Similar to RAID 5 except there are two parity blocks and can survive a double drive failure. Important to new SATA drive technologies where during the drive rebuild process a second failure is likely.
- Bottleneck – a term used to discuss what is holding the system back from performing better. Bottlenecks can be in Processors, HBAs, Controllers or Disk drives.

Overview of components of a storage subsystem



VDBENCH

- An application that simulates a controlled IO load on a storage system
- It is written in 99% Java and 1% C for exceptional efficiency
- Designed to execute a workload on a storage system
- Performance output can be thought of as a simple equation: **f(Workload, Config) = Performance + Power**

Workload Dimensions

- Workload is a very complex multi-dimensional problem
  - Number of threads or queue depth to storage
  - Transfer size
  - Read to write ratio
  - Sequential vs random
- Cache hit or cache miss

Configuration Dimensions

- Configuration is equally complex multi-dimensional problem
  - Number/type of drives
  - Capacity of configured system
  - Raid Level
  - Size of RAID set
  - Size of Stripe
  - Controller or JBOD
  - Number/type of back-end connections
  - Number/type of front-end connections
  - Volume Manager configuration
  - System parameters that affect storage (sd_max_throttle, max_contig, multi-pathing software, etc)
  - cache mirroring
  - broken hardware (failed controller, disk drive, path, etc)
  - Accessed RAW or Buffered
  - Tiering software active
- Compression enable / disabled

Performance outputs

- IOs per second for small block workloads
- MB per second for large block workloads
- Average response time in ms
- Combined with the Power Meter
  - Average Watts over the interval
  - Average Amps over the interval
- Generally shows the peak performance of some system resource bottleneck

VDBENCH (cont.)

- VDBENCH is an IO driver that allows for a workload targeted to specific storage and reports performance
  - vdbench has three basic statements to the script
    - SD - Storage Definition - defines what storage to be used in the run
    - WD - Workload Definition - Defines the workload parameters for the storage
    - RD - Run Definitions - determines what storage and workload will be run together and for how long. Causes IO to be executed and report IOPS, Response Times, MB/sec, etc
- Output from vdbench is a web browser friendly .html file.

Simple 3 line VDBENCH Script

```
* Author: Henk Vandenbergh.
*
* Example 1: Single run, one raw disk

* SD:  Storage Definition
* WD:  Workload Definition
* RD:  Run Definition
* Solaris style Raw Disk

sd=sd1,lun=/dev/rdsk/c6t0d0s4
wd=rr,sd=sd1,xfersize=4096,rdpct=100
rd=run1,wd=rr,iorate=100,elapsed=10,interval=1

* Single raw disk, 100% random read of 4k records at i/o rate
*  of 100 for 10 seconds
```

Storage Definitions

- This part of the script defines the storage to be used in this script
- SNIA/EPA workload is designed to run against “RAW” Storage. No buffering.
- Make sure you select the right storage, it will destroy everything on the disk. This includes your root or C: disk.
- Make sd name unique. SD=unique_name

RAW vs Buffered

OS	RAW	Buffered
Windows	lun=\\.\d: lun=\\.\PhysicalDrive4	d:
Solaris	lun=/dev/rdsk/c3t0d2s4 lun=/dev/vx/rdsk/c3t0d2s4	lun=/dev/dsk/c3t0d2s4 lun=/dev/vx/dsk/c3t0d2s4
Linux	lun=/dev/sdb,openflags=o_direct	lun=/dev/sdb
AIX	lun=/dev/rsatathin1	???

```
sd=default,size=300g

sd=sd1,lun=/dev/rdsk/c6t3d0s0

sd=sd2,lun=/dev/rdsk/c7t1d0s0,size=200g

sd=sd3,lun=/dev/rdsk/c8t6d0s0,size=200g
```

Workload Definitions

- Each WD name must be unique wd=wd_unique
- Parameters include:
  - sd= devices to run against
  - seekpct= Pct time to move location
  - rdpct= read pct
  - xfersize= transfer size
  - skew= Percent of workload for this definition
  - threads= number of threads this definition
  - wd=default setup defaults for the following wd
- hotband=(10,18) execute hot band workload against a range of storage

```
wd=HOTwd_uniform,skew=6,sd=sd*,seekpct=100,rdpct=50
wd=HOTwd_hot1,sd=sd*,skew=28,seekpct=rand,hotband=(10,18)
```

Run Definition

- Each run definition name must be unique rd=rd_unique
- Parameters include:
  - wd= which workload definitions to run now
  - iorate= define either io/sec or the keyword “max” or “curve”
  - warmup= define period where ios do not count towards average (30 or 5m or 12h)
  - elapsed= define length of run
  - interval= time between reporting statistics in seconds
  - threads= number of threads per lun or concatenated storage
  - forrdpct= range of pct read to execute

```
rd=rd1_hband,wd=HOTwd*,iorate=MAX,warmup=30,elapsed=6H,interval=10,pause=30,th=200
rd=rd1_seq,wd=wd_seq,iorate=max,forrdpct=(0,100),xfer=256K,warmup=30,el=20m,in=5,th=20
```

Performance outputs summary.html

Vdbench summary report, created 13:09:26 Mar 13 2013 MST

Link to logfile: logfile
Run totals: totals
Copy of input parameter files: parmfile
Copy of parameter scan detail: parmscan
Link to errorlog: errorlog
Link to flatfile: flatfile
Link to HOST reports: localhost
Link to response time histogram: histogram
Link to SD reports: sd1 sd2
Link to workload report: wd_mixed
Link to workload report: wd_seq
Link to Run Definitions: rd1_mixed000 For loops: rdpct=0.0 xfersize=8k threads=48.0
rd1_mixed100 For loops: rdpct=100.0 xfersize=8k threads=128.0
rd1_seq For loops: rdpct=0.0 xfersize=256k threads=48.0
rd1_seqR For loops: rdpct=100.0 xfersize=256k threads=128.0

13:09:31.014 Starting RD=rd1_mixed000; I/O rate: 1000; elapsed=1800; For loops: rdpct=0.0 xfersize=8k threads=48.0

Mar 13, 2013	interval	i/o rate	MB/sec 1024**2	bytes i/o	read pct	resp time	read resp	write resp	resp max	resp stddev	queue depth
13:10:31.415	1	991.57	7.75	8192	0.00	1.708	0.000	1.708	23.479	1.093	1.7
13:11:31.294	2	1002.72	7.83	8192	0.00	1.804	0.000	1.804	4.974	0.638	1.8
13:12:31.271	3	994.57	7.77	8192	0.00	1.797	0.000	1.797	4.780	0.634	1.8
13:13:31.290	4	1000.23	7.81	8192	0.00	1.802	0.000	1.802	5.278	0.645	1.8
13:14:31.339	5	1004.10	7.84	8192	0.00	1.805	0.000	1.805	29.753	0.654	1.8
13:15:31.280	6	1002.27	7.83	8192	0.00	1.848	0.000	1.848	46.246	0.682	1.9
.											
.											
13:39:31.214	30	995.17	7.77	8192	0.00	1.800	0.000	1.800	5.211	0.633	1.8
13:39:31.222	avg_2-30	999.11	7.81	8192	0.00	1.816	0.000	1.816	83.487	0.652	1.8

Running vdbench

- Parameters to vdbench
  - -f file(s) to be part of script
  - -o output directory (add a “+” to keep from overwriting earlier runs)
  - -e elapsed time override
  - -i interval time override
  - -w warmup time override
  - -s simulate execution (open storage, check syntax)

/vdbench/vdbench -f comp_25.txt t5a_config.txt script.txt -o t5_comp_25+
/vdbench/vdbench -i 10 -f one_file_script.txt -o simple_test+

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