

Classroom VM Structure

I/O Performance of Different Host Configurations

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Continuation of Building a Computing Cloud for Education and Development

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Previous Key Observations

- Easier to assess homework on networked vs non-networked computers
- Possible to replicate Internet Protocols and Services
- OK to disrupt services in a network sandbox but not on a school wide network

Key Points Of This Study

- Replicate the classroom VM structure
- Outreach to secondary school technology classes
- Consistent VM performance valued over high throughput
- Stable configuration very important

VM Specifications Target

- Single Classroom
- 20-30 students
- Linux and Web Curriculum
- Minimal VM load

Hardware Source

Desktop computers removed from classroom use following planned upgrade and replacement cycle . DISCARDED!
Destined for auction.

Hardware Modifications

RAM and hard drives from 2 classroom desktops were consolidated to build one Xen host supporting 15 VMs.

Software RAID 5 required a third hard drive.

Host Configurations

- Dell dual core, 2x40 GB drives, 4GB RAM
- HP quad core, 2x320 GB drives, 8 GB RAM
- HP quad core, 3x320 drives, 8 GB RAM, software RAID 5

Original desktop configuration each had half the RAM and one hard drive.

Host Software

- Debian 8 Jessie
- Xen kernel
- Xen Tools
- BASH Scripts
- Linux iostat

VM Configuration

- Debian 8 Jessie
- Workload generator stress
- 128 MB RAM
- 4 GB disk
- RAM is limiting factor building VM on host. Use 128 MB for Linux only, 256 MB for Web Tech curriculum using full LAMP stack

I/O Performance Testing

- 15 VM on each host
- Reboot all VMs
- Initiate stress workload on each VM
- Collect iostat reports
 - Total I/O for host
 - Each VM I/O

Data Collection

Record transactions per second (TPS) for the previous second once each minute during a test run. A test run lasted at least 30 minutes so 30 data collections per test run.

Preliminary Host Results

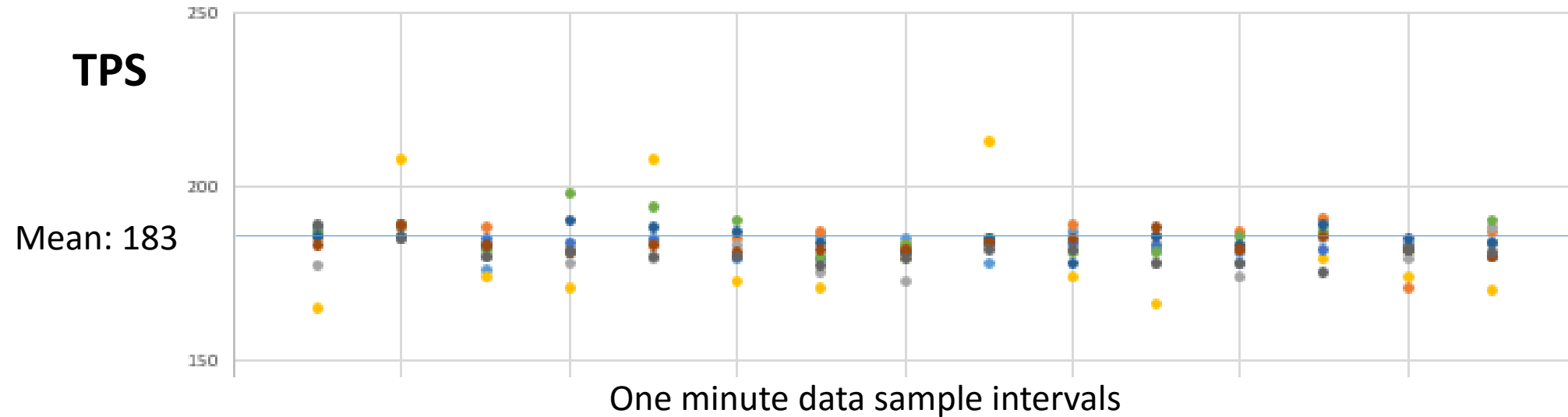
- Total I/O for all VM on a host consistent over all test runs
- Less than 5% standard deviation for total I/O on all test runs

	Host Total Average Transactions Per Second					
	Test 1	Test 2	Test 3	Test 4	AVG	SDEV
Dell dual core	2641	2599	2700	2647	2647	36
HP quad core	7151	7685	7698	7202	7434	258
HP quad core with software RAID 5	2289	2311	2320	2295	2304	12
HP quad core with software RAID 5 #2	2192	2293	2307	2288	2270	46

Preliminary VM Results

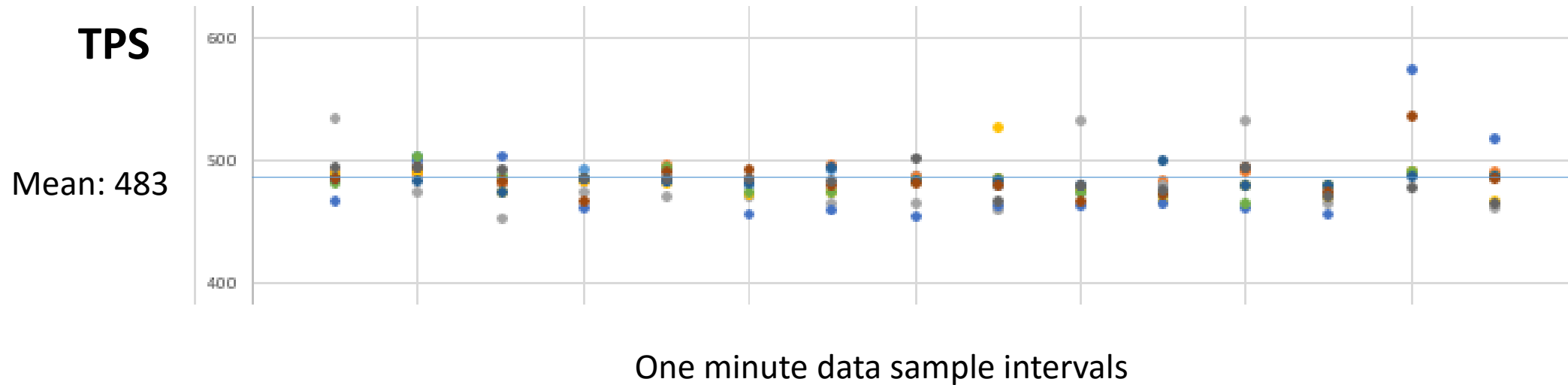
- Older Dell dual core less transactions per second than newer HP quad core
- Each VM I/O consistent at each one minute interval measure point
 - Except with software RAID 5

VM Sample Data (Dell Dual Core)



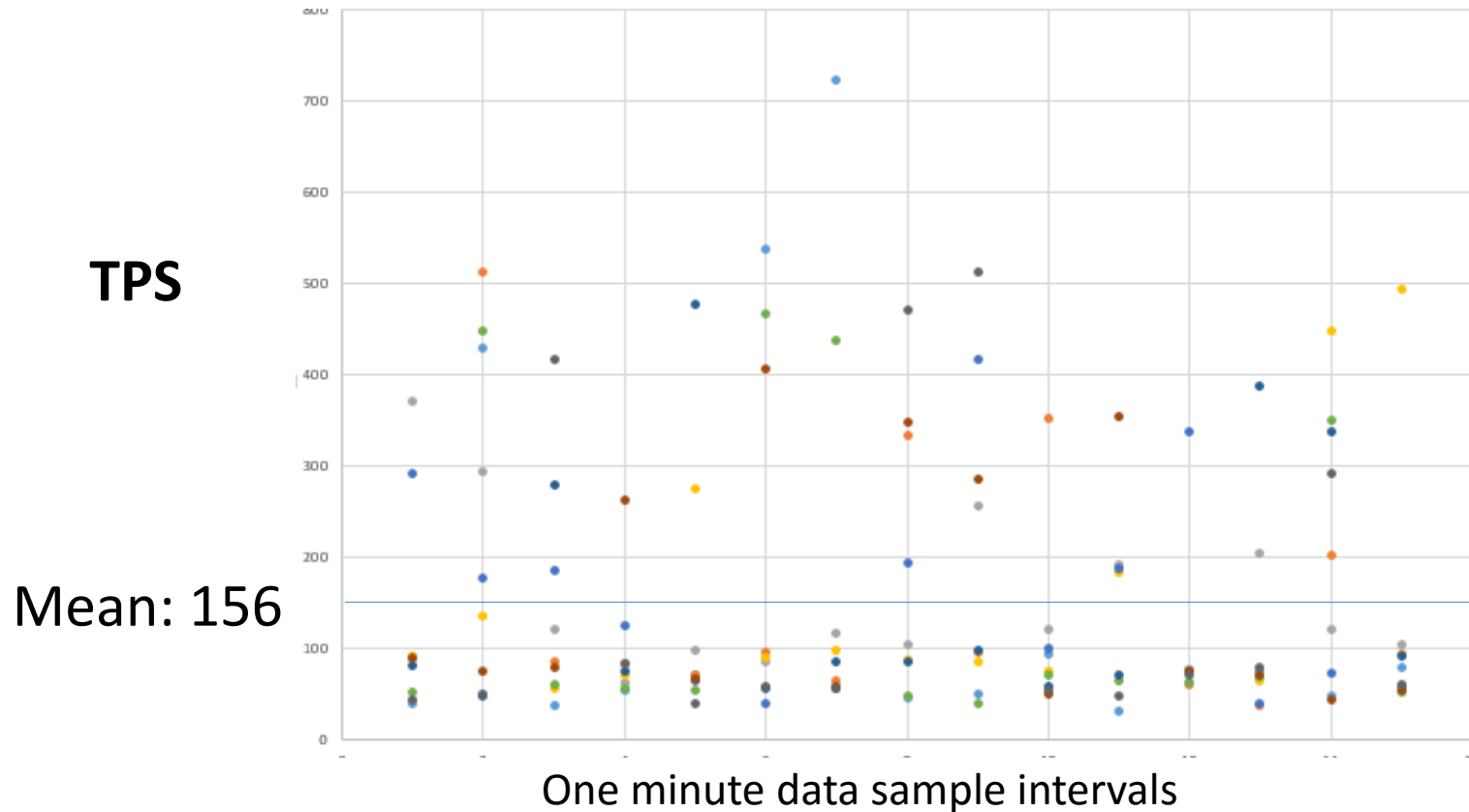
15 VM sampled at one minute intervals. TPS tight cluster with little deviation from average. All TPS were in the displayed range. Each dot represents one VM.

VM Sample Data (HP Quad Core)



15 VM sampled at one minute intervals. TPS tight cluster with little deviation from average. All TPS were in the displayed range. Each dot represents one VM.

VM Sample Data (HP Quad Core with software RAID5)



15 VM sampled at one minute intervals. TPS large deviation from average. All TPS were in the displayed range. Each dot represents one VM.

Summary

- Software RAID 5 degrades VM I/O Performance to lowest mean TPS of all configurations tested
- Dell dual core and HP quad core both have predictable VM I/O with little deviation at one minute data sample intervals

Classroom VM Per Host Requirements

- RAM is the limiting factor in our configurations
- Linux curriculum: 128 MB
- Web Tech LAMP curriculum: 256 MB
- HP configuration can host 24 Web Tech students each with a full LAMP stack and dynamic website.

	Total RAM	Host RAM	VM RAM	Number VM@128MB	Number VM@256MB
Dell	4 GB	2 GB	2 GB	16	8
HP	8 GB	2 GB	6 GB	48	24

Conclusions

- Dell dual core good candidate for classroom use but 4 GB RAM configuration limits number of VMs
- HP quad core 8 GB RAM better candidate to host classroom VM