



# **Benchmark Study: A Performance Comparison Between RHEL 5 and RHEL 6 on System z**

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# Lab Environment Setup

- Hardware and z/VM Environment
  - z10 EC, 4 IFLs used (non concurrent tests)
  - Separate LPARs for RHEL 5, RHEL 6
  - z/VM 6.1
  - IBM DS8000 Storage Array
    - ECKD DASD, mod 9
    - FCP through Fiber Switch
  - VSWITCH used for networking
- RHEL 5.5 GA, default install
- RHEL 6.0 GA, default install



# Case 1: System Startup

- Test plan
  - Measure System startup using default options, with similar services configured
  - Leave as many defaults as possible
- Technical details
- `/etc/rc.local`: Last startup file to get executed after system boot
  - Add these lines:
    - `echo "Startup complete:" >> /tmp/startup.test`
    - `date >> /tmp/startup.test`
  - Now reboot with this command:
    - `date > /tmp/startup.test; reboot`



# Case 1: System Startup

## ■ Results

- RHEL 5.5
  - **1 minute, 12 seconds**
- RHEL 6.0
  - **34 seconds**
- Over twice as fast (actual: 212%)

## ■ Reasons

- RHEL 6 has “upstart”, an event-based replacement for the /sbin/init daemon which handles starting of tasks and services during boot, stopping them during shutdown and supervising them while the system is running. RHEL 5 starts services in order (serially, one after another).
- RHEL 6 default bootloader timeout has been reduced.

# Case 2: Networking

## ■ Test Plan

- Use Apache web server benchmark to simulate heavy client network traffic
- Client and server on same LPAR, using same VSWITCH, to avoid benchmarking external network speeds in lab

## ■ Technical Details

- 100,000 connections
- 4 concurrent connections at a time
- Payload size: small (170 bytes)
- 3 test runs, then average results
- RHEL 5.5: Apache version 2.2.3
- RHEL 6.0: Apache version 2.2.15



# Case 2: Networking

## ■ Results

	RHEL 5.5	RHEL 6.0	% improvement
HTTP requests/sec	7289	9712	33%
Time per request	0.551 ms	0.413 ms	33%
Time per request, across all concurrent requests	0.138 ms	0.103 ms	34%
Transfer rate	3125 Kbytes/sec	4154 Kbytes/sec	33%

## ■ Reasons

- Network driver (qeth) redesigned. Also many kernel network subsystem improvements in RHEL 6.

# Case 3: Sysbench

## ■ Sysbench

- <http://sysbench.sourceforge.net/>
- “SysBench is a modular, cross-platform and multi-threaded benchmark tool for evaluating OS parameters that are important for a system running a database under intensive load. The idea of this benchmark suite is to quickly get an impression about system performance without setting up complex database benchmarks or even without installing a database at all.”

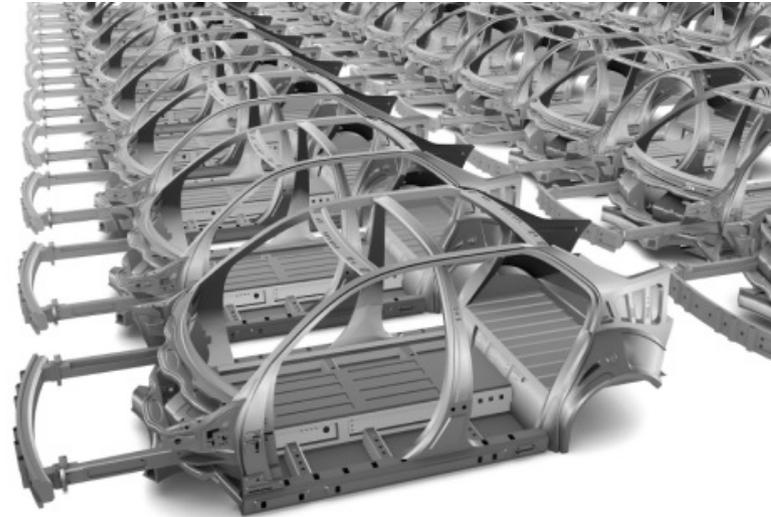
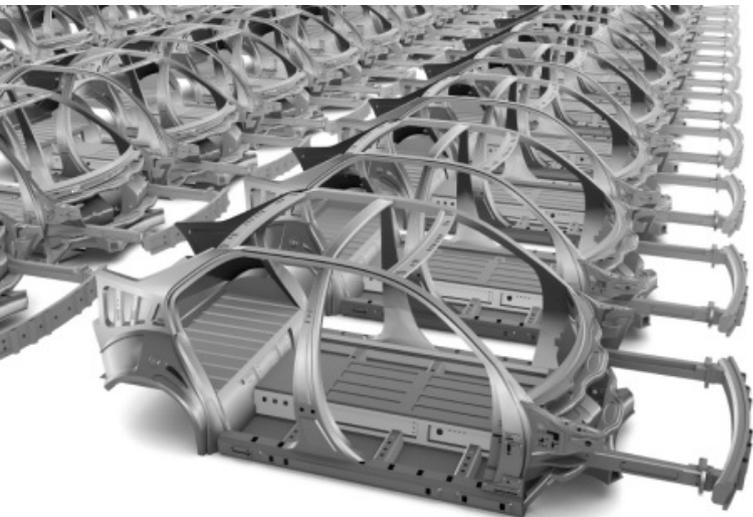
## ■ Technical Details

- Download and install sysbench package from Fedora
- Rebuild source RPM required on RHEL 5



# Case 3: Sysbench: Application Scheduler

- Test 1: Linux Kernel Scheduler
  - SysBench creates a specified number of threads and a specified number of locks. Then each thread starts running to compete for the locks. The more iterations are performed, the more concurrency is placed on the system.
- Background:
  - RHEL 5 introduced the O(1) scheduler in 2007, which scaled better than kernel schedulers of the past.
  - Today, RHEL 6 uses the Completely Fair Scheduler (CFS), which is designed for multi-core CPU topologies, and operates with nanosecond granularity to maximize CPU utilization, and with lower power consumption.

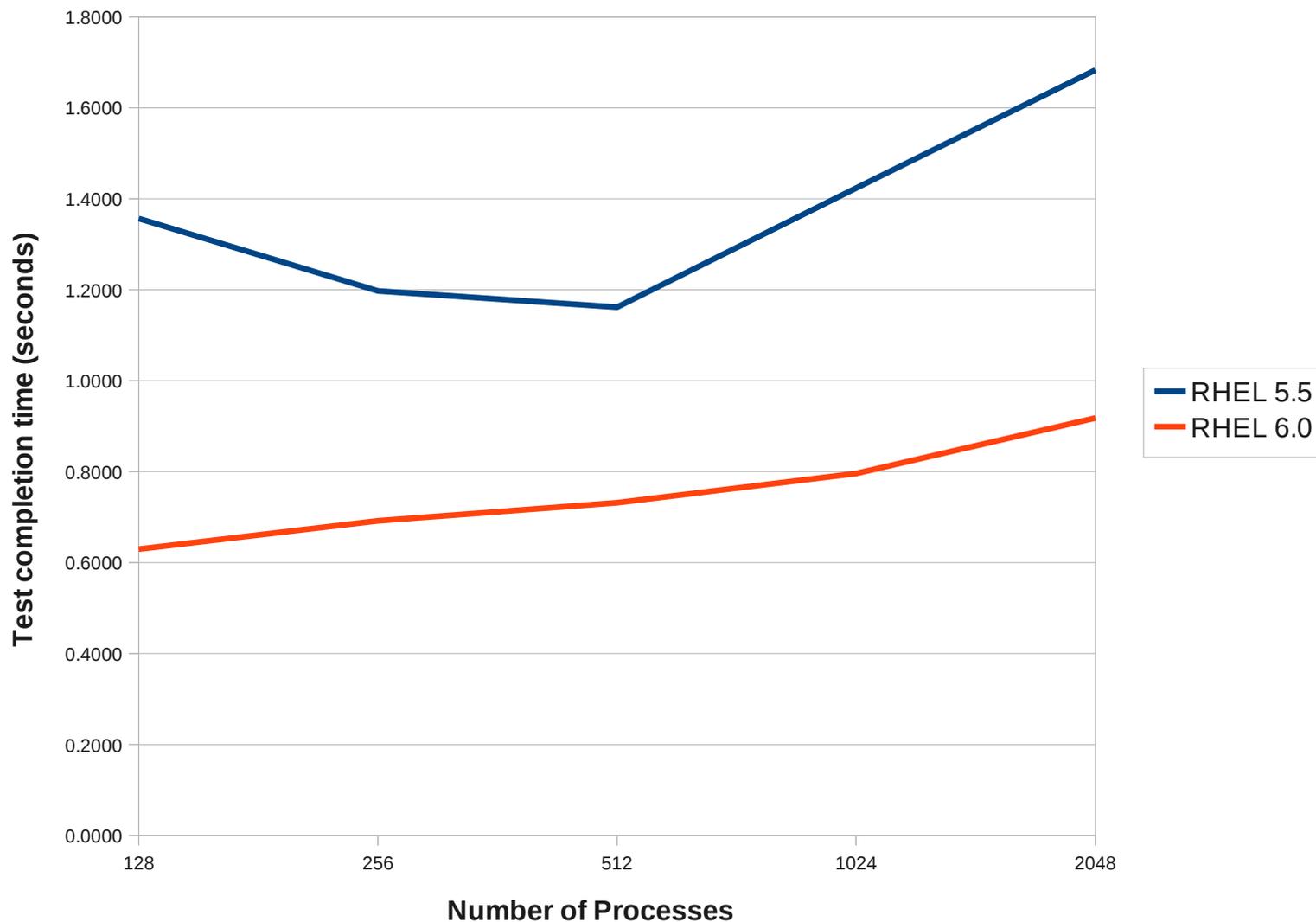


# Case 3: Sysbench: Application Scheduler

■ Results:

## Scheduler Benchmark

Concurrent Thread Test



# Case 3: Sysbench: Memory Performance

- Test 2: Memory reads and writes
  - This is a simple test of reads and writes to memory.
  - Test memory size in all tests is 8GB. Guest memory size is 512MB.
- Results

	RHEL 5.5	RHEL 6.0	% improvement
Write Speed	1295 MB/s	2019 MB/s	56%
Read Speed	2471 MB/s	7735 MB/s	213%

- Reasons
  - Major improvements to the Linux kernel memory subsystem between RHEL 5 and RHEL 6.

# Case 3: Sysbench: Disk I/O Performance

- Test 3: File I/O

- This test simulates I/O workload to disk. The test was run on both ECKD Mod-9 DASD.

- Results

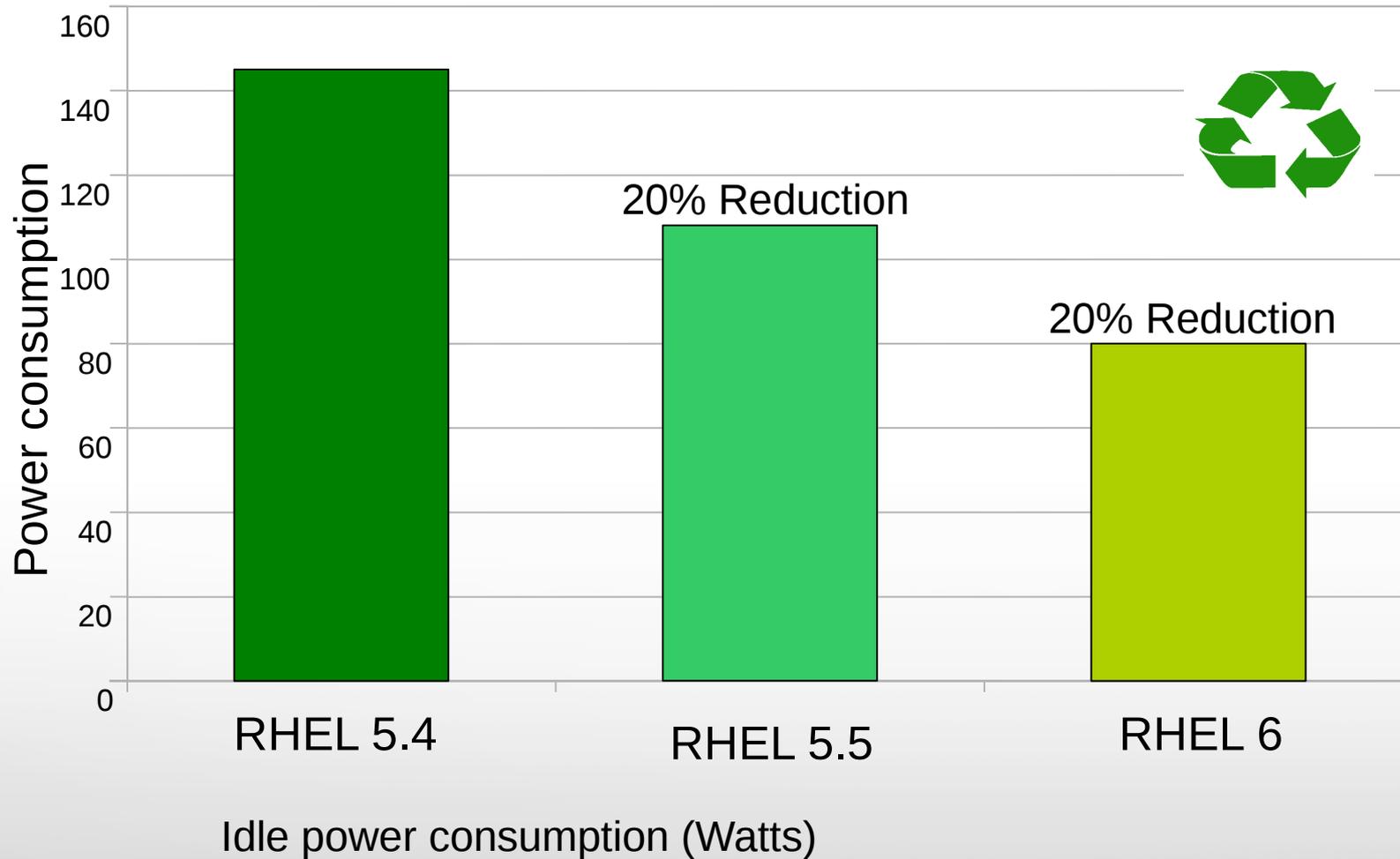
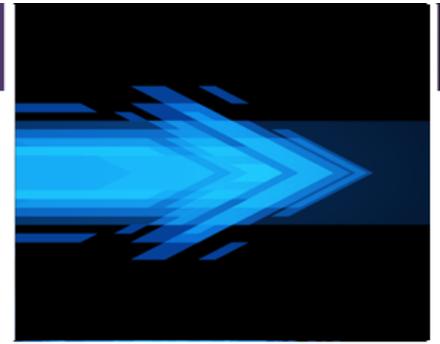
	RHEL 5.5 (ext3)	RHEL 6.0 (ext4)	% improvement
ECKD data operations/sec	963.29	1708.88 MB/s	77%
ECKD total speed	15.051 MB/s	26.701 MB/s	77%

- Reasons

- Improvements to the DASD driver, as well as file system improvements in ext4, which is now the default in RHEL 6. Compared to ext3, the ext4 file system is faster, more robust, and supports extended functionality like thin provisioning.

# Case 4: Run Leaner

## Lower Power Consumption





Questions?

