



UBUNTU CPU BENCHMARK TEST RESULTS

FOR JOYENT
Revision 8

January 21st, 2010

Scope:

This report summarizes the CPU benchmark testing performed in December of 2010 for Joyent Ubuntu Linux cloud servers.

References:

[1]: <http://blog.cloudharmony.com/2010/05/what-is-ecu-cpu-benchmarking-in-cloud.html>

[2]: Svn repository: <https://svn.codespaces.com/ims/joyent-ubuntu>
username: joyent **password:** joyent

[3]: Raw test data: CPU_Final_Results.xlsx

[4]: Phoronix Test Suite 2.6.1:
<http://www.phoronix-test-suite.com/download.php?file=phoronix-test-suite-2.6.1>

[5]: <http://byte-unixbench.googlecode.com/files/unixbench-5.1.2.tar.gz>

Joyent CPU Benchmark Testing Report

Introduction

The CPU testing was performed as part of a larger benchmark effort intended to provide a basis for comparison between the Joyent Ubuntu and other virtual servers offered by cloud service providers.

Earlier in 2010, CloudHarmony engaged in an extensive benchmarking effort intended to provide "information and analysis to enable educated decisions pertaining the adoption of, and migration to cloud services". Their results and analysis are presented in a series of articles published online ref[1]. The CloudHarmony blog does not contain results for the Joyent Ubuntu servers. Our testing procedures are intended to follow CloudHarmony's efforts as closely as possible and extend benchmarking for the Joyent servers.

Instead of trying to reproduce all of the CloudHarmony results, we focused on those outlined for the Amazon EC2 servers used in their benchmark tests ref[1]. Our tests closely approximate the methods from CloudHarmony in regards to calculations and tests used. Figures for the Joyent Ubuntu servers should be a useful addition to the other benchmarks included in CloudHarmony's blog. It should be noted that not all test executables and versions contained in this report are identical to those of CloudHarmony due to differences in operating systems. These results should not be compared side-by-side to those of CloudHarmony. Our mathematical calculations for the baseline numbers and server instances are however identical.

CloudHarmony standardized on CentOS 64bit as the operating system used for baseline tests except where it was unavailable. The Joyent Ubuntu servers run version 10.04 of the operating system.

The Joyent servers provide a "bursting" capability that allows a service to use more processor resources on a temporary basis than the guaranteed minimum. This differs from nearly all other cloud providers that provide a fixed processor configuration. While bursting capability can be a tremendous advantage to an

operational system, it can complicate benchmark testing which will stress the system to its maximum capacity. On the Joyent Ubuntu servers the bursting capability allows a process on even the smallest server to potentially use nearly the entire compute capability of the underlying hardware.

The Joyent Ubuntu servers use large commodity servers with an available 4 hyper-threaded processors that effectively yield 8 processor cores. This means that Joyent's smallest server, the 1 GB, can in some cases outperform Amazon's largest EC2 instance. Due to this bursting capability, side-by-side comparisons may not be identical in nature between the Joyent Ubuntu servers and other cloud providers. Our conclusions outline the similar comparison between Joyent's 8GB Linux server and Amazon's EC2 c1.xlarge instance which both yield 8 total cores.

Benchmark Setup

Amazon EC2 was used as our primary baseline benchmark for all CPU tests. The servers used consist of: m1.small, c1.medium, m1.large, m1.xlarge, m2.xlarge, c1.xlarge, m2.2xlarge, m2.4xlarge. All Amazon servers – 8 servers in 4 regions, were configured identically in terms of OS, CentOS 5.4 64-bit (or 32-bit in the case of EC2 m1.small and c1.medium where 64-bit is not supported). Joyent Ubuntu servers included: 1GB, 2GB, 4GB, 8GB, 16GB.

To run the majority of benchmark tests, CloudHarmony made use of the Phoronix Test Suite ref[1]. Version 2.6.1 was used for compatibility and comparison with our benchmarks performed on the Joyent SmartMachine ref[2]. There are several differences between version 2.2.0 used by CloudHarmony and 2.6.1 used in this report. These include test versions, source code, and executables. Our tests however used version 2.6.1 on all servers including the baselines.

The Joyent Ubuntu servers utilize version 10.04 and only required minor tweaks to the phoronix test suite.

Benchmark Tests

There are 19 benchmarks CloudHarmony used to compute the CCU comparison metrics. All of the tests ran properly on the Joyent Ubuntu servers and include:

espeak, mafft, nero2d, opstone-svd, opstone-svsp, opstone-vsp, c-ray, crafty, dcraw, geekbench, graphics-magick, hmmer, john-the-ripper-blowfish, john-the-ripper-des, john-the-ripper-md5, openssl, sudokut, tscp, unixbench

There are several packages that were required to perform all of the tests. The additional apt packages installed consisted of:

php5-cli, gcc, autoconf, libpng-dev, unzip, libespeak-dev, libportaudio-dev, ia32-libs, build-essential, tcl, libnuma-dev, gfortran, libfftw3-dev, libblas-dev, liblapack-dev

Testing Procedures

The Phoronix Test Suite 2.6.1 was setup on each Joyent Ubuntu Linux and Amazon server to run all the CPU benchmarks except unixbench. Phoronix compiles their

results in xml files to be displayed in a web browser. The suite also creates image graphs for visual comparison. Unixbench was run independently from the others with output saved to a flat-file for record keeping.

In order to reproduce our testing procedures on the Joyent Ubuntu servers see ref[2]: joyent_ubuntu_install_cpu.sh, phoronix-test-suite-JoyentUbuntu-2.6.1.tar.gz. The following guidelines should produce similar or identical test results:

1. Install the Phoronix Test Suite into a local directory within the user's folder on each server. Tar files for Joyent Ubuntu are included ref[2]: phoronix-test-suite-JoyentUbuntu-2.6.1.tar.gz. This tar file includes the small tweaks required for Joyent's Ubuntu servers. If using this tar file, extract into the user directory and skip to step 6.
2. If installing the default Phoronix Test Suite 2.6.1 ref[4], apply the patch file ref[2] phoronix-suite-2.6.1-ubuntu.patch to the test suite. This patch makes changes to the installation files and performs all alterations necessary for the Ubuntu servers.
3. Install the required dependencies:
apt-get install php5-cli, gcc, autoconf, libpng-dev, unzip, libespeak-dev, libportaudio-dev, ia32-libs, build-essential, tcl, libnuma-dev, gfortran, libfftw3-dev, libblas-dev, liblapack-dev
4. Install the tests via Phoronix or use the script ref[2] joyent_ubuntu_install_cpu.sh.

```
cd ~/phoronix-test-suite
```

```
./phoronix-test-suite install c-ray dcrow geekbench graphics-magick hmmmer  
john-the-ripper mafft openssl opstone sudokut tscp crafty espeak nero2d
```

The tests should all install properly and run without additional modifications. To see the small changes required see the ref[2] phoronix-suite-2.6.1-ubuntu.patch file. And additionally, crafty, unixbench and geekbench needed slight modifications. See ref[2] joyent_ubuntu_install_cpu.sh for a list of additional steps performed.

5. Download and extract the Unixbench source ref[5] into the folder unixbench-5.1.2. Follow the directions contained in the Unixbench source code to compile.
6. Manually run the tests via these commands:

```
cd ~/phoronix-test-suite
```

```
./phoronix-test-suite run c-ray dcrow geekbench graphics-magick hmmmer  
john-the-ripper mafft openssl opstone sudokut tscp crafty espeak nero2d
```

```
cd ~/.unixbench-5.1.2
./Run
```

7. If installing the provided tar archive, simply run the ref[2] joyent_ubuntu_install_cpu.sh script which modifies all files required and tars the results for record keeping.

Note: If any tests fail to run, make the following modifications to the test suite core files to see the full executable outputs for troubleshooting:

```
phoronix-test-suite/pts-core/library/pts-functions_shell.php
```

At line 110 add:

```
echo pts_variables_export_string($extra_vars) . "\n\n";
echo $exec . "\n\n";
```

This will output the Phoronix variables and executable to the command line.

Baselines

A cumulative baseline was taken from all Amazon results and calculated based on the methodology from CloudHarmony. It should be noted that our benchmark results compare to the CPU comparison score (CCS) and CloudHarmony Compute Unit (CCU) values ref[1]. Our CCS and CCU results for the Amazon baseline servers were comparable to the corresponding results posted on the CloudHarmony blog.

Test Results

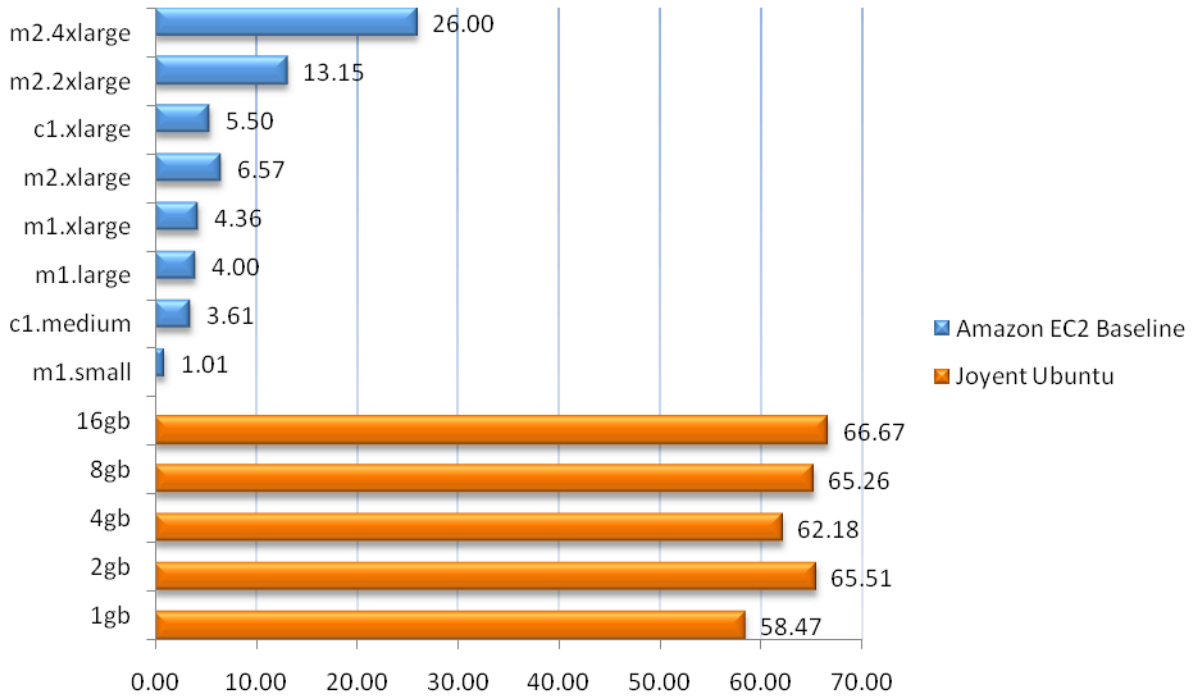
For the full raw test data and calculations see the spreadsheet ref[3] and traverse to the Joyent Ubuntu worksheet. Datasets and breakdowns from each benchmark test from the different servers are presented in several spreadsheets.

To calculate CCS and CCU please refer to the ref[3] CPU_Final_Results.xlsx document worksheet titled Scores. The CCS scores are compared and calculated against an average of the Amazon server tests. Our calculations are based on and have been verified against those found on the CloudHarmony blog.

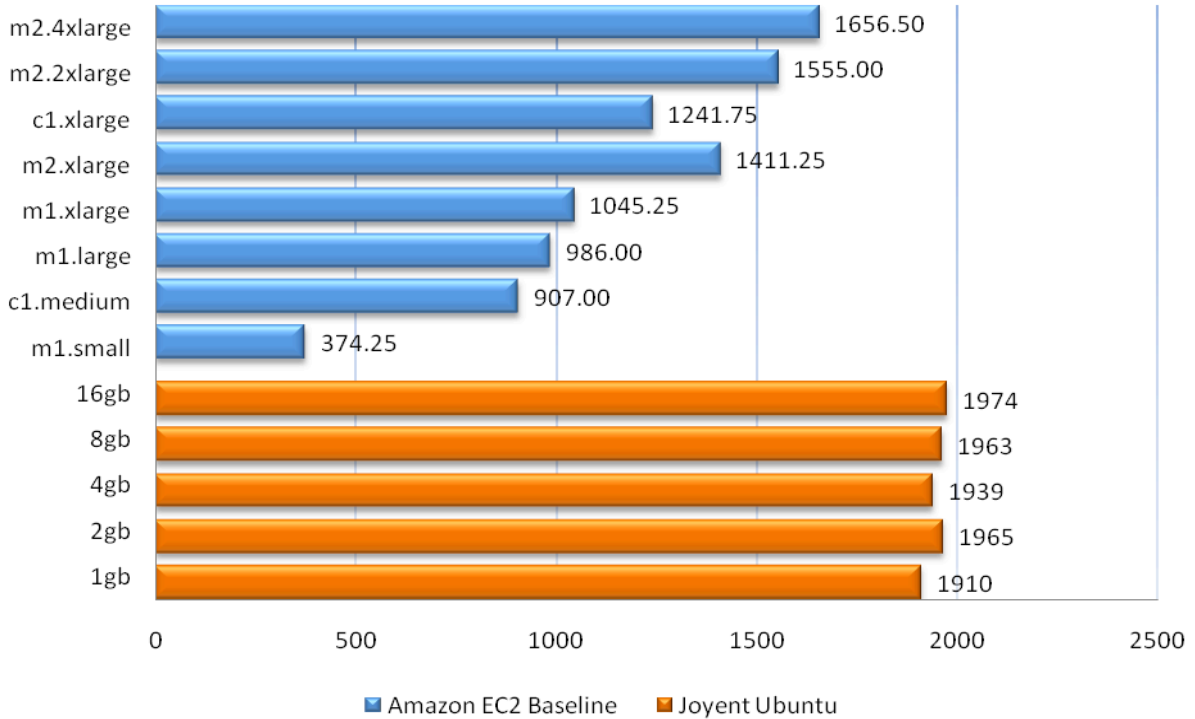
As shown in the following graphs, the Joyent Ubuntu servers outperform the Amazon EC2 servers, which may be a result of Joyent's underlying architecture and bursting capability. The Unixbench scores were calculated uniformly across all servers with a detected 4 cpus and 4 parallel processes running.

Each metric and comparison for CCS and CCU is shown in these two graphs. CCS is the raw and weighted scores. A table lists each server's exact calculations for CCU below. The Joyent 32gb servers were not currently available. For the full unaveraged raw scores see ref[3].

CPU Benchmark Scores - CCU [higher is better]

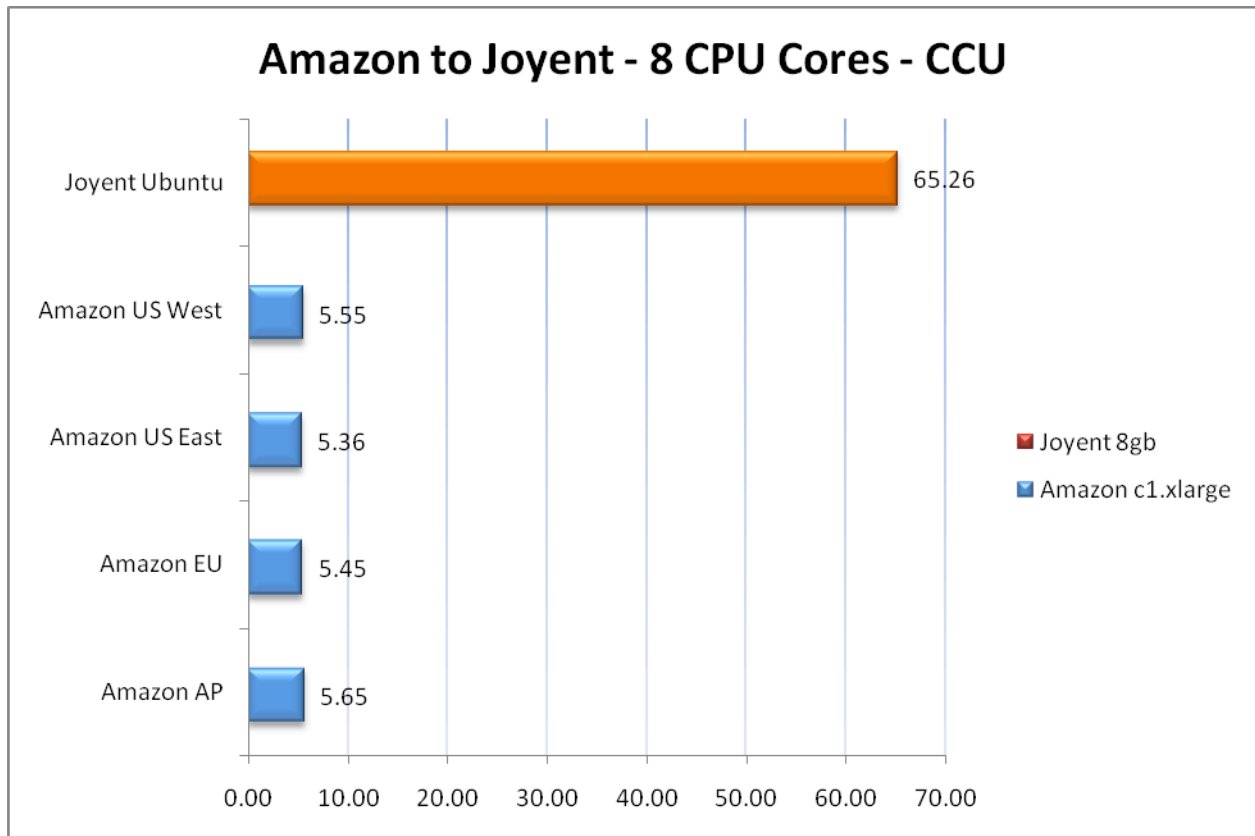


CPU Benchmark Scores - CCS [higher is better]



Conclusion

From our calculations and test results, Joyent outperforms the established baselines across the Amazon instance sizes in terms of CPU performance. Since Joyent's bursting capability allows a process to potentially use nearly the entire CPU capacity of the underlying hardware, Joyent's smallest Ubuntu server, the 1 GB SmartMachine considerably outperforms Amazon's smallest, m1.small, server. It should be noted that some of the Amazon instances from the Asia Pacific region produced higher than normal results possibly due to their hardware load.



The most equivalent comparison among the results is Joyent's largest server, the 8 GB and Amazon's EC2 c1.xlarge instance. During our tests, the CPU information was calculated as 4 CPU with 8 cores across all Joyent Ubuntu servers and Amazon's c1.xlarge instance reports 8 available cores and 7GB of memory. The Joyent 8GB machine scored significantly higher due to the hdparm test. Although the scores are weighted, an extremely high number can throw off the average.

These benchmark scores put the Joyent Ubuntu servers much higher than Amazon EC2 with the c1.xlarge instance reporting an averaged result of 1242 CCS and 5.5 CCU. The similar Joyent Ubuntu server at 8GB of memory and 8 CPU cores scored in at 1963 CCS and 65.26 CCU.

Additionally, while comparing the Joyent Ubuntu CCU values, the 1GB to 16GB server sizes show little variation in CPU performance with an increase in server capacity. This is mainly due to Unixbench detecting 4 CPUs and running 4 processes across all Joyent servers. Amazon servers however showed a consistent increase in

the CCU test result values from small to large based on server capacity. The Joyent Ubuntu server test scores were expected due to their CPU bursting capability.

Both of the below graphs show a much higher CPU performance comparison based on the similar 8 available cores on Amazon EC2 and Joyent Ubuntu servers. Overall, there appeared to be interestingly higher scores for the Asia Pacific region on EC2.

