Cloud Computing Workload Benchmark Report

Workload Benchmark Testing Results Between ProfitBricks and Amazon EC2 AWS: Apache Benchmark, nginx Benchmark, SysBench, pgbench, Postmark

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Introduction

You've heard the claims – this cloud is faster than that cloud and this cloud is less expensive than that cloud. And both companies have reports confirming they are faster or less expensive.

Eventually, this simply becomes unbelievable - and further adds to the confusion of the cloud infrastructure buyer.

The Cloud Computing industry has settled on a series of open-source, synthetic benchmarks including UnixBench, DBENCH, and Iperf. Wherever ProfitBricks is tested against another public cloud, ProfitBricks comes out on top, and in the case of the current market leader – Amazon EC2 AWS – ProfitBricks has 2x to 17x better performance results, even with their new (2014) m3 class of cloud instances.

We like to think that ProfitBricks has taken a different approach to the question of performance. Our approach is rooted in the technology our Cloud Computing platform is built upon, and the personal business philosophy of our founders. They could see, as far back as 2010, that Cloud Computing would grow to replace traditional IT infrastructure deployments. They knew the Cloud would have many competitors and need much innovation along the way to become a commodity and a default deployment model for all IT across the board.

Keeping this in mind, they decided in advance on the technology and architectural choices for our engineers to design and implement in our Public Cloud platform to ensure ProfitBricks becoming the price/performance leader – not just when we launched in 2012, but far beyond that, for when IaaS became a commodity. These choices included deploying InfiniBand vs. Ethernet for the interconnect technology, selecting the highly efficient and performance optimized KVM for a virtualization layer, and ensuring our engineers had access to the best technology available to build a Cloud Computing automation platform second to none. Our data center operations teams then selected the ProfitBricks’ foundational elements, including the hardware, networking equipment, and data center providers which would enable a true second generation IaaS provider with the legitimate claim of “Cloud Computing price/performance leader” – then and in the future. Now, in late 2014, we are the price leader - and we don’t have any performance equals at any price.

Synthetic benchmarks are great at measuring raw performance of a cloud instance, and it helps to create a standard with which to compare cloud providers. One must keep in mind, though, that specific workloads will have a different performance profile, whether these are your current workloads or those you wish to implement. In this report we want to help you learn what to expect from your specific workloads. We used open-source and popular workload level performance benchmarking software to compare Amazon AWS EC2’s new (2014) instances, the “m3” series, with ProfitBricks instances of the same size.
In this report we’ve also included some pricing data, as any move to the cloud or new deployment must factor in both price and performance when making instance sizing or provider choices. Over the decades price/performance ratios and true cost of ownership (TCO) have become the primary metrics IT teams use to compare providers or assess their success/failures for IT infrastructure deployments. From the first PCs to the database wars of the 1990’s, price/performance ratios and vendor supplied, third-party verified “transactions per second”, “requests per second” benchmarks have provided teams with predictive views on how their new deployments should fare.

At ProfitBricks, Cloud Computing performance is the primary focus for our engineering teams, and the pricing of our service is designed to be competitive with every competitor. Our teams have experience with large scale providers – with millions of customers and hundreds of thousands of servers, with the relevant data centers and networking gear to support them. We take a comprehensive view of IaaS performance benchmarking and competitive pricing. We regularly contract with 3rd parties to explore, research and develop new testing methodologies in-house, and discover the bugs and limitations of traditional and new benchmarking tools. As a Cloud Computing service provider, we realize that we are an edge case. We operate at web scale and are not an in-house data center. Our responsibility for high performance extends from the hardware and network architecture to the virtualization layer, as well as the software we develop to manage the environment. Cloud Computing’s multi-tenant architecture requires that we keep and maintain performance levels that exceed our customers’ expectations, and we strive to remain the highest performance Cloud Computing 2.0 provider available in the market. To this end, the ProfitBricks performance engineering team continually tests the performance of competitor cloud platforms and services. Performance is our passion – and our team is dedicated to publishing accurate and repeatable results.

Benchmark testing dissimilar Cloud Computing environments requires a thorough understanding of the respective environments and the effects that each included aspect may have on performance. It’s also essential that each benchmark test is run on top of a similar stack and software configuration. We recommend you download our Cloud Computing Performance Synthetic Benchmarking Report, in which we share our performance findings when using the standard synthetic benchmarking tools used by the industry. We then recommend you read this report and compare the workload level and pricing comparisons and align those results with what you expect from your workloads.

ProfitBricks strives to share our expertise with the community and to engage in an open dialogue about cloud performance. We welcome questions about our methodologies.
Executive Summary

In this report, the ProfitBricks performance engineering team presents our newest series of standardized open-source Cloud Computing benchmark testing results. This report adds to our existing reports, in that it focuses on Workload level benchmarks and how they compare on a cost basis when comparing the ProfitBricks Cloud to Amazon AWS EC2 instances. Workloads compared in this report include: Apache Benchmark, nginx, Sysbench(MySQL), PostMark (small file transactions), and pgbench (PostgreSQL). We strive to create an apples-to-apples comparison of virtual servers/instances at both ProfitBricks and Amazon EC2 AWS, and have presented our methodologies with full transparency (see the next section, Benchmark Testing Methodology). ProfitBricks engineers have spent months configuring and testing these instances, validating their results and compiling cost data to ensure an accurate report. The results confirm that ProfitBricks continues to be the performance leader in the cloud over all tested configurations, using all standard benchmarks - with results of 1.3x to 2.2x higher performance workload results. When you factor in the pricing advantage ProfitBricks has over Amazon’s AWS EC2 – you’ll see price/performance ratio advantages for ProfitBricks of 4.1x to 3.1x.
Benchmark Testing Methodology

All benchmarking tools were compiled on Ubuntu 12.04 (64-bit) servers running the latest supported Linux kernel, and each test was performed nine times with results averaged. By taking advantage of ProfitBricks’ granular scaling features, we were able to compare Amazon’s latest EC2 AWS offerings to ProfitBricks servers with similar resource specifications. For example: we contrasted the performance of an EC2 m3.large with 2 vCPUs and 7.5GB of RAM to a ProfitBricks server containing 2 dedicated CPU cores and 7.5GB of dedicated RAM (and equivalent InfiniBand-powered double redundant block storage).

In all cases, these are standard configurations at both ProfitBricks and Amazon. No special or optional services were added to the configurations. For each report, nine test runs were completed on each instance. Note: we continually see performance variations (sometimes large variations) on Amazon EC2 AWS services that vary by instance size, by time of day, and by data center. This is the main reason for multiple runs – we want to ensure that we’ve determined a representative composite result.

Server Configuration:
Amazon virtual instances are sold and packaged with a pre-packaged quantity of vCPUs, RAM and temporary storage.

ProfitBricks virtual instances servers are not pre-packaged, they are on-demand - so your every instance can be uniquely configured. We’ve done our best to match equivalent ProfitBricks instances to Amazon instances on a hardware basis – not a cost basis.

OS Configuration:
Operating System: Ubuntu 12.04 (64-bit) with 3.2.0.69 Linux kernel.

All benchmark software used in these tests is open source. We have provided the information you would need (including configuration details) to independently run these tests. Download the tools from these URLs:

Apache Benchmark 2.4.7: http://openbenchmarking.org/test/pts/apache
nginx 1.0.11: http://openbenchmarking.org/test/pts/nginx
SysBench (MySQL) v0.4.12.32: https://launchpad.net/sysbench
pgbench PostgreSQL 8.1.11: http://www.postgresql.org/docs/devel/static/pgbench.html
PostMark 1.51: http://openbenchmarking.org/test/pts/postmark
Apache Benchmark Results

ApacheBench or “ab” is included with the Apache webserver and is designed to benchmark a webserver. It will test for the number of requests per second a specific Apache installation is capable of serving. This a key metric to keep in mind when unexpectedly high or nefarious traffic volumes hit.

Result:
In this Apache Benchmark test, ProfitBricks exceeds the performance of Amazon EC2 AWS’ new m3 instances by 2.2x These tests were run three separate times and the results and test configuration can be found in the Apache Benchmark test results on the next page.

Apache test configuration:

Compile Apache:
- phoronix-test-suite install apache

Run Apache test:
- phoronix-test-suite run apache
Apache Benchmark Results:
ProfitBricks Cloud Server Instances vs. Amazon AWS EC2 Instances – type m3

<table>
<thead>
<tr>
<th>Instance Size</th>
<th>ProfitBricks Apache Bench score</th>
<th>AWS EC2 Apache Bench score</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC2: m3.large, ProfitBricks equivalent (2 CPU cores/7.5GB RAM)</td>
<td>11,580.6</td>
<td>5,225.4</td>
</tr>
</tbody>
</table>
**nginx Benchmark Results**

*nginx* is a popular open source webserver, and the Apache Benchmark “ab” program has been configured to run against it. The test profile used here measures how many requests per second a given system can sustain when carrying out 500,000 requests with 100 requests being carried out concurrently.

**Result:**
In this nginx benchmark test, ProfitBricks exceeds the performance in transactions per second with Amazon EC2 AWS’ m3 instances by nearly 2x. These tests were run nine separate times and the results and test configuration can be found on the nginx test results on the next page.

**Nginx test configuration:**

- **Compile nginx:**
  - phoronix-test-suite install nginx

- **Run nginx test:**
  - phoronix-test-suite run nginx
nginx Benchmark Results:
ProfitBricks Cloud Server Instances vs. Amazon AWS EC2 Instances – type m3

<table>
<thead>
<tr>
<th>Instance Size</th>
<th>ProfitBricks nginx Benchmark (requests per second)</th>
<th>AWS EC2 nginx Benchmark (requests per second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC2: m3.large, ProfitBricks equivalent (2 CPU cores/7.5GB RAM)</td>
<td>19,008.4</td>
<td>9,813.5</td>
</tr>
</tbody>
</table>
SysBench Results

SysBench is a popular modular and multi-threaded benchmark tool for evaluating OS parameters which provides performance details for a system running a database with an intensive load. The test helps provide insight into file I/O performance, memory transfer speed, scheduler performance, and overall database server performance (OLTP benchmark).

Result:
In this SysBench benchmark test, ProfitBricks exceeds the performance of Amazon EC2 AWS' new m3 instances by 1.8x. These tests were run nine separate times and the results and test configuration can be found on the SysBench test results on the next page.

Sysbench test configuration:

Install sysbench:
- wget http://downloads.mysql.com/source/sysbench-0.4.12.5.tar.gz
- gunzip sysbench-0.4.12.5.tar.gz && tar xvf sysbench-0.4.12.5.tar

Compile sysbench:
- ./configure --with-mysql-includes --with-mysql-libs
- make install

Prepare sysbench:
- mysql –u[username] –p –e "create database sbtest"
- sysbench prepare --test=oltp --mysql-user=root --num-threads=32

- Run sysbench:
- sysbench run --test=oltp --mysql-user=root --num-threads=32
SysBench Results:
ProfitBricks Cloud Server Instances vs. Amazon EC2 AWS Instances – type m3

<table>
<thead>
<tr>
<th>Instance Size</th>
<th>ProfitBricks SysBench (Transactions per second)</th>
<th>AWS EC2 SysBench (Transactions per second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC2: m3.large, ProfitBricks equivalent (2 CPU cores/7.5GB RAM)</td>
<td>753.8</td>
<td>478.1</td>
</tr>
</tbody>
</table>
pgbench Results

pgbench is a simple program for running benchmark tests on PostgreSQL. It runs SQL commands repeatedly and sometimes with multiple concurrent database sessions and then produces an average number of transactions per second. ProfitBricks used the standard out of the box scenario based on TPC-B with five SELECT, UPDATE, and INSERT commands per transaction.

Result:
In this pgbench benchmark test, ProfitBricks exceeds the performance of Amazon EC2 AWS’ new m3 instances by 1.4x. These tests were run three separate times, and the results and test configuration can be found on the pgbench test results on the next page.

Pgbench test configuration:

Compile pgbench:
- phoronix-test-suite install pgbench

Run pgbench test:
- phoronix-test-suite run pgbench
pgbench Benchmark Results:
ProfitBricks Cloud Server Instances vs. Amazon EC2 AWS Instances – type m3

<table>
<thead>
<tr>
<th>Instance Size</th>
<th>ProfitBricks pgbench Benchmark (transactions per second)</th>
<th>AWS EC2 pgbench Benchmark (transactions per second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC2: m3.large, ProfitBricks equivalent (2 CPU cores/7.5GB RAM)</td>
<td>686.0</td>
<td>497.4</td>
</tr>
</tbody>
</table>
PostMark Results

PostMark is a test that NetApp developed and is designed to simulate small-file testing similar to how web and mail servers perform. ProfitBricks used the standard settings of 25,000 transactions with 500 files (5 to 512 kilobytes in size) simultaneously.

Result:
In this PostMark benchmark test, ProfitBricks exceeds the performance of Amazon EC2 AWS’ new m3 instances by 1.2x. These tests were run nine separate times and the results and test configuration can be found on the PostMark test results on the next page.

PostMark test configuration:

Compile postmark:
- phoronix-test-suite install postmark

Run postmark test:
- phoronix-test-suite run postmark
PostMark Benchmark Results:
ProfitBricks Cloud Server Instances vs. Amazon EC2 AWS Instances – type m3

<table>
<thead>
<tr>
<th>Instance Size</th>
<th>ProfitBricks PostMark Benchmark (transactions per second)</th>
<th>AWS EC2 PostMark Benchmark (requests per second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC2: m3.large, ProfitBricks equivalent (2 CPU cores/7.5GB RAM)</td>
<td>2,388.0</td>
<td>1,980.6</td>
</tr>
</tbody>
</table>
Special Note – Price/Performance Ratios

These results show a large performance gap between the two Cloud Computing vendors. There is also a cost gap between ProfitBricks and Amazon EC2 AWS. ProfitBricks is half the price of Amazon EC2 AWS – whether you compare similar machine sizes and factor in the costs for IOPS, with or without 24/7 live technical support. Our team has taken the same configurations in this benchmark report and factored in the price of the instances and the performance of the instances and combined them into a price/performance ratio.

Amazon AWS EC2: m3.large 2 vCPU, 7.5GB RAM 50GB EBS
Monthly Fee (Support Included): $116.38
Monthly Fee (No Support): $105.80

ProfitBricks equivalent (2 CPU cores/7.5GB RAM, 50GB of Block Storage)
Monthly Fee (Free Support): $56.54

The following table is a ratio that is calculated by dividing the average number of transactions or requests per second and dividing by the monthly cost. This table includes Amazon’s extra fees for support – ProfitBricks doesn’t charge for support!

<table>
<thead>
<tr>
<th>Benchmark Type</th>
<th>ProfitBricks Transactions/Requests Per Second</th>
<th>Amazon AWS EC2 m3 Transactions/Requests Per Second</th>
<th>Price/Performance Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apache Benchmark</td>
<td>11,581</td>
<td>5,225</td>
<td>4.5x (ProfitBricks price/performance ratio advantage)</td>
</tr>
<tr>
<td>nginx Benchmark</td>
<td>19,008</td>
<td>9,814</td>
<td>3.9x (ProfitBricks price/performance ratio advantage)</td>
</tr>
<tr>
<td>SysBench</td>
<td>805</td>
<td>478</td>
<td>3.4x (ProfitBricks price/performance ratio advantage)</td>
</tr>
<tr>
<td>pgbench</td>
<td>686</td>
<td>497</td>
<td>2.8x (ProfitBricks price/performance ratio advantage)</td>
</tr>
<tr>
<td>PostMark</td>
<td>2,388</td>
<td>1,981</td>
<td>2.4x (ProfitBricks price/performance ratio advantage)</td>
</tr>
</tbody>
</table>

The following table is a ratio that is calculated by dividing the average number of transactions or requests per second and dividing by the monthly cost. This table does not include Amazon’s extra support fees (ProfitBricks never charges support!).
<table>
<thead>
<tr>
<th>Benchmark Type</th>
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<th>Amazon AWS EC2 m3 Transactions/Requests Per Second</th>
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<tr>
<td>Apache Benchmark</td>
<td>11,581</td>
<td>5,225</td>
<td><strong>4.1x</strong> (ProfitBricks price/performance ratio advantage)</td>
</tr>
<tr>
<td>nginx Benchmark</td>
<td>19,008</td>
<td>9,814</td>
<td><strong>3.6x</strong> (ProfitBricks price/performance ratio advantage)</td>
</tr>
<tr>
<td>SysBench</td>
<td>805</td>
<td>478</td>
<td><strong>3.1x</strong> (ProfitBricks price/performance ratio advantage)</td>
</tr>
<tr>
<td>pgbench</td>
<td>686</td>
<td>497</td>
<td><strong>2.5x</strong> (ProfitBricks price/performance ratio advantage)</td>
</tr>
<tr>
<td>PostMark</td>
<td>2,388</td>
<td>1,981</td>
<td><strong>2.2x</strong> (ProfitBricks price/performance ratio advantage)</td>
</tr>
</tbody>
</table>

**Summary**

These workload benchmarks and their results clearly demonstrate that not only does every Cloud Computing IaaS provider have different performance characteristics for these benchmarks, they also indicate that individual "real world" workloads vary widely in their actual performance on each cloud provider.

In the synthetic benchmarks that all Cloud Computing vendors use to compare their performance today, ProfitBricks sees a 2x to 17x performance advantage with similar instances of Amazon AWS EC2 m3 instances and ProfitBricks instances. These workload benchmarks provide a new data point to consider. With these tests, ProfitBricks has a 2.2x to 1.3x performance advantage. What would your workloads reveal? These results show the importance of testing each Cloud Computing provider individually, and selecting the provider that will provide the best performance, for the right price, especially on a workload level.

Everything comes back to the price/performance ratio, without hidden, add-on fees included in the mix to further confuse the equation. This ratio should be the key metric that you, as a cloud buyer, will use to make their vendor selection.

For a comprehensive overview of our pricing compared to our competitors, take a look at our “Secret World of Cloud Computing Pricing – How To Compare Providers” 2014 White Paper!
Next Steps

ProfitBricks is here to help you evaluate us as a cloud provider, from benchmark testing to pricing questions. Our team of knowledgeable Cloud Computing pre-sales engineers assist clients in replicating these benchmarks, or recommending further benchmarking tools to help them assess their real-world workload performance. Our teams are available by emailing inbound-us@profitbricks.com or calling 866-852-5229.

ProfitBricks offers a 14-day, no obligation trial account that does not require a credit card for activation. Visit http://www.profitbricks.com/trial today!

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