Performance Benchmark for Cloud Databases

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(updated pricing on 7/15/2013)
Contents

• **Summary** of the performance benchmark tests
• **Description** of the tests
• Charts and Data! Results of the benchmark tests
  – **Performance** (transactions per second)
  – **Cost of Performance**
  – **Performance per dollar**
• **New flavors**: commentary on 8GB and 16GB Cloud Databases instances

• Appendix:
  – **Basics** of Cloud Databases
Bottom Line
Summary

• CLOUD DATABASES DELIVERED BETTER PERFORMANCE THAN COMPARABLE-SIZED RDS INSTANCES
  – Rackspace Cloud Databases performance better than AWS RDS instances of same (and in some cases bigger) sizes

• WITH BETTER COST OF PERFORMANCE (PERFORMANCE PER DOLLAR)
  – Rackspace Cloud Databases “cost of performance” is also significantly better in many cases

• Next steps:
  – Provisioned IOPS tests
The Performance Benchmark
Performance benchmark description

• Sysbench 0.4.12 (used version that you get with apt-get)
  – OLTP test
  – Table using 20M rows and up to 20M transactions
  – Across all flavors
    • AWS: 8 flavors in standard deployment (Single Availability zone)
    • RAX: 6 flavors
  – From 1 to 128 threads per run

• MySQL test
  – Rackspace: 30GB Cloud Server (Ubuntu 12.10) connected to Cloud Databases instances
  – AWS: M3.XLARGE EC2 Server (Ubuntu 12.04.2 LTS) connected to AWS RDS

• Standard SYSBENCH tests use a single table for benchmarks. In future tests we could test across different number of tables.
Caveat: A benchmark is not “real world”

What it is
- Idealized measurement
- Guideline

What it is not
- Exactly what the customer or application will see

THIS CANNOT BE OVERSTATED
Always benchmark your own application!
AWS RDS Flavors
All instances are Standard deployment (single availability zone)
Cloud Databases Flavors

512MB  1GB  2GB  4GB  8GB  16GB
Pricing (7/15/2013)
Note that pricing is likely to change

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### Cloud Databases Pricing

<table>
<thead>
<tr>
<th>Storage Size</th>
<th>Price Per Hour</th>
<th>Price Per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>512 MB</td>
<td>$0.06/hr</td>
<td>$43.80/mo</td>
</tr>
<tr>
<td>1 GB</td>
<td>$0.115/hr</td>
<td>$83.95/mo</td>
</tr>
<tr>
<td>2 GB</td>
<td>$0.21/hr</td>
<td>$153.30/mo</td>
</tr>
<tr>
<td>4 GB</td>
<td>$0.40/hr</td>
<td>$292.00/mo</td>
</tr>
<tr>
<td>8 GB</td>
<td>$0.76/hr</td>
<td>$554.80/mo</td>
</tr>
<tr>
<td>16 GB</td>
<td>$1.44/hr</td>
<td>$1,051.20/mo</td>
</tr>
</tbody>
</table>

Storage is 75¢/GB/month.

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### Region: US East (N. Virginia)

<table>
<thead>
<tr>
<th>DB Instance Class (On-Demand)</th>
<th>Price Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro DB Instance</td>
<td>$0.025</td>
</tr>
<tr>
<td>Small DB Instance</td>
<td>$0.080</td>
</tr>
<tr>
<td>Medium DB Instance</td>
<td>$0.160</td>
</tr>
<tr>
<td>Large DB Instance</td>
<td>$0.320</td>
</tr>
<tr>
<td>Extra Large DB Instance</td>
<td>$0.640</td>
</tr>
</tbody>
</table>

### High-Memory DB Instance Class

<table>
<thead>
<tr>
<th>DB Instance Class</th>
<th>Price Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra Large DB Instance</td>
<td>$0.555</td>
</tr>
<tr>
<td>Double Extra Large DB Instance</td>
<td>$1.110</td>
</tr>
<tr>
<td>Quadruple Extra Large DB Instance</td>
<td>$2.215</td>
</tr>
</tbody>
</table>

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### Standard Storage

For each DB instance class, Amazon RDS provides you the ability to select from 5 GB to 3 TB of associated storage capacity for your primary data set.

- **Storage Rate**: $0.10 per GB-month
- **I/O Rate**: $0.10 per 1 million requests

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Performance (transactions per second)

Cloud Databases vs. AWS RDS
Measuring performance in databases

Transactions Per Second, or TPS (more is better)

Charts will show markers at 50 and 100 threads

Number of threads (more means more work on the database)
Cloud Databases: transactions per second
AWS RDS: transactions per second
Flavors sorted by the performance at 50 threads

16GB is performing as the m2 4XL (68GB)
8GB beats m2 2XL (34GB)
4GB beats m2 XL (17.1GB)

AWS t1micro does not appear as it only reaches 33 threads
Cost of Performance
The cost of performance

• The next charts measure the cost of achieving certain performance
• We divide the monthly cost of the service by the TPS measured
  – This is the “price of TPS” or “the price of speed”

• The cost includes
  – Cost of the MySQL instance
  – Cost of the storage (we used 30GB for all tests)
  – In the case of AWS RDS, the cost of I/O
    • We assumed 100 IO operations per second ($26 / month), using AWS own estimate for medium site

• At 50 threads, the price of TPS is lower with Cloud Databases, with the exception of the 0.5 GB instance size of Cloud Databases
**RAX Cloud Databases: price of TPS (lower is better)**

Cloud Databases costs from $0.45 to $0.53 per TPS at 50 threads (excluding smallest instance size)

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**Markers at 50 and 100 threads**

- 1GB and 4GB instances with best cost of performance

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![Graph showing the price of TPS for different instance sizes, with 1GB and 4GB instances highlighted as having the best cost of performance.](image)
AWS RDS: price of TPS (lower is better)

AWS RDS costs from $0.54 to $0.79 per TPS at 50 threads (excluding smallest instance size)

T1.micro starts low on a perf basis ($0.30 / tps @25 threads), but only supports up to 30 threads
Rackspace cost of performance is better (with the exception of the 0.5 GB instance) [chart at 50 threads]
Performance per dollar
(this is just the inverse of “price of TPS”)
Performance per dollar

- The next charts measures the performance seen by dollar spent
- We divide the TPS measured by the monthly cost of the service
  - This is the “performance per dollar” or “TPS per dollar”
- The performance per dollar is just the inverse of the “price of performance”

- The cost includes
  - Cost of the MySQL instance
  - Cost of the storage (we used 30GB for all tests)
  - In the case of AWS RDS, the cost of I/O
    - We assumed 100 IO operations per second ($26 / month), using AWS own estimate for medium site

- At 50 threads, the performance per dollar is higher with Cloud Databases, with the exception of the 0.5 GB instance size of Cloud Databases
RAX Cloud Databases: TPS per dollar (more is better)

Starting at about 2.2 tps / dollar

1GB and 4GB instances a good deal
AWS RDS: TPS per dollar (more is better)

Starting at about 2 tps / dollar
Rackspace Cloud Databases delivers more perf for your money across all flavors (except the 0.5 GB instance)

Rackspace Cloud Databases and AWS RDS: TPS per dollar
(assumes 730 hr/month, prices as of 7/15/2013)

50 threads

“more for your money”

Rackspace Cloud Databases

AWS RDS

AWS t1micro does not appear as it only reaches 33 threads
Commentary on new 8GB and 16GB flavors
Cloud Databases 8GB instance is 162% faster than AWS RDS M1.Large
Cloud Databases 8GB instances delivers 19% more performance for the money than AWS RDS M1.Large
Cloud Databases 8GB instances is 20% cheaper on a performance basis than AWS RDS M1.Large
Cloud Databases 16GB instance was 200% faster than AWS RDS M1.Xlarge and 141% faster than M2.XLarge.
Cloud Databases 16GB instance was a comparable deal to either AWS RDS M1.XLarge or M2.Xlarge from about 35 to 96 threads.
Price of TPS for Cloud Databases 16GB instance comparable to AWS RDS M1.XLarge and M2.XLarge starting at 32 threads to about 100
To match Rackspace’s Cloud Databases 16GB instance performance, an AWS RDS M2.4XLarge was needed.
AWS RDS M2.4XLarge was 51% more expensive on performance basis at 50 threads.
Put differently, Rackspace Cloud Database 16GB instance got 51% more TPS per dollar at 50 threads than AWS RDS M2.2XLarge and M2.4XLarge.
THANK YOU

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Basics of Cloud Databases
Relational Databases: a pillar of computing

Simple notions (SQL) …
- Tables, Columns, Data types
- Constraints
- Referential Integrity
- Relationships
- Indexes
- Relational Algebra (“Queries”)
- Transactions

... lead to powerful solutions
- Data store and retrieval
- Data organization
- Data integrity
- Transactional applications
- Reporting and Querying
- Systems of record
Relational Database Management Systems (RDMS) are difficult to manage and operate

Expectations are high
• High Performance
• Reliability
• Resilience
• Short development times
• No room for error

Implementation is difficult
• Storage complexities
• Hardware dependencies
• Complex installation
• Complex configuration
• Maintenance and Administration
  – Backup, monitoring, tuning

Database Administrators (DBAs) and developers face significant pressures to perform their jobs and add value to their businesses
Cloud Databases
The first relational database service built on the OpenStack® Nova Compute codebase

- Performance
- Reliability
- Simple, self-service provisioning
- Automated maintenance
Cloud Databases: Performance through container-based (OS) virtualization

Traditional hardware virtualization limits performance

• They virtualize key HW features
  – Memory, processor, hard drives
  – Critical for database performance
• They impose penalties for DBs
  – Full Hardware Emulation
  – Paravirtualization

Container-based virtualization provides close to native perf

• No virtual hardware
• A single shared operating system
• Close to native performance
• Higher density
Cloud Databases: Reliability through built-in data redundancy

- MySQL connected to SAN storage with built-in data replication
- Increased performance
- Greater reliability
- Less downtime
Cloud Databases: faster “time to database” with simple, self-service provisioning

- Quick provisioning:
  - Easier to use by less skilled DBAs and developers
  - Flexible enough for advanced users

- Easy to get started with your app
  - No need to perform app changes
  - Just connect app to the database
Cloud Databases: Automated maintenance

- Configuration and patching
- Reduces your operational costs
- Lets your team focus on other tasks