Oracle MySQL HeatWave on AWS Overview and Highlights

It is rare, special, and permanently memorable when witnessing historical performance achievements. Performance accomplishments such as Usain Bolt of Jamaica setting the 100 meter dash record at 9.58 seconds at a Berlin meet 16 August 2009—13 years ago; Andy Green setting the land speed record at 760 [...]

Oracle MySQL HeatWave Shatters Boundaries on AWS  
by, Marc Staimer  
September 26th, 2022
It is rare, special, and permanently memorable when witnessing historical performance achievements. Performance accomplishments such as Usain Bolt of Jamaica setting the 100 meter dash record at 9.58 seconds at a Berlin meet 16 August 2009—13 years ago; Andy Green setting the land speed record at 760 mph (1224 kmph) 15 October 1997—25 years ago; or the Lockheed Martin SR-71 set the London to LA world speed record of an average of 1,435 mph (2320 kmph) in 3 hours, 47 minutes, and 39 seconds, 13 September 1974—48 years ago[1]. Each of these remarkable performance records have stood the test of time and are still unbroken after many years.

Now the world is witnessing another unprecedented performance from Oracle’s MySQL HeatWave engineering team led by Nipun Agarwal. They have been shattering performance records on par with the Usain Bolts of history. That is not hyperbole. Just look at the records they keep setting.

Ever since they first introduced the MySQL HeatWave cloud database service in December of 2020, their pace of delivering highly significant innovations and performance advantages is unprecedented in the cloud database software and services industry. Their first release completely changed the game of MySQL cloud database services by integrating an incredibly fast OLAP engine into the traditional OLTP-oriented MySQL database. It’s still the only MySQL cloud database service to do so. The performance and TCO/performance of MySQL HeatWave versus other MySQL cloud database services and OLAP cloud database services was nothing short of astounding. Up to an order of magnitude greater performance at a cost that ranged between 1/3 to 1/6 that of the competition.

Within a short eight months they raised the bar even higher by adding an extensive ML-based automation engine called Autopilot. It both simplified DBA operations while increasing performance to greater heights,
extending the distance from their competitors.

Eight months after that, they moved the goal posts again by introducing MySQL HeatWave ML, in-database machine learning based on AutoML capabilities, plus transparent compression, enhanced end-to-end security, and added real elastic non-disruptive scalability. AutoML is unmatched in ease-of-use, accuracy, and performance. MySQL HeatWave ML again amplified the distance other cloud database providers need to bridge to be competitive. Just don’t expect that to happen very soon.

Consider that the Oracle MySQL HeatWave team has been introducing greater performance and new highly desirable capabilities approximately every eight months. By any measure that’s an incredibly rapid rate. The majority of cloud database service providers or software suppliers deliver upgrades, on average, approximately every one to two years. Most of those upgrades are nominal incremental changes or bug fixes, not significant innovations that up their game considerably. Comparing the rest of the MySQL cloud database services industry to MySQL HeatWave is analogous to the average sprinter trying to race Usain Bolt in his prime. It is not a fair competition.

The Oracle MySQL HeatWave release schedule of major innovations has not slowed down one bit and appears to be accelerating. As one example, Oracle is now offering MySQL HeatWave on Amazon Web Services (AWS). That’s not a misprint. They’re offering the same revolutionary exceptionally high performance, low cost service on AWS.

Why Offer MySQL HeatWave on AWS?

The reason Oracle did this is because too many potential customers that wanted to use the MySQL HeatWave faced AWS’ exorbitant egress fees. The cost of moving their data out of AWS was prohibitive. Oracle solved this for Azure customers by partnering with Azure and making OCI database services including MySQL HeatWave (to be available soon), look like Azure resources even though they’re actually running on OCI. And there are zero egress fees from either cloud to the other. Tackling the problem on AWS required a different methodology. They had to develop a new augment MySQL HeatWave to run native in the AWS infrastructure. They succeeded beyond all expectations and, in the process, expanded its performance and function envelope even further.

The Oracle engineering team specifically optimized MySQL HeatWave for the AWS infrastructure. They improved both HeatWave OLAP performance in addition to MySQL OLTP performance. Versus AWS’s own Aurora, Redshift, AQUA, and Redshift ML services (ostensibly optimized for their infrastructure), MySQL HeatWave on AWS delivers substantially higher unparalleled performance and markedly better cost/performance as demonstrated by industry standard benchmarks.

- Based on a 4TB TPC-H[2] benchmark, MySQL HeatWave on AWS delivers 7X better price/performance than Amazon Redshift, 10X better than Snowflake, 12X better than Google BigQuery, and 4X better than Azure Synapse. For Redshift, Snowflake, BigQuery, and Synapse, the costs do not include the MySQL, ETLs, required services and tools, or additional storage fees.
- MySQL HeatWave on AWS machine learning (ML) is 25X faster than Redshift ML and at no cost to HeatWave customers.
- MySQL HeatWave on AWS running a 10GB TPC-C workload delivers up to 10X higher and sustained throughput versus Amazon Aurora at high concurrency.
- Benchmark scripts are fully transparent and available on GitHub and are easily replicable.

AWS users will perceive the MySQL HeatWave on AWS as a native service. However, they’ll find it much simpler to set up, operate, and manage than any other cloud database service on AWS. The MySQL HeatWave new interactive console expedites schema, data management, and queries. It also enables monitoring of query performance and provisioned resource utilization. As part of the latest MySQL HeatWave on AWS innovations, Autopilot is integrated with the interactive console, making it that much
easier to use.

Greater performance, much better cost performance, more functionality, and simpler setup, operations, and management are all quite good; but, what about security? In the current era of clever ransomware extortion and hacker-caused data breeches, security is paramount. The Oracle MySQL HeatWave engineering team recognized the need for increasing security capabilities on AWS and raised the standard by delivering best-in-class security. MySQL on HeatWave on AWS comes with comprehensive security capabilities noticeably greater than what’s currently available with Amazon Aurora. For example, MySQL HeatWave on AWS includes:

- Server-side data masking and de-identification to hide personal data from hackers.
- Asymmetric data encryption enables developers and DBAs to increase the protection of confidential data and implement digital signatures to confirm the identity of people signing documents.
- Database firewall offers real-time protection against database-specific attacks, such as SQL Injections.

These security capabilities are deeply integrated in the database as part of MySQL HeatWave on AWS. In contrast, Aurora security is layered on top of - not within - the database, leaving security gaps.

As important as performance, costs, native feel, and security are, it’s Autopilot with its highly intuitive built-in automation that simply blows the minds of users. It’s that good and it’s exclusive to MySQL HeatWave.

MySQL Autopilot provides machine learning-based automation. It’s workload-aware while providing amazing amounts of database automation including auto-provisioning, auto-parallel loading, auto-encoding, auto-data placement, auto-scheduling, auto-query plan improvement, auto-change propagation, and auto-error handling.

Autopilot radically reduces DBAs’ manual and labor-intensive administrative tasks and processes such as provisioning, performance tuning, and workload optimization, which typically take a lot of trial and error. Autopilot is architected to substantially improve application performance and significantly reduce costs substantially, by predicting optimal workload configurations. And all of this is done auto-magically[3].

The latest MySQL HeatWave on AWS offering takes Autopilot to a higher level. Autopilot now includes machine learning automation for OLTP workloads. Automation such as auto-thread pooling that determines the optimal number of transactions which should be executed delivering significantly higher and sustained throughput at high concurrency. And Auto-shape prediction calculates the ideal instance type to be provisioned to achieve the best cost/performance for OLTP workloads.

Auto-shape is not static nor a one-time thing. It works on running systems and can recommend continued use of the current shape, upgrade to a larger shape, or downgrade to a smaller shape. The fundamental key is that auto-shape recommends whichever shape delivers the best price/performance. It does not automatically make the change. That’s up to the customer and is a very simple process.

One more Oracle MySQL HeatWave innovation is in-database ML augmentations. Although autoML with in-database learning, training, inference, and explanations was introduced in the last round of innovations, Oracle MySQL HeatWave on AWS has added significant enhancements. It now includes much increased flexibility that empowers advanced users to influence ML training. It also includes data and time data type support, new algorithms for classification and regression, and more user friendly messages for ML training and explanations.

Take the example of MySQL HeatWave ML in action. Consider a customer who has an eCommerce application and would like to have an ML model that automatically recommends additional products and services to customers based on their prior purchases. Within the MySQL HeatWave database, the system automatically provides real-time recommendations when the purchases are processed.
At the same time, real-time analytics on customer behavior and metrics can be provided. No need to move data to a separate analytics database or ML product or service. And since no data is transferred between data stores, there’s no risk that it would be compromised, corrupted, or lost during the transfer. It increases security and helps with regulatory compliance by collecting what data was used where and by whom.

**Oracle MySQL HeatWave on AWS** enables customers to use real-time data securely and easily with built-in autoML. They’re able to do this without time-wasting, labor-intensive, high-latency, and high-cost ETLs. MySQL HeatWaveML fully automates the ML lifecycle while storing all trained models inside the MySQL database. No separate ML tool or service is required. No extensive trial and error to determine an effective, accurate, and fast model.

MySQL HeatWave ML is an integrated non-chargeable feature of MySQL HeatWave. There are no additional charges. No other cloud database service or open source database provides such advanced ML capabilities inside the database. HeatWave ML trains models 25 times faster than Redshift ML and scales with the cluster size. MySQL HeatWave on AWS customers can now train models more often and keep them updated in near real-time for increased prediction accuracy. AWS Redshift ML requires SageMaker – its ML modeling service – to create and train models. The process of moving data to be trained and modeled in SageMaker adds huge amounts of latency. This means the data, models, and predictions are stale, not in real-time, and less accurate. Customers incur additional SageMaker charges.

Oracle MySQL HeatWave on AWS is much more cost effective than relying on different specialized services, tools, or products for OLTP, OLAP, ML, ETLs, storage duplication, and data egress fees. This scenario is all too familiar to AWS users as is the surprising invoice at the end of the month as tallying some subset of these separately charged services is.

**What Oracle MySQL HeatWave on AWS Means**

AWS customers are no longer barred by high egress fees from taking advantage of MySQL HeatWave and all its industry-leading capabilities. They can now enjoy much greater performance, significantly simpler implementations, operations, and management, have substantially better security, contract for far fewer services at lower costs, and get better results. They can additionally keep using whatever Amazon services they are used to without any increased cloud-to-cloud latency.

Putting this announcement into some perspective, AWS started providing cloud services in 2006. Oracle introduced its MySQL HeatWave cloud service 14 years later. MySQL HeatWave completely eclipsed AWS competing database cloud services in performance, cost, and automation. But AWS was able to prevent some customer moves to MySQL HeatWave because of their egregious egress fees. Less than two years after MySQL HeatWave’s introduction, it has been optimized to run much faster and much less costly on AWS’ own architecture than AWS’ own Redshift and Aurora. That’s the equivalent of an NBA championship-winning team being swept in the finals on their home court. This ought to be a wake-up call to AWS. Developers, CIOs, CFOs, and CEOs that take notice, will derive noticeably faster and better outcomes at a much lower cost.

For AWS, Snowflake, GCP, and Azure, it means the goal posts to being competitive with MySQL HeatWave have moved out that much further. Catching up will be extremely difficult, as the MySQL HeatWave engineering team keeps pushing the innovation flywheel. Meanwhile, the lack of integration, automation, and meaningful performance enhancements means it will be problematic for them to win any competitive bake-off.

For everyone else watching from the sidelines, there is the excitement and joy witnessing unexpected and unprecedented gains in performance, simplicity, automation, security, at a considerable savings. Usain Bolt has nothing on Nipun Agarwal when it comes to setting new records and shattering boundaries.
For More Information on the Oracle MySQL HeatWave Service

Go to:

HeatWave Explainer Video
HeatWave on AWS Announcement
HeatWave

[1] The SR-71 landed more than 4 hours before it took off.

[2] Benchmark queries are derived from the TPC benchmarks, but results are not comparable to published TPC benchmarks results since these do not comply with the TPC specifications.

[3] “Any sufficiently advanced technology is indistinguishable from magic.” Arthur C. Clarke, Profiles of the Future: An Inquiry into the Limits of the Possible
President and CDS of Dragon Slayer Consulting in Beaverton OR since 1998, is renown for his in-depth and keen understanding of user problems, especially with storage, networking, applications, cloud services, data protection, and virtualization. Marc has published thousands of technology articles and tips from the user perspective for internationally renowned online trades including many of TechTarget’s Searchxxx.com websites, Wikibon, Network Computing, and GigaOM. Marc has additionally delivered hundreds of white papers, webinars, and seminars to many well-known industry giants such as: Brocade, Cisco, DELL, EMC, Emulex (Avago), HDS, HPE, LSI (Avago), Mellanox, NEC, NetApp, Oracle, QLogic, SanDisk, Toshiba, and Western Digital. He has additionally provided similar services to smaller, less well-known vendors/startups including: Asigra, BrainChip, Cloudtenna, Clustrix, Condusiv, DH2i, Diablo, FalconStor, Gridstore, ioFABRIC, Nexenta, Neuxpower, NetEx, NoviFlow, Pavilion Data, Permabit, Qumulo, SBDS, StorONE, Tegile, and many more. His speaking engagements are always well attended, often standing room only, because of the pragmatic, immediately useful information provided. Marc can be reached at marcstaimer@me.com, (503)-312-2167, in Beaverton OR, 97007.

Marc Staimer
marcstaimer@me.com