

Exploring Datastore Access Latency across AWS Compute Services

Bhupendra Singh | Scalable Software Systems | Bachelor's Thesis | December 4, 2024

Why Access Latency?

- Even slight increases in access latency can harm application performance
- Access latency reveals the distance between components

Why AWS?

- AWS leads the market with 31% share (Richter, 2024)
- Limited understanding of AWS compute and datastore pair behavior
- Such insights can guide AWS developers in optimizing performance

Our Contribution

- We benchmark access latency between AWS compute and datastore services to understand how the choice of compute service influences access latency dynamics

Services in Scope

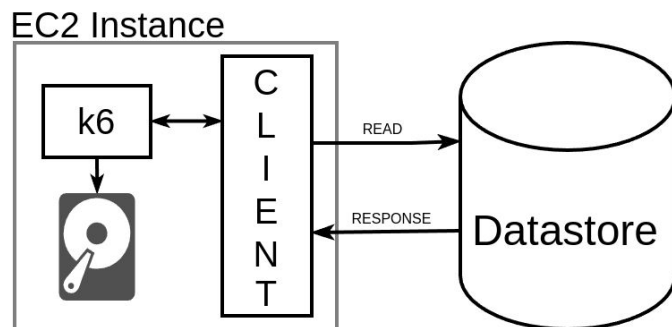
- **Datastore Services:** RDS, DynamoDB, and S3
- **Compute Services:** EC2 and Lambda

Approach

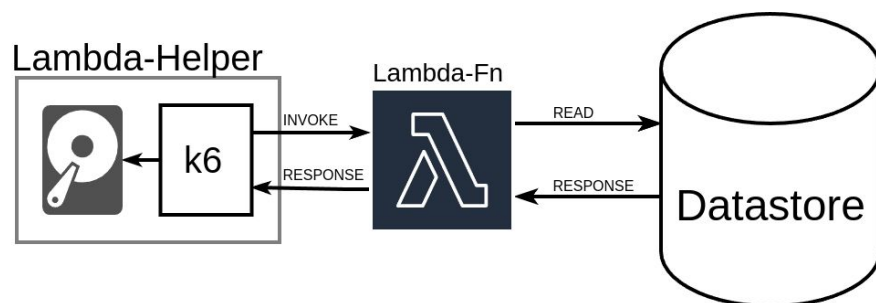
- Focus on access latency as the key metric
- Perform read-only operations on datastores
- Use an open workload model
- Test with constant and burst workloads
- Evaluate each pair twice under both workload types
- Meet cloud benchmarking requirements in implementation
- Consider AWS Free Tier limitations

Implementation Overview

- EC2 Pairs



- Lambda Pairs

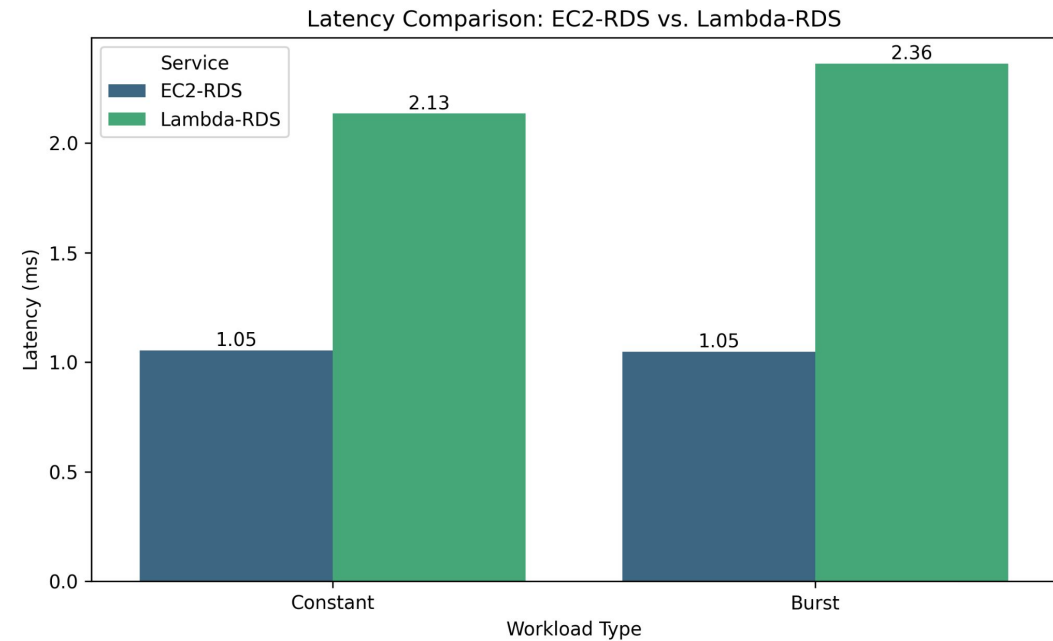


- AWS Region *eu-central-1*
- Fair resource allocation
- 800K datapoints for RDS
- 800K datapoints for DynamoDB
- 18K datapoints for S3
- 3σ rule for outlier detection

Benchmark Results



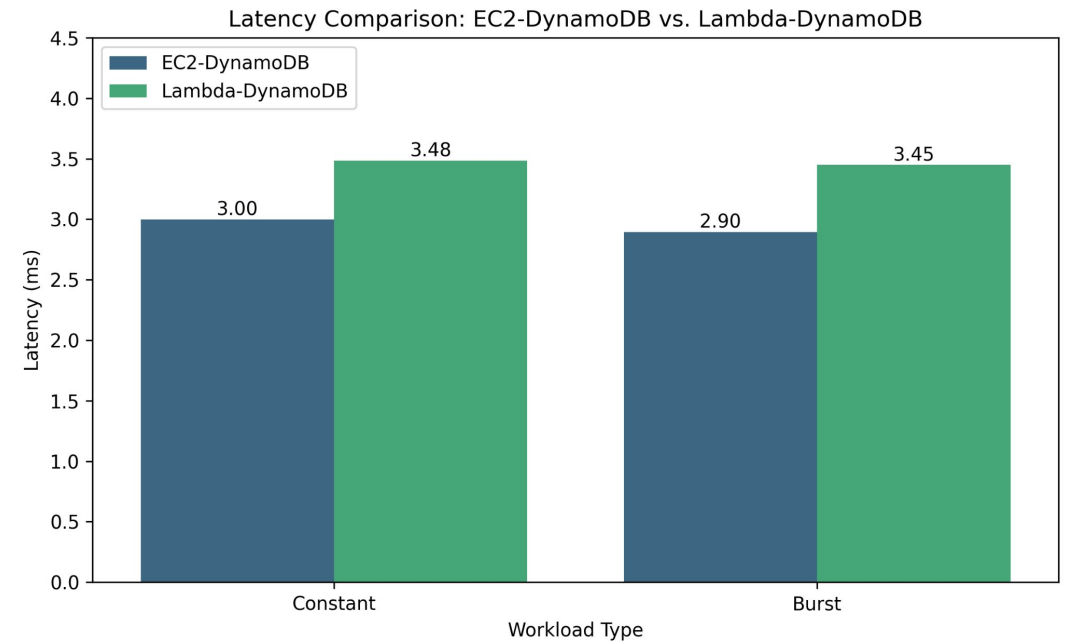
- EC2-RDS vs. Lambda-RDS
 - EC2-RDS outperforms Lambda-RDS
 - EC2-RDS shows less variance
 - 962 vs. 1879 Outliers



Benchmark Results



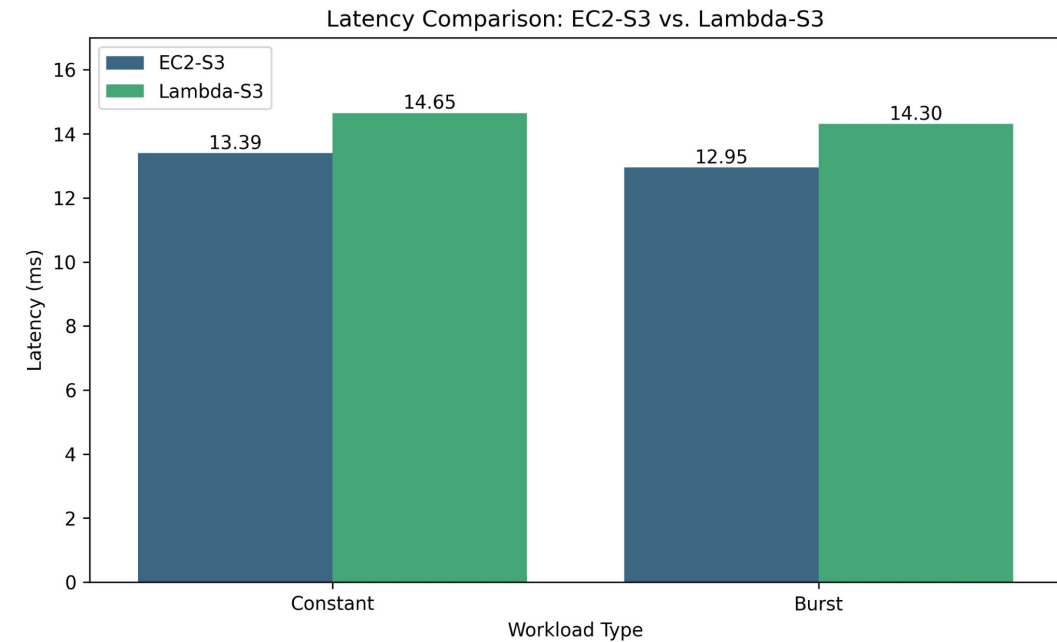
- EC2-DynamoDB vs. Lambda-DynamoDB
 - EC2-DynamoDB outperforms Lambda-DynamoDB
 - Lambda-DynamoDB shows less variance
 - 3956 vs. 3073 Outliers



Benchmark Results



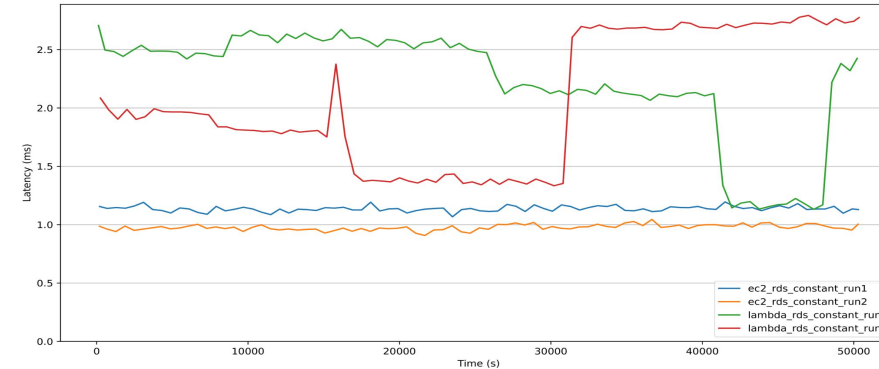
- EC2-S3 vs. Lambda-S3
 - EC2-S3 outperforms Lambda-S3
 - Lambda-S3 less varied under constant load
 - EC2-S3 less varied under burst load
 - 128 vs. 148 Outliers



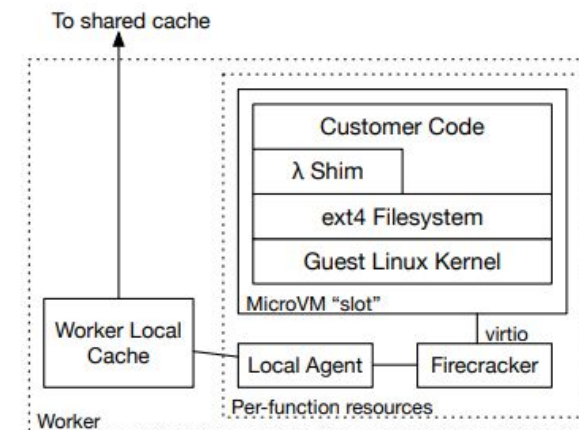
Why is EC2 faster?



- Performance variability in Lambda
- Complex architecture of Lambda
- Networking Configuration



Time-Series Representation: EC2-RDS vs Lambda-RDS under constant workload



High level architecture of Lambda (Brooker, 2023)

Thank you for your attention!

Question or Feedback?

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References

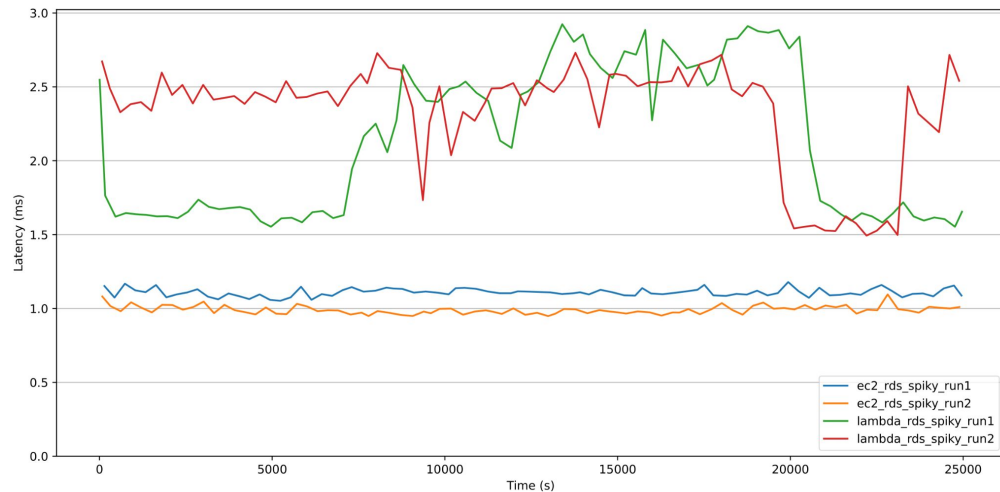
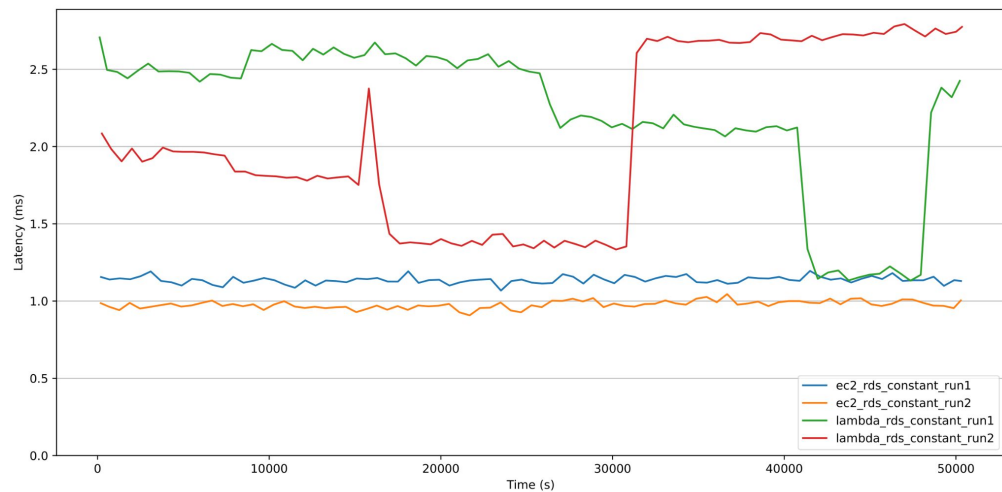
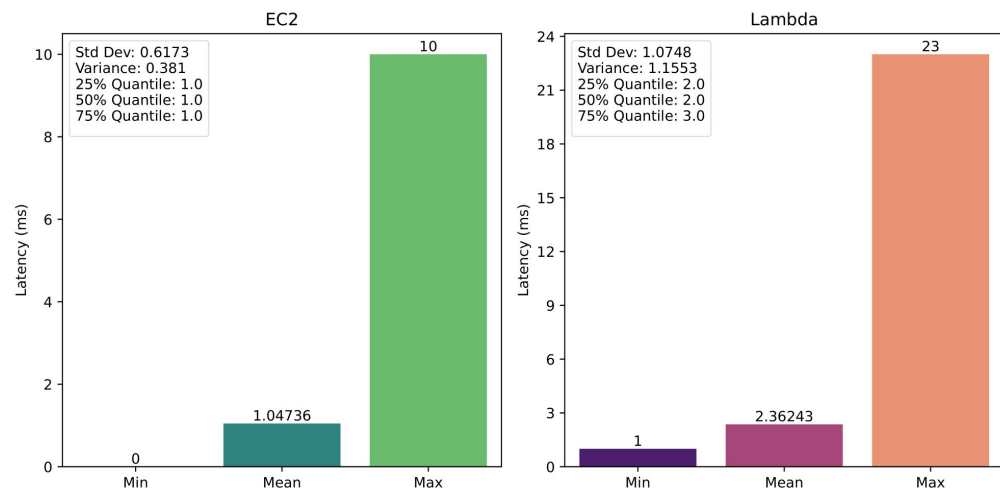
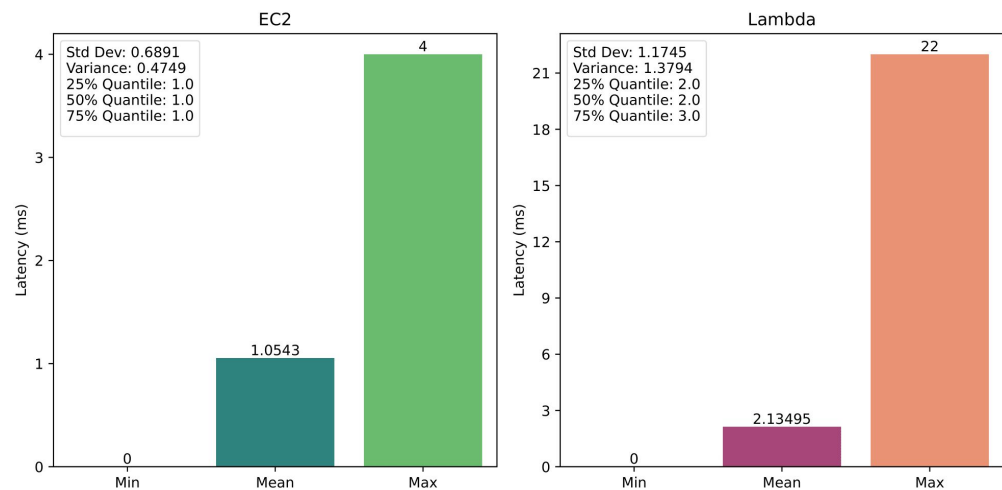
- Marc Brooker, Mike Danilov, Chris Greenwood, and Phil Piwonka. “On-demand Container Loading in AWS Lambda”. In: 2023 USENIX Annual Technical Conference (USENIX ATC 23). Boston, MA: USENIX Association, July 2023, pp. 315–328.
- Felix Richter. “Worldwide Market Share of Leading Cloud Infrastructure Service Providers”. November 2024. <https://www.statista.com/chart/18819/>.
- Alexandru Agache, Marc Brooker, Alexandra Iordache, Anthony Liguori, Rolf Neugebauer, Phil Piwonka, and Diana-Maria Popa. “Firecracker: Lightweight Virtualization for Serverless Applications”. In: 17th USENIX Symposium on Networked Systems Design and Implementation (NSDI 20). Santa Clara, CA: USENIX Association, Feb. 2020, pp. 419–434.

Backup Slides

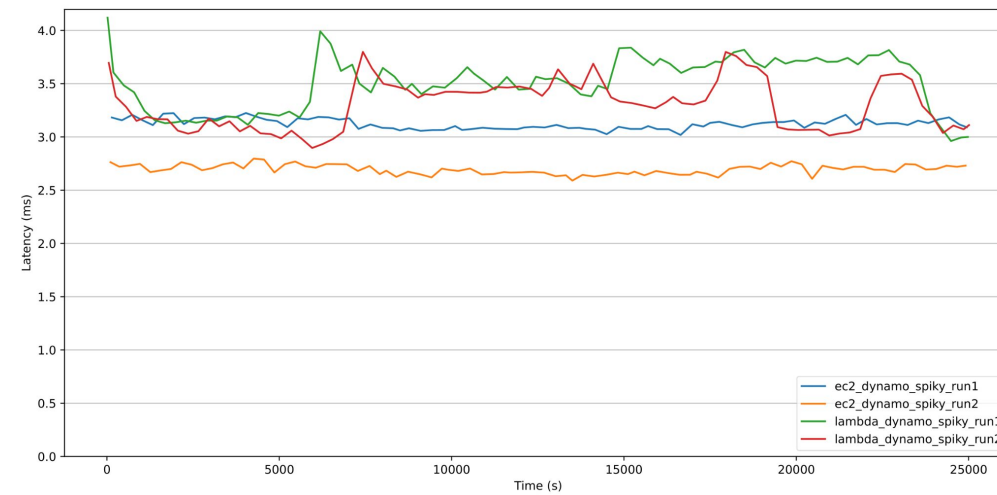
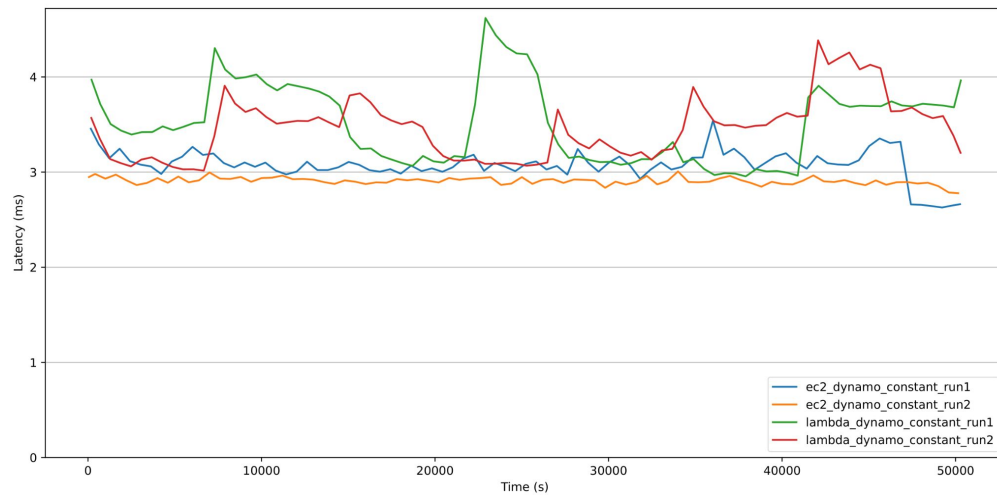
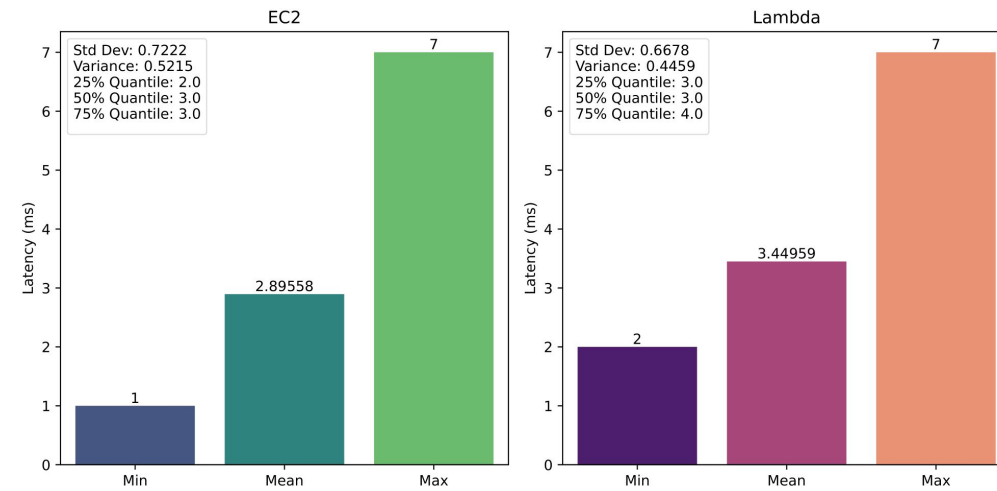
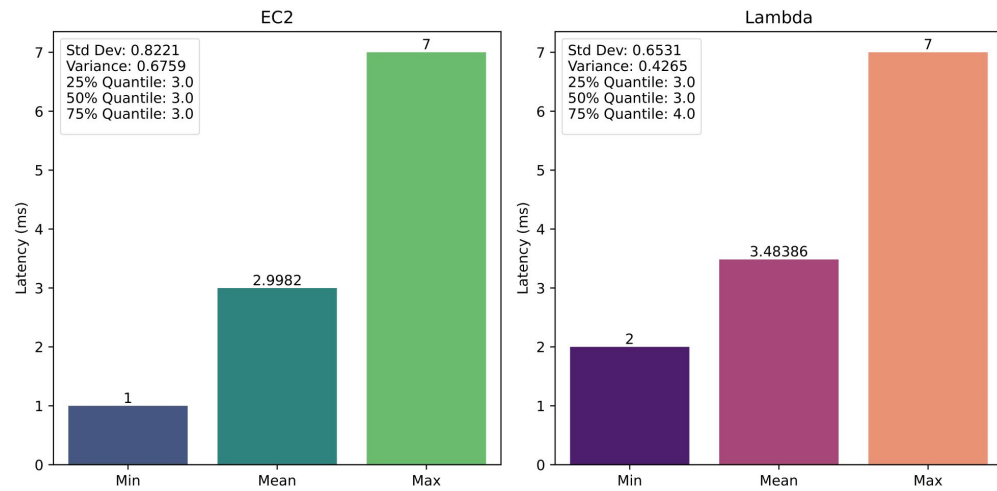
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EC2-RDS vs. Lambda-RDS



EC2-DynamoDB vs. Lambda-DynamoDB



EC2-S3 vs. Lambda-S3

