**Assignment - Cloud Provider Comparison**

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IFT 320: Managing The Cloud

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10/5/2024

**Part 1**

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| Service | AWS Pricing | Azure Pricing | Google Cloud Pricing |
| Compute | **On-Demand**: $0.0116 per vCPU/hr (t3.medium) | **Pay-as-you-go**: $0.008/hr (B1s VM) | **On-Demand**: $0.0098 per vCPU/hr (n1-standard-1) |
| **Reserved**: Up to 72% savings with 1- or 3-year commitments (e.g., $0.04/hr for t3.medium RI) | **Reserved**: Up to 72% savings (1 or 3-year) | **Committed Use Discounts (CUDs)**: Up to 57% off for 1- or 3-year commitments |
| **Spot Instances**: Up to 90% off (e.g., $0.0034/vCPU/hr for t3.medium) | **Spot VMs**: Up to 90% savings | **Sustained Use Discounts (SUDs)**: Applied automatically based on continuous usage |
| Storage | **S3 Standard**: $0.023/GB per month for the first 50 TB | **Blob Storage Hot**: $0.0184/GB per month | **Standard Storage**: $0.020/GB per month for the first 50 TB |
| **S3 Infrequent Access**: $0.0125/GB | **Cool Storage**: $0.01/GB | **Nearline Storage**: $0.010/GB per month |
| **S3 Glacier**: $0.004/GB | **Archive Storage**: $0.001/GB | **Coldline Storage**: $0.004/GB per month |
| Databases | **RDS (MySQL)**: $0.017/hr (db.t3.micro) | **Azure SQL Database (Basic)**: $0.00012/DTU/hr (Elastic Pool starts at $0.146/hr) | **Cloud SQL (MySQL)**: $0.0216/vCPU/hr (db-n1-standard-1) |
| **RDS Reserved**: Up to 65% off with 1- or 3-year reservations | **Azure SQL Reserved Capacity**: Up to 33% savings on 1- or 3-year reservations | **Committed Use Discounts**: Available, similar to Compute pricing |
| Machine Learning/AI | **Amazon SageMaker**: Training: $0.13/hr (ml.m5.large), Inference: $0.03/hr (ml.t2.medium) | **Azure ML Studio Standard**: $9.99 per workspace per month​ | **Vertex AI**: Training: $0.10/node/hr (n1-standard-4), Inference: $0.004/operation |
| **Azure ML API**: $100.13/month for Standard S1, $9999.98/month for Standard S |

**Part II**

When comparing the pricing structures of AWS, Microsoft Azure, and Google Cloud, the differences in how each provider charges for cloud services can significantly impact an organization’s decision-making process. Each provider has its own unique pricing models for compute, storage, databases, and machine learning, which cater to varying workloads and organizational needs. This essay highlights those differences, focusing on workload optimization, cost efficiency, and strategies for building a cost-effective infrastructure.

**Compute Services**

For compute services, AWS, Azure, and Google Cloud offer flexible options with pricing models tailored to different types of workloads. AWS EC2 offers On-Demand pricing for flexibility, Reserved Instances for predictable long-term usage, and Spot Instances for cost savings of up to 90%, ideal for interruptible workloads such as batch processing or big data analysis​ (AWS, 2024). Azure VMs provide similar models, with Pay-as-you-go and Reserved Instances, but Azure's Spot VMs offer up to 90% savings, making it competitive with AWS in handling cost-sensitive, fault-tolerant workloads (Microsoft, 2024). Google Cloud Compute Engine has a unique Sustained Use Discount that automatically applies after continuous use, making it more cost-effective for businesses with steady, long running workloads​ (Google Cloud, 2024).

Workloads that require high flexibility or intermittent usage would benefit from AWS’s On-Demand or Spot Instances, while businesses with predictable usage patterns may find Azure's or Google Cloud's long-term commitment options more appealing. For example, running 10 instances for 1000 hours on AWS Spot Instances would be far cheaper than using On-Demand instances, while Google Cloud's Sustained Use Discount would apply automatically, offering cost efficiency without any upfront commitment​ (Microsoft, 2024).

**Storage Services**

In terms of storage pricing, Google Cloud offers the most competitive pricing for standard storage at $0.020 per GB per month, slightly cheaper than AWS S3 at $0.023 per GB per month and Azure Blob Storage at $0.0184 per GB per month (Amazon, 2024). For organizations that need cold storage or long-term archival solutions, AWS Glacier and Google Coldline are both excellent options, but Google Cloud generally edges out with lower rates for colder storage tiers (Google, 2024).

For a workload with 10 TB of storage, using Google Cloud's standard storage would result in a monthly cost of $200, while the same storage on AWS would cost around $230, and on Azure, approximately $184. For long-term, infrequently accessed data, the cost savings with Google Coldline ($40/month for 10 TB) compared to AWS Glacier ($40/month) are comparable, with minor differences based on retrieval fees.

**Database Services**

AWS, Azure, and Google Cloud all offer managed database services with similar pricing structures. AWS RDS provides On-Demand pricing starting at $0.017 per hour for smaller instances, with Reserved Instances offering savings for long-term usage. Azure SQL Database provides flexible pricing based on service tiers and database transaction units (DTUs), which allows for fine-tuned scaling as needed​ (Amazon, 2024). Google Cloud SQL, similar to AWS RDS, provides pay-as-you-go pricing and savings with Committed Use Discounts. In scenarios where five database servers are required, AWS’s Reserved Instances would provide the most predictable long-term costs, while Google Cloud's sustained-use model would lower prices for long-running workloads.

**Machine Learning (ML) Services**

When it comes to machine learning services, Amazon SageMaker is one of the most comprehensive platforms, but its pricing can add up quickly for large-scale projects. Azure Machine Learning Studio offers a cost-effective workspace pricing model at $9.99 per workspace per month, and Google Vertex AI provides a transparent and flexible pricing structure that includes per-operation costs for training and inference, ideal for businesses looking to experiment with AI without upfront investment​ (Amazon, 2024).

For example, deploying 5 ML servers for training models would cost approximately $650 per month on AWS, while Azure and Google Cloud may offer more savings for smaller-scale projects. Google's Vertex AI would be ideal for companies that rely heavily on AI but are also cost-conscious, as its pricing applies only to resources actively used for training and inference​(

Azure (Microsoft, 2024).

**Recommended Approach for Lowest Cost Infrastructure**

To build the most cost-effective cloud infrastructure, companies should first evaluate their specific workloads and how they plan to use the cloud. Businesses with steady workloads can benefit from AWS Reserved Instances or Google Cloud’s Committed Use Discounts for predictable savings. Those with fluctuating or unpredictable workloads might find Google Cloud’s Sustained Use Discounts or AWS Spot Instances most advantageous. For data storage, Google Cloud provides the lowest standard and cold storage costs, while Azure’s Blob Storage offers a good balance of price and performance.

In conclusion AWS is strong for flexibility and extensive service offerings, Azure integrates well with Microsoft environments, and Google Cloud provides cost advantages for sustained use, particularly for AI and storage-heavy applications. Each provider’s strengths and pricing mechanisms cater to different organizational requirements, making it essential to align cost strategies with cloud workloads.

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