

CLOUD COMPUTING - ELL887 (COST ASSIGNMENT)
By: Ritika Soni (2020MT10838)

Question 1

I have used *Azure Pricing Calculator*, *AWS Pricing Calculator*, and *Google Cloud Pricing Calculator*. Here, I have used the basic architecture for all three calculators to check the minimum cost needed to create a web app with a database.

- **Microsoft Azure**
Services used: Azure app service, Azure web service



ESTIMATE NAME	PRICE LEVEL	CREATED (UTC)	MONTHLY TOTAL*
WebService Cost	Microsoft Customer Agreement	04/09/2024 16:23:07	\$61.75
SQL Estimate	Microsoft Customer Agreement	04/09/2024 05:17:22	\$5.47

Microsoft Azure Estimate					
WebService Cost					
Service category	Service type	Custom name	Region	Description	Estimated monthly cost
Compute	App Service		Central India	Basic Tier; 1 B1 (1 Core(s), 1.75 GB RAM, 10 GB Storage) x 31 Days; Windows OS; 0 SNI SSL Connections; 0 IP SSL Connections; 0 Custom Domains; 0 Standard SLL Certificates; 0 Wildcard SSL Certificates	\$61.75
Support			Support		\$0.00
			Licensing Program	Microsoft Customer Agreement (MCA)	
			Billing Account		
			Billing Profile		
			Total		\$61.75
Disclaimer					
All prices shown are in United States – Dollar (\$) USD. This is a summary estimate, not a quote. For up to date pricing information please visit https://azure.microsoft.com/pricing/calculator/ . This estimate was created at 4/13/2024 8:27:53 PM UTC.					

SQL Estimate					
Service category	Service type	Custom name	Region	Description	Estimated monthly cost
Databases	Azure SQL Database		Central India	Single Database, vCore, General Purpose, Serverless, Standard-series (Gen 5), Locally Redundant, 2 Billed vCores, RA-GRS Backup Storage Redundancy, 2 GB Point-In-Time Restore, 4 x 2 GB Long Term Retention	\$5.47
Support			Support		\$0.00
			Licensing Program	Microsoft Customer Agreement (MCA)	
			Billing Account		
			Billing Profile		
			Total		\$5.47
Disclaimer					
All prices shown are in United States – Dollar (\$) USD. This is a summary estimate, not a quote. For up to date pricing information please visit https://azure.microsoft.com/pricing/calculator/ . This estimate was created at 4/13/2024 8:29:38 PM UTC.					

- **AWS(Amazon Web Services)**

Services used: AWS Elastic Beanstalk, Amazon RDS for MySQL

AWS Elastic Beanstalk provides the hosting and execution environment for web applications, similar to Azure App Service. It simplifies the deployment, management, and scaling of web applications. Elastic Beanstalk **does not add additional charges**; you only pay for the underlying resources used by your application, such as EC2 instances and RDS databases.

pricing calculator

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Estimate summary [Info](#)

Upfront cost 0.00 USD	Monthly cost 80.56 USD	Total 12 months cost 966.72 USD <small>Includes upfront cost</small>
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My Estimate

Duplicate
Delete
Move to
Create group
Add support
Add service

	Service Name ▾	Status ▾	Upfront cost ▾	Monthly cost ▾	Description ▾	Region ▾	Config Sum... ▾
<input type="checkbox"/>	Amazon RDS for MySQL ↗	-	0.00 USD	74.35 USD	-	Asia Pacific (Mumbai)	Storage for eac...
<input type="checkbox"/>	Amazon EC2 ↗	-	0.00 USD	6.21 USD	-	Asia Pacific (Mumbai)	Tenancy (Share...

Estimate summary									
Upfront cost	Monthly cost	Total 12 months cost	Currency						
0	80.56	966.72	USD						
* Includes upfront cost									
Detailed Estimate									
Group hierarchy	Region	Description	Service	Upfront	Monthly	First 12 months total	Currency	Status	Configuration summary
									Storage for each RDS instance (General Purpose SSD (gp2)), Storage amount (20 GB), Quantity (1), Instance type (db.t2.medium), Utilization (On-Demand only) (100 %Utilized/Month), Deployment option (Single-AZ), Pricing strategy (OnDemand), Additional backup storage (2 GB)
My Estimate	Asia Pacific (Mumbai)		Amazon RDS for MySQL	0	74.35	892.2	USD		Tenancy (Shared Instances), Operating system (Windows Server), Workload (Consistent, Number of instances: 1), Advance EC2 Instance (t2.nano), Pricing strategy (On-Demand Utilization: 100 %Utilized/Month), Enable monitoring (disabled), DT Inbound: Not selected (0 TB per month), DT Outbound: Not selected (0 TB per month), DT Intra-Region: (0 TB per month)
My Estimate	Asia Pacific (Mumbai)		Amazon EC2	0	6.205	74.46	USD		
Acknowledgement									
* AWS Pricing Calculator provides only an estimate of your AWS fees and doesn't include any taxes that might apply. Your actual fees depend on a variety of factors, including your actual usage of AWS services.									

- **Google Cloud**

Services used: Google App Engine, Google Cloud SQL




Google App Engine's Standard Environment offers a free tier that includes 28 instance hours per day, suitable for small-scale applications. So, as I have used just basic architectures in all the clouds, it is charging **no money** for use here.






Cost details

USD

+ Add to estimate

DATABASES	
 MySQL Cloud SQL	\$85.60 
	\$85.60 

SERVERLESS	
 Standard Environment App Engine	\$0.00 
	\$0.00 

name	quantity	region	service_id	sku	total_price, USD	notes
Cloud SQL for MySQL: Zonal - vCPU in Mumbai	46.5	asia-south1	9662-B51E-5089	FD1C-BF76-E3AA	55.3536	
Cloud SQL for MySQL: Zonal - RAM in Mumbai	139.5	asia-south1	9662-B51E-5089	EAF1-CE88-2F23	28.1232	
Cloud SQL for MySQL: Zonal - Standard storage in Mumbai	310	asia-south1	9662-B51E-5089	8E8D-BF79-E47F	1.93633	
Cloud SQL: Backups in Mumbai	62	asia-south1	9662-B51E-5089	D737-A9D2-80AB	0.18224	
Frontend Instances Mumbai	1	asia-south1	F17B-412E-CB64	35F6-8391-2A56	0	
				Total Price:	85.59538	
Prices are in US dollars, effective date is 2024-04-13T20:54:31.048Z						
The estimated fees provided by Google Cloud Pricing Calculator are for discussion purposes only and are not binding on either you or Google. Your actual fees may be higher or lower than the estimate.						
Url to the estimate:	https://cloud.google.com/calculator?dl=CiQ5YzBkOTIxZi0zMTEyLTRlZlRlZWUyYjI2MS04ZjRmNmThhYzlmMjU=					

Question 2

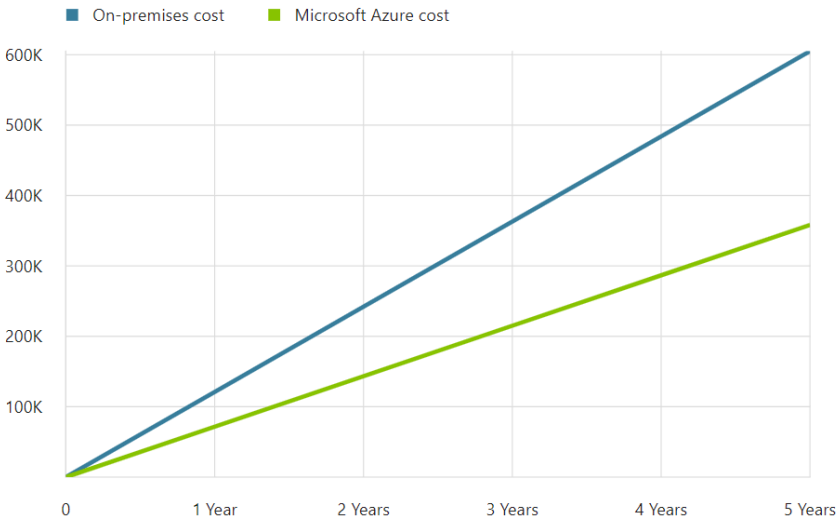
Scenario where moving to the cloud is advisable

- Background of Hypothetical Scenario
 - An e-commerce company, "GlobalShop," has been experiencing rapid growth due to increased online shopping. Their current on-premise infrastructure struggles to keep up with the demand, especially during peak sales periods like Black Friday and holiday seasons. The company's IT team is facing challenges with scalability, maintenance, and the high costs associated with upgrading its on-premise hardware to meet the growing traffic demands.
- Current Infrastructure Challenges
 - *Scalability Issues:* Unable to quickly scale up resources during peak traffic times, leading to slow website performance and potential loss of sales.
 - *High Maintenance Costs:* Significant expenses are associated with maintaining and upgrading on-premise servers, including hardware costs, electricity, and IT labor.
 - *Limited Global Reach:* The on-premise setup limits the company's ability to easily expand its services to new geographical markets due to latency issues and the need for additional data centers.
- Proposed Cloud Migration: GlobalShop is considering moving its e-commerce platform to the cloud after using the Total Cost of Ownership (TCO) Calculator from Microsoft Azure. The TCO Calculator estimates a significant cost saving over five years, with a detailed breakdown as follows:
 - *Compute Costs:* The on-premise compute costs amount to \$891,039.00, including hardware and software licenses. Migrating to Azure, the compute cost is estimated at \$104,210.40, offering a more cost-effective solution with the ability to scale resources as needed
 - *Data Center Costs:* GlobalShop has incurred \$45,340.50 in data center costs over five years. Moving to Azure eliminates these costs, as Azure manages the infrastructure.
 - *Storage Costs:* On-premise storage costs are \$3,392.00 over five years. Azure's estimated storage cost is \$49,482.13, which includes geo-redundant storage capabilities, enhancing data durability and availability.
 - *IT Labor Costs:* The on-premise environment requires significant IT labor, costing \$46,000.00 over five years. In Azure, the IT labor cost is reduced to \$19,167.05 due to automation and managed services.

- Here are screenshots of the Total Cost of Ownership (TCO) calculator

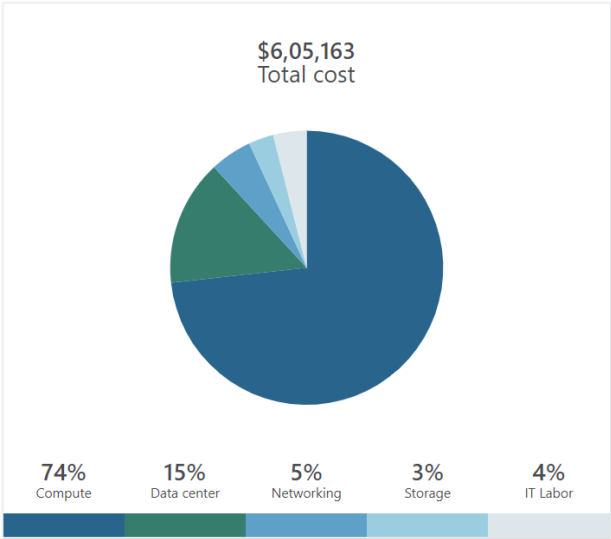
Total on-premises vs. Azure cost over time

Savings from running workloads in Azure accrue over time. The following shows how those savings add up over years.



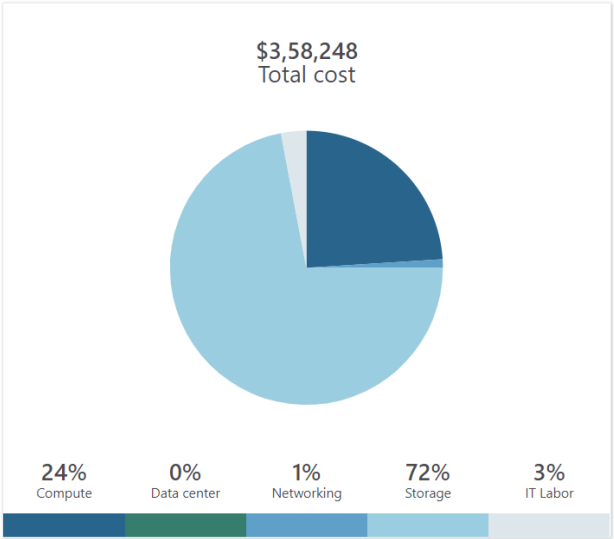
Total on-premises over 5 year(s)

TCO of on-premises environments tends to be driven by compute and data center costs.



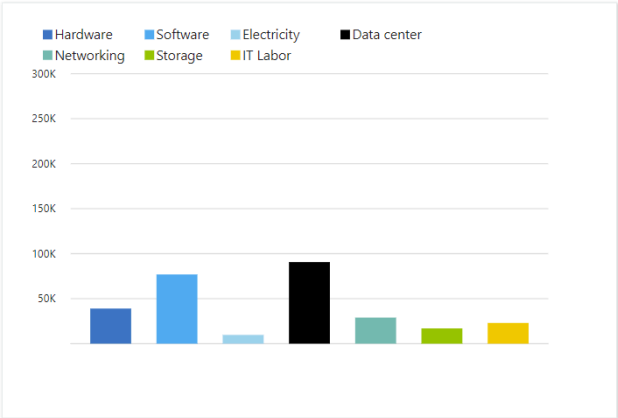
Total Azure cost over 5 year(s)

In Azure, certain cost categories decrease or go away completely.



Total on-premises cost breakdown

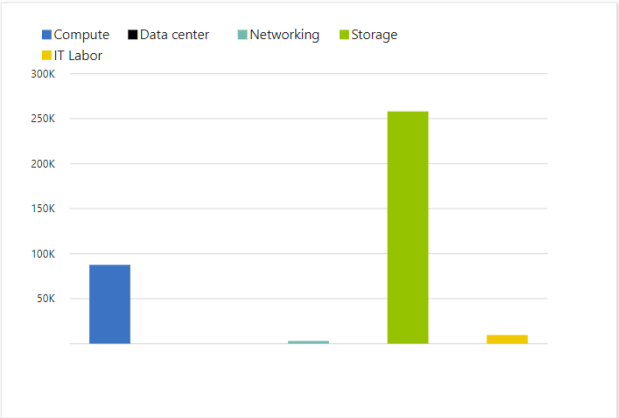
In Azure, several of the cost categories from the on-premises environment are consolidated and decrease with the efficiency that comes with the cloud.



\$6,05,163
Cost over 5 year(s)

Total Azure cost breakdown

In Azure, several of the cost categories from the on-premises environment are consolidated and decrease with the efficiency that comes with the cloud.



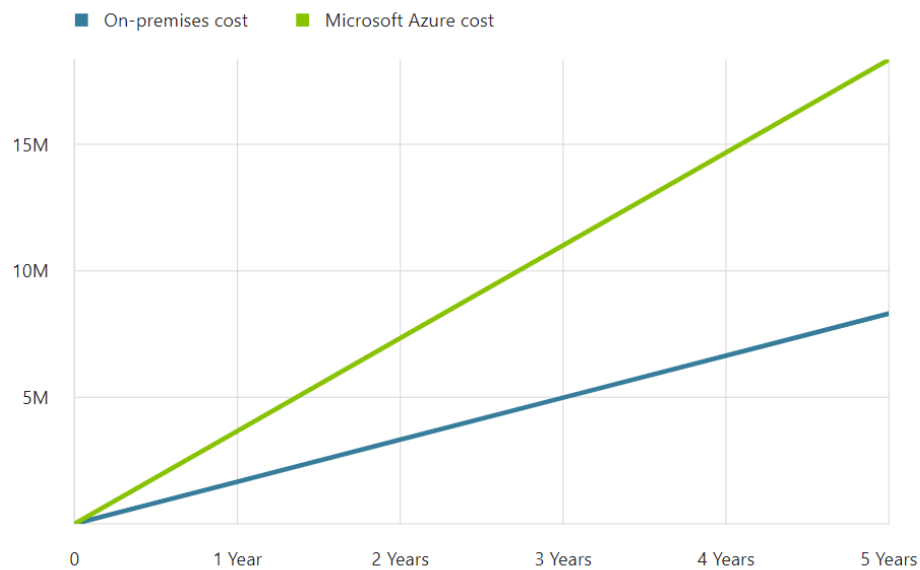
\$3,58,248
Cost over 5 year(s)

On-premises cost breakdown summary		Azure cost breakdown summary	
Category	Cost	Category	Cost
Compute	\$4,45,519.50	Compute	\$87,597.00
Hardware	\$39,020.00	Data Center	\$0.00
Software	\$76,937.50	Networking	\$2,985.00
Electricity	\$9,702.00	Storage	\$2,58,083.22
Database	\$3,19,860.00	IT Labor	\$9,582.95
Data Center	\$90,681.00		
Networking	\$29,002.66		
Storage	\$16,960.00		
IT Labor	\$23,000.00		
Total	\$6,05,163.00	Total	\$3,58,248.00

Scenario where moving to cloud is NOT advisable

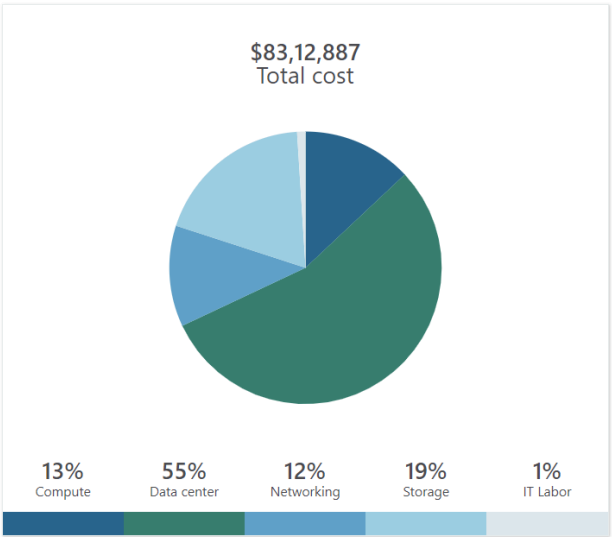
- Background of Hypothetical Scenario
 - "StreamWorld" is a rapidly growing global media streaming service that offers movies, TV shows, and exclusive content to millions of subscribers worldwide. With an expanding library of 4K and HDR content, StreamWorld faces the challenge of storing and delivering vast amounts of high-definition video data to users across different regions with minimal latency.
- Challenge
 - StreamWorld's on-premise data centers are struggling to keep up with the storage demands of their growing content library and the high bandwidth required for streaming 4K content. Additionally, the company aims to expand its services to new regions, requiring a scalable and reliable storage solution that can support global content delivery with low latency.
- Azure Cloud Migration Plan - StreamWorld migrates its entire content library to Azure Blob Storage to leverage Azure's global infrastructure and advanced storage solutions. The migration plan includes:
 - *Storage Requirements*: StreamWorld's content library is currently 5 Petabytes (PB) and is expected to grow by 20% annually.
 - *Azure Storage Selection*: StreamWorld opts for Azure Blob Storage, utilizing a mix of Hot and Cool access tiers to balance frequently accessed new releases and older, less-accessed content.
 - *Redundancy and Performance*: To ensure high availability and global reach, StreamWorld chooses Geo-Redundant Storage (GRS) for its content, ensuring data is replicated in multiple regions.
- Cost Estimation
 - Initial Storage Cost for 5 PB in Hot Tier: Assuming that Hot Tier GRS storage costs \$0.046 per GB per month, the initial cost for 5 PB (5,120,000 GB) would be approximately \$235,520 per month.
 - Annual Growth and Cost Increase: With an expected annual growth of 20%, the storage requirement will increase to 6 PB (6,144,000 GB) by the end of the first year. The cost for the increased storage would be approximately \$282,624 per month.
 - Cool Tier for Older Content: Approximately 2 PB of older content is moved to the Cool Tier, costing \$0.01 per GB per month, adding \$20,480 monthly for the Cool Tier storage.
 - Data Transfer and Transactions: Considering the global audience and the constant upload of new content and user access, data transfer and transaction costs would significantly add to the monthly expenses. Assuming an average of \$0.05 per GB for data egress and \$0.0004 per 10,000 transactions, these costs could easily add tens of thousands monthly, depending on user access patterns and content delivery network efficiency.

● Here are screenshots of the Total Cost of Ownership (TCO) calculator



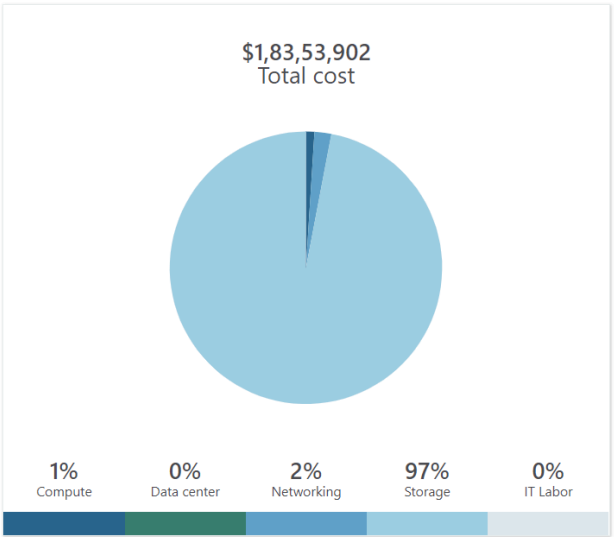
Total on-premises over 5 year(s)

TCO of on-premises environments tends to be driven by compute and data center costs.



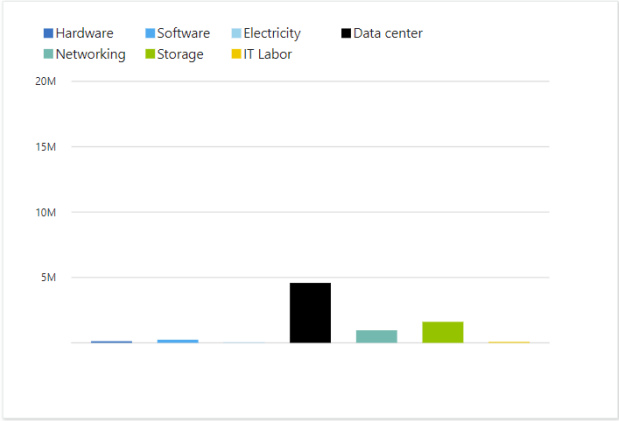
Total Azure cost over 5 year(s)

In Azure, certain cost categories decrease or go away completely.



Total on-premises cost breakdown

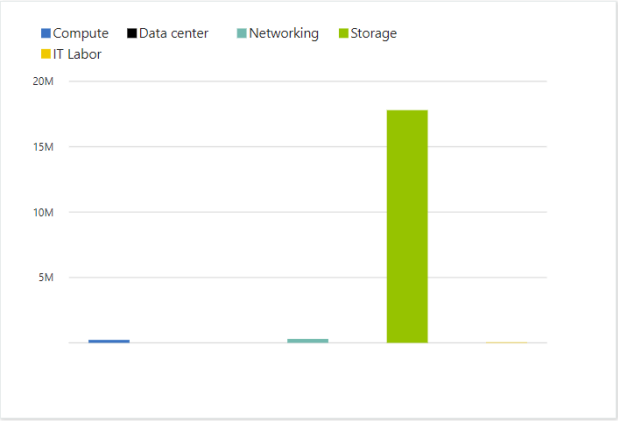
In Azure, several of the cost categories from the on-premises environment are consolidated and decrease with the efficiency that comes with the cloud.



\$83,12,887
Cost over 5 year(s)

Total Azure cost breakdown

In Azure, several of the cost categories from the on-premises environment are consolidated and decrease with the efficiency that comes with the cloud.



\$1,83,53,902
Cost over 5 year(s)

On-premises cost breakdown summary		Azure cost breakdown summary	
Category	Cost	Category	Cost
Compute	\$10,93,236.45	Compute	\$2,23,169.40
Hardware	\$1,20,962.00	Data Center	\$0.00
Software	\$2,38,506.25	Networking	\$2,99,985.00
Electricity	\$30,076.20	Storage	\$1,77,92,414.40
Database	\$7,03,692.00	IT Labor	\$38,332.95
Data Center	\$45,80,901.85		
Networking	\$9,62,008.28		
Storage	\$16,05,440.00		
IT Labor	\$71,300.00		
Total	\$83,12,887.00	Total	\$1,83,53,902.00