

10 February 2022

Thursday

## Q) What Is Cloud Computing?

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Ans) Cloud computing is an Information Technology (IT) paradigm that delivers cloud services such as servers, software, storage, databases, networking, analytics and much more over the internet. The companies which provide cloud computing services are known as cloud providers and they typically charge their customers based on usage, similar to how we are charged for gas or electricity.

### Delivery Models

- Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)

### Deployment Models

- Public cloud
- Private cloud
- Community cloud
- Hybrid cloud

### Cloud Computing

#### Resources

Compute & storage servers

#### Networks

#### Services

#### Applications

#### Infrastructure

Distributed Infra-  
Resource virtualizat

Autonomous -  
systems

#### Defining attributes

Massive infrastructure

Pay per usage

Accessible via Internet

Elasticity

Utility computing

A man who has never made a woman angry is a failure in life. - Christopher Morley

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### \* Early Models of Cloud Computing

a) Grid computing — It is a collection of computer resources from multiple locations to reach a common goal. It can be thought as a distributed system with non interactive workloads that involves a large numbers of files. (Initiated by National labs in 1990s)

b) Utility computing — It is a service provisioning model in which service provider makes computing resources and infrastructure management available to the customer as needed, and charges them for specific usage rather than a flat rate.

### \* Cloud Computing — Characteristics

Cloud computing provides on demand, scalable and elastic computing. Customers use the resources and are charged as per the resources used.

- Cloud uses a shared pool of resources.
- Provides on demand scalable and elastic computing.
- Uses Internet to provide services.
- Cost effective due to resource multiplexing.
- Resources are metered and customers are charged accordingly.
- The data storage strategy near the site where it is used provides self-ability, security, and lowers the communication costs.
- The services are managed more efficiently due to specialization and centralization.

Do not take life too seriously. You will never get out of it alive. - Elbert Hubbard

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## \* Cloud Computing Advantages:

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- a) Lower Capital Costs: No need for physical servers or infrastructure.
- b) Pay-as-you-use model: Customers only pay for the resources they need, reducing waste of resources.
- c) Scalability: Provides flexibility to businesses with fluctuating workloads.
- d) Accessibility: Customers can access data and apps from anywhere in the world using the Internet.
- e) Recovery and Backup: Reduces the risk of data loss due to hardware failure or cyberattack.
- f) Security: Data is often encrypted and stored across multiple locations.
- g) Speed & Performance: Quick deployment of services and updates.
- h) Environmentally friendly: Providers often use energy-efficient data centers.
- i) Automatic Updates: Cloud services regularly update services, software, and infrastructure.

You can't cross the sea merely by standing and staring at the water. - Rabindranath Tagore

Phones

without user intervention

## \* Cloud Computing Disadvantages:

- a) Internet Required: without Internet cloud services can't be used.

## b) Security and Privacy Concerns: Your data is stored on someone else's server so there's always a risk of hacking or unauthorized access even with strong security.

- c) Possible Downtime: If the cloud services are down then you may not be able to use applications or resources.

- d) Cost Can Add Up: While it is cheap at first, if you use a lot of services then it can get expensive overtime.

- e) Data Transfer Speed: Uploading or downloading large files can be slow.

- f) Vendor Lock-in: Once you start using a cloud provider, later it's difficult to switch to another provider.

## \* Cloud Computing Challenges:

- i) Data Confidentiality: a serious problem.
- ii) Lock-in Vendor: One customer is hooked to one provider.
- iii) Security and Confidentiality: major concern for sensitive applications like bank and healthcare.

It's a conundrum. Or an enigma. I forgot which. - James A. Owen.

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## \* Cloud Computing Uses:

Cloud computing is like a backbone of tech and is helping businesses in a more efficient way.

- Data Storage & Backup - No need for bulky hard drives when you can store everything in the cloud.
- Machine Learning & AI: All models are trained and deployed using cloud resources.
- Streaming Services: Your favorite movies, music, books, games rely on cloud services.
- IoT & Smart devices: Every smart device depends on cloud processing to function smoothly.
- Software as a Service (SaaS): Think of Google docs or Microsoft 365 run online without needing installations.
- Gaming: Cloud gaming platforms let users stream high-end games without needing powerful hardware.
- Retail & E-commerce: Online e-commerce platforms use cloud service for inventory management, customer insights and transactions.
- Education & E-learning: Online courses, digital textbooks and virtual classrooms are powered by cloud.

The future belongs to the competent. Get good, get better, be the best! -Brian Tracy

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## \* Types of Cloud (Cloud deployment Models)

1. Public Cloud: Cloud services provided by third-party vendors like Azure, AWS, Google Cloud, and is available to anyone on a pay-as-you-go basis.  
Benefits: cost-effective, scalability, high scalability, less capital investment.
  2. Private Cloud: The infrastructure is operated solely for an organization, offering more control.  
Benefits: high security and privacy, more control, cost & energy efficient, restricted access.
  3. Hybrid Cloud: A mix of public and private clouds or community clouds, allowing organizations to use the benefits of all the clouds while maintaining sensitive data privately.  
Benefits: scalability, flexibility, high security, networking issues, security compliance, instant access.
  4. Community Cloud: Share cloud infrastructure for organizations with similar needs, like govt or hospital.  
Benefits: cost effective, more secure than public cloud, data accessible by authorized users.
- Q) Why cloud computing is successful when other paradigms have failed?

- 5.) Scalability & Flexibility: It allows businesses to scale up or down based on demand.
6. Cost efficiency: With the pay-as-you-go model, company no longer have to invest in infrastructure.
7. Accessibility: It can be accessed from anywhere in the world.
8. Disaster Recovery & Reliability: Cloud computing offers redundancy, backups and disaster recovery to keep data safe.

Each day of our lives we make deposits in the memory banks of our children. Charles R. Swindoll

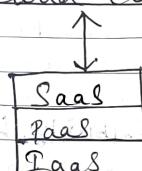
9. Integration & Compatibility: It allows seamless integration with other techs like IoT, block chain & edge computing.

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High level Low level  
Cloud Delivery Models: (SaaS), (PaaS), (IaaS)

### Cloud Clients



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- Infrastructure as a Service (IaaS)
- It is compute resources, CPUs, VMs, storage, etc.
- The user is able to deploy and run arbitrary software.
- The user do not manage the underlying cloud infrastructure
- Services offered: server hosting, storage, computing hardware, OS, load balancing, internet access.
- Eg Amazon EC2

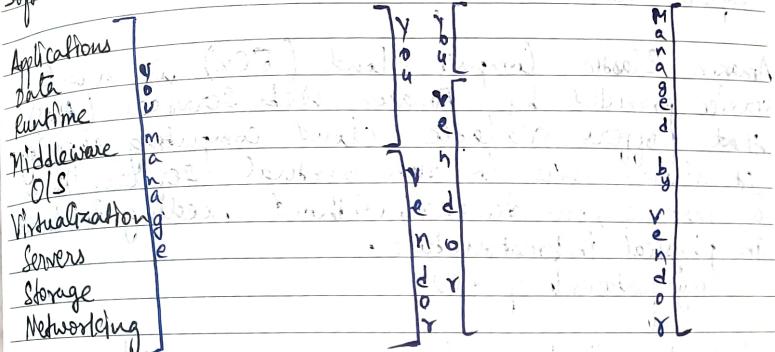
### Cloud Service Models

Packaged Software

Infrastructure (as a Service)

Platform (as a Service)

Software (as a Service)



I'm told I'm very charming when people do what I want. - Steven Brust.

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I'm not stubborn. My way is just better. Maya Banks.

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Q) What is AWS? What service does it provide?

Sol) Amazon Web Services (AWS) is a collection of web services providing developers with compute, storage and more advanced services.

AWS is mostly popular for PaaS services and primarily for its elastic compute service EC2.

It is a platform allowing the development of flexible applications by providing solutions for elastic infrastructure, scalability, messaging and file and data storage.

Q) Explain amazon EC2

1) Amazon Elastic Compute Cloud (EC2) is a web service provided by Amazon Web Services (AWS) that offers scalable cloud computing capacity. It allows users to run virtual servers, known as instances, on-demand, without needing to invest in physical infrastructure.

Key features of EC2

- Elasticity: Easily scale resources up or down based on demand.
- Variety of Instance Types: Different configurations optimized for computing, memory, storage or networking

All of life is peaks and valleys. Don't let the peaks get too high and the valleys too low. John Wooden

needs.

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Pay-as-you-go Pricing: You only pay for the compute capacity you use.

Security: Includes features like firewall configurations, encryption, and compliance support.

Integration with AWS Services: Works seamlessly with services like Amazon S3 (storage) and AWS Lambda (serverless computing).

Uses of EC2:

- Hosting websites and applications.
- Big data analytics and ML workloads.
- High Performance Computing.
- Run applications and databases.

EC2 Instances: 6 types

- Standard Instances: provide a set of configurations that are suitable for most applications.
- Micro Instances: suitable for applications that consume a limited amount of computing power and memory to process surges in the workload.
- High Memory Instances: suitable for applications that need to process huge workloads and require large amounts of memory.
- High CPU Instances: targets compute intensive applications.
- Cluster Compute Instances: Used to provide virtual clusters.

A brother may not be a friend, but a friend will always be a brother. Benjamin Franklin

services.

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## Q) Resource Pooling

Sol: It is a concept of cloud computing with the help of which provider's computing resources are shared among multiple customers using a multi-tenant model. Resources are dynamically assigned and reassigned based on demand.

Eg: A cloud service provider allocates CPU power and memory to customers as needed, allowing for efficient usage across multiple clients.

Like AWS has thousand of servers which are not dedicated to one customer only. Instead by using virtualization, they can host virtual machines for many clients simultaneously.

When a client needs more power and storage, AWS allocates more resources as per the need of the customer from the resource pool and when the demand drops, those resources are returned to the pool and reassigned to someone else as per need.

Go confidently in the direction of your dreams! Live the life you've imagined. -Henry David Thoreau

b/w Amazon RDS and Amazon Simple DB.	Amazon RDS	Amazon Simple DB
Feature	Relational (SQL Based)	No SQL (Schema-less)
Database Type	MySQL, SQL Server, Oracle	No predefined database engines
Supported Engines	SQL-based queries	Single query API, no SQL support
Query Language	Strong consistency	Supports Eventual Consistency
Consistency Model	Manual Indexing	Automatic Indexing
Indexing	Structured data	Unstructured Data
Date	Automated backups	No built-in backup
Backup & Recovery	Vertical scaling	Horizontal scaling
Scalability	Requires a predefined schema	Schema-less
Schema Requirement		

The important thing is not to stop questioning. Curiosity has its own reason for existing. - Albert Einstein

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virtualization and reducing idle resources.

- b) Cost Efficiency: It reduces the need for physical hardware cutting down infrastructure costs..
- c) Scalability & Flexibility: Cloud environments can easily scale resources up or down by deploying or decommissioning (VMs) as needed.
- d) Improved Disaster Recovery: VMs can be backed up and restore quickly, supporting better disaster recovery.
- e) Energy Efficiency: It reduces power by consolidating workloads onto fewer physical machines.

Type of Hardware Virtualization? Full, Para, Emulation.

Full Virtualization: In FV, the underlying hardware is completely simulated. Guest software does not require any modification to run.

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Para Virtualization: In PV, the hardware is not simulated. The guest software runs their own isolated domains.

Virtualization Advantages:-

Resource Optimization: It allows multiple (VMs) to run on a single physical server maximizing hardware

If you win, you need not have to explain...if you lose, you should not be there to explain! - Adolf Hitler

Be happy just as you are. Don't think you have to change a single thing about yourself. - Marty Rubin

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## What is Google AppEngine?

Ans: It is a Platform-as-a-Service implementation providing services for developing and hosting scalable web applications. It is a scalable and distributed runtime environment that leverages Google's distributed infrastructure to scale out applications facing a large amount of requests by allocating more computing resources to them and balancing the load among them. Developers can develop applications in Java, Python and Go.

The platform can be logically divided into four major components: Infrastructure, runtime environment, underlying storage, and the set of scalable services that can be used to develop applications.

Infrastructure: Its function is to serve user requests efficiently. It is also responsible for monitoring the application performance and for collecting statistics on top of which the billing is calculated.

Runtime Environment: It represents the execution context of applications hosted on AppEngine. The runtime comes into existence when the request handler starts to execute and terminates once the handler has completed.

There is only one happiness in this life, to love and be loved. - George Sand

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Storage: AppEngine provides different types of storage which operate differently according to the volatility of the data they are designed for.

Application Services: Applications hosted on AppEngine take the most from the services made available through the runtime environment. Common operations: access to data, account management, integration of external resources, messaging and communication, image manipulation, and synchronous computation.

① What is Data Store? What type of data does it stores?

It refers to a system designed to store, manage and retrieve data efficiently. Cloud based data stores are typically scalable, secure and accessible from anywhere, making them ideal for businesses and individuals who require reliable data storage.

Types of data stored in Cloud Data Stores:

- i) Structured data: Organized data stored in databases, e.g. customer records, financial transactions.
- ii) Unstructured data: Unorganized data like emails, docs, PDFs.
- iii) Semi structured data: Data that has some structure but doesn't fit neatly into databases, such as JSON or XML files.
- iv) Multimedia files: Images, videos, audio files, others.
- v) Big Data - Large scale data sets that require high

The last capitalist we hang shall be the one who sold us the rope. - Karl Marx

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performance processing, such as analytics data for ML and AI applications.

v) Application Data - Software generated logs, caches.

vii) Backup and Archival Data - Cloud storage is often used for disaster recovery and long term archiving of important files.

Q) Define SQL Azure & App fabric In MS?

- SQL Azure is a relational database service hosted on Windows Azure and built on the SQL Server technologies. The service extends the capabilities of SQL Server to the Cloud and provides developers with a scalable, highly available and fault tolerant relational database.
- It is fully exposed by SQL Server.
- SQL Azure is accessible from either the Windows Azure Cloud or any other location that has access to the Azure Cloud. The service is fully manageable by using REST API, allowing developers to control databases deployed in the Azure Cloud as well as the firewall rules set up for their accessibility.

App fabric: It is a comprehensive middleware for developing, deploying and managing applications on the

wise men speak because they have something to say; fools because they have to say something. - Plato

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Cloud or for integrating existing applications with Cloud services. App fabric implements an optimized infrastructure supporting scaling out and high availability; load balancing and multi-tenancy; state management and dynamic address resolution and routing.

It also offers a collection of services that simplify many of the common tasks in a distributed application such as communication, authentication, authorization and data access, thus allowing developers to build heterogeneous applications.

Q) Diff b/w cloud / grid / parallel Computing.

	CC	GC	PC
Feature definition	Borrows on demand access to computing resources over internet	Uses a distributed network of comps to solve complex prob	Uses multiple processors to execute task simultaneously
Architecture	Centralized managed by cloud providers	Distributed, multiple comps independently working together	Shared memory or distributed memory systems
Usage	Hosting applicat <sup>n</sup> , storage & scalable computing	Scientific research large scale computations	High performance computing, adreal some processing
	Good friends, good books, and a sleepy conscience: this is the ideal life. - Mark Twain	Appointment:	Phone:

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Cloud feature

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PC

Scalability

Highly Scalable

• Scalable but requires coordination b/w nodes

Limited by hardware constraints

Dependency

Relies on cloud providers like AWS, Azure, Google Cloud

Uses multiple independent computers connected via a network

Requires highly coupled processors or cores

Cost Model

Pay-as-you-go model

Shared computing resources, often free or low cost

Expensive due to specialized hardware

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Q) What is Amazon Cloud Watch & S3?

Ans: Amazon Cloud Watch and Amazon S3 are two essential services in AWS, each serving different purposes.

Amazon Cloud Watch:

- Amazon Cloud Watch is a monitoring and observability service that helps track metrics, logs and events for AWS resources. It enables users to:
  - Monitor CPU usage, memory, network traffic and other performance metrics.
  - Set up alarms to trigger actions when thresholds are exceeded.
  - Collect and analyze logs for troubleshooting.
  - Optimize resource usage and cost efficiency.

Amazon S3: (Simple Storage Service)

It is a scalable object storage service used for storing and retrieving data. It provides:

- Unlimited storage for files, images, videos and backups.
- High durability and availability with multiple data replication.
- Security features like encryption and access control.
- Integration with other AWS services for data analytics and processing.

The day the power of love overrules the love of power, the world will know peace. - Mahatma Gandhi

Show me a family of rebels, and I will show you the people who move the world. - Napoléon Bonaparte

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Q) What is SLA?

A Service Level Agreement (SLA) in cloud computing is a contract between a cloud service provider and a customer that defines the expected level of service. It outlines key metrics such as uptime, performance, response time and support availability.

Key Components of SLA:

- i) Service availability: Specifies the guaranteed uptime and downtime.
- ii) Performance Metrics: Defines response time, latency and processing speeds.
- iii) Support & Maintenance: Details customer support availability and issue resolution timelines.
- iv) Security & Compliance: Ensures data protection, encryption and regulatory compliance.
- v) Penalties & Remedies: Outlines compensation if the provider fails to meet SLA terms.

SLAs help businesses ensure reliable cloud services while holding providers accountable for performance and security.

In the end, it's not the years in your life that count. It's the life in your years. - Abraham Lincoln

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b/w Cloud delivery models.

Q) Comparison b/w Cloud delivery models.

PaaS

IaaS  
Provides virtualized computing resources over the internet

SaaS  
Delivers fully functional applications over the internet

ii) High control over infrastructure

Limited control over infrastructure

Cloud provider manages OS, applications and runtime

Cloud provider manages OS and infrastructure, users manage applications

including updates & security

iv) Highly scalable

Scalable for application development and deployment

Scalable based on user demand

v) Users are responsible for securing their infrastructure

Security is managed by the provider, but users must secure their applications

Fully managed security by the provider

vi) Pay-as-you-go based on usage

Subscription based or usage based

Fixed subscription pricing or usage based

vii) AWS EC2, MS Azure VMs

Eg: Google App Engine, Microsoft Azure App Services

Eg: MS 365, Box, Dropbox

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VMs = Virtual Machines

## (Q) Hypervisor Clustering Architecture (Its types, working, procedure)

It is a technique used in virtualization to ensure high availability and fault tolerance by grouping multiple hypervisors together.

It enhances reliability, scalability and fault tolerance in cloud environments.

### \* Types of Hypervisor Clustering:

i) Active-Active Clustering: All hypervisors actively run VMs, distributing workloads efficiently.

ii) Active-Passive Clustering: One hypervisor remains idle while another runs actively. If the hypervisor fails, the passive one takes over.

iii) Fault Tolerant Clustering: Uses real-time replication to ensure VMs continue running without downtime in case of failure.

### \* Working of Hypervisor:

• Heartbeat Monitoring: Hypervisors send periodic signals to the Central Virtual Infrastructure Manager (VIM) to confirm their status.

• Shared Storage: VMs are stored in shared storage system, allowing migration b/w hypervisors.

I use bits and pieces of others personalities to form my own. - Kurt Cobain,

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HRs: Hypervisors

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• Live Migration: If a hypervisor fails, VMs are automatically moved to another hypervisor in the cluster.

• Load Balancing: Workloads are distributed across hypervisors to optimize performance.

\* Procedure for Hypervisor Clustering

i) Setup Hypervisors: Install and configure HRs on multiple physical servers.

ii) Configure Shared Storage: Ensure all HRs have access to a common storage system.

iii) Enable Cluster Communication: Setup heartbeat monitoring and networking b/w HRs.

iv) Implement VM Migration Policies: Define rules for VM migration in case of failure.

v) Monitor and Optimize: Continuously track performance and adjust configurations for efficiency.

However difficult life may seem, there is always something you can do and succeed at. - Stephen Hawking

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Week 10 • 065-300

APRIL '22

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066-299 • Week 11

2022 March 07

Monday

## Q) Deployment Technologies supported by App Engine?

- i) Command Line Tools: Developers can use gcloud CLT to deploy applications.
- 2) CI/CD Integrations: App Engine integrates with Github Actions, Jenkins and Cloud Build to automate testing and deployment.
- 3) Cloud Build: Enables deployment using container images.
- 4) Admin API: Allows programmatic deployment of apps.
- 5) Version Control & Traffic Splitting: Supports deploying multiple versions of an application and routing traffic b/w them.

These technologies make deployment efficient, scalable and automated.

**Cloud Provider:** A cloud provider is a company or organization that offers cloud computing services. These include storage, computing power, networking and databases over the internet. These providers manage infrastructure, security and scalability for their customers.

Eg: AWS, MS Azure, Google Cloud, IBM Cloud.

**Cloud Consumer:** A cloud consumer is an individual or business that uses cloud services for computing, storage or application hosting. Consumers access these services via the internet without managing the underlying infrastructure.

Eg: Startups, enterprises, developers and individuals.

## Q) What is On-premise?

It refers to IT Infrastructure and computing resources that are hosted and managed locally within an organization's own facility rather than using cloud based services.

**Key Characteristics of On-premise computing are - Full Control, Security & Compliance, Higher Upfront Cost, Limited Scalability.**

On-premise systems are entirely self managed within an organization's own data center.

08 March 2022

Tuesday

Q) What is IT Resource and Virtual Resource?  
Week 11 - 067-298

MARCH'22

APRIL'22

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25 26 27 28 29 30 068-297 Week 11

March 09

Wednesday

Vertical Scaling: Increasing the power of existing machines (CPU, RAM, storage). It simplifies management but has hardware limitations.

Q) Draw a block diagram of Google AppEngine.

Sol) An IT resource refers to the physical or logical computing assets used to support operations. These include hardware (servers, storage devices, network), software (OS, applications, databases), Network Resources (firewalls, routers, bandwidth). IT resource can be on-premise or cloud based.

A virtual resource is a simulated version of an IT resource created using virtualization technology. It allows multiple instances to run on the same physical hardware.

Eg: VMs, Virtual Networks, Virtual Storage Containers

What is scaling? What is  $\neq$  &  $\neq$  scaling?

Scaling refers to the ability to increase or decrease computing resources based on demand. It ensures applications remain efficient and responsive under varying workloads. Types → Horizontal & Vertical.

Horizontal Scaling: Adding more machines or instances to distribute the load. It improves fault tolerance and load balancing.

Bad times have a scientific value. These are occasions a good learner would not miss. - Ralph Waldo Emerson

Phone

Appointment

Notes

Go to heaven for the climate and hell for the company. - Benjamin Franklin Wade

Notes

Appointment

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