

Cloud Cheat sheet

Introduction to Cloud Computing

- **Definition:**
 - Cloud computing delivers computing services over the internet, including storage, servers, databases, networking, software, and analytics.
- **Key Characteristics:**
 - **On-Demand Self-Service:** Users can access computing resources as needed without human interaction with service providers.
 - **Broad Network Access:** Resources are accessible over the network via standard mechanisms, promoting use on various platforms (e.g., mobile phones, laptops).
 - **Resource Pooling:** The provider's resources are pooled to serve multiple customers, with resources dynamically assigned according to demand.
 - **Rapid Elasticity:** Resources can be quickly scaled up or down according to demand.
 - **Measured Service:** Cloud systems automatically control and optimize resource use by leveraging a metering capability.
- **Types of Cloud Computing:**
 - **Public Cloud:** Services are provided over a network that is open for public use. (e.g., AWS, Azure)
 - **Private Cloud:** Services are maintained on a private network.
 - **Hybrid Cloud:** Combines public and private clouds, allowing data and applications to be shared between them.

Cloud Service Models

1. Infrastructure as a Service (IaaS):

- Provides virtualized computing resources over the internet.

- **Example:** Amazon EC2 (Elastic Compute Cloud) provides scalable computing capacity.
- **Use Case:** Hosting websites, big data analysis, storage and backup, and high-performance computing.

2. Platform as a Service (PaaS):

- Provides a platform allowing customers to develop, run, and manage applications without the complexity of building and maintaining the infrastructure.
- **Example:** Google App Engine offers a platform for developing and hosting web applications.
- **Use Case:** Application development, web application hosting, and API development.

3. Software as a Service (SaaS):

- Delivers software applications over the internet, on a subscription basis.
- **Example:** Microsoft Office 365 provides productivity software through the cloud.
- **Use Case:** Email services, CRM, ERP, and collaboration tools.

Cloud Deployment Models

- **Public Cloud:**
 - Operated by third-party cloud service providers; services are delivered over the internet.
 - **Examples:** AWS, Google Cloud Platform (GCP), Microsoft Azure.
- **Private Cloud:**
 - Cloud infrastructure operated solely for a single organization. It can be managed internally or by a third party.
 - **Example:** An organization's own datacenter providing virtualized resources.
- **Hybrid Cloud:**

- A combination of public and private clouds that allows data and applications to be shared.
- **Example:** An organization using on-premises resources for sensitive operations while leveraging the public cloud for less critical tasks.
- **Community Cloud:**
 - Shared infrastructure for a specific community, typically from the same industry.
 - **Example:** Government agencies sharing a cloud for data management.

Key Cloud Providers

- **Amazon Web Services (AWS):**
 - Services: EC2 (Compute), S3 (Storage), RDS (Database), Lambda (Serverless).
 - **Example:** Netflix uses AWS for global content delivery.
- **Microsoft Azure:**
 - Services: Virtual Machines, Azure Blob Storage, SQL Database, Azure Functions.
 - **Example:** LinkedIn uses Azure to improve its services' performance and scalability.
- **Google Cloud Platform (GCP):**
 - Services: Compute Engine, Cloud Storage, BigQuery, Cloud Functions.
 - **Example:** Snapchat uses GCP to handle its cloud operations.

Cloud Security

- **Security Challenges:**
 - **Data Breaches:** Unauthorized access to data.
 - **Data Loss:** Data could be lost due to factors like hardware failure, natural disasters, or human error.

- **Account Hijacking:** Malicious actors may gain unauthorized access to accounts.
- **Insecure APIs:** Vulnerabilities in cloud APIs can expose systems to attacks.
- **Security Solutions:**
 - **Encryption:** Encrypting data both at rest and in transit.
 - **Identity and Access Management (IAM):** Controlling who can access what resources.
 - **Multi-Factor Authentication (MFA):** Adding an extra layer of security beyond just passwords.
 - **Regular Audits:** Performing regular security audits to ensure compliance with security policies.
- **Example:** AWS provides tools like AWS Identity and Access Management (IAM) and AWS Key Management Service (KMS) for enhanced security.

Cloud Storage

- **Types of Cloud Storage:**
 - **Object Storage:** Stores data as objects. (e.g., AWS S3, Azure Blob Storage)
 - **File Storage:** Provides shared file systems. (e.g., Google Cloud Filestore)
 - **Block Storage:** Stores data in blocks, typically used for databases. (e.g., AWS EBS, Azure Disk Storage)
- **Use Cases:**
 - **Object Storage:** Backup and restore, media storage, big data analytics.
 - **File Storage:** File sharing, content management.
 - **Block Storage:** Database storage, transactional applications.
- **Example:** Dropbox uses Amazon S3 to store and manage its vast amount of user data.

Cloud Networking

- **Virtual Private Cloud (VPC):**
 - Allows you to create an isolated network within a public cloud.
 - **Example:** AWS VPC provides control over the network configuration, including IP address ranges and subnets.
- **Load Balancers:**
 - Distribute incoming application traffic across multiple instances.
 - **Example:** AWS Elastic Load Balancing automatically distributes incoming application traffic.
- **Content Delivery Networks (CDN):**
 - Distributes content to users globally with minimal latency.
 - **Example:** Amazon CloudFront, a CDN service, delivers content with low latency.
- **Firewalls:**
 - Protects cloud resources by controlling incoming and outgoing traffic based on security rules.
 - **Example:** Azure Firewall provides network security to protect cloud workloads.

Cloud Cost Management

- **Cost Optimization Techniques:**
 - **Right-Sizing:** Adjusting resource sizes according to workload requirements.
 - **Reserved Instances:** Committing to use a service for a longer term at a lower cost.
 - **Auto-Scaling:** Automatically scaling resources up or down based on demand.
- **Tools:**
 - **AWS Cost Explorer:** Visualizes and manages your AWS costs and usage.

- **Azure Cost Management and Billing:** Helps monitor and control Azure expenditures.
- **GCP Cost Management Tools:** Provides insights into GCP spending and helps optimize resources.
- **Example:** A company using AWS might reserve instances for predictable workloads and use auto-scaling for unpredictable demand.

Cloud Migration

- **Steps for Cloud Migration:**
 - **Assessment:** Evaluate current infrastructure and applications.
 - **Planning:** Define the migration strategy (e.g., rehosting, replatforming, refactoring).
 - **Execution:** Migrate data and applications.
 - **Optimization:** Post-migration, optimize cloud resources for performance and cost.
- **Migration Strategies:**
 - **Rehosting:** "Lift and shift" existing applications to the cloud without changes.
 - **Replatforming:** Making a few optimizations without changing the core architecture.
 - **Refactoring:** Rewriting applications to take full advantage of cloud-native features.
- **Example:** Netflix migrated to AWS to improve scalability and global availability.

Cloud Computing Best Practices

- **Security Best Practices:**
 - **Regularly update and patch systems.**
 - **Use IAM roles instead of root accounts.**

- **Implement network segmentation.**
- **Operational Best Practices:**
 - **Implement monitoring and logging.**
 - **Automate where possible (e.g., using Infrastructure as Code).**
 - **Regularly review cloud architecture for optimization.**
- **Cost Management Best Practices:**
 - **Monitor usage and set budget alerts.**
 - **Use cost-effective storage classes.**
 - **Implement reserved instances and spot instances.**
- **Example:** A financial services company could implement these best practices by using AWS CloudTrail for logging, setting up cost alerts in AWS Budgets, and using reserved instances for steady workloads.

Real-Life Cloud Computing Situations

1. A startup is developing a mobile app with fluctuating demand.
 - **Solution:** Use **Public Cloud IaaS** for scalable compute resources to handle spikes in traffic.
2. A healthcare organization needs to securely store and process sensitive patient data.
 - **Solution:** Implement a **Private Cloud** to ensure data security and compliance with regulatory standards.
3. An e-commerce platform experiences high traffic during sales events.
 - **Solution:** Leverage **Hybrid Cloud** to scale resources in the public cloud during peak times while keeping critical operations on a private cloud.
4. A company wants to deploy a new web application quickly without managing the underlying infrastructure.
 - **Solution:** Choose **PaaS** to streamline application development and deployment.
5. A business needs to provide global access to its content with minimal latency.

- **Solution:** Utilize a **Content Delivery Network (CDN)** within a public cloud to distribute content efficiently.
6. A research institution needs high-performance computing for complex simulations.
- **Solution:** Use **IaaS** in the public cloud to access powerful compute instances on-demand.
7. A company is moving legacy applications to the cloud but wants to maintain control over the infrastructure.
- **Solution:** Opt for **Rehosting** by using IaaS in a **Public Cloud** to lift and shift applications without modification.
8. An organization needs to provide temporary resources for a project with a limited duration.
- **Solution:** Utilize **Spot Instances** in the public cloud to reduce costs while maintaining flexibility.
9. A development team requires a collaborative environment to develop and test applications.
- **Solution:** Implement **PaaS** to provide an integrated environment for coding, testing, and deploying applications.
10. A financial services firm needs to perform big data analysis on large datasets.
- **Solution:** Use **Big Data Processing Services** in the public cloud to efficiently analyze and process vast amounts of data.
11. **You need to host a scalable web application and handle variable workloads without managing the underlying infrastructure.**
- **Service Model:** Platform as a Service (PaaS)
12. **Scenario: You require complete control over the virtual machines and storage resources for a custom application.**
- **Service Model:** Infrastructure as a Service (IaaS)
13. **Scenario: You want to use software applications such as email and collaboration tools without worrying about maintenance or updates.**
- **Service Model:** Software as a Service (SaaS)

14. **Scenario:** You need to develop and test applications with an environment that supports continuous integration and delivery (CI/CD).
- **Service Model:** Platform as a Service (PaaS)
15. **Scenario:** Your team needs to access the latest version of productivity software from any device without managing software installation.
- **Service Model:** Software as a Service (SaaS)

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