

Cloud Computing

Cloud Computing – Structured Study Notes

1. What Is Cloud Computing?

Definition	A model for delivering on-demand computing resources (servers, storage, databases, networking, software, analytics, AI, etc.) over the Internet, with pay-as-you-go pricing.
Key Characteristics	• On-demand self-service • Broad network access (any device, any location) • Resource pooling (multi-tenant, virtualized) • Rapid elasticity (scale up/down automatically) • Measured service (usage-based billing)
Primary Benefits	• Reduced capital expenditure (CAPEX) • Faster time-to-market • Global reach & reliability • Automatic updates & maintenance • Scalability & flexibility

2. Service Models (The “X-as-a-Service” Stack)

Service Model	What It Provides	Typical Use Cases	Example Providers
IaaS – Infrastructure as a Service	Virtualized compute, storage, networking (VMs, block storage, load balancers)	Hosting legacy apps, dev/test environments, big-data processing	Amazon EC2, Google Compute Engine, Microsoft Azure VMs
PaaS – Platform as a Service	Runtime environment, middleware, development tools, database services	Application development, API management, CI/CD pipelines	Google App Engine, Azure App Service, Heroku
SaaS – Software as a Service	Fully functional applications delivered over the web	CRM, email, collaboration, ERP	Salesforce, Office 365, Slack

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Service Model	What It Provides	Typical Use Cases	Example Providers
FaaS – Function as a Service (Serverless)	Executes individual functions in response to events, no server management	Event-driven processing, microservices, APIs	AWS Lambda, Azure Functions, Google Cloud Functions
DaaS – Desktop as a Service	Virtual desktops delivered to end-users	Remote workstations, secure corporate desktops	Amazon WorkSpaces, Citrix Virtual Apps

3. Deployment Models

Model	Description	Typical Scenarios
Public Cloud	Resources owned & operated by a third-party provider, shared among many customers	Startups, variable workloads, global services
Private Cloud	Dedicated infrastructure (on-premises or hosted) for a single organization	Regulated industries, legacy workloads, strict compliance
Hybrid Cloud	Combination of public & private clouds with orchestration between them	Bursting to public cloud, disaster recovery, phased migration
Multi-Cloud	Use of two or more public cloud providers simultaneously (not necessarily connected)	Avoid vendor lock-in, leverage best-of-breed services, geographic redundancy

4. Core Cloud Architecture Components

1. Virtualization Layer

- Hypervisors (e.g., KVM, VMware ESXi, Hyper-V) abstract physical hardware.
- Enables multi-tenant isolation and dynamic provisioning.

2. Compute

- Virtual machines (VMs) or containers (Docker, Kubernetes).
- Autoscaling groups adjust capacity automatically.

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3. Storage

- **Object storage** (e.g., Amazon S3) – unstructured data, high durability.
- **Block storage** (e.g., Azure Disk) – low?latency volumes for VMs.
- **File storage** (e.g.,