22AIE305

22AIE305: CLOUD COMPUTING

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Learning Objectives

- Understand cloud computing.
- Distinguish between public, private and hybrid clouds.
- Demonstrate the functionalities of cloud computing.
- Apply cloud native application development for containerization and container orchestration.
- Analyze different types of cloud services – Delivery models, Deployment models.
- Implement different solution approaches in Cloud – containers in public cloud, setting up private cloud and convert monolithic applications to containers.

Introduction

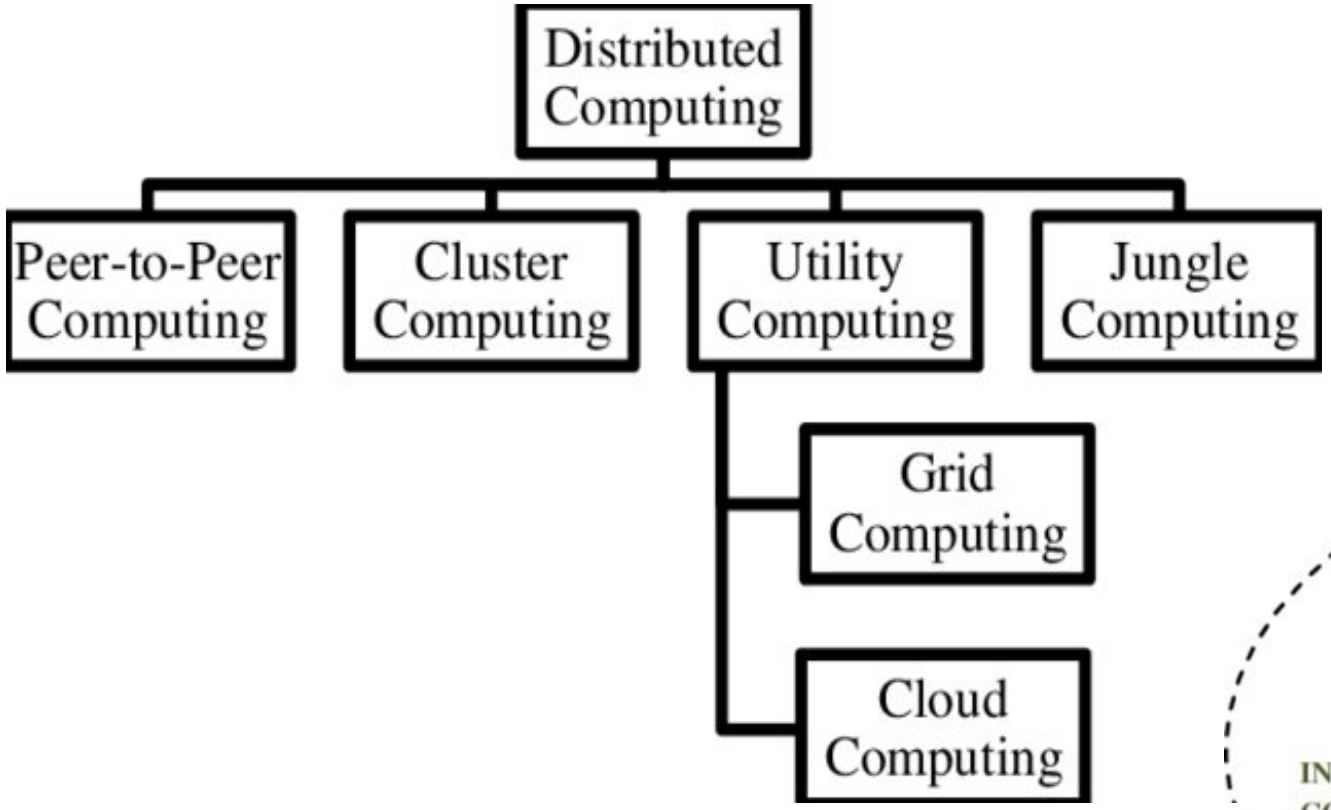
- Ever wondered how millions of people are able to watch thousands of movies on Netflix instantaneously?
- How searching though billions of documents as done by Google happens in less than a second?
- How you can backup your computer remotely?
- How multiple people work on shared document in Google Docs?

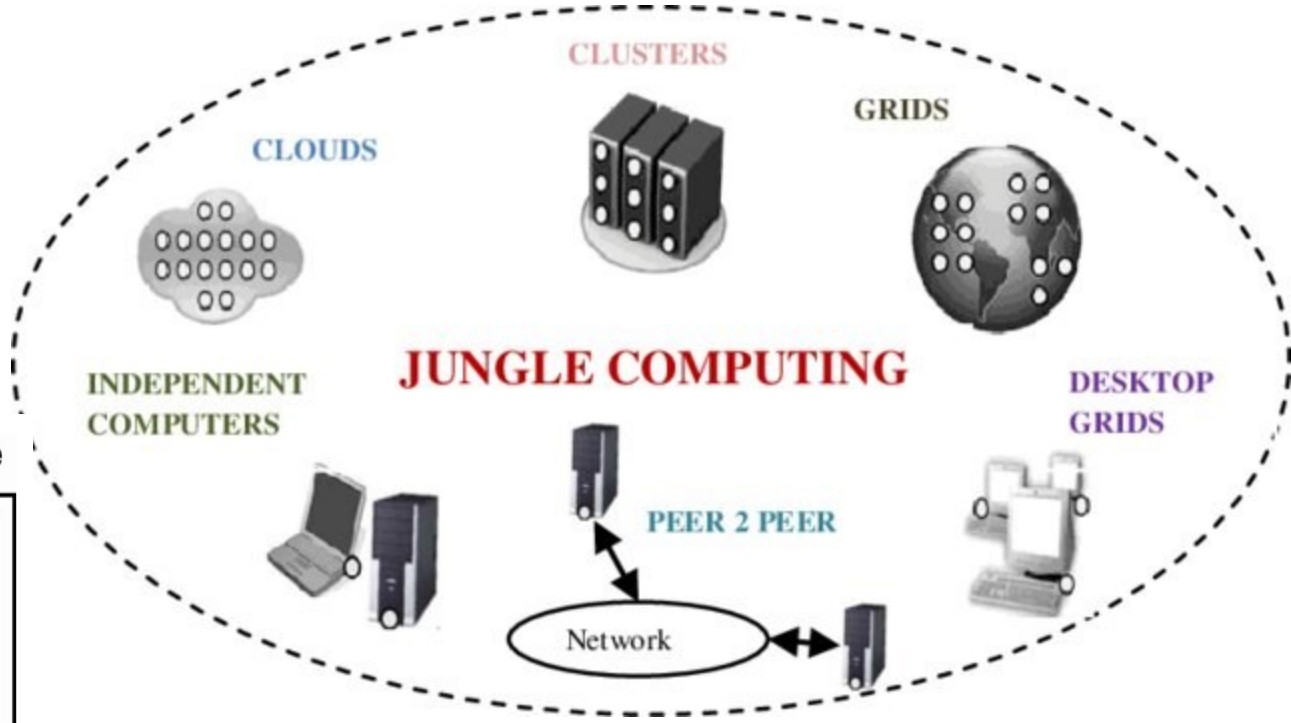
What is Cloud Computing?

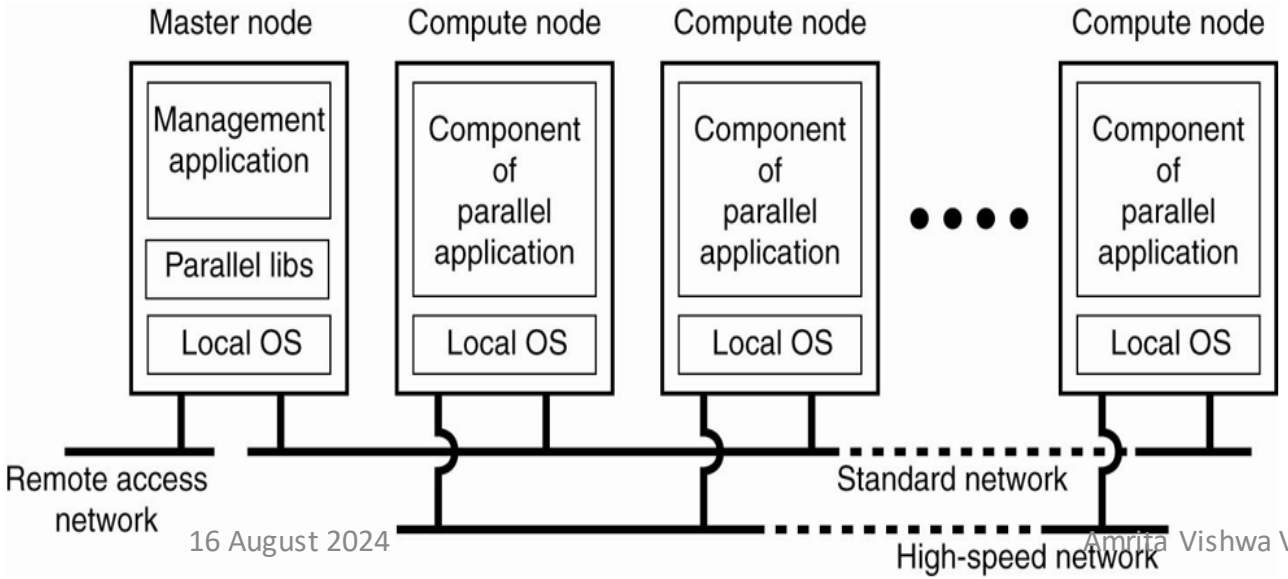
- IT as a service is known as Cloud Computing. In the past IT meant computers, infrastructure, computer scientists, electrical power, cooling, repair, etc.

- ***"Cloud computing** is an IT paradigm that enables ubiquitous access to shared pools of configurable system resources and higher-level services that can be rapidly provisioned with minimal management effort, often over the Internet. Cloud computing relies on sharing of resources to achieve coherence and economies of scale, similar to a public utility."* https://en.wikipedia.org/wiki/Cloud_computing

- *"Simply put, cloud computing is the delivery of computing services – servers, storage, databases, networking, software, analytics and more – over the Internet ("the cloud"). Companies offering these computing services are called cloud providers and typically charge for cloud computing services based on usage, similar to how you're billed for gas or electricity at home."* *https://azure.microsoft.com/en-gb/overview/what-is-cloud-computing/*


Distributed Computing
Peer-to-Peer Computing
Cluster Computing
Utility Computing
Jungle Computing
Grid Computing
Cloud Computing

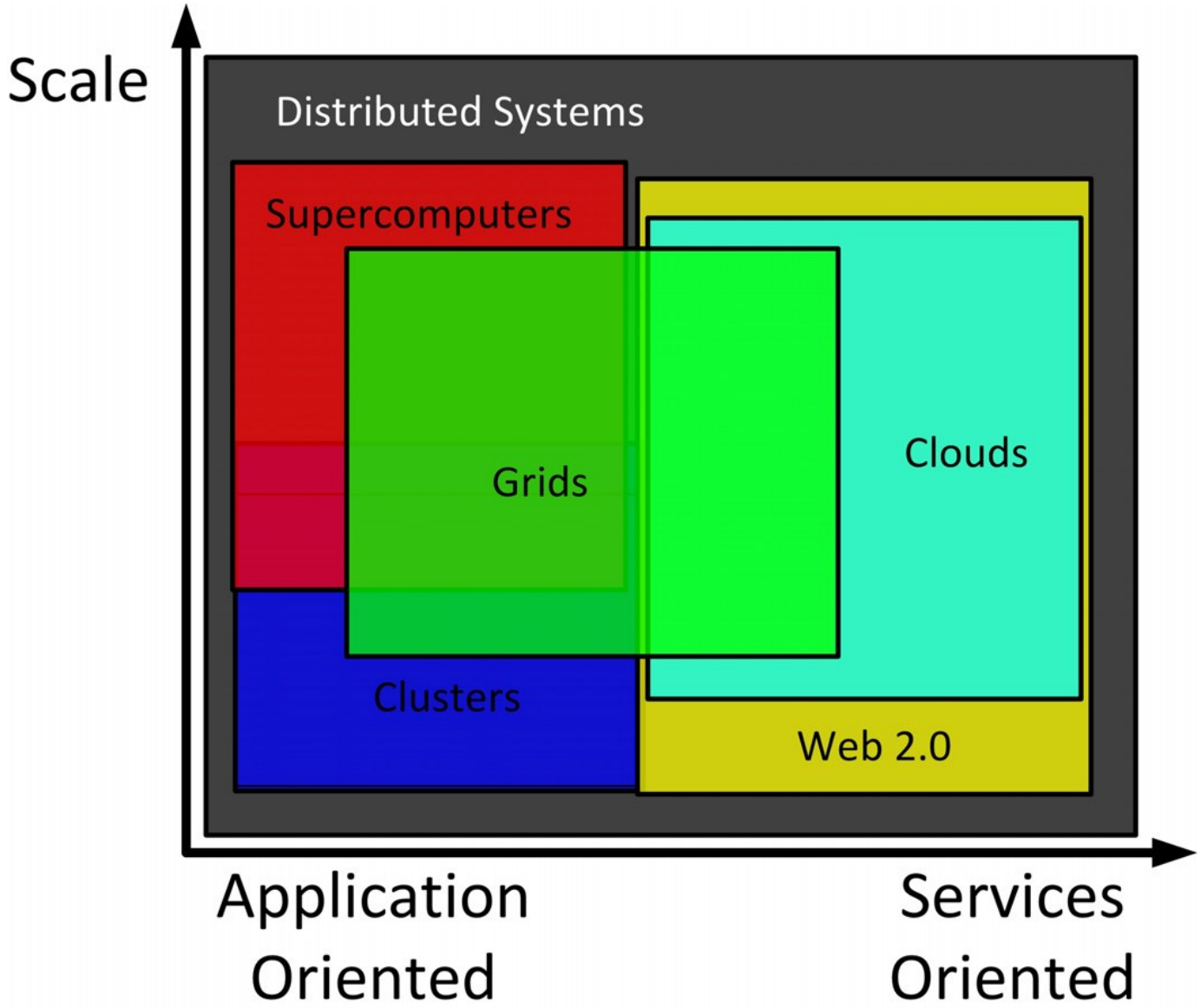

CLUSTERS
GRIDS
CLOUDS
INDEPENDENT COMPUTERS
JUNGLE COMPUTING
DESKTOP GRIDS
PEER 2 PEER
Network


Master node
Compute node
Compute node
Compute node
Management application
Parallel libs
Local OS
Component of parallel application
Local OS
Component of parallel application
Local OS
Component of parallel application
Local OS
Remote access network
Standard network
High-speed network

Cloud: Some key points

- Differences related to traditional distributed paradigms:
  - Massively scalable
  - Can be encapsulated as an abstract entity that delivers different levels of service
  - Driven by economies of scale
  - Services can be dynamically configured (via virtualization or other approaches) and delivered on demand

Cloud: Relation with other paradigms

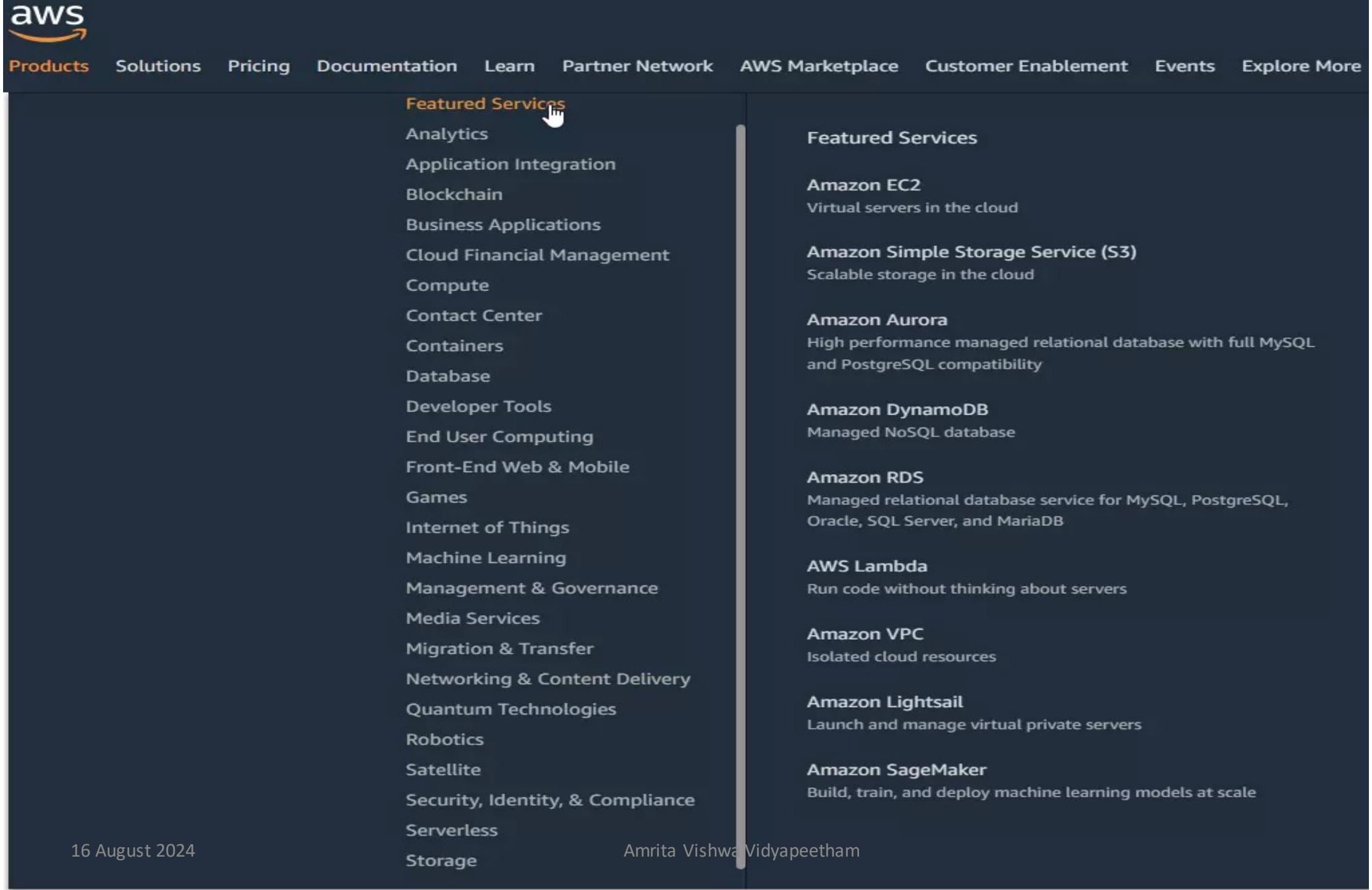


Popular Cloud-Platforms

- **Amazon Web Services (AWS)**: Best for **Public Cloud**
- **Microsoft Azure**: Best for **Developer Solutions**
- **Salesforce**: Best for **CRM Solutions**
- **VMWare**: Best for **Multi-Cloud Services**
- **Alibaba Cloud**: Best for **Elastic Computing**
- **Oracle Cloud**: Best for **Data Management**
- **Rackspace**: Best for **Cloud Optimization**
- **Digital Ocean**: Best for **Web Applications**
- **ServiceNow**: Best for **Enterprise Automation**
- **NetApp**: Best for **Data Intelligence**
- **Google Cloud**: Best for **Cloud Computing**
- **CloudSigma**: Best for **Cloud Hosting**
- **IBM Cloud**: Best for **Integrated Cloud Experience**
- **Cisco Cloud Solutions**: Best for **Hybrid Cloud Strategy**
- **RedHat Hybrid Cloud**: Best for **Edge Architecture**
- **Tencent Cloud** Best for **Cheap development**
- **Manjrasoft Aneka** (http://www.manjrasoft.com/manjrasoft_downloads.html)

AWS

- Launched in 2006, AWS is the best cloud service provider **leading in the market**. It becomes a major player in AI, database, machine learning, 5G cloud, multi-cloud and serverless deployments. AWS operates in **20 geographical regions** across the world.
- AWS offers **175 fully-featured services** to meet any kind of business requirements. These services are database storage, computing power, networking and many more
- You can virtually host any application, including networks like firewall, DNS, Load balancing, or even you can have your virtual private cloud.
- AWS applications are scalable, flexible, reliable, secure and trustworthy.
- Easy sign-up and fast deployment. The best thing is there is no upfront cost and you pay for what you use.
- It also offers a FREE tier for some of their popular services.

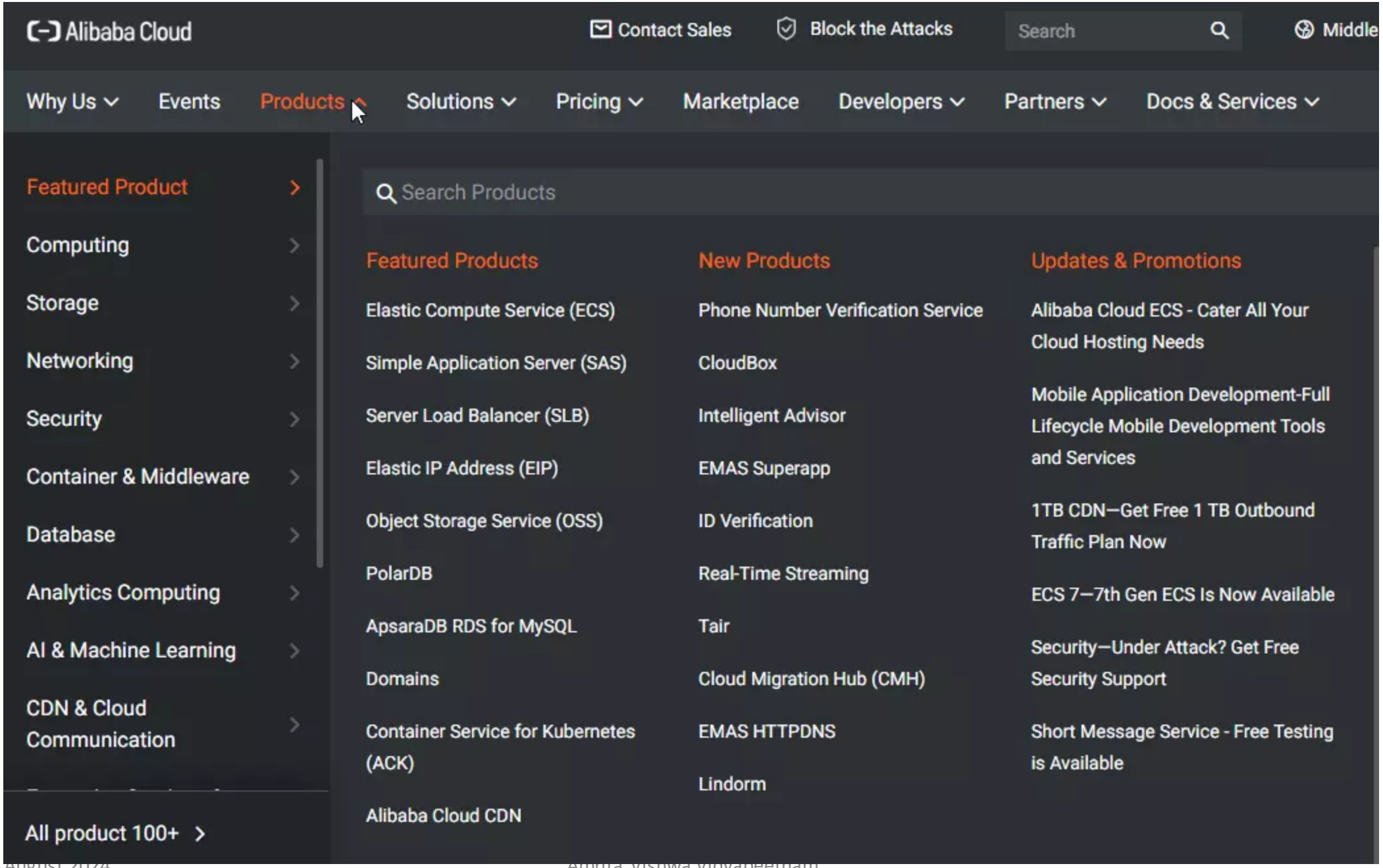

aws
Products
Solutions
Pricing
Documentation
Learn
Partner Network
AWS Marketplace
Customer Enablement
Events
Explore More
Featured Services
Analytics
Application Integration
Blockchain
Business Applications
Cloud Financial Management
Compute
Contact Center
Containers
Database
Developer Tools
End User Computing
Front-End Web & Mobile
Games
Internet of Things
Machine Learning
Management & Governance
Media Services
Migration & Transfer
Networking & Content Delivery
Quantum Technologies
Robotics
Satellite
Security, Identity, & Compliance
Serverless
Storage
Featured Services
Amazon EC2
Virtual servers in the cloud
Amazon Simple Storage Service (S3)
Scalable storage in the cloud
Amazon Aurora
High performance managed relational database with full MySQL and PostgreSQL compatibility
Amazon DynamoDB
Managed NoSQL database
Amazon RDS
Managed relational database service for MySQL, PostgreSQL, Oracle, SQL Server, and MariaDB
AWS Lambda
Run code without thinking about servers
Amazon VPC
Isolated cloud resources
Amazon Lightsail
Launch and manage virtual private servers
Amazon SageMaker
Build, train, and deploy machine learning models at scale

MS Azure (https://azure.microsoft.com)

- The Azure cloud delivers over 200 cloud services in the form of Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), as well as Edge and Server-less computing.
- Azure was first announced two years after AWS launched in 2006, but launched in 2010.
- It has since gained market share to 23% from AWS by appealing to enterprises, hybrid cloud embracers, and companies that mainly use Microsoft products, including Office 365.

Google Cloud (https://cloud.google.com)

- The Google Cloud Platform offers similar services to Azure and AWS, although it has carved a niche for itself through innovations across Artificial Intelligence (AI), Machine Learning (ML), Data Analytics, and Kubernetes, the popular container management platform.
- GCP is also popular with smaller companies who routinely use Alphabet's services such as Google Workstation (Docs, Spreadsheets, Gmail, etc), Google Drive, YouTube, and Google Console.


Alibaba Cloud
Contact Sales
Block the Attacks
Search
Middle
Why Us
Events
Products
Solutions
Pricing
Marketplace
Developers
Partners
Docs & Services
Featured Product
Computing
Storage
Networking
Security
Container & Middleware
Database
Analytics Computing
AI & Machine Learning
CDN & Cloud Communication
All product 100+
Search Products
Featured Products
Elastic Compute Service (ECS)
Simple Application Server (SAS)
Server Load Balancer (SLB)
Elastic IP Address (EIP)
Object Storage Service (OSS)
PolarDB
ApsaraDB RDS for MySQL
Domains
Container Service for Kubernetes (ACK)
Alibaba Cloud CDN
New Products
Phone Number Verification Service
CloudBox
Intelligent Advisor
EMAS Superapp
ID Verification
Real-Time Streaming
Tair
Cloud Migration Hub (CMH)
EMAS HTTPDNS
Lindorm
Updates & Promotions
Alibaba Cloud ECS - Cater All Your Cloud Hosting Needs
Mobile Application Development-Full Lifecycle Mobile Development Tools and Services
1TB CDN—Get Free 1 TB Outbound Traffic Plan Now
ECS 7—7th Gen ECS Is Now Available
Security—Under Attack? Get Free Security Support
Short Message Service - Free Testing is Available

Explore IBM Cloud products

A full stack cloud platform with over 170 products and services covering data, containers, AI, IoT, and blockchain.

Use IBM Cloud Satellite to take Cloud anywhere: on premises, multicloud and to the Edge.

IBM Cloud Satellite


AI / machine learning


Analytics


Automation


Blockchain


Compute


Containers


Databases


Developer tools


Integration


Internet of things


Logging and monitoring


Networking


Quantum


Security


Storage

DigitalOcean Products Solutions Marketplace Community Pricing Log in

FEATURED PRODUCTS

Droplets
Scalable virtual machines

Kubernetes
Managed Kubernetes clusters

Cloudways
Managed cloud hosting

App Platform
Get apps to market faster

Databases
Worry-free setup & maintenance

Spaces
Simple object storage

COMPUTE

- Droplets
- Kubernetes
- App Platform
- Functions

CLOUD WEBSITE HOSTING

- Cloudways

STORAGE

- Spaces Object Storage
- Volumes Block Storage

NETWORKING

- Virtual Private Cloud (VPC)
- Cloud Firewalls
- Load Balancers
- DNS

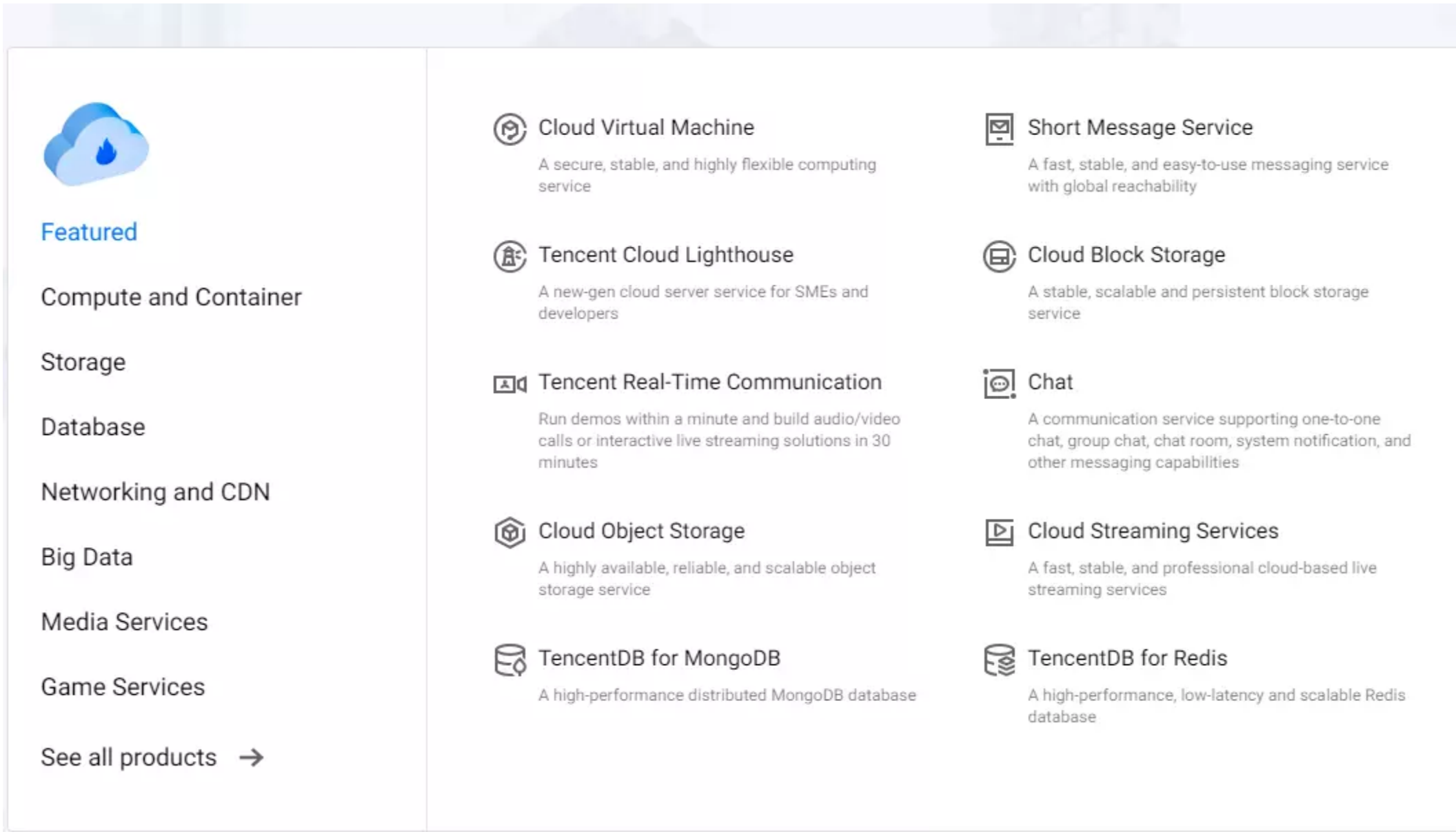
MANAGED DATABASES

- MongoDB
- MySQL
- PostgreSQL
- Redis™

DEVELOPER TOOLS

- API
- CLI
- Support Plans
- Monitoring
- Uptime
- SnapShooter

TenCent Cloud



Aneka Software for Download

Aneka Software (free evaluation version) Latest Release.

Aneka 5.0 (also known as Aneka 5G) Cloud Application Platform Software

- Aneka 5G Release Notes
- Aneka 5.0 Software (Free Evaluation Version) Direct Download
- Aneka 5.0 Installation Guide
- Another Installation Guide in Brief
- Video on Installing Aneka Master
- Video on Installing Aneka Worker
- Refer to Blog for Aneka Cloud for latest user information.

NOTE: This evaluation version supports limited features with 1 master and 2 workers.. Those interested in long-term license with all features and support (including installation and training), please contact Manjrasoft (for pricing details).

A Book for Teaching Cloud Computing with Aneka

Check out Mastering Cloud Computing published by McGraw Hill, China Machine Press, and Elsevier/Morgan Kaufmann for Indian, Chinese and international markets respectively. The book has many example programs of Cloud Application Programming. Some useful documents and examples are noted below:

Aneka User Documents

- Task Model Programming Tutorial
- Thread Model Programming Tutorial
- Map Reduce Programming Tutorial
- Aneka Task Submission Web Service
- Aneka Dynamic Provisioning

Programming Models - Example Code

- README.txt
- Thread and Task Model Examples Code
- Parallel Programming with Aneka Thread Model
- MapReduce Model and Other Examples

Cloud Certifications

- **Google Certified Professional (GCP)** Cloud Architect, Foundational certification, Associate certification, Professional certification
- **Amazon Web Services (AWS) Solutions Architect –** (Foundational, Professional, Associate, Specialty) aws.amazon.com/certification
- **Microsoft Certified: Azure Fundamentals**
- **Certified Cloud Security Professional (CCSP) (www.isc2.org)**
- **Cloud Security Alliance: Certificate of Cloud Security Knowledge (CCSK) https://ccsk.cloudsecurityalliance.org**

Top Nine Leading Quantum Computing Companies & Their Focus

Name	Ticker Symbol	Key Areas of Quantum Research
IBM	IBM	Encompasses the theoretical underpinnings, algorithmic development, hardware improvements, and software tools needed to build a robust and practical quantum computing ecosystem.
Google (Alphabet)	GOOGL	The goal is to develop a large-scale computer that can perform complex, error-corrected computations.
Amazon	AMZN	Aims to democratize access to quantum computing to help researchers, developers, and businesses explore and experiment with quantum computing.
Microsoft	MSFT	The focus includes developing a topological qubit that aims to deliver greater stability and reduce error rates better than other qubit types.
Intel	INTC	Focused on silicon spin qubits. Aims to develop scalable quantum processors and quantum computing technologies that can reliably operate at larger scales.
D-Wave Quantum	QBTS	This approach involves using quantum annealing, a specific type of quantum computation, to address optimization and sampling problems that apply to various industries.
IonQ	IONQ	Leverages the unique properties of ions trapped by electromagnetic fields to create highly stable and coherent qubits.
Quantinuum	Private	Focuses on quantum error correction, quantum algorithms, and scalable quantum architectures.
Rigetti Computing	RGTI	Specializes in quantum integrated circuits. Developing quantum computers based on superconducting qubits.