

Investigates Regarding Cloud Vendors Products and Services

*¹ Mrs. Nithya R., *² Mr. Viswanathan R.

*¹M. Phil Research Scholar, Department of Computer Science, Muthurangam Govt Arts College (Autonomous), Vellore, Tamil Nadu, India.

*²Assistant Professor, Department of Computer Science, Muthurangam Govt Arts College (Autonomous), Vellore, Tamil Nadu, India

Abstract: The computational world is becoming very large and complex. Cloud computing has emerged as a popular computing model to support processing large volumetric data using clusters of commodity computers. In today's world, cloud computing has generated a lot of interest and competition in the industry. With the emergence of new cloud providers, identifying one that best suits the business needs of an enterprise is a challenging and difficult task. For to a novice or user with little knowledge about cloud computing, it is still very hard to make a reasonable choice. In this paper begins with a glimpse of cloud computing. The main aim of this paper is to focus on the various cloud vendor products and services comparison for decision making process of optimal service selection and to provide a brief comparative analysis of various cloud services. This paper also presents a table of comparison of some same products and services for some renowned cloud service providers, some pros, cons and features. Finally compare with security algorithms for various cloud vendors.

Keywords: Cloud Service Providers, Security Algorithms, Cloud Providers Comparisons, Cloud Products, Cloud Services.

I. INTRODUCTION

Cloud computing is a completely new technique to put forward from industry circle, it is the development of parallel computing, distributed computing and grid computing, and is the combination and evolution of virtualization, utility computing [25]. Cloud computing is the outsourcing of IT communications by the use of the Internet and maintaining own hardware and software environment. Cloud computing facilitates computing assets on demand by the use of a service provider. It is there whenever you need it, as much as you need, and you pay as you go and only for what you use. The vendors provide services according to various service models for e.g. IaaS, PaaS, SaaS. Infrastructure as a Service (IaaS): This service provides the infrastructure. Like, Servers, Operating Systems, Virtual Machines, Networks, and Storage on rent basis. Eg: Amazon Web Service, Microsoft Azure. Platform as a Service (PaaS): This service is used in developing, testing and maintaining of software. PaaS is same as IaaS but also provides additional tools like DBMS and BI service. Eg: Apprenda, Red Hat OpenShift. Software as a Service (SaaS): This service makes the users connect to the applications through the Internet on a subscription basis. Eg: Google Applications, Salesforce. This paper discusses various cloud Products, Services, Service providers and Security Algorithms available in cloud computing. The below figure (Fig 1) shows cloud computing structure.

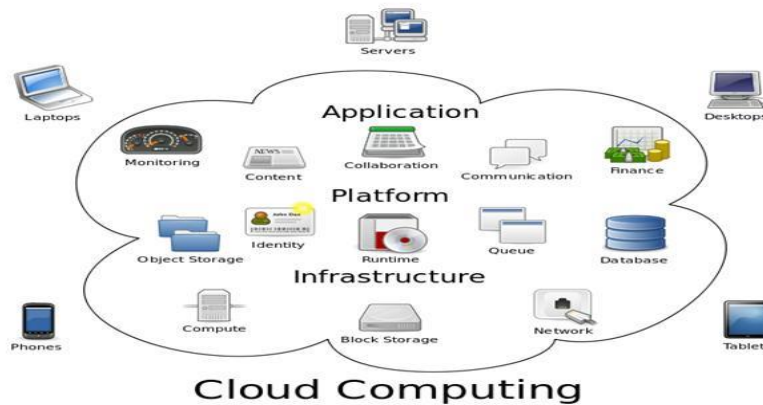


Fig 1: Cloud Computing

TABLE 1: Cloud Vendors Services

Services	Managed by You	Managed by Vendors
IaaS	Hosted applications, Development and Management tools Operating system	Servers and storage, Networking resources, Data center
SaaS	-	Hosted applications, Development and management tools , Operating system Servers and storage, Networking resources, Data center
PaaS	Hosted Applications	Development and management tools, Operating system, Servers and storage, Networking resources, Data center

TABLE 2: Services With Functions

Functions	IaaS	PaaS	SaaS
Provided resources	Virtual machines, Servers , Data storage, Load balancers Network components	Execution runtime Databases, Web Servers, Development tools	CRM Virtual desktop Email Cloud-based storage Productivity tools
Client's sphere of control	App configuration, Application Server configuration, Operating system, Security, Network	App configuration Application Server configuration	App configuration
People who deal with the model directly	IT administrators	Developers QA Operational staff	Regular customers Business people

II. RELATED PAPERS

This paper describes cloud computing, which is a computing environment for the next generation of the Internet. This paper discusses clouds, cloud storage and service providers on the basis of different parameters such as pricing maximum storage limit, security of data etc. This paper also discusses the advantages and disadvantages of cloud computing [23]. In this paper make comparison between the three giants of Cloud-Computing, the major takeaways are as, Foundation, Availability Zones, Services, Usability, Pricing, Market Growth. The comparisons between the three dominating Cloud-Computing giants infer that while choosing the Cloud Service Provider, one needs to focus on the type and the usability of the business and not choose the best out of the three. Choosing the best CSPs won't really make a difference to a company's Cloud-native development instead choosing the right one as per needs will enhance their credibility in the market [24]. Similarly Comparison of Several Cloud Computing Platforms is proposed by Junjie Peng, Xuejun Zhang, Zhou Lei, Bofeng Zhang, Wu Zhang *is told that*, this is a favorable situation to study and application of cloud computing related techniques. Though interesting, there are also some problems for so many platforms. For to a novice or

user with little knowledge about cloud computing, it is still very hard to make a reasonable choice. What differences are there for different cloud computing platforms and what characteristics and advantages each has? To answer these problems, the characteristics, architectures and applications of several popular cloud computing platforms are analyzed and discussed in detail. From the comparison of these platforms, users can better understand the different cloud platforms and more reasonably choose what they want. It can provide self-help services without need any manual interactions with service providers. And all the resources on the cloud are transplant to the users, that is, users can dynamically lease physical or virtual resources and don't need to know the exact places of the resources existed. Besides, all the resources on cloud computing platform can be quickly and elastically deployed. Last but not least, as users can use the IT infrastructure with Pay-per-Use-On-Demand mode, this would be much benefit them and much save the cost to buy the physical resources that may be vacant [25].

III. AIM AND OBJECTIVES

The main aim of this paper is to focus on the various cloud vendor products and services comparison for decision making process of optimal service selection and to provide a brief comparative analysis of various cloud services. This comparison will help individuals and organizations make critical decisions on benefits, Products, Services, Security and Features of cloud technology before they move their business to this new environment. This paper also presents a table of comparison of some same products and services for some renowned cloud service providers, some pros, cons and features. finally compare with security algorithms for various cloud vendors.

IV. CLOUD COMPUTING PRODUTS AND SERVICES

TABLE 3: Cloud Service Providers with Algorithms

S.No	Service Providers	IaaS	PaaS	SaaS	Security Algorithm
1	Amazon AWS	√	√		AES_GCM
2	Digital Ocean	√	√		
3	Microsoft Azure	√	√	√	AES-256,Hash MD5 and SHA
4	RackSpace	√	√	√	AES-256
5	Google Cloud	√	√	√	AES-256(or)128
6	HP-Enterprise	√		√	
7	IBM-Cloud	√	√	√	RC4-128,AES-128,256
8	Green Cloud	√			Heuristic Algorithm
9	SalesForce	√	√		AES,RSA
10	Adobe Creative Cloud			√	SHA-256
11	Slack			√	
12	Zendesk			√	AES-256,SHA1
13	Oracle	√	√	√	AES-128
14	Cisco	√		√	128-Bit Symmetric Key (or) 2048 Bit Asymmetric Key
15	SAP HANA	√	√		
16	Cloud Stack	√			
17	Word Day			√	AES-256
18	Vm-Ware	√			
19	Engine Yard	√	√		
20	Red Hat		√	√	
21	Drop box			√	RSA-4096,AES-256
22	Kamatera			√	
23	Massive Grid	√	√		
24	Alibaba Cloud	√	√	√	
25	Verizon Cloud	√			
26	Navisite	√			
27	Phoenix NAP			√	
28	AppAgile		√		
29	AppFog		√		
30	Apprenda		√		

TABLE 4: Cloud Vendors Products and Services

Providers	Products and Services
Google Cloud	<p>AI and Machine Learning : AI Building Blocks, AI building blocks, Auto ML ,Vision AI, Video AI ,Cloud Natural Language, Cloud Translation, Text-to-Speech ,Speech-to-Text, Dialog flow, Auto ML Tables (beta) , Cloud Inference API (alpha),AI Platform and Accelerators, AI Platform, AI Platform Deep Learning VM Image, AI Platform Notebooks (beta),AI Platform Deep Learning Containers (beta),AI Hub (beta),Cloud GPUs, Cloud TPU</p> <p>API Management : Apigee API Platform.API Analytics.API Monetization. Apigee Hybrid, Apigee Sense, Cloud Endpoints, Developer Portal, Apigee Healthcare APIx, Apigee Open Banking APIx,Cloud Healthcare API.</p> <p>Compute : Compute Engine, App Engine, Cloud GPUs, Migrate for Compute Engine, Preemptible VMs Shielded VMs, Sole-tenant nodes)</p> <p>Containers : Google Kubernetes Engine (GKE),Container Registry, Container Security, Container Options, Cloud Build, Deep Learning Containers Kubernetes applications on GCP Marketplace, Batch (beta)</p> <p>Data Analytics : Big Query, Cloud Composer, Cloud Data flow, Cloud Data Fusion, Cloud Data prep, Cloud Data proc, Google Data Studio*,Cloud Pub/Sub, Data Catalog, Cloud Life Sciences (beta),Google Marketing Platform.</p> <p>Databases : Cloud Big table (No SQL wide-column database service.),Cloud Fire store (NoSQL document database for mobile and web app data.),Cloud Memory store(Fully managed in-memory data store service.),Cloud Spanner(Mission-critical, scalable, relational database service.),Cloud SQL(My SQL, Postage SQL, and SQL Server database services.),Firebase Real time Database(Store and sync data in real time.),Developer Tools ,Cloud SDK(CLI for GCP products and services.),Container Registry(Store, manage, and secure your Docker container images.),Cloud Code(Everything you need to write, debug, and deploy your Kubernetes applications.),Cloud Build(Continuously build, test, and deploy.),Cloud Source Repositories(A single place for your team to store, manage, and track code.),Cloud Scheduler(Fully managed cron job service.),Cloud Tasks(Asynchronous task execution.),Cloud Code for Interlay (Debug production cloud apps inside Interlay.),Cloud Tools for Power Shell(Full cloud control from Windows Power Shell.),Cloud Tools for Visual Studio(Deploy Visual Studio applications to GCP.),Cloud Tools for Eclipse(Deploy Eclipse projects to GCP.), Gradle App Engine Plugin(Use Gradle for your App Engine projects.), Maven App Engine Plug in(Use Maven for your App Engine projects.), Cloud Test Lab(On-demand testing infrastructure for Android apps.), Firebase Crashlytics(Prioritize and fix stability issues faster.), Tekton (Kubernetes-native CI/CD building blocks.)</p> <p>Healthcare and Life Sciences : Apogee healthcare APIx (Accelerate building new FHIR API-based digital services.),Cloud Life Sciences (beta)(Process, analyze, and annotate genomics and biomedical data at scale using containerized workflows.),Cloud Healthcare API(Secure APIs powering actionable healthcare insights.),Hybrid and Multi-cloud ,Anthos(Modernize existing apps and build new apps rapidly in hybrid and multi-cloud environments.),Anthos deployed on VMware(Modernize existing apps and build new apps on your VMware environments.),Anthos GKE(Reliable, efficient, and secured way to run containerized apps across hybrid and multi-cloud environments.),Anthos Confer Management(Automate policy and security at scale for your hybrid Kubernetes deployments.),Anthos Service Mesh(The fully managed service mesh for your complex micro services architectures.),Cloud Run for Anthos(Easily leverage the benefits of Kubernetes and serverless together.),GCP Marketplace for Anthos(Containerized apps featuring prebuilt deployment templates and consolidated billing.),Migrate for Anthos(Migrate VMs from on-premises or other clouds directly into containers in GKE.), Stack driver(Monitoring and management for services, containers, applications, and infrastructure.),Cloud Build(Continuously build, test, and deploy.),Traffic Director(Enterprise-ready traffic management for open service mesh.),Apigee API Management(Develop, secure, deploy, and monitor your APIs everywhere.)</p> <p>Internet of Things (IoT): Cloud IoT Core(Secure device connection and management.), Edge TPU(Purpose-built ASIC designed to run inference at the edge.)</p> <p>Management Tools: Stack driver(Monitoring and management for services, containers, applications, and infrastructure.), Monitoring(Monitoring for applications on GCP and AWS.), Service Monitoring (alpha)(Stackdriver Service monitoring for Istio and Google App Engine services.), Logging(Logging for applications on GCP and AWS.), Error Reporting(Identifies and helps you understand application errors.), Trace(Find performance bottlenecks in production.), Debugger(Investigate code behavior in production.), Profiler(Low-impact CPU and heap profiling to reduce latency.), Private Catalog (beta)(Control and make internal enterprise solutions easily discoverable.), Transparent Service Level Indicators(Monitor Google Cloud services and their effects on your workloads.), Cloud Deployment Manager(Manage cloud resources</p>

<p>Google Cloud</p>	<p>with simple templates.), Cloud Console(GCP's integrated management console.), Cloud Shell(Command-line management from any browser.), Cloud Mobile App(Manage GCP services from your mobile device.), Cost management(Tools for monitoring, controlling, and optimizing your costs.), Cloud APIs(Programmatic interfaces for all GCP services.), Orbitera White-Label Marketplace(Enable customers to find and purchase your solutions.), Anthos Service Mesh (beta)(The fully managed service mesh for your complex microservices architectures.), Incident Response and Management (alpha)(Improve your incident median time to mitigation.)</p> <p>Media and Gaming: Game Servers (alpha)(Deliver seamless multiplayer gaming experiences to a global player base.), Zync Render(Render directly from your 3D modeling tools, quickly and cost efficiently.),Anvato(Stream live and on-demand video to any device.), OpenCue(An open source render manager for media content.)</p> <p>Networking : Cloud Armor(Protect your services against DoS and web attacks.),Cloud CDN(Content delivery on Google's global network.),Cloud DNS(Reliable, resilient, low-latency DNS serving.),Cloud Load Balancing(High-performance, scalable load balancing.),Cloud NAT(GCP-managed high-performance Network Address Translation.), Hybrid Connectivity(Connect your infrastructure to GCP on your terms, from anywhere.), Network Intelligence Center(A comprehensive network monitoring, verification, and optimization platform.), Network Service Tiers(Optimize your network for performance or cost.), Network Telemetry(In-depth network telemetry to keep your services secure.), Traffic Director(Enterprise-ready traffic management for open service mesh.), Virtual Private Cloud (VPC)(VPC networking for GCP resources.)</p> <p>Security and Identity : Security, Access Transparency(Get visibility over your cloud provider through near real-time logs.), Binary Authorization(Deploy only trusted containers on Kubernetes Engine.), Cloud Asset Inventory(View, monitor, and analyze Google Cloud and Anthos assets across projects and services.), Cloud Audit Logs(Gain visibility into who did what, when, and where for all user activity on GCP.), Cloud Data Loss Prevention(Discover and redact sensitive data.),Cloud HSM(Protect cryptographic keys with a fully managed hardware security module service.), Cloud Key Management Service(Manage encryption keys on GCP.), Cloud Security Command Center(Comprehensive security and data risk platform for GCP.), Cloud Security Scanner(Automatically scan your App Engine apps.), Event Threat Detection (beta)(Uncover security threats in GCP environments.), Shielded VMs(Hardened virtual machines on GCP.), VPC Service Controls(Protect sensitive data in GCP services using security perimeters.), Incident Response and Management (alpha)(Improve your incident median time to mitigation.), Backstory(Extract signals from your security telemetry to find threats instantly.)</p> <p>Server less Computing: Cloud Run(Run stateless containers on a fully managed environment or on Anthos.), App Engine(Serverless application platform for apps and backends.),Cloud Functions(Event-driven serverless compute platform.),Knative(Components to create modern, Kubernetes-native cloud-based software.)</p> <p>Storage : Cloud Storage(Object storage with global edge-caching.), Persistent Disk(Block storage for VM instances.), Cloud Storage for Firebase(Store and serve content with ease.), Cloud Filestore(High-performance file storage.), Drive Enterprise(Cloud-based content collaboration and storage.)</p> <table border="1"> <thead> <tr> <th>Other Products</th> <th>Featured products</th> </tr> </thead> <tbody> <tr> <td>Google Maps Platform</td> <td>Compute Engine</td> </tr> <tr> <td>G Suite</td> <td>Cloud Run</td> </tr> <tr> <td>Google Hardware</td> <td>Anthos</td> </tr> <tr> <td>Cloud Identity</td> <td>Vision AI</td> </tr> <tr> <td>Chrome Enterprise</td> <td>Cloud Storage</td> </tr> <tr> <td>Android Enterprise</td> <td>Cloud SQL</td> </tr> <tr> <td>Apigee</td> <td>BigQuery</td> </tr> <tr> <td>Firebase</td> <td>Security key enforcement</td> </tr> </tbody> </table>	Other Products	Featured products	Google Maps Platform	Compute Engine	G Suite	Cloud Run	Google Hardware	Anthos	Cloud Identity	Vision AI	Chrome Enterprise	Cloud Storage	Android Enterprise	Cloud SQL	Apigee	BigQuery	Firebase	Security key enforcement
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Android Enterprise	Cloud SQL																		
Apigee	BigQuery																		
Firebase	Security key enforcement																		
<p>Microsoft Azure</p>	<p>AI+ Machine Learning : Cognitive Services, Azure Bot Service, Machine Learning, Azure Data bricks, Azure Cognitive Search, Gather, store, process, analyses and visualize data of any variety, volume or velocity, Azure Synapse Analytics ,Azure Data bricks, HD Insight, Azure Data Lake Storage, Azure Analysis Services, Hubs.</p> <p>Block chain: Azure Block chain Service(Build, govern and expand consortium block chain networks) Azure Block chain Tokens(Easily define, create, and manage ledger-based tokens),Azure Block chain Workbench , Logic Apps, Azure Cosmos DB(Globally distributed, multi-model database for any scale)</p>																		

<p>Microsoft Azure</p>	<p>Compute: Access cloud compute , Virtual Machines(Provision Windows and Linux virtual machines in seconds),Virtual Machine Scale Sets, Azure Kuber netes Service (AKS), Azure Spring, Cloud App Service Azure Functions, Azure Dedicated Host, SQL Server on Virtual Machines.</p> <p>Containers: Azure Kuber netes Service (AKS), Container Instances, Service Fabric, Container Registry , Web App for Containers, Azure Functions, Azure Red Hat Open Shift.</p> <p>Databases: Azure Cosmos DB , Azure SQL Database , Azure Database for MySQL, Azure Database for PostgreSQL, Azure Database for MariaDB, SQL Server on Virtual Machines , Azure Database Migration Service, Azure Cache for Redis, SQL Server Stretch Database , Table Storage.</p> <p>Developer Tools: Build, manage and continuously deliver cloud applications, Visual Studio, Visual Studio Code, Visual Studio Online, Git Hub, Power Apps, SDKs, Developer tool integrations, HockeyApp , Azure Monitor.</p> <p>Internet of Things: Azure IoT Hub(Connect, monitor and manage billions of IoT assets), Azure IoT Edge, Azure IoT Central, Azure IoT solution accelerators, Azure Sphere, Azure Digital Twins , Azure Time Series Insights, Azure Maps, Azure Machine Learning.</p> <p>Networking : Virtual Network , Load Balancer, Application Gateway, VPN Gateway, Azure DNS , Content Delivery Network, Azure DDoS Protection, Traffic Manager, Azure ExpressRoute.</p> <p>Security: Azure Sentinel , Security Center , Key Vault , Application Gateway , Azure Information Protection, VPN Gateway, Azure Active Directory (AD), Protection, Azure Dedicated HSM, Manage hardware security modules , Azure Active Directory.</p> <p>Storage:Disk Storage, Azure Data Lake Storage, File Storage, Azure Data Explorer, Azure NetApp Files, Azure Backup, Blob Storage, Data Box, Archive Storage.</p> <table border="1"> <thead> <tr> <th>Other Products</th> <th>Featured Products</th> </tr> </thead> <tbody> <tr> <td>Hybrid</td> <td>Virtual Machines</td> </tr> <tr> <td>Identity</td> <td>Windows Virtual Desktop</td> </tr> <tr> <td>Integration</td> <td>Azure SQL Database</td> </tr> <tr> <td>Windows Virtual Desktop</td> <td>App Service</td> </tr> <tr> <td>Web</td> <td>Azure Cosmos DB</td> </tr> <tr> <td>Management and Governance</td> <td>PlayFab</td> </tr> <tr> <td>Media</td> <td>Azure Kubernetes Service (AKS)</td> </tr> <tr> <td>Migration</td> <td>Azure Functions</td> </tr> <tr> <td>Mixed Reality</td> <td>Cognitive Services</td> </tr> </tbody> </table>	Other Products	Featured Products	Hybrid	Virtual Machines	Identity	Windows Virtual Desktop	Integration	Azure SQL Database	Windows Virtual Desktop	App Service	Web	Azure Cosmos DB	Management and Governance	PlayFab	Media	Azure Kubernetes Service (AKS)	Migration	Azure Functions	Mixed Reality	Cognitive Services
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Mixed Reality	Cognitive Services																				
<p>Amazon Web Services</p>	<p>Analytics : Amazon Athena Query data in S3 using SQL , Amazon Cloud Search Managed search service , Amazon Elastic search Service Run and scale Elastic search clusters , Amazon EMR Hosted Hadoop framework , Amazon Kinesis Analyze real-time video and data streams , Amazon Managed Streaming for Apache Kafka Fully managed Apache Kafka service , Amazon Red shift Fast, simple, cost-effective data warehousing , Amazon Quick Sight Fast business analytics service , AWS Data Exchange Find, subscribe to, and use third-party data in the cloud , AWS Data Pipeline Orchestration service for periodic, data-driven workflows , AWS Glue Prepare and load data , AWS Lake Formation Build a secure data lake in days</p> <p>Application Integration: AWS Step Functions Coordination for distributed applications , Amazon Event Bridge Server less event bus for SaaS apps & AWS services , Amazon MQ Managed message broker for Active MQ , Amazon Simple Notification Service (SNS)Managed message topics for pub/sub , Amazon Simple Queue Service (SQS)Managed message queues , AWS App Sync Power your apps with the right data from many sources, at scale .</p> <p>AWS Cost Management : AWS Cost Explorer Analyze your AWS cost and usage , AWS Budgets Set custom cost and usage budgets , AWS Cost and Usage Report Access comprehensive cost and usage information , Reserved Instance Reporting Dive deeper into your reserved instances (RIs) ,Savings Plans Save up to 72% on compute usage with flexible pricing</p> <p>Block chain: Amazon Managed Block chain Create and manage scalable block chain networks ,Amazon Quantum Ledger Database (QLDB)Fully managed ledger database</p> <p>Business Applications : Alexa for Business Empower your organization with Alexa ,Amazon Chime Frustration-free meetings, video calls, and chat ,Amazon Work Docs Secure enterprise document storage and sharing ,Amazon Work Mail Secure email and calendaring</p> <p>Compute : Amazon EC2Virtual servers in the cloud , Amazon EC2 Auto Scaling Scale compute capacity to meet demand , Amazon EC2 Container Registry Store and retrieve docker images , Amazon Elastic Container Service Run and manage docker containers , Amazon Elastic Kuber netes Service Run managed Kuber netes on AWS , Amazon Light sail Launch and manage virtual private servers , AWS Batch Run batch jobs at any scale , AWS Elastic Beans talk Run and manage web apps , AWS Fargate Run containers</p>																				

Amazon Web Services	<p>without managing servers or clusters , AWS Lambda Run code without thinking about servers , AWS Outposts Run AWS infrastructure on-premises , AWS Serverless Application Repository Discover, deploy, and publish serverless applications , VMware Cloud on AWS Build a hybrid cloud without custom hardware</p> <p>Database : Amazon Aurora High performance managed relational database , Amazon Document DB (with Mongo DB compatibility) Fully managed document database , Amazon DynamoDB Managed NoSQL database , Amazon ElastiCache In-memory caching service , Amazon Neptune Fully managed graph database service , Amazon Quantum Ledger Database (QLDB) Fully managed ledger database , Amazon RDS Managed relational database service for MySQL, PostgreSQL, Oracle, SQL Server, and MariaDB , Amazon RDS on VMware Automate on-premises database management , Amazon Redshift Fast, simple, cost-effective data warehousing , Amazon TimeStream Fully managed time series database , AWS Database Migration Service Migrate databases with minimal downtime .</p> <p>Developer Tools: Amazon Corretto Production-ready distribution of OpenJDK , AWS Cloud Development Kit (CDK) Model cloud infrastructure using code , AWS Cloud9 Write, run, and debug code on a cloud IDE , AWS CodeBuild Build and test code , AWS CodeCommit Store code in private Git repositories , AWS CodeDeploy Automate code deployments , AWS CodePipeline Release software using continuous delivery , AWS CodeStar Develop and deploy AWS applications , AWS Command Line Interface Unified tool to manage AWS services , AWS Device Farm Test Android, iOS, and web apps on real devices in the AWS cloud , AWS Tools and SDKs Tools and SDKs for AWS , AWS X-Ray Analyze and debug your applications</p> <p>Internet of Things : Amazon FreeRTOS IoT operating system for microcontrollers , AWS IoT 1-Click One-click creation of an AWS Lambda trigger , AWS IoT Analytics Analytics for IoT devices , AWS IoT Button Cloud programmable dash button , AWS IoT Core Connect devices to the cloud , AWS IoT Device Defender Security management for IoT devices , AWS IoT Device Management Onboard, organize, and remotely manage IoT devices , AWS IoT Events IoT event detection and response , AWS IoT Greengrass Local compute, messaging, and sync for devices , AWS IoT SiteWise IoT data collector and interpreter , AWS IoT Things Graph Easily connect devices and web services, AWS Partner Device Catalog Curated catalog of AWS-compatible IoT hardware</p> <p>Machine Learning : Amazon SageMaker Build, train, and deploy machine learning models at scale , Amazon Comprehend Discover insights and relationships in text , Amazon Elastic Inference Deep learning inference acceleration , Amazon Forecast Increase forecast accuracy using machine learning , Amazon Lex Build voice and text chatbots , Amazon Personalize Build real-time recommendations into your applications , Amazon Polly Turn text into life-like speech , Amazon Rekognition Analyze image and video , Amazon SageMaker Ground Truth Build accurate ML training datasets , Amazon Textract Extract text and data from documents , Amazon Translate Natural and fluent language translation , Amazon Transcribe Automatic speech recognition , AWS Deep Learning AMIs Deep learning on Amazon EC2 , AWS Deep Learning Containers Docker images for deep learning , AWS DeepLens Deep learning enabled video camera , AWS DeepRacer Autonomous 1/18th scale race car, driven by ML , AWS Inferentia Machine learning inference chip , Apache MXNet on AWS Scalable, open-source deep learning framework , TensorFlow on AWS Open-source machine intelligence library .</p> <p>Management & Governance : Amazon CloudWatch Monitor resources and applications , AWS AutoScaling Scale multiple resources to meet demand , AWS Chatbot ChatOps for AWS , AWS CloudFormation Create and manage resources with templates , AWS CloudTrail Track user activity and API usage , AWS Command Line Interface Unified tool to manage AWS services , AWS Config Track resources inventory and changes , AWS Control Tower Set up and govern a secure, compliant multi-account environment , AWS Console Mobile Application Access resources on the go , AWS License Manager Track, manage, and control licenses , AWS Management Console Web-based user interface , AWS Managed Services Infrastructure operations management for AWS , AWS OpsWorks Automate operations with Chef and Puppet , AWS Organizations Central governance and management across AWS accounts , AWS Personal Health Dashboard Personalized view of AWS service health , AWS Service Catalog Create and use standardized products , AWS Systems Manager Gain operational insights and take action , AWS Trusted Advisor Optimize performance and security , AWS Well-Architected Tool Review and improve your workloads</p> <p>Mobile : AWS Amplify Build and deploy mobile and web applications , Amazon API Gateway Build, deploy, and manage APIs , Amazon Pinpoint Personalized user engagement across channels , AWS AppSync Power your apps with the right data from many sources, at scale , AWS Device Farm Test Android, iOS, and web apps on real devices in the AWS cloud</p> <p>Networking & Content Delivery : Amazon VPC Isolated cloud resources , Amazon API Gateway Build, deploy, and manage APIs , Amazon CloudFront Global content delivery network , Amazon Route 53 Scalable domain name system (DNS) , AWS App Mesh Monitor and control microservices , AWS Cloud</p>
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	<p>MapService discovery for cloud resources , AWS Direct ConnectDedicated network connection to AWS , AWS Global AcceleratorImprove application availability and performance , AWS PrivateLinkSecurely access services hosted on AWS , AWS Transit GatewayEasily scale VPC and account connections , AWS VPNSecurely access your network resources , Elastic Load Balancing (ELB)Distribute incoming traffic across multiple targets</p> <p>Security, Identity, & Compliance : AWS Identity and Access Management (IAM)Manage user access and encryption keys, Amazon CognitoIdentity management for your apps , Amazon GuardDutyManaged threat detection service , Amazon InspectorAnalyze application security , Amazon MacieDiscover, classify, and protect your data , AWS ArtifactOn-demand access to AWS' compliance reports , AWS Certificate ManagerProvision, manage, and deploy SSL/TLS certificates , AWS CloudHSMHardware-based key storage for regulatory compliance , AWS Directory ServiceHost and manage active directory , AWS Firewall ManagerCentral management of firewall rules , AWS Key Management ServiceManaged creation and control of encryption keys , AWS Resource Access ManagerSimple, secure service to share AWS resources , AWS Secrets ManagerRotate, manage, and retrieve secrets , AWS Security HubUnified security and compliance center , AWS ShieldDDoS protection , AWS Single Sign-OnCloud single sign-on (SSO) service , AWS WAFFilter malicious web traffic</p> <p>Storage : Amazon Simple Storage Service (S3)Scalable storage in the cloud , Amazon Elastic Block Store (EBS)EC2 block storage volumes , Amazon Elastic File System (EFS)Fully managed file system for EC2 , Amazon FSx for LustreHigh-performance file system integrated with S3, Amazon FSx for Windows File ServerFully managed Windows native file system , Amazon S3 GlacierLow-cost archive storage in the cloud , AWS BackupCentralized backup across AWS services , AWS Snow FamilyPhysical devices to migrate data into and out of AWS , AWS Storage GatewayHybrid storage integration , CloudEndure Disaster RecoveryHighly automated disaster recovery</p> <p>End User Computing : Amazon WorkSpacesVirtual desktops in the cloud , Amazon AppStream 2.0Stream desktop applications securely to a browser , Amazon WorkLinkEnable mobile access to internal websites , Game Tech : Amazon GameLiftSimple, fast, cost-effective dedicated game server hosting , Amazon LumberyardA free cross-platform 3D game engine, with Full Source, integrated with AWS and Twitch .</p> <p>Media Services : Amazon Elastic Transcoder, Amazon Kinesis Video StreamsProcess , AWS Elemental MediaConnect, AWS Elemental MediaConvert, AWS Elemental MediaLive , AWS Elemental MediaPackage , AWS Elemental MediaStoreMedia , AWS Elemental MediaTailorVideo , AWS Elemental Appliances & Software</p> <p>Robotics : AWS Robo Maker Develop, test, and deploy robotics applications</p> <p>Satellite: AWS Ground Station Fully managed ground station as a service</p>
Oracle Cloud	<p>Analytics and Big Data: Analytics Cloud,Big Data Cloud Service, Big Data SQL Cloud Service, Data Science, Essbase, Streaming.</p> <p>Application Development: API Platform, Block chain Platform, Container Engine for Kubernetes, Container Pipelines, Container Registry, Data Science, Developer Digital Assistant, Events ervice, Functions, Java, Messaging, Mobile Hub, Visual Builder</p> <p>Compute: Bare Metal Compute, Container Engine for Kubernetes, Container Registry, Virtual Machines and Bare Metal (GPU),Virtual Machines.</p> <p>Database Management: Autonomous Data Warehouse, Autonomous Transaction Processing, Database Cloud Service: Bare Metal, Database Cloud Service: Virtual Machine, Exadata Cloud at Customer, Exadata Cloud Service, NoSQL Database.</p> <p>Emerging Technologies: Artificial Intelligence, Block chain, Data Science, Digital Assistant, Machine Learning, Tactical Edge Cloud, Infrastructure Integration, API Platform, Oracle Data Integrator Marketplace, Golden Gate Marketplace, Application Integration, SOA Cloud Service.</p> <p>Management and Governance : Application Performance Monitoring, Audit, Cost Management, IT Analytics, IT Infrastructure Monitoring, Log Analytics, Monitoring, Notifications, Resource Manager, Tagging, Networking, Connectivity, and Edge Services, DNS, Email Delivery, Fast Connect, Health Checks, Load Balancing, Service Gateway, Traffic Management, Virtual Cloud Network</p> <p>Security and Identity: Cloud Access Security Broker (CASB),Database Security, Identity and Access Management, Identity Cloud Service, Key Management, Web Application Firewall (WAF)</p> <p>Storage: Archive Storage, Block Volumes, Data Transfer, File Storage, Local NV Me SSD, Object Storage, Storage Gateway.</p>

<p style="text-align: center;">IBM Cloud</p>	<p>Compute : Bare metal servers ,Red Hat® OpenShift® on IBM Cloud ,Container registry ,IBM Cloud Kubernetes Service ,Orchestrate intelligent scheduling, self-healing and horizontal scaling ,Cloud foundry ,IBM Cloud Functions ,IBM WebSphere® Application Server on Cloud ,Auto scaling ,IBM Cloud for VMware Solutions ,HPCaaS from Rescale .</p> <p>Network : Network appliances , Content Delivery Network (CDN) , Direct link , Domain name services , Load balancer , Network security , IBM Cloud Internet Services , Virtual Private Cloud</p> <p>Storage : Object storage , Block storage , File storage , IBM Cloud Backup</p> <p>IBM Cloud Paks : IBM Cloud Pak for Management , IBM Cloud Pak for Integration , IBM Cloud Pak for Automation , IBM Cloud Pak for Applications , IBM Cloud Pak for Data</p> <p>Management : IBM Cloud Pak for Multicloud Management ,Netcool Operations Insight ,IBM Cloud App Management ,IBM Multicloud Manager ,Availability monitoring ,IBM Cloud Automation Manager ,IBM Cloud Event Management ,IBM Log Analysis with LogDNA,IBM Cloud Monitoring with Sysdig ,IBM IT Operations Management ,Istio .</p> <p>Security : IBM Cloud Activity Tracker , App ID , Network security , SSL certificates , IBM Cloud Certificate Manager , Hardware security module , Hyper protect services , IBM Cloud Data Shield , IBM Cloud Security Advisor , Key Protect</p> <p>Databases : IBM Cloudant® , IBM Compose for JanusGraph , IBM Cloud Databases for MongoDB , IBM Compose for MySQL for Cloud , IBM Compose for RethinkDB for Cloud , IBM Compose for ScyllaDB for Cloud , IBM Cloud Databases for Elasticsearch , IBM Cloud Databases for etcd , IBM Cloud Databases for PostgreSQL , IBM Cloud Databases for Redis , IBM Db2® Hosted Flex , IBM Db2 on Cloud , IBM Informix® on Cloud , IBM Lift , IBM Cloud SQL Query</p> <p>Analytics : IBM Analytics Engine , IBM Analytics for Apache Spark for Cloud , IBM Cloud SQL Query , IBM Decision Optimization , IBM Db2 Warehouse on Cloud , IBM Master Data Management on Cloud ,IBM InfoSphere® Information Server on Cloud , IBM Streaming Analytics</p> <p>AI : IBM Watson Studio , IBM Watson Knowledge Catalog , IBM Watson Assistant , IBM Watson Discovery , IBM Watson IoT Platform , IBM Watson Speech to Text , IBM Watson Text to Speech , IBM Watson Language Translator , IBM Watson Natural Language Classifier , IBM Watson Natural Language Understanding , IBM Watson Visual Recognition , IBM Watson Tone Analyzer , IBM Watson Personality Insights , IBM Data Refinery , IBM Watson Machine Learning , Deep learning , IBM Watson Discovery for Salesforce, IBM Watson Knowledge Studio , IBM Watson OpenScale</p> <p>IoT : IBM Edge Computing , IBM Watson IoT Platform , Weather data APIs</p> <p>Mobile : IBM Mobile Foundation , IBM Cloud App ID , IBM Push Notifications</p> <p>Developer Tools : IBM Cloud Continuous Delivery , IBM Cloud DevOps Insights, IBM Cloud Lift CLI , Starter kits , IBM Cloud Developer Console for Apple</p> <p>Block Chain : IBM Blockchain Platform ,Accelerate the development, governance and operation of a multi-institution network</p> <p>Integration: Cloud Pak for Integration , IBM API Connect , IBM App Connect , IBM Aspera on Cloud , IBM Event Streams , IBM MQ on Cloud , IBM Cloud Messages for Rabbit MQ , IBM Cloud Direct Link , Secure gateway</p> <p>Migration : IBM Lift , IBM Cloud Mass Data Migration , IBM Web Sphere Application Server on Cloud</p> <p>Private Cloud : IBM Cloud Private , IBM Cloud delivered behind your firewall and in your data center</p> <p>VMware : IBM Cloud for VMware Solutions , F5 on IBM Cloud , Fortinet on IBM Cloud , IBM Cloud Secure Virtualization , IBM Cloud for Skytap Solutions , IBM Spectrum Protect Plus on IBM Cloud , Veeam on IBM Cloud , VMware Horizon on IBM Cloud , Zerto on IBM Cloud</p>
<p style="text-align: center;">Alibaba Cloud</p>	<p>Elastic Computing: Elastic Compute Service, Simple Application Server, Elastic GPU Service, Auto Scaling, Server Load Balancer, Container Service, Container Service for Kubernetes, Elastic Container Instance, Container Registry, Resource Orchestration Service, E-HPC,ECS Bare Metal Instance,Super Computing Cluster,Function Compute,Batch Compute, Dedicated Host</p> <p>Storage & CDN: Object Storage Service,Table Store,Alibaba Cloud CDN,Network Attached Storage,Hybrid Cloud Storage Array,Data Transport,Hybrid Backup Recovery,Cloud Storage Gateway,Dynamic Route for CDN.</p> <p>Networking: Virtual Private Cloud, Express Connect, NAT Gateway, Server Load Balancer, Elastic IP,VPN Gateway, Cloud Enterprise Network, Smart Access Gateway, Data Transfer Plan, Alibaba Cloud Private Zone.</p> <p>Internet of Things: IoT Platform, Intelligent Speech Interaction</p> <p>Database Services : Apsara DB for Redis,ApsaraDB RDS for MySQL,ApsaraDB RDS for SQL Server,ApsaraDB RDS for PostgreSQL,ApsaraDB RDS for PPAS, ApsaraDB for MongoDB,ApsaraDB for Memcache,Data Transmission Service (DTS),AnalyticDB for MySQL,AnalyticDB for PostgreSQL,Distributed Relational Database Service,Time Series Database,ApsaraDB for MariaDB</p>

<p>TX, Database Backup, Data Management Service, Data Lake Analytics, ApsaraDB for POLARDB.</p> <p>Security : Protect your data, applications and servers from malicious attacks, Anti-DDoS Basic, Anti-DDoS Pro, Anti-DDoS Premium.</p> <p>Cloud Firewall: Web Application Firewall, Server Guard, SSL Certificates Service, Website Threat Inspector, Managed Security service, Content Moderation, Anti-Bot Service, Security Center, GameShield.</p> <p>Monitoring Management: Cloud Monitor, Resource Access Management, Key Management Service, Action Trail, Open API Explorer, Cloud Shell, Global Traffic Manager</p> <p>Domains & Website : Manage your domain name and DNS securely on Alibaba Cloud, Web Hosting, Domains, Alibaba Cloud DNS, WHOIS.</p> <p>Analytics & Data Technology: MapReduce, MaxCompute, DataWorks, Data Integration, Quick BI, DataV, Image Search, Intelligent Service Robot, Dataphin, Machine Learning Platform For AI, Elasticsearch, Realtime Compute, Machine Translation.</p> <p>Application Service: Message Service, API Gateway, Log Service, DirectMail, Blockchain as a Service, Alibaba Mail.</p> <p>Media Services: A professional solution for live video and audio., Apsara Video Live, Apsara Video for Media Processing, Apsara Video VOD</p> <p>Middleware Application deployment and micro services solutions: Enterprise Distributed Application Service, Message Queue, Application Configuration Management, Tracing Analysis, Application Real-Time Monitoring Service, Application High availability, AliwareMQ for IoT, Cloud Communication, Short Message Service, Apsara Stack, Deliver Alibaba Cloud services from your on-premises data center.</p>

The Cloud is becoming a socio-economic issue. TABLE 4 shows cloud vendors products and services. Reason is the gap between Cloud users and non-users is getting bigger and bigger. The number of companies that have firmly established Cloud Computing as part of their IT strategy is growing daily. Nevertheless, there remains a strong core of companies that use the Cloud, preferring to adhere strictly to existing on-premise models. TABLE 5 shows the comparison between top cloud vendors products. This comparison gives a better idea to cloud users for choosing best products of our own use.

TABLE 5: Providers Products Comparison

Category	Services	Providers					
		Amazon	Azure	Google	IBM	Oracle	Alibaba
Compute	Virtual Server	Amazon EC2	Azure Virtual Machine	Compute Engine	1. Classic Virtual Server 2. Virtual Server for VPC 3. Power Systems Virtual Servers	Compute	Alibaba ECS
	Bare Metal Server	Amazon Ec2 Bare Metal Server	Azure Bare Metal Server		Bare Metal Server	Bare Metal Server	ECS Bare Metal Instance
	Virtual Dedicated Host	Amazon EC2 Dedicated Host		Sole Tenant Node(Beta)	Dedicated Virtual Server Infrastructure(VSi)	Dedicated Compute Classic	Dedicated Host
	Container Registration Service	Amazon Ec2 Container Registry	Azure Container Registry	Container Registry	IBM Cloud Container Registry	Oracle Cloud Infrastructure	Container Registry
	Container Management Service	1. Amazon EC2 Container Service 2. Amazon Elastic Container Service For Kubernetes(EKS)	Azure Kubernetes Service Azure Container Instances	Cuber Engine	1. IBM Cloud Kubernetes Service 2. IBM Cloud Open shift Service	Container Engine For Kubernetes	1. Container Service 2. Container For Kubernetes Service
Storage	Auto Scaling	Amazon EC2 Auto Scaling	Azure Auto Scale Virtual Machine Scale Set	Auto Scaling	Auto Scaling	Auto Scaling	Auto Scaling
	Batch Jobs	AWS Batch	Azure Batch	Batch(Beta)	IBM Cloud Function		Batch Compute

	Object Storage	Amazon Simple Storage Service(S3)	Azure Blob Storage	Global Edge Caching	Cloud Object Storage	Object Storage Services	Object Storage
	Disk Storage and Block Storage	Amazon Elastic Block Storage(EBS)	Disk Storage(Persistence)	Persistent Disk	Block Storage For SAN Persistence	Block Volume	Block Storage
	Long Term Storage	Amazon Glacier	Azure Archive			Archive Storage	Object Storage
			Storage Azure Cool Storage				Archive
	Storage Gateway/Hybrid Storage	AWS Storage Gateway			Storage Gateway	Storage Software Appliances	Hybrid Cloud Storage Array
Database	Relational Database Management Service	Amazon Aurora Amazon RDS	Azure SQL Database SQL Server Stretch Database Azure Database For MySQL Azure Database For PostgreSQL	Cloud SQL Cloud Spanner(MySQL, PostgreSQL, SQL Server)	IBM Cloud Databases for PostgreSQL IBM Compose for MySQL		Apsara DB for RDS MySQL Apsara DB for RDS SQL Server ApsaraDB for RDS PostgreSQL Distributed Relational Database Service(DRDS)
	Non Relational Database Management Service	Amazon Dynamo DB Amazon Dynamo DB Accelerator(DAX) Amazon Neptune(Preview)	Azure Cosmos DB Table Storage Azure Time Series Insights	Cloud Data Store Cloud Big Table	Cloudant NoSQL DB IBM Compose for Janus Graph Database for Mongo DB	NoSQL Database	Apsara DB for Mongo DB Time Store
	Time Series Database	Amazon Dynamo DB	Azure Time Series Insights	Cloud Big Table	Infomix		HiTSDB(High Performance Time Series Database)
	In-Memory Data Store	Amazon Elastic Cache	Azure RedisCache	Cloud Memory Store(Beta)	Database For Redis		ApsaraDB for Redis
	Data Warehousing	Amazon Redshift	Azure SQL Data Warehouse	Big Query	DB2 Warehouse on Cloud	Exa data Autonomous Data Warehouse Cloud	Alibaba Max Compute ODPS
Migration Services	Database Migration Services	AWS Migration Service	Azure Database Migration Service		LiftCLI	Migrate To The Cloud	Data Transmission Service
Network and Content Delivery	Virtual Networking	Amazon VPC	Azure VNet	Cloud Virtual Network	Network Appliances	Oracle Virtual Cloud Network	Virtual Private Cloud
	Network Gateway	Amazon VPN	Azure VPN Gateway	Cloud VPN	Classic IPSEC-VPN VPN Gateway for VPC	Oracle IPsec VPN	VPN Gateway
	Content Delivery Network	Amazon Cloud Front Global	Azure CDN	Cloud CDN	Content Delivery Network	Edge Services	Alibaba Content Delivery Network
	Networking & Content	Amazon Route S3	Azure DNS	Cloud DNS	Internet Services	Oracle DNS	Alibaba Cloud DNS

	Delivery							
Management Tools	Logging and Monitoring	Azure Cloud Watch Azure Cloud Trail	Log Analytics Azure Portal Application Insights	Google Stack Driver Monitoring Logging Error Reporting Trace Debugger	Monitoring IBM Cloud Log Analysis with Log DNA IBM Cloud Activity Tracker with Log DNA Sysdig	Application Performance Monitoring Management Cloud	Cloud Monitor Action Trail Application Real Time Monitoring Service	
Security & Identity, Compliance	Key Management Service	AWS Key Management Service	Azure Key Vault	Cloud HSM	Key Protect Cloud HSM Hyper Protect Crypto Services	Key Management Service	Key Management Service	
	Identity & Access Management	AWS Identity and access Management(IAM)	Azure Active Directory	Cloud IAM Cloud Identity-Aware Proxy	Identity & Access Management	Identity & Access Management	Resource Access Management	
	HardWare Based Security Module	AWS Cloud HSM AWS Secrets Manager	Azure Dedicated HSM	Cloud Key Management Service Cloud HSM	Key Protect Cloud HSM Hyper Protect Crypto Services	Identity Cloud Service	Key Management Service	
	DDoS Protection Service	AWS Shield	Azure DDoS Protection	Cloud Armor(Beta)			Anti-DDoS Pro Anti-DDoS Basic Anti-DDoS Premium	
Big Data & Advanced Analytics	Big Data Managed Cluster as a Service	Amazon EMR	Azure HD Insight	Cloud Data Proc	IBM-Analytics Engine	Big Data Cloud Service SQL Cloud Service	E-Map Reduce Service	
	Cloud ETL	AWS Data Pipeline Orchestration AWS Glue Amazon Simple Work Flow Service(SWF)	Azure Data Catalog Azure Data Factory Logic Apps	Cloud Data Prep Cloud Composer	Data Stage Watson Knowledge catalog	Data Integrator	Data Works Data Integration	
	Business Intelligence & Data Visualization	Amazon Quick Sight	Azure Bot Service	Google Data Studio(Beta)	Watson Studio	Data Visualization Business Intelligence	Data IDE	
Artificial Intelligence	Machine Learning	Amazon Machine Learning Amazon Sage Maker	Azure Machine Learning	Cloud Data Lab Cloud Auto ML(Alpha) Cloud Machine Learning Service	Machine Learning	Machine Learning Platform For AI		
Application Services	Media Transcoders	Amazon Elastic Transcoder, AWS Elemental Media Convert AWS Elemental Media Live Amazon Kinesis Video Streams	Azure Media Services Live On Demand Streaming Azure Media Player		Digital Transcoding		Apsara Video Live	
	Block Chain Services	Amazon Managed Block Chain Amazon Quantum Ledger Database	Block Chain Service Block Chain Workbench		IBM Block Chain Platform Accelerate the Development	Block Chain	Block Chain as a Service	
Internet	IoT Platform	AWS IoT	Azure IoT	Cloud IoT	IBM Edge	Internet	Aliware MQ	

of Things		Platform Amazon Free RTO Slot IoT AWS IoT Analytics	Hub Azure IoT Edge	Core(Beta) Edge TPU	Computing Watson IoT Platform Weather Data I	Of Things Cloud Service	for IoT
Big Data & Advanced Analytics	Big Data Managed Cluster as a Service	Amazon EMR	Azure HD Insight	Cloud Data Proc	IBM-Analytics Engine	Big Data Cloud Service SQL Cloud Service	E-Map Reduce Service
	Cloud ETL	AWS Data Pipeline Orchestration AWS Glue Amazon Simple Work Flow Service(SWF)	Azure Data Catalog Azure Data Factory Logic Apps	Cloud Data Prep Cloud Composer	Data Stage Watson Knowledge catalog	Data Integrator	Data Works Data Integration
	Business Intelligence & Data Visualization	Amazon Quick Sight	Azure Bot Service	Google Data Studio(Beta)	Watson Studio	Data Visualization Business Intelligence	Data IDE
Artificial Intelligence	Machine Learning	Amazon Machine Learning Amazon Sage Maker	Azure Machine Learning	Cloud Data Lab Cloud Auto ML(Alpha) Cloud Machine Learning Service	Machine Learning	Machine Learning	Machine Learning Platform For AI
Application Services	Media Transcoders	Amazon Elastic Transcoder, AWS Elemental Media Convert AWS Elemental Media Live Amazon Kinesis Video Streams	Azure Media Services Live On Demand Streaming Azure Media Player		Digital Transcoding		Apsara Video Live
	Block Chain Services	Amazon Managed Block Chain Amazon Quantum Ledger Database	Block Chain Service Block Chain Workbench		IBM Block Chain Platform Accelerate the Development	Block Chain	Block Chain as a Service
Internet of Things	IoT Platform	AWS IoT Platform Amazon Free RTO Slot AWS IoT Analytics	Azure IoT Hub Azure IoT Edge	Cloud IoT Core(Beta) Edge TPU	IBM Computing Edge Watson IoT Platform Weather Data I	Internet Of Things Cloud Service	Aliware MQ for IoT

TABLE 6: Pros, Cons and Features for Cloud Computing

Providers	Pros	Cons	Features
Google Cloud Platform	Designed for cloud-native businesses Commitment to open source and portability Deep discounts and flexible contracts DevOps expertise	Late entrant to IaaS market Fewer features and services Historically not as enterprise focused	Gmail, Calendar, Currents, Hangouts Chat, Hangouts Meet, Docs, Sheets, Forms, Slides Sites, App Maker, Keep, Drive, Cloud Search, Admin, Vault, Mobile
Microsoft Azure	Highly scalable & secure High operational performance Lots of cost-efficient options for businesses Focus on IaaS and PaaS	Steep learning curve Comparatively hard to use and manage Expensive (compared to AWS and GCP)	Build websites with ASP.NET, PHP or Node.js Deploy and run Windows Server and Linux virtual machine Migrate applications and infrastructure

	Strong hybrid options Open source support	Pay-as-you-go is additionally billed Poor DevOps support	SQL Database Caching CDN Virtual Network Mobile Services Cloud Services Business Analytics Hadoop Media Services
Amazon Web Services	Highly flexible Instant scalability Rapid deployment Pay-per-use and pay-as-you-go pricing models Focus on security (AWS shared responsibility model) Hassle-free digital infrastructure transition A wide variety of services and applications for any business — from SMEs to large enterprises Availability of the AWS Partner Network (APN) to oversee the digital infrastructure transition process (if required) Regular and frequent updates of available services and applications User-friendly support	Difficult to use Cost management Overwhelming options	AWS offers cloud storage that supports managed, hybrid, block, and low-cost archive storages (such as Elastic File System, Storage Gateway, Glacier, S3, EBS), as well as a wide range of data transport functionalities. Support for various databases (Aurora, RDS, Redshift, DynamoDB). Note: Aurora, Redshift, and DynamoDB are AWS custom technologies. Support for advanced technologies (the Internet of Things, augmented reality and virtual reality, machine learning) Advanced computing functions. Tools that enable monitoring of workloads, configuration, and more. Tools for security and performance optimization. Content delivery and networking. Analytics and business productivity, Business Intelligence (BI). Migration tools. A broad range of developer tools (AWS Code Build, CodePipeline, CodeDeploy). Top security, identity, and compliance management. Mobile services.
Oracle Cloud	Integrated technology stack Smooth customization technologies Scalable architecture Niche focus Great customer support.	No solution is perfect, and Oracle Cloud also has its cons. Here are the most important disadvantages of this cloud vendor you should be aware of: Poor low end offering. Poor performance with solutions based on .NET. A minimum product might not be enough	Oracle offers more options for where and how you make your journey to the cloud Oracle helps you realize the importance of modern technologies including Artificial intelligence, chatbots, machine learning, and more Offers Next-generation mission-critical data management in the cloud Oracle provides better visibility to unsanctioned apps and protects against sophisticated cyber attacks.
Alibaba Cloud	Growing rapidly and strongly Has the funding to become a powerhouse Partnered with seven well-known IT companies, including Intel and data center company Equinix to help grow their international cloud presence	Potential compliance issues – not an American company, so runs the risk of having sensitive data on servers completely outside of the US or loss of data entirely New into US cloud market Customer service lacking	Helps you to achieve faster results Helps you to protect and backup your data Full management permissions and multiple management methods Highly stable applications and reliable data storage

Cloud computing has emerged as a popular computing model. Every Cloud has its own disciplines and also having advantages and disadvantages. Such that TABLE 6 describes Cloud vendors pros, cons and their features.

TABLE 7: Network Security Algorithms

Algorithm	DES	3DES	AES	Blowfish	RC5	RSA	RC4	Diffie Hellman
Developed	IBM in 1978	IBM	John Deaman, Vincent Rijmen in 1998	Bruce Schneier in 1998	Ronald Rivest in 1994	Ron Rivest, Adi Shamir, Leonard Adleman	Ron Rivest in 1987	Whitefield Diffie & Martin
Key Size	56	112	128,192,256	32-448	128	1024-4096	64 (or)128	1024
Block Length	64	64	128	64	64		8 to 2048	
Rounds	16	48	10,12,14	16	12	1		
Security	Proven adequate	Considered Security	Considered Security	Considered Security	Considered Security	Considered Security	Considered Security	
Computational Speed	Fast	Moderate	Fast	Very Fast	Fast	Fast	Fast	
Cipher Type	Block	Block	Block	Block	Block	Assymmetric Block	Stream Cipher	
Algorithm Structure	Balance d Feistel	Feistel Network	Substitution Permutation Network	Feistel Network	Feistel Network			
Encryption	Medium	Low	High	Very High	High		High	
Decryption Throughput	Medium	Low	High	Very High	High		High	
Power Consumption	Low	High	Low	Very High	Low	High	Low	
Memory Usage	High	Very High	Medium	Very Low			Medium	
Security Against Attacks	Brute Force	Brute Force Chosen Plain Text Known Plaintext	Brute Force	Dictionary Attack	Brute Force	Brute Force Timing Attack	Brute Force Timing Attack	Logjam Attack
Confidentiality	Low	High	High	Very High	High	High	High	
Security/Comments	Many Attacks and Methods Have	Triple DES Systems are More Secure Than Single DES Algorithms	Stronger and Faster Than 3DES	Blowfish is a Variable Length Block Cipher	Widely Used (Web SSL/TLS)	RSA is Slower Than other Symmetric Algorithm	Uses Exponentiation is a Finite Based Difficulty Computing Discrete Logarithm	Widely Used in Secure Shell(SSH) Transport Layer Security (TLS)and Internet Protocol Security(IPsec)Limitations is Lack

Cryptography plays a prominent role to “protecting client data and information”, keeping shared data secure, hide the very presence of communication by embedding messages and assuring reliable access and network performance as well as protection from cyber threats. Cryptography used encryption algorithms for making user data security. TABLE 7 shows more number of security algorithm and their features. Already TABLE 3 shows Cloud vendors with their security algorithms

V. CONCLUSION

The computational world is becoming very large and complex. Cloud computing has emerged as a popular computing model to support processing large volumetric data using clusters of commodity computers. In today’s world, cloud computing has generated a lot of interest and competition in the industry. All the cloud computing service providers provides their best to the customers. Providers like, Amazon, Microsoft, Google and etc.... In our paper, we investigate some comparisons between most of the famous cloud computing service providers. This comparison will help individuals

and organizations make critical decisions on benefits, Products, Services, Security and Features of cloud technology before they move their business to this new environment.

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