Unit-5
Difference between GCP vs Microsoft Azure vs AWS

Subject	Google Cloud Platform	Microsoft Azure	Amazon Web Services
Launched	2008	2010	2006
Storage Domain	Cloud Storage	Blocked storage	S3
Monitoring	Stackdriver monitoring services	Azure Application Insight	Cloud watch
Block Storage	Persistent disk	Page blobs	EBS
Firewall	Fortigate Next Generation Firewall	Application Gate Away	Web Application Firewall
Cloud Services(Protection)	Shield	DDos	Cloud Armor
Market Share	9%	22%	33%
DNS Service	Cloud DNS	Azure traffic manager	Amazon Route 53
Automation	Compute Engine Management	Azure Automation	AWS Opsworks
Location	22 Regions (61 zones Zones)	60+ Regions	26 Regions
Security	Cloud security Command Centre	Azure Security Centre	AWS Security Hub

Overview of AWS, Azure and GCP

Amazon Web Services: AWS is a cloud service platform offered by Amazon. The benefits of AWS has flexibility, cost-effectiveness, scalability, and security. AWS has currently 26 regions (Global availability). In AWS what services you used, you have to pay for it, AWS

provides over 200 featured services globally. Examples – Amazon EC2 (Elastic Compute Cloud), Amazon S3, etc. It has a 33% global market share.

Microsoft Azure: Azure is the Microsoft cloud solution. It contains all different types of services whether you need a VM, a big or small website, to run a database or your container, or just some kind of Server support all those services are available in Azure. The beauty of it is like all other cloud solution providers you pay for what you use, so instantiate buy yours by yourself by going through the portal what you need and you will pay for it. Azure has more than 200 services.

Google Cloud Platform: Google Cloud Platform is a public cloud computing service offered by Google. It has multiple services example – computing, Storage, Networking, Big data, Developer Tools, IOT, Cloud AI, Data Transfer, Identity & Security. Google Cloud Platform is a world-leading company Google Cloud Platform has high-level security and GCP has the biggest networking and better pricing model.

How to choose a cloud service provider

Choosing a cloud service provider can be a significant decision for any organization. Here are some key factors to consider when making your choice:

- **Service Offerings**: Evaluate the range of services offered by each provider and match them with your specific needs. Consider compute, storage, networking, databases, AI/ML, IoT, analytics, and other specialized services.
- **Scalability**: Ensure that the provider can accommodate your current and future scalability requirements. The ability to scale resources up or down based on demand is crucial for many businesses.
- **Performance and Reliability**: Look into the provider's track record for uptime and reliability. Check for redundancy and failover mechanisms to minimize downtime.
- **Security**: Assess the provider's security measures, including data encryption, compliance certifications, access controls, and monitoring capabilities. Ensure they meet your organization's security and compliance requirements.
- **Cost**: Compare pricing structures, including pay-as-you-go vs. reserved instances, discounts, and any hidden costs. Consider your budget and projected usage to determine the most cost-effective option.
- **Support and SLAs**: Review the provider's support options, response times, and service level agreements (SLAs). Make sure they offer adequate support for your needs, especially if you're running critical workloads.
- **Geographic Presence**: Consider the provider's global footprint and availability zones. Choose a provider with data centers in regions that align with your business requirements for latency, data sovereignty, and disaster recovery.
- **Integration and Compatibility**: Assess how well the provider's services integrate with your existing systems, tools, and workflows. Compatibility with third-party software and open standards can be important for seamless integration.

- **Community and Ecosystem**: Look into the provider's developer community, documentation, and ecosystem of partners and third-party tools. A strong ecosystem can provide additional resources, support, and innovation opportunities.
- **Vendor Lock-In**: Consider the potential for vendor lock-in and evaluate each provider's flexibility and portability options. Look for open standards and APIs that facilitate interoperability and data migration.
- **Future Roadmap and Innovation**: Research the provider's roadmap and commitment to innovation. Choose a provider that continually invests in new technologies and services to stay ahead of evolving business needs.

Advantages of AWS, Azure and GCP

Advantages of Amazon Web Services:

- Users using AWS may pay for only the resources they truly use. Therefore, AWS is affordable.
- AWS provides many different kinds of the services and has a size and dynamic developer and partner ecosystem.
- Users can access or store the data with a low latency because of the AWS's multiple data centers around the globe.

Advantages of Microsoft Azure:

- Azure's global network of data centers guarantees a very low latency for retrieve any type of the data.
- Azure provides a strong safety features.
- Easy communication with on-premises systems is made feasible by Azure, providing a seamless hybrid experience. where security and deployment are better.

Advantages of Google Cloud Platform:

- The Google Cloud Platform enables resource scaling easy. As an example, we can swiftly construct virtual machines if our business needs additional servers.
- Because of GCP's extensive global network of data centers, accessing any data has extremely little latency.
- GCP offers solid safety.

Use cases for AWS, Azure and GCP

Amazon Web Services

- AWS provides web app and web hosting and administrative services, include the Amazon Elastic Compute Cloud (EC2).
- The backup data can be maintained on AWS. But for a free tier account, it is not free.
- We may distribute the user's load between multiple instances utilizing an AWS service comparable to a load balancer.

Microsoft Azure

- Hosting and managing web applications and websites. And you have to pay for what you used.
- Building and deploying machine learning models using Azure Machine Learning.
- Developing the blockchain application using Azure.

Google Cloud Platform

- GCP is also used in games. GCP is running multiplayer games.

- GCP provides the virtual desktop experience.
- GCP is used to process the big query and analyze the big data.

Disadvantages of AWS, Azure and GCP

Disadvantages of AWS:

- While users may find AWS to be cost-effective, using specific services comes at more expense.
- Since AWS offers numerous services, consumers might discover it challenging to get around the platform.
- Given the wide range of services provided by AWS, some users might discover that they are unable to tailor these services to suit their specific needs. Thus, AWS's customer service is inadequate.

Disadvantages of Azure:

- Comparing with some other cloud providers, Azure might be more expensive.
- Azure is also dependent on the Microsoft connection.
- Workloads operating on Linux cannot be as well accepted by Azure as workloads operating on Windows.

Disadvantages of GCP:

- Comparing with some other cloud providers, GCP is more expensive.
- Because Google provides so many services, it can be difficult.
- The Google Cloud Platform is more dependent on Google or is a part of their ecosystem.

Aneka in Cloud Computing

Aneka is an infrastructural application for Cloud Computing that is specifically designed for supporting purposes. It helps in the use of varied computer resources and the organization of the resources into a single virtual space called the Aneka Cloud, where applications are run. Aneka is a Cloud middleware product that could be implemented on a Computer network, a multicore server, Data centres, Virtual cloud environments what we now call Cloud infrastructures, or a combination of any of these. This system entails middleware for practice and provisioning dispersed applications and programs and a set of moldable APIs for designing them.

What Is Aneka in Cloud Computing

Aneka is an agent-based software product that provides the support necessary for the development and deployment of distributed applications in the cloud. In particular, it enables to beneficial utilize numerous cloud resources by offering the logical means for the unification of different computational programming interfaces and tools. By using Aneka, consumers are in a position to run applications on a cloud structure of their making; and efficiency and effectiveness are not being compromised. The provided platform is universal and can be used in computations and data processing, both for calculations with a large number of tasks and complex working schemes.

Classification of Aneka Services in Cloud Computing

1. Fabric Services

The Fabric services in Aneka represent the basic part of the infrastructural framework through which the resources of the cloud environment can be managed and automated. They implement as they involve the physical or low level of resource provision and allocation and also virtualization. Here are some key components:

- Resource Provisioning: Fabric services are to provide computational assets such as virtual machines, containers, or otherwise deploying bare metal hardware.
- Resource Virtualization: These services conceal the lower-level physical resources present there and offer a virtual instance for running the applications. From the above, they are also responsible for identifying, distributing, and isolating resources to optimize them.
- Networking: Fabric services are fairly involved with the connectivity of the network as it is in the context of virtual networking and routing thereby facilitating interactions between various parts of the cloud.
- Storage Management: They manage storage assets within a system, specifically creating and managing storage volumes, managing file systems as well as performing data replication for failover.

2. Foundation Services

As you move up in the stack, foundation services rely on the fabric layer and provide further enhancement for the development of applications in the distributed environment. The following are the benefits of microservices: They provide basic foundations that are necessary for constructing applications that are portable and elastic. Key components include:

- Task Execution: Foundation services are responsible for coordinating the work and processes in the systems of a distributed environment. These include the capability of managing the tasks' schedule, distributing the workload, and using fault tolerance measures that guarantee efficient execution of tasks.
- Data Management: These provide the main function of data storage and retrieval as we see in distributed applications. The need to be able to support distributed file systems, databases, or requests and data caching mechanisms is also present.
- Security and Authentication: Foundation services include the security of data-bearing services implemented by authentication, authorization, and encryption standards to comply with the required level of security.
- Monitoring and Logging: They allow us to track the application usage and its behaviour in real-time mode as well as track all the events and the measures of activity for the usage in the analysis of the incident.

3. Application Services

Subservices in Aneka are many but they are more generalized services built on top of the core infrastructure to support specialized needs of different types of applications. It is worth mentioning that they represent typical application templates or scenarios that can help to promote application assembly. Key components include:

- Middleware Services: Application services can involve various distributed applications fundamental components like messaging services, event processing services or a service orchestration framework in case of complex application integration.

- Data Analytics and Machine Learning: Certain application services are dedicated to delivering toolkits and platforms for analyzing the data, training as well as deploying machine learning models and performing predictive analysis.
- Content Delivery and Streaming: These services focus on the efficient transport of multimedia content, streaming information, or real-time communications for video streaming services or online gaming, for instance.
- IoT Integration: Apiproducts can provide support for IoT devices and, in essence, for IoT protocols, for data collection, processing, and analysis of sensor data from distributed IoT networks.

Aneka Framework Architecture

1. Core Components

- **Aneka Container:** Integral to the Aneka architecture is the Aneka container that forms the core of the environment and is responsible for the management of jobs and tasks across the distributed infrastructure. The middleware hides the fundamental infrastructure and offers a standard API to host applications.
- **Resource Manager:** The resource manager component is another pivotal component that becomes involved in the provisioning and management of the available computational resources in the cloud environment. In turn, it implies deep interactions with the substrate to make decisions on resource provisioning depending on the applications' loads and profiles.
- **Task Scheduler:** The task scheduler component is responsible for managing and scheduling the tasks with the resources available, the dependency they have, and even the performance of the resources and the tasks set. It means to optimize resource application and minimize time as well as cost of the job completion.

2. Middleware Services

- **Communication Middleware:** Aneka has middleware components that are used to enable generic interaction and data exchange to various functionalities of the application. This can be as simple as message queuing systems, RPC frameworks or as complex as publish-subscribe mechanisms.
- **Data Management Middleware:** Middleware services for data management are services that provide control over the storage, access, and modification of data in applications. They may include distributed file systems, servers, databases, or data caching systems.

3. Application Services

- **Workflow Orchestration:** Aneka supports workload orchestration paradigms that comprise the management of many tasks and/or services to address complex business processes. These frameworks deal with the issue of the dependencies of the tasks, and concurrent processes as well as the issues of handling errors.
- **Data Analytics and Processing:** Aneka offers functionalities and classes relevant to data analysis, artificial intelligence, and big data computation within an application. This encompasses data streaming, batch, and real-time to support the mining of massive data sets.

4. Management and Monitoring

- **Management Console:** An administration console interface in the form of a graphical user interface (GUI) or a comprehensive command-line interface (CLI) enables the administrators and users to control and observe the condition of the Aneka framework and the running applications. Resource management, including tools for budgeting and procurement, job tracking, as well as performance measures are also offered.
- **Logging and Monitoring:** A similar statement can be made about Aneka with its logging and monitoring engine to assist in capturing and monitoring the performance, utilization and health state of distributed applications. This involves more logging-related events, metrics gathering to make predictions and sending out alerts for preventive measures.

5. Integration Interfaces

- **APIs and SDKs:** Aneka offers application programming interfaces (APIs) and software development kits (SDKs) that can enable developers to embed this framework together with developing new applications. These interfaces declare operations related to the submission of tasks, management of resources, and the tracking of jobs.
- **Integration with Cloud Platforms:** Aneka can connect with existing and leading cloud approaches and architectures, making it possible to host applications on public, private or even hybrid cloud structures. This also encompasses additions to the visibility of cloud APIs, virtualization solutions, and services based on containers.

Components of the Aneka Framework

1. Aneka Runtime Environment

The Aneka Runtime Environment is the component within the Aneka computing system that supports the execution of distributed applications. It has a container net – the Aneka container that is responsible for the scheduling of computational tasks and distribution of jobs over the extended topology. Key features include:

- Task Execution Management: The Aneka container is responsible for the management of specific tasks, it decides how the tasks are to be a resource and then manages their execution, their progress and any issue or failure that occurs in the process.
- Resource Abstraction: It hides the backend computing resources, these may be physical hosts, virtual hosts or containers and presents a common execution model for applications.
- Scalability and Fault Tolerance: The main features of the runtime environment include the ability to scale anticipating the levels of workload along with the means of handling faults so that distributed applications can run effectively.

2. Aneka Development Toolkit

The Aneka Development Toolkit is made up of tools, a library, and an Application Programming Interface that can be used by developers in creating distributed applications on Aneka. It includes:

- Task Submission APIs: Interface for enlisting tasks and jobs to be run in an Aneka runtime environment, as well as defining characteristics of job execution.
- Resource Management APIs: The following includes the APIs for guaranteed access and usage of compute resources allotted to the application and may also involve the APIs for applications to be informed of available compute resources to use and when to release them for other uses.

- Development Libraries: Software libraries for data handling, interaction with other processes and services, and defining workloads in distributed environments.

3. Aneka Marketplace

It can commonly be described as a place for users to search for already existing components, applications and/or services to use with Aneka, indeed it is more accurately described as an online directory or a catalogue if you will of ready-made. It provides:

- Component Repository: A set of tools that may include individual tasks or a set of tasks that can be reused as templates; algorithms, or middleware services acquired from the community or third-party developers or created during previous projects.
- Application Templates: A readiness-made application designs or frameworks for deployment of distributed applications where the user has several categories of applications ready and can install any application according to the model.
- Service Integration: Subscription to other software or application services, whereby users can employ other modules and utilities in their Aneka applications.

4. Aneka Cloud Management Console

The Aneka Cloud Management Console is a GUI that offers an interactive web-based interface for administrators and users to manage the Aneka framework in addition to the applications that are deployed. It offers:

- Resource Management: Tools to acquire, control and oversee virtual and physical resources of computing in the cloud such as virtual machines, stations, containers, and storage.
- Job Monitoring: Employing performance and resource metrics collected during the runtime to track jobs, resources and application performance, with visualizations that incorporate insights into the problem-solving and improvement processes.
- User Management: Design of tools and services that will help to implement and manage user accounts, their privileges and security policies for the Aneka environment.

5. Aneka Cloud Connectors

Aneka Cloud Connectors are software components or agents or simply interface Extensions that allow it to interconnect to other clouds and cloud providers. They provide:

- Cloud API Integration: API support for interfacing with the specific cloud APIs and services provided by known cloud computing vendors such as AWS, Azure, or Google Cloud.
- Virtualization Technologies: Some of the future features include compatibility with VMware, Microsoft Hyper-V, Docker, etc., and the ability to deploy Aneka applications in virtual environments.

6. Aneka Software Development Kit (SDK)

Its other functionalities include access to detailed documentation and samples that will enable the experienced programmer to satisfy their specific needs regarding the Aneka framework in the form of components, applications or services. It includes:

- **API Documentation:** The detailed manual of the Aneka APIs: how to use basic and advanced methods, how some of them work, and recommendations for Aneka application development.

- Development Tools: Components of an IDE for building Aneka applications, which include code editing tools, debuggers, and unit test tools that can be used as plug-ins in the supported IDEs – Eclipse or Visual Studio.
- **Sample Applications:** Examples of code stubs and initial Aneka applications illustrating some key aspects of GDI application implementation: Task submission, resource management, and data processing.

Advantages of Aneka in Cloud Computing

- **Scalability:** Aneka is self-sufficient in the dynamism of resource provisions and allocations; hence applications can scale to as far as the required workload as envisaged. It looks efficiently at the resource and allows for horizontal scaling to make sure the cloud platforms are being used to their full benefit.
- **Flexibility:** Aneka supports various programming paradigms and orientations allowing software developers to execute a broad range of different types of distributed applications as per their needs. It organizes the architectural design and the deployment of an application while enabling it to be used in a variety of contexts and under various architectures of the application.
- **Cost Efficiency:** Aneka has the potential to minimize the overall cost of infrastructure as it increases resource utilization and allows for the predictable scaling of such infrastructures in contexts that entail the deployment of clouds. This is because it extends the notion of usage allowance to a broader sense where customers only are billed according to the number of resources they use, hence avoiding careless usage of some resources while other important resources lag, thus good cost-performance ratios are achieved.
- **Ease of Development:** The focussed aspects of Aneka are to ease the creation of distributed applications and to offer high-level framework, tools and libraries. It has APIs provided for task submission, resource management and data processing, which ensures that the application is built with increased efficiency in a shorter time.
- **Portability:** Currently, Aneka applications are independent of the specific cloud platform and infrastructure software. It works on public, private or hybrid cloud environments without requiring additional modifications and thus provides contractual freedom.
- **Reliability and Fault Tolerance:** Aneka consists of several components, for graceful failure and resiliency of jobs which will enable the implementation of securely developing and running distributed applications. It also tracks applications and provides failover in case of application failures at the level of the cluster.
- **Integration Capabilities:** Aneka can easily work in conjunction with current and active cloud solutions, virtualization solutions, and containerization technologies. It comes with integrations for different clouds and lets you work with third-party services and APIs, which is useful for functioning in conjunction with existing systems and tools.
- **Performance Optimization:** Aneka improves the utilization of resources schedules missions' tasks and efficiently processes data. It utilizes parallelism, distribution, and caching techniques to optimize the rate at which an application runs and its response time.
- **Monitoring and Management:** The features of Aneka include, monitoring and management tools for assessing the performance of the applications that are hosted in it,

consumption rates of the resources as well as the general health of the system. It offers a dashboard, logging as well as analyses to support proactive monitoring and diagnosing.

Disadvantages of Aneka in Cloud Computing

- **Learning Curve:** There is the possibility that Aneka would take some time to understand for the new developers in distributed computing or those who are not aware of the programming models and abstractions used as part of the system. The concepts in Aneka can take some time to understand and get acquainted with, so there are more things to do here.
- **Complexity:** Dealing with complexity while constructing and administering distributed applications based on Aneka might occur if the application scale reaches considerable sizes or encompasses sophisticated structural designs. Due to the distributed computing environment utilized by Aneka, developers who wish to maximize the platform should know distributed computing concepts and patterns.
- **Integration Challenges:** Some of the complexities involved may include; Aneka may be challenging to integrate with other structures, applications, or services. Limitations could emerge in the form of compatibility concerns when integrating Aneka with this dynamic environment or platforms as well and the different configurations can create complex concerns with APIs disparately.
- **Resource Overhead:** While Aneka's runtime environment and middleware components can be beneficial for the management and delivery of computational resources, they may also cause additional overhead in the required memory, computational or network capabilities. This overhead could potentially slow down application performance or even raise the amount of resources required for execution, especially in contexts where resources are limited.
- **Vendor Lock-in:** Aneka, on the other hand, has the advantage of portability across various cloud platforms and services but it should be noted that some constraints or qualities may lock one into a certain platform. The difficulty is that some users may even face problems simply when trying to move existing Aneka applications to a different cloud provider, or when trying new technologies or platforms.
- **Limited Ecosystem:** Compared to other more mature cloud platforms or frameworks, Aneka can be considered to have limited amounts of resources available in tools, libraries as well as communities. This might limit the kind or level of resources, documentation or even professional support required by users who require help or need to expand the range of possibilities offered by Aneka.
- **Maintenance Overhead:** Like a typical software system, the management and support of an Aneka deployment may continue to need resources and time. Maintenance activities including updates, securing of software vulnerabilities, as well as fine-tuning could prove to be overburdensome to administrators and DevOps groups.
- **Performance Bottlenecks:** At some moments, resource utilization, scheduling, or communication strategies of Aneka may become an issue and slow down the application. Application performance as well as its scalability might be vital and should sometimes be tuned and profiled.
- **Cost Considerations:** While Aneka can aid in solving the problem of excessive consumption of resources and lower costs of infrastructure, there may also be license

expenses that may be incurred or monthly subscription fees. Managers should consider if the total cost of ownership is justified or if there are more suitable solutions we can use instead.

Protein structure prediction in Cloud Computing

- Cloud computing is an emerging technology that provides various computing services on demand. It provides convenient access to a shared pool of higher-level services and other system resources. Nowadays, cloud computing has a great significance in the fields of geology, biology, and other scientific research areas.

  Protein structure prediction is the best example in research area that makes use of cloud applications for its computation and storage.

  A protein is composed of long chains of amino acids joined together by peptide bonds. The various structures of protein help in the designing of new drugs and the various sequences of proteins from its three-dimensional structure in predictive form is known as a **Protein structure prediction**.
  Firstly primary structures of proteins are formed and then prediction of the secondary, tertiary and quaternary structures are done from the primary one. In this way predictions of protein structures are done. Protein structure prediction also makes use of various other technologies like artificial neural networks, artificial intelligence, machine learning and probabilistic techniques, also holds great importance in fields like theoretical chemistry and bioinformatics.

  There are various algorithms and tools that exists for protein structure prediction. CASP (Critical Assessment of Protein Structure Prediction) is a well-known tool that provides methods for automated web servers and the results of research work are placed on clouds like CAMEO (Continuous Automated Model Evaluation) server. These servers can be accessed by anyone as per their requirements from any place. Some of the tools or servers used in protein structure prediction are Phobius, FoldX, LOMETS, Prime, Predict protein, SignalP, BBSP, EVfold, Biskit, HHpred, Phre, ESyired3D. Using these tools new structures are predicted and the results are placed on the cloud-based servers.

Satellite Image Processing

Satellite Image Processing is an important field in research and development and consists of the images of earth and satellites taken by the means of artificial satellites. Firstly, the photographs are taken in digital form and later are processed by the computers to extract the information. Statistical methods are applied to the digital images and after processing the various discrete surfaces are identified by analyzing the pixel values.

The satellite imagery is widely used to plan the infrastructures or to monitor the environmental conditions or to detect the responses of upcoming disasters.
In broader terms we can say that the Satellite Image Processing is a kind of remote sensing which works on pixel resolutions to collect coherent information about the earth surface.

Majorly there are four kinds of resolutions associated with satellite imagery. These are:

- **Spatial resolution –**
  It is determined by the sensors Instantaneous Field of View(IFoV) and is defined as the pixel size of an image that is visible to the human eye being measured on the ground. Since it has high resolving power or the ability to separate and hence is termed as Spatial Resolution.
- **Spectral resolution –**
  This resolution measures the wavelength internal size and determines the number of wavelength intervals that the sensor measures.
- **Temporal resolution –**
  The word temporal is associated with time or days and is defined as the time that passes between various imagery cloud periods.
- **Radiometric resolution –**
  This resolution provides the actual characteristics of the image and is generally expressed in bits size. It gives the effective bit depth and records the various levels of brightness of imaging system.

Thus, Satellite Image Processing has huge amount of applications in research and development fields, in remote sensing, in astronomy and now even in cloud computing on a large scale.

CRM in Cloud Computing

What is CRM?

CRM stands for Customer Relationship Management and is a software that is hosted in cloud so that the users can access the information using internet. CRM software provides high level of security and scalability to its users and can be easily used on mobile phones to access the data.
Now a days, many business vendors and service providers are using these CRM software to manage the resources so that the user can access them via internet. Moving the business computation from desktop to the cloud is proving a beneficial step in both the IT and Non-IT fields.
Some of the major CRM vendors include Oracle Siebel, Mothernode CRM, Microsoft Dynamics CRM, Infor CRM, SAGE CRM, NetSuite CRM.

Advantages of CRM

Few advantages of using CRM are as follows:

- High reliability and scalability
- Easy to use
- Highly secured
- Provides flexibility to users and service providers

- Easily accessible

Difference Between Cloud Computing and Data Analytics

Cloud Computing: Cloud Computing is a technique in which a network of remote servers is hosted on the Internet. These servers primarily store the data, manage the data, and process the data. But this is not done by a local server or a personal computer.
In short, data here is gathered on the internet. Thus, eliminating the use of a physical server.
Cloud Computing doesn't depend on data analytics for anything.
Data Analytics: Data analysis is defined as a process where data is inspected, cleaned, transformed, and modeled. The primary aim of data analytics is to discover information that is useful. So that a conclusion is made which further helps in the decision-making process of a company.
In data analytics, the data is measured and estimated from big data sources.
Data storage is done on cloud and data analytics involves the extraction of data. Thus, data analytics depends on cloud computing for data extraction.

S.No.	Cloud Computing	Data Analytics
1	Data storage and retrieval from whichever place at whatever time.	A process where data is inspected, cleaned, transformed and modelled
2	Is independent of data analytics	Is dependent on cloud computing.
3	Has solutions to data intensive computing and doesn't focus on a particular organization.	Works on the improvement of a particular organization
4	Involves SaaS (Software as a Service), PaaS (Platform as a Service), IaaS (Infrastructure as a Service)	Involves python, Sas, Apache Spark, etc.
5	Is further categorized as public cloud, private cloud, community cloud and hybrid cloud.	Big Data Technology is Hadoop, MapReduce, and HDFS are important aspects
6	Cloud Computing providers are Google, Amazon Web Service, Microsoft, Dell, Apple, IBM.	Data Analytics providers are Cloudera, Hortonworks, Apache and MapR.

S.No.	Cloud Computing	Data Analytics
7	Less Costly	Costlier
8	Roles related to cloud computing are cloud resource administrator, cloud service provider, cloud consumer, cloud auditor, etc	Roles related to data analytics are data developer, data administrator, data analyst, data scientist, etc.