

## UNIT- 6

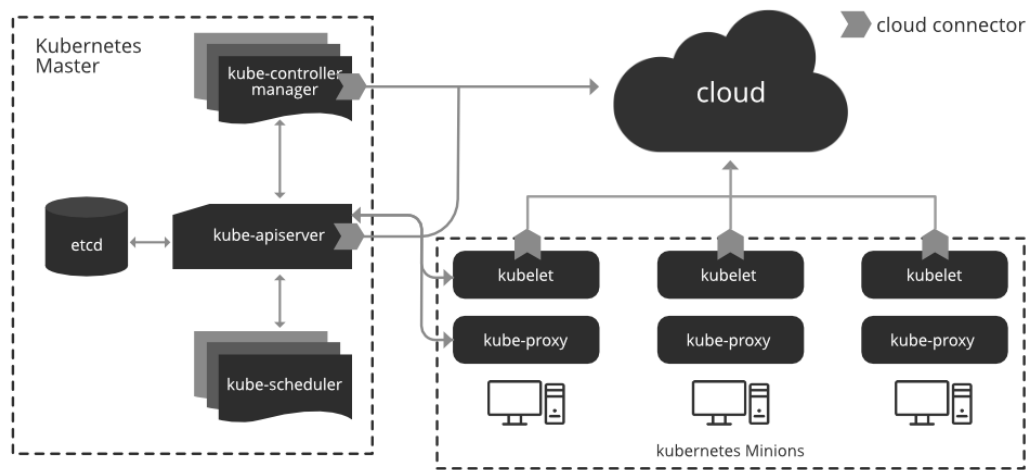
### Q1. What is Kubernetes – Concept of Containers. Explain the few features of Kubernetes with suitable Architecture ?

Ans:- Kubernetes is an open-source container orchestration framework that was originally developed by Google.

#### Features of Kubernetes

Following are the various features or characteristics of Kubernetes:

1. **Multi-Host Container Scheduling:** Done by Kube-scheduler, it assigns containers, also referred to as pods in Kubernetes to nodes at runtime. It accounts for resources, quality of service, and policies before scheduling.
2. **Scalability and availability:** The Kubernetes master is often deployed during a highly available configuration. Multi-region deployments are available as well.
3. **Flexibility and modularization:** Kubernetes includes a plug-and-play architecture that permits you to increase it when you need to. There are specific add-ons from network drivers, service discovery, container runtime, visualization, and command. If there are tasks that you need to perform for your environment specifically, you'll be able to create an add-on to suit your needs.
4. **Registration:** New worker nodes can register themselves with the Kubernetes master node.
5. **Service discovery:** Service discovery allows for automatic detection of new services and endpoints via DNS or environment variables.
6. **Persistent storage:** It is a much-requested feature when working with containers. Pods can use persistent volumes to store data and therefore the data is retained across pod restarts and crashes.
7. **Maintenance:** When it involves Kubernetes maintenance and upgrades, Kubernetes features are always backward compatible for some versions. All APIs are versioned and when upgrading or running maintenance on the host, you'll unschedule the host so that no deployments can happen thereon. Once you're done, you'll simply turn the host back on and schedule deployments or jobs.
8. **Logging and Monitoring:** In terms of logging and monitoring, application monitoring or health checks are also built-in, TCP, HTTP, or container exact health checks are available out of the box. There are also health checks to give you the status of the nodes and failures monitored by the node controller. Kubernetes status can also be monitored via add-ons like Metrics Server, cAdvisor, and Prometheus. And lastly, you can use the built-in logging frameworks or if you choose, you can bring your own.
9. **Secrets Management:** Sensitive data is a first-class citizen in Kubernetes. Secrets mounted to data volumes or environment variables. They're also specific to a single namespace so aren't shared across all applications.



## Understanding the Master node:

- **Kube-apiserver:** a frontend of the cluster that allows you to interact with the Kubernetes API and connects to the etcd database.
- **Kube-scheduler:** schedules pods on specific nodes supported labels, taints, and tolerations set for pods
- **etcd:** a database, stores all cluster data which includes job scheduling info, pod details, stage information, etc.
- **Kube – controller – manager:** manages the current state of the cluster
- **cloud – controller – manager:** interacts with outside cloud manager

## Q2. Write a short note on Google App Engine ? Give some Advantages of GAE ?

Ans :- Google App Engine is mostly used to run Web applications. These dynamic scales as demand change over time because of Google's vast computing infrastructure. Because it offers a secure execution environment in addition to a number of services, App Engine makes it easier to develop scalable and high-performance Web apps. Google's applications will scale up and down in response to shifting demand. Cron tasks, communications, scalable data stores, work queues, and in-memory caching are some of these services.

### Advantages of Google App Engine

The Google App Engine has a lot of benefits that can help you advance your app ideas. This comprises:

1. **Infrastructure for Security:** The Internet infrastructure that Google uses is arguably the safest in the entire world. Since the application data and code are hosted on extremely secure servers, there has rarely been any kind of illegal access to date.
2. **Faster Time to Market:** For every organization, getting a product or service to market quickly is crucial. When it comes to quickly releasing the product, encouraging the development and maintenance of an app is essential. A firm can grow swiftly with Google Cloud App Engine's assistance.
3. **Quick to Start:** You don't need to spend a lot of time prototyping or deploying the app to users because there is no hardware or product to buy and maintain.
4. **Easy to Use:** The tools that you need to create, test, launch, and update the applications are included in Google App Engine (GAE).
5. **Rich set of APIs & Services:** A number of built-in APIs and services in Google App Engine enable developers to create strong, feature-rich apps.
6. **Scalability:** This is one of the deciding variables for the success of any software. When using the Google app engine to construct apps, you may access technologies like GFS, Big Table, and others that Google uses to build its own apps.

7. **Performance and Reliability:** Among international brands, Google ranks among the top ones. Therefore, you must bear that in mind while talking about performance and reliability.
8. **Cost Savings:** To administer your servers, you don't need to employ engineers or even do it yourself. The money you save might be put toward developing other areas of your company.
9. **Platform Independence:** Since the app engine platform only has a few dependencies, you can easily relocate all of your data to another environment.

### Q3. Write the short notes on AWS ? Give its Advantage and Disadvantage ?

Ans :- AWS provides on-demand IT resources to its account holders on a pay-as-you-go pricing model with no upfront cost. Amazon Web services offers flexibility because you can only pay for services you use or you need. Enterprises use AWS to reduce capital expenditure of building their own private IT infrastructure (which can be expensive depending upon the enterprise's size and nature). AWS has its own Physical fiber network that connects with Availability zones, regions and Edge locations. All the maintenance cost is also bared by the AWS that saves a fortune for the enterprises.

#### Advantages of Amazon Web Services

- AWS allows you to easily scale your resources up or down as your needs change, helping you to save money and ensure that your application always has the resources it needs.
- AWS provides a highly reliable and secure infrastructure, with multiple data centers and a commitment to 99.99% availability for many of its services.
- AWS offers a wide range of services and tools that can be easily combined to build and deploy a variety of applications, making it highly flexible.
- AWS offers a pay-as-you-go pricing model, allowing you to only pay for the resources you actually use and avoid upfront costs and long-term commitments.

#### Disadvantages of Amazon Web Services

- AWS can be complex, with a wide range of services and features that may be difficult to understand and use, especially for new users.
- AWS can be expensive, especially if you have a high-traffic application or need to run multiple services. Additionally, the cost of services can increase over time, so you need to regularly monitor your spending.
- While AWS provides many security features and tools, securing your resources on AWS can still be challenging, and you may need to implement additional security measures to meet your specific requirements.
- AWS manages many aspects of the infrastructure, which can limit your control over certain parts of your application and environment.

### Q4. How can Azure help in business? What are the services provided by Azure?

Ans :- Azure can help our business in the following ways-

- **Capital less:** We don't have to worry about the capital as Azure cuts out the high cost of hardware. You simply pay as you go and enjoy a subscription-based model that's kind to your cash flow. Also, setting up an Azure account is very easy. You simply register in Azure Portal and select your required subscription and get going.
- **Less Operational Cost:** Azure has a low operational cost because it runs on its servers whose only job is to make the cloud functional and bug-free, it's usually a whole lot more reliable than your own, on-location server.

- **Cost Effective:** If we set up a server on our own, we need to hire a tech support team to monitor them and make sure things are working fine. Also, there might be a situation where the tech support team is taking too much time to solve the issue incurred in the server. So, in this regard is way too pocket-friendly.
- **Easy Back-Up and Recovery options:** Azure keeps backups of all your valuable data. In disaster situations, you can recover all your data in a single click without your business getting affected. Cloud-based backup and recovery solutions save time, avoid large up-front investments and roll up third-party expertise as part of the deal.
- **Easy to implement:** It is very easy to implement your business models in Azure. With a couple of on-click activities, you are good to go. Even there are several tutorials to make you learn and deploy faster.
- **Better Security:** Azure provides more security than local servers. Be carefree about your critical data and business applications. As it stays safe in the Azure Cloud. Even, in natural disasters, where the resources can be harmed, Azure is a rescue. The cloud is always on.
- **Work from anywhere:** Azure gives you the freedom to work from anywhere and everywhere. It just requires a network connection and credentials. And with most serious Azure cloud services offering mobile apps, you're not restricted to which device you've got to hand.
- **Increased collaboration:** With Azure, teams can access, edit and share documents anytime, from anywhere. They can work and achieve future goals hand in hand. Another advantage of Azure is that it preserves records of activity and data. Timestamps are one example of Azure's record-keeping. Timestamps improve team collaboration by establishing transparency and increasing accountability.

### Microsoft Azure Services

Following are some of the services Microsoft Azure offers:

1. **Compute:** Includes Virtual Machines, Virtual Machine Scale Sets, Functions for serverless computing, Batch for containerized batch workloads, Service Fabric for microservices and container orchestration, and Cloud Services for building cloud-based apps and APIs.
2. **Networking:** With Azure, you can use a variety of networking tools, like the Virtual Network, which can connect to on-premise data centers; Load Balancer; Application Gateway; VPN Gateway; Azure DNS for domain hosting, Content Delivery Network, Traffic Manager, ExpressRoute dedicated private network fiber connections; and Network Watcher monitoring and diagnostics
3. **Storage:** Includes Blob, Queue, File, and Disk Storage, as well as a Data Lake Store, Backup, and Site Recovery, among others.
4. **Web + Mobile:** Creating Web + Mobile applications is very easy as it includes several services for building and deploying applications.
5. **Containers:** Azure has a property that includes Container Service, which supports Kubernetes, DC/OS or Docker Swarm, and Container Registry, as well as tools for microservices.
6. **Databases:** Azure also included several SQL-based databases and related tools.
7. **Data + Analytics:** Azure has some big data tools like HDInsight for Hadoop Spark, R Server, HBase, and Storm clusters
8. **AI + Cognitive Services:** With Azure developing applications with artificial intelligence capabilities, like the Computer Vision API, Face API, Bing Web Search, Video Indexer, and Language Understanding Intelligent.
9. **Internet of Things:** Includes IoT Hub and IoT Edge services that can be combined with a variety of machine learning, analytics, and communications services.
10. **Security + Identity:** Includes Security Center, Azure Active Directory, Key Vault, and Multi-Factor Authentication Services.
11. **Developer Tools:** Includes cloud development services like Visual Studio Team Services, Azure DevTest Labs, HockeyApp mobile app deployment and monitoring, Xamarin cross-platform mobile development, and more.

## EDGE COMPUTING

# Q1. What is Edge Computing? Explain with suitable Diagram? Give its advantage and disadvantage?

Ans:- Edge Technology aims at making Internet Of Things (IOT) with 100 thousand of sensors in next decade, with the increased usage and manipulation of large data it becomes important to get used to this technology which refers to computing on sensor itself

## Benefits of Edge Computing

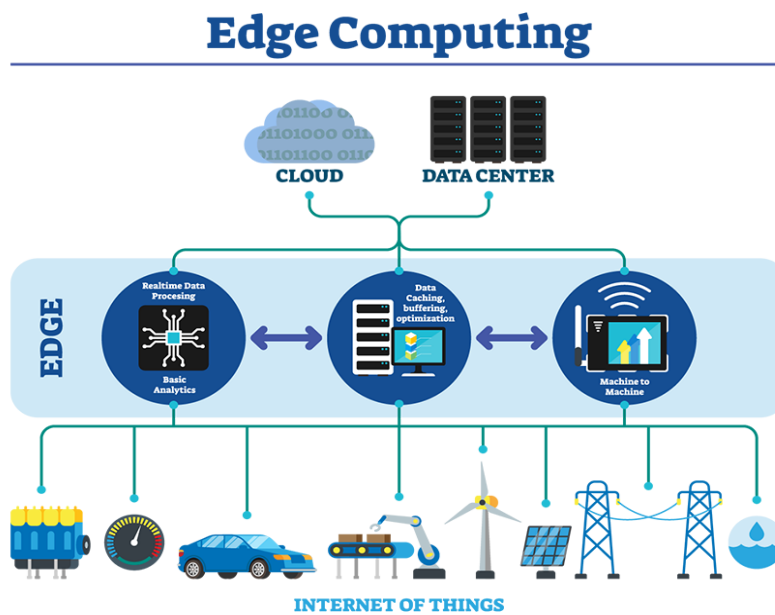
1. Faster response time.
2. Security and Compliance.
3. Cost-effective Solution.
4. Reliable Operation With Intermittent Connectivity.
5. Reduced latency

## Limitation Of Edge Computing:

1. **Complexity:** Setting up and maintaining edge computing systems can be challenging, especially if there are many devices or a vast geographic region involved.
2. **Limited resources:** Edge devices frequently have constrained processing, storage, and bandwidth, which can restrict their capacity to carry out specific activities.
3. **Dependence on connectivity:** In order for edge computing to work correctly, connectivity is required. If the connection is lost, the system may not be able to work.
4. **Security Concern:** Edge devices may be susceptible to security risks such malware, hacking, and physical interference.

## Edge Cloud Computing Services:

- IOT (Internet Of Things)
- Gaming
- Health Care
- Smart City
- Intelligent Transportation
- Enterprise Security



## Advantages

### 1. Lesser Transmission Costs:-

- In addition to the possibility of simplifying cloud security approaches, edge computing can also result in significant cost reductions due to lower bandwidth. Because so much data is now processed and stored in localized servers and devices, there is no need for most data to go to data centers. As a result, edge computing requires less bandwidth at the data center level.

## 2. Scalability and Versatility:-

Data must be transmitted to a centralized data center in a cloud computing system. Modifying or expanding this data center can be pricey at times. On the other hand, the edge may be utilized to scale your own IoT network without having to worry about storage. Furthermore, IoT devices can be placed here with just one implantation

## 3. Faster response time and lower latency:-

- A company's every millisecond is critical to its success. Downtime or latency might cost them thousands of dollars. Edge computing can reduce latency and hence boost network speed. In addition, processing data closer to the source of information, considerably lowers the distance it must travel.

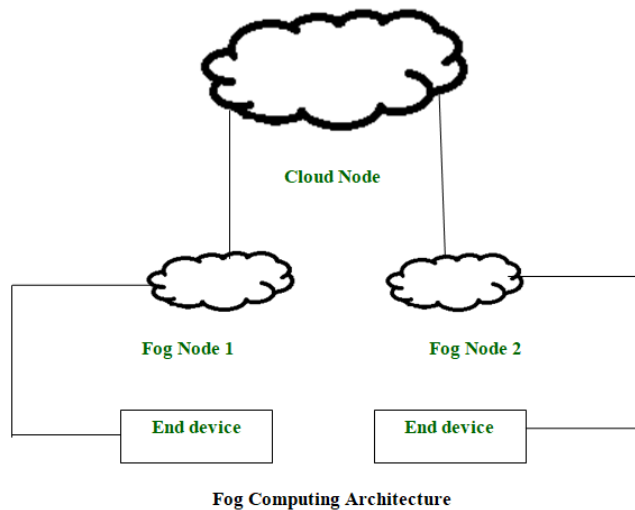
## 4. High Security and Less Risk:-

- The data stored in the cloud has a high risk of being hacked. This can be avoided since edge computing only sends the appropriate data to the cloud. In addition, edge computing does not always necessitate the use of a network connection. Therefore, even if hackers gain access to the cloud, not all users' information is at risk.

## Q2. What is Fog Computing? Explain with suitable diagram ?

Ans:- Fog is something which we see in between land and cloud .. And when we talk about fog computing we see distributed computing where we relied on distribute network switch and router which work together to compute information. **Fog computing found some where in between data and application..** here in cloud computing we try to compute near data generation in order to decrease data latency and maintain data security and integrity. If we take example of traffic network management.





## Advantage of Fog Computing

### 1. Bandwidth conversation:-

- Fog computing reduces the volume of data that is sent to the cloud, thereby reducing bandwidth consumption and related costs.

### 2. Improved response time:-

- Because the initial data processing occurs near the data, latency is reduced, and overall responsiveness is improved.

### 3. Network-Agnostic:-

- Although fog computing generally places compute resources at the LAN level -- as opposed to the device level, which is the case with edge computing -- the network could be considered part of the fog computing architecture.

## Disadvantage of Fog Computing

### Physical Location:-

- Because fog computing is tied to a physical location, it undermines some of the "anytime/anywhere" benefits associated with cloud computing.

### 2. Potential Security Issues:-

- Under the right circumstances, fog computing can be subject to security issues, such as Internet Protocol (IP) address spoofing or man in the middle (MitM) attacks.

### 3. Startup Costs:-

- Fog computing is a solution that utilizes both edge and cloud resources, which means that there are associated hardware costs.

# Industrial Internet of Things (IIOT)

**Q1. What is IIOT ? Gives some advantages and Disadvantages of IIOT and its Applications?**

**Ans :- The intelligent communication loop setup between machines enables timely attention to maintenance issues. The safety level of the operations is also boosted by alleviating the risk factors.**

## **Advantages of IIOT**

- **Improved efficiency :** The biggest advantage of IIoT is that it gives manufacturers the ability to automate, and therefore optimize their operating efficiency. Robotics and automated machinery can work more efficiently and accurately, boosting productivity and helping manufacturers streamline their functions.
- **Quality control :** By monitoring the condition (speed, vibration, etc.) and calibration of machines responsible for the creation of a certain product, quality control assessment can instantly be undertaken following production.
- **Cost Savings:** By monitoring and optimizing processes, IIoT can help reduce waste, increase energy efficiency, and lower operating costs.
- **Predictive Maintenance:** IIoT can predict when equipment or machines may need maintenance or repairs, reducing unplanned downtime and maintenance costs.
- **Data Analytics:** IIoT generates large amounts of data, which can be analyzed to identify patterns, trends, and anomalies. This can provide insights for optimizing operations and improving decision-making.

## **Disadvantage of IIOT**

- **Security risks:** The increased connectivity of devices and systems creates more potential entry points for cyber attacks, which can compromise sensitive data and operations.
- **Cost:** The deployment of IIoT solutions can be expensive, and may require ongoing investments in maintenance, upgrades, and training.
- **Reliance on connectivity:** IIoT systems depend on stable and reliable connectivity, which can be disrupted by a variety of factors, including network outages, interference, and environmental factors.

## **Applications of IIOT**

- The industrial internet of things (IIoT) refers to the extension and use of the IoT in industrial sectors and applications.
- A strong focus on machine-to-machine (M2M) communication, big data, and machine learning, the IIoT enables industries and enterprises to have better efficiency and reliability in their operations.

The IIoT encompasses industrial applications, including robotics, medical devices, and software-defined production processes



Q2. What is the different Between Cloud Computing and Green Computing ?

Ans :-

Cloud Computing	Green Computing
It is all about delivery of computing services including servers, storage, databases, networking, etc., over internet.	It is all about utilizing energy to perform operations in most efficient way possible.
It offers utility-oriented IT services to users worldwide.	It helps in using least amount of computing resources for doing most amount of work.
Its main goal is to provide magnitude improvement in cost effective, dynamic provisioning of IT services.	Its main goal is to attain economic viability and improve way of how computing devices are used.
It reduces energy consumption, waste, and carbon emissions, reduce carbon foot print, etc.	It reduces use of hazardous materials, increase energy efficiency during product's lifetime, manage power and energy efficiency, create sustainable business processes, etc.
It increases revenue of business organizations and help them to achieve business goals, provide faster communication, secure network collaboration, promote efficient utilization of existing resources, etc.	It reduces carbon footprint of business and provide a reputation boost, help business responsibly use energy and keep business running on energy-lean diet.
It is internet service that provides computing needs to computer users.	It is that a computer and technology is how much responsible for environmental change.
It allows company to diversity its network and server infrastructure.	It allows companies to improve disposal and recycling procedures.
It lowers IT costs, maintain business continuity, provide scalability, allows automatic software integrations, etc.	It lowers energy bills, lower overall power usage, cost-effective due to less energy usage and cooling requirements, etc.
It is less cost effective as compared to green computing.	It is more cost effective as compared to cloud computing.

## Q2. What is green Cloud Computing ? Explain its applications? Advantages and Disadvantages ?

Ans :- **Green Computing** also called as Green IT (Information Technology) or Green Technology refers to the durable computing of the environment which means eco-friendly use of computers, and it's related resources.

### Objectives of Green Computing :

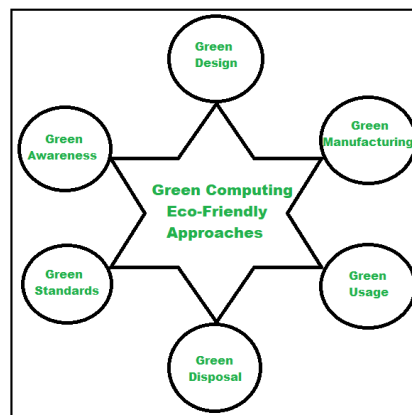
- To minimize the use of hazardous IT/computing products.
- To make the computing process more eco-friendly.
- To make the computing process energy efficiency.
- Reducing travel requirements.
- Recycling of computing wastage product.
- Purchasing and using green energy.
- Save money due to reduced utility cost.
- Reducing the use of papers.
- Designing good algorithms for better computer's efficiency.

### APPROACHES TO GREEN COMPUTING :

For the promotion of green computing, the below four approaches are utilized

1. **Green Use** –  
Reducing the power usage of computers and its periphery subsystems and using them in an eco-friendly manner. Also adopting virtualization reducing the need of energy.
2. **Green Disposal** –  
Recycling and reusing existing equipment, properly disposing the wasted IT/computing materials, electronic equipment etc.
3. **Green Design** –  
Designing energy efficient as well as effective systems which have a minimal impact on the green environment.
4. **Green manufacturing** –  
Manufacturing Biodegradable materials, also manufacturing long usable, recyclable products and reducing wastage during manufacturing process.

The below figure represents the approaches of green computing :



### Applications of Green Computing :

1. Green Wireless Network.
2. Energy Management in Data Centre's.
3. Green Cloud Computing.
4. Green Parallel Computing.

Advantages and Disadvantages of Green Computing :

**Advantages :**

- Reduced energy consumption.
- Maintaining green environment.
- Cost-effective computing.
- Conservation of resources.

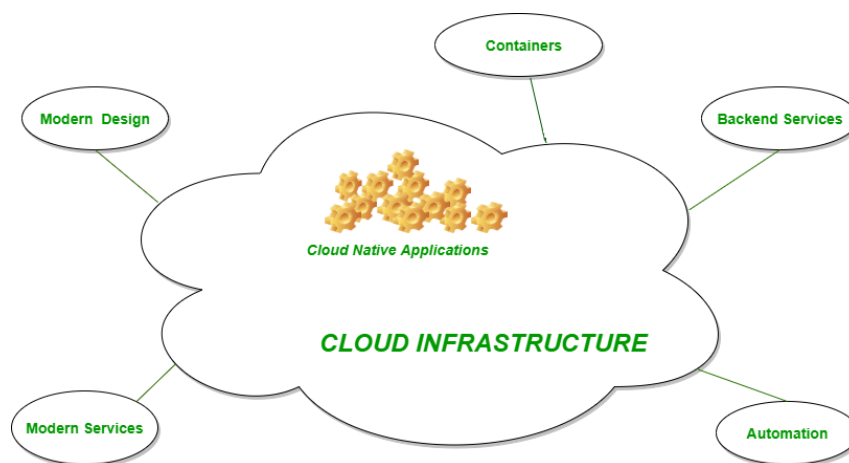
**Disadvantages :**

- Rapid change in technology.
- Initial implementation may be costly.
- Requires care from user.
- Requires deep understanding of green computing concept.

### Q3. Explain briefly about Cloud Native ?

**Ans:- Cloud-Native :**

Cloud-Native can be described as an approach that builds Software Applications as Micro-services and runs as well as maintains them on a containerized platform to utilize the proper advantages of the cloud computing model., i.e., each organization will have to modernize its infrastructure, processes, and organizational structure while choosing the right cloud technologies as per their respective requirements and user's total usage.

**Advantages of Cloud-Native :**

- **Speed** –  
Faster to deploy than Cloud-based approach as in cloud-native no hardware and software has to be deployed while in the case of cloud computing they are slower because of hardware provisioning or software setup.
- **Reusability** –  
Since reusable elements, as well as services, constitute the cloud environment, so they can be maintained and reused easily.
- **Reduced Cost** –  
Since Cloud-native is server-less architecture so reduced cost as compared to a container-based architecture.
- **On-demand Infrastructure** –  
An invisible infrastructure that is easily portable and can be provided whenever there is a requirement or user demand.
- **Reliability** –  
Cloud-native is further scalable, flexible, and quite secure which makes it reliable for consumers.