Assignment - 02

Q2. Differentiate between Grid computing & cluster computing.

The following table highlights the major difference between grid computing & cluster computing.

Cluster Computing	Grid computing
Nodes must be homog-eneous i.e., they should have same type of h/w & OS	Nodes may have different OS & h/w. Machines can be homogenous or heterogenous
Computer in a cluster are dedicated to the same work & perform no other task.	Computers in a grid contribute their unused processing resources to the grid computing network.
Computers are located close to each other	Computers may be locat-ed at a huge distance from one another
Computers are connected by a high speed local area network bus	Computers are connected using a low speed bus or the internet
Computers are connected in a centralized netw-ork topology	Computers are connected in a distributed or de-centralized network topology

Assignment - 02

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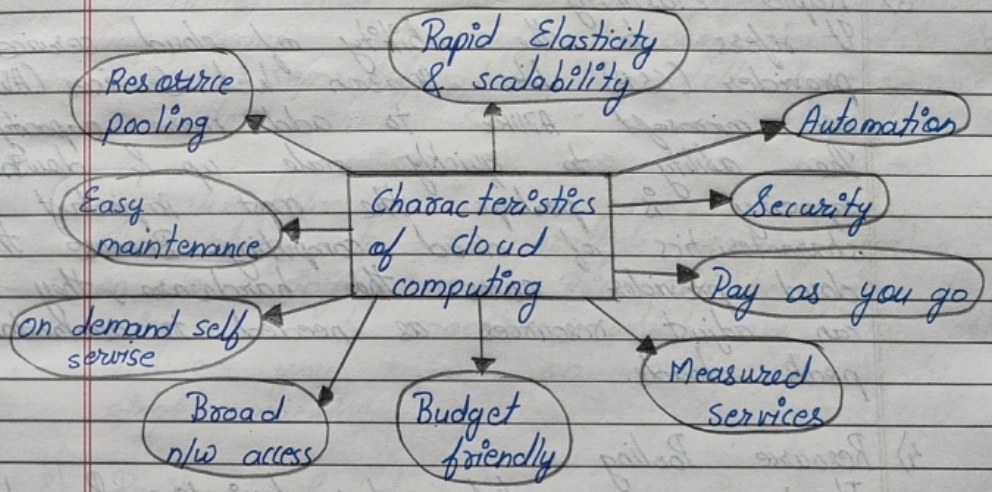
Computers are connected in a centralized netw-ork topology	Computers are connected in a distributed or de-centralized network topology

Scheduling is controlled by a central server	It may have servers, but mostly, ~~but~~ each node node behaves independently
Whole system has a centra-lized resource manager	Every node manages it's resources independently
Whole system functions as a single system	Every node is autonomous & anyone can opt out anytime
Cluster comp. is used in areas such as weblog-ic applica^ servers, db, etc	Grid computing is used in areas such as predictive, modeling, automa^, stimula^ ck.
It has centralized resource management.	It has distributed resource management.
Cluster computing has rigit & specific b/w tasks & control structures	Grid computing is flexible in terms of resource sharing
A centralized server contro-ols the scheduling of tasks in cluster computing	Here multiple servers can exist. Each node behaves independently without the need of any server

Q7 Explain characteristics of cloud computing

=> Cloud computing is a type of internet based computing that allows users to access their data & s/w over the internet, regardless of their location.



* Key characteristics of cloud computing:-

1) On-demand self-services
It means that you can start using your chosen cloud services whenever you need it. You don't have to wait for someone else to make it available or set up the right equipment for you. you just log in and get started right away.

2) Broad Network Access.
It means that cloud services are accessible from anywhere in the world via internet.

This means that you don't have to worry about working remotely. You can simply log into your account from wherever there's an internet connection.

3) Rapid Elasticity
It refers to the ability of cloud services provider (CSP) like Amazon Web Services (AWS) or microsoft AZURE to add more capacity. The ability to quickly scale up & down capacity is perhaps the most important characteristics of cloud computing. Because the cloud provider owns the hardware, they can adjust resources as needed to accomodate peak loads.

4) Resource Pooling
It is an essential characteristics. By pooling resources across multiple users & applications, cloud computing can be more cost-effective than traditional IT systems. This resources pooling also makes it easier to scale up & down resources, which helps business respond quickly to changes in demand without having to invest in new h/w or s/w

5) Measured services.
This is the characteristic of a CC that refer to the ability to pay for only what you use. You are billed for the resources you have used, rather than paying for your entire infrastructure based on capacity.

6) Multi-Tenancy
It refers to the fact that multiple customers share the same physical infrastructure. This means that different companies data is stored separately, but they all have access to the same services.

7) Virtualization
The ability to run multiple operating systems on a single server. This can be done by using virtual machines, which are s/w that allows you to run an entire OS on a single machine.

8) Resiliency & Availability
The ability for your data to be resilient in the event of a failure or to be available when it's needed. This can be accomplished by redundancy & failover features.

9) Security
CC features provide security by using multiple layers of protection, including firewalls, encryption & identity management systems. It provides enhanced security for your business data & app" by leveraging standard practices in informa" security.

10) Pay-Per-Use pricing
You can use resources as you need them instead of paying for storage space that may go unused.
This is the one of the many effective CC features.

Q3) Describe pros & cons of cloud computing

* Pros of Cloud computing.

1) Reduce infrastructure costs.
In house data storage costs companies a significant amount of money. Even when you invest in the best equipment, something can always go wrong due to human error. But with CC, the headache associated with maintaining in-house systems disappears as you have the support of your service provider. Because the cost of infrastructure is included in your plan & split among all the service provider's clients, you save money.

2) Impact to personnel
Maintaining an in-house IT team big enough to manage local servers can quickly lead to a ballooning budget. The time spent recruiting & the money spent training are all with the hopes that you're developing a highly effective & dedicated employee - but that's not always the case. Some employees will underperform, and others may decide to leave organization.

3) Increased IT resources
Enterprises can access more resources for internal services development & digital transformation projects that directly support business units for easier business experimentation & innovation.

4) Convi Convenient, rapid access to technology
Enterprises can work with the latest h/w & such as new CPU's & GPU's, ML & AI applica^ & network interfaces - often before P/s available or affordable to enterprise buyers.

5) Faster connectivity.
Cloud provides invest in the latest o/w interfaces cards & switches along with multiple GBPS circuits to internet exchange points. This provides the fastest access to data & applications both within the data center & customers.

6) Greater scale
The p/l public cloud is engineered for massive scale. Provide is can easily expand resources capacity for individual services to meet customer workload demands.

7) Greater expertise.
Few organisa" possess the internal expertise in secure infrastructure & secure engineering offered by cloud provider. The expertise allows for highly specialized services, such as powerful analytics & AI, which might be impossible to implement with local data center staff.

* Cons of Cloud Computing.

1) A complicated shared security model
Security policies & mgmt are split bet" the provider & user. Understanding the division in shared responsibility of crucial as mistakes or neglected can be exposed vast amounts of sensitive data.

2) Vendor lock-in
Cloud vendors aren't ubiquitous. Cloud providers share many common service types, but access techniques - such as APIs service levels & pricing can vary dramatically. It might not be ++ possible to migrate a workload from one cloud provider to the other without some amount of re-architecting of new cloud enviroa".

3) Complex pricing ~~statements~~ structures.
Some services, such as compute instances have multiple subscrip" tiers & pricing schemes. There variables make pricing & ver total cost of ownership analysis tedious & time consuming doing so typically requires s/w assistance from built-in or third-party tools.

4) Outbound data transfer costs.
It's expensive to egress large data sets from cloud provider to the local data center or another level cloud this also creates a distinctive for an organiza" to move from one cloud provider to another.

5) less flexibility than DIY enviroarments.
Many configura" choices are made by the providers, so customers have limited control.

6) Sketchy, inconsistent customer support.
Cloud providers can be difficult to reach as slow to respond to technical issues & cost concerns. As a result many ~~applica~~ organiza" contract with 3rd-party cloud mgmt for support partner.

7) Fast redundancy connectivity.
CC requires either reliable connec" to networks & the internal or direct private link to the provider in This is especially imp. for remote loca" such as edge facilities.

Q4) Explain benefits of Cloud computing.

1) Accessibility anywhere within any devices.
Each branch or office across various states or countries. The improved accessibility doesn't just impact employee, client & customers can also log in to an account & access their infor" as well. This ensure everyone has up-to-date info" whether they're at office or on the go.

2) Ability to get rid of most or all h/w & s/w. With CC, you're no longer required to have your own servers, cables, network switches, back-up generators, redundant routers & so on. Depending on the cloud providers you choose, they can manage all of this for a monthly fee. Reducing expenses is essential in any business model & every cloud-based platform benefits from this factor alone.

3) Centralized data security
When you use CC, data backups are centralized in the cloud providers data centers, removing the need for individual users or teams to maintain their own backups onsite & offsite. This lowers the risk of data loss should any one backup fail or be destroyed by a disaster. Cloud providers can restore the data from another copy maintained in their cloud storage which is continuously updated with every piece of data added. Teams can take adv of cloud security technologies such as data encryp" & two-factor authentica" for greater privacy than they'd have when relying on their own equipment or servers at home or in office.

4) Higher performance & ability availability
By using CC resources together simultaneous you reap greater performance gains than by having your own dedicated server h/w. CC increases i/o opera" per second (IOPS)

5) Quick applica" development
Unpredictable business needs often require CC resources on short notice. You can improve your cloud app" development by quickly deploying cloud app" because they are readily available without the need of procure additional h/w or wait for IT staff to set up servers.

6) Instant business insights
Cloud based platform provide a unique opportunity to access data as soon as it's collected. This facilitates better decision making as well as insights into what the future may hold for your organiza" based on predic" from historical data.

7) Business continuity.
In the event of disaster or unforeseen circumstances do you have an effective plan? If not, relaying on CC services can benefit your organi". CC users uses infinite datata storage space & systems that can be activated remotely if necessary to ensure business continuity.

8) Price performance & cost savings.
Although an initial financial investment is required to implement a cloud strategy, organi" save substantial amounts in the long run bcz they don't have to maintain expensive H/w or local data centers. Also, since there are no upfront costs to use cloud based systems, businesses can test them out before investing in them at their own pace.

9) Virtualized Computing
CC is perfect for virtualized computer env. bcz cloud resources can be allocated instantly to support significant increases in demand so you never experience downtime again. With CC, for your business can expand its capabilities almost effortlessly to meet growing demands without increasing staff or capital expenditures.

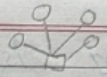
10) Cloud Computing is greener.
By moving to the cloud, business can reduce their energy consump" & carbon footprint by up to 90%. Rather than having in-house servers & s/w businesses can use cloud-based services to access the same app" & data from any computer or device with an internet connec".

Q5) Explain Evolu" of Cloud Computing
The phrase "CC" was 1st introduced in the 1950's to describe internet-related services & it evolved from distributed computing to modern technology known as CC. Cloud services include those provided by Amazon, Google & Microsoft. CC allows users to access a wide range of services stored in the cloud or internet

Evolu" of Cloud Computing

1950 → Distributed Computing
→ Mainframe computing
→ Cluster computing
→ Grid computing
→ Virtualiza"
→ Wb 2.0
→ Service Orienta"
→ Utility Computing
→ Cloud computing
2007 →

1) Distributed systems.

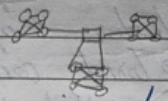


It is a composi" of multiple independent systems but all of them are depicted as a single entity to the users. The purpose of distributed systems is to stow share resources & also use them effectively & effiiently. Distributed systems passes characteri--stics such as scalability, concurrency, continuous availability, heterogeneity & independence in failures.

2) Mainframe Computing

It first came into existence in 1951 are highly powerful & reliable computing machines. There are responsible for handling large data such as massive i/o opera". Even today these are used for bulk processing tasks such as online transac" etc. These systems have almost no downtime with high fault tolerance.

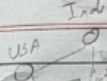
3) Cloud (Cluster) computing.



In 1980s Cluster computing came as an alternative to mainframe computing. Each machine in the cluster was connected to each other by a network with high. computa". Also, new nodes could easily be added to the cluster if it was required.

4) Grid computing

In 1990s, the concept of grid computing was



an alternative to mainframe introduced. It means that different systems were placed at entirely different geographical loca" & these all were connected via the internet.

5) Virtualization

It was introduced nearly 40 years back. It refers to the process of creating a virtual layer over the h/w which allows the users to run multiple instances simultaneously on the h/w. It is a key technology used in CC.

6) Web 2.0

Web 2.0 is the interface through which the CC services interact with the clients. It is because of web 2.0 that we have interactive & dynamic web pages. It also increases flexibility among the web pages.

7) Service Orientation.

A service orienta" acts as a reference model for cloud computing. It supports low-cost, flexible, & evaluable applications. Two imp concepts was introduced in this concepts was introduced in this computing model. They also include SLA & SaaS.

Software as a service

8) Utility Computing

It defines service provising techniques for

Services such as compute services provisioning along with the other major services such as storage, infrastructure, etc which are provisioned on pay-per-use basis.

9) Cloud Computing
It means storing & accessing the data & programs on remote servers that are hosted on the internet instead of the computers hard drive or local server. Cloud computing is also referred to as internet based computing, it is the technology where the resources is provided as a service through the internet to the user. The data that is stored can be files images, documents or any other storable document.

Q6 Explain recent trends in cloud computing
Many cloud services providers like google, Microsoft, IBM, etc are working on these cloud trends so that more cost-effective services can be provided to users with high efficiency.

* Cloud computing trends:

1) AI & ML
They are cost effective technologies as they required high computational power & storage for the collection of data & training. Major trends that will grow in this sector in the upcoming years are self-automation, self-learning, personalized cloud, high data security, & privacy. AWS deeplens camera & google lens are two such eg., of their products based on ML.

2) Data security
Security of organizational data is a top priority threats such as data leaks, data deletion & unauthorized amendments to the data need to be minimized. Data breaches can be minimized with the help of encryption & authentication. Data losses can be reduced with the help of backups, reviewing privacy policies & data recovery systems.

3) Multi- & hybrid cloud development.
Many organizations like banks, insurance companies etc are using hybrid cloud service that offer a combination of both private & public clouds to store there data. Now, businesses are dividing the workload among multiple cloud service providers (CSP) to control their data & resources as well as utilize the strength of each cloud service provider. The use of multi-cloud minimizes the potential risks & failure points & provides cost effectiveness

4) Low code & no code solu".
Business can create app" & make use of AI & its subdomains can help in the development of website, apps, services etc without having any technical knowledge.

5) Edge computing
It includes storage of data, data processing & data analytics which is done graphically nearer to the source. It means that the computa" & storage of data are brought closer to the source sensors & devices. It provides many benefits like reduced latency, enhanced efficiency, increased privacy, security & high rate of data transmission. It works in real-time & processes data that is not bounded by time.

6) IOT
IOT involves the use of many sensors that generate huge amount of data which gets storage on cloud servers. IOT makes use of many sensors & actuators & performs analysis on the data collected to yield results that will help in taking business decisions. It involves connectivity among computers, networks & Servers.

7) Kubernetes & Docker
Kubernete is an open source orchestra" platform where scaling, mgmt & deployment of applica"s is done automatically. It provides automa" to the cloud network users.
Docker is a platform where developers can package applica" & can deploy them anywhere in the form of containers.

8) Serverless architecture / computing
It provides backend services on the pre-users basis. Serverless architecture offers many adv. such as no requirements for system administra", low cost & liability, easy mgmt of opera" & enhanced user experience even in case of no internet.

9) ~~DevOps~~ DevSecOps
It is an integra" of security with the ongoing development process. It embeds many processes in its workflow to ensure secure task automa". It will provide all the acquired security to provide a secure system to users.

10) Disaster recovery & backup
Many organiza" have faced huge losses of unsaved data due to server crashes. With help of CC & a backup of critical data of businesses can be stored to quickly recover from disrup" such as data

loss, power outages, natural disasters, h/w failures.

Q7. Differentiate bet" Cloud computing & grid computing

Cloud Computing	Grid Computing
Compiles with the client server computing architecture	Follows distributed computing arch"
The high scalability provided by CC enables effective resource mgmt & alloca"	GC delivers typical scaling. Thus, it might not give as much scaling as CC
Compare to GC the CC is more flexible.	In comparison to CC the GC is less flexible
Cloud servers are owned & controlled by infrastructure providers in centralized mgmt system used for CC	GC fun" as a decentralized mgmt system with the organiza" owning & running grids
Infrastructure providers own & oversee cloud servers	The organiza" is the owner & manager of grids
Service paradigms like infrastructure as a service (IaaS), PaaS, SaaS are used in CC	Systems like distributed computing, distributed inform", distributed ubiquitously are used in GC
Service-oriented CC focuses on providing various services over internet	GC is applica" oriented, emphasising the resolu" of challenging issues that call for substantial computational resources.
Because it can be accessed using common web protocols CC is widely available & simple to use	Grid middleware, which offers the essential s/w archi" for resource co-ordina" & communica", makes grid computing accessible.
Dynamic resource mgmt & alloca" are provided via CC	GC includes managing & allocating static resources.
Users pay for the resources they use in a pay-as-you-go model, which is typical for CC	Given that resources are owned & devoted within the organiza" grid computing frequently has set costs.
Delivering customers with storage, services & computing resources as needed is the main goal of CC	GC is focused on pooling & managing computer resources via a network for certain projects or applica".
Through centralized platforms & tools, CC makes it easier for people to collaborate & share data	Through grid middleware, grid & GC facilitates collabora" bet" users & dispersed resources

Q8. Differentiate bet" CC & cluster computing.

Cloud Computing	Cluster Computing
Providing on demand IT resources & services	Performing a complex task in a modular approach
Specific assigned to resources are not ~~sharable~~ shareable	Specific assigned resources are not ~~st~~ shareable
In CC there is heterogeneous resource type	In CTC there is homogeneous resource type
Virtualiza" h/w & s/w resources	No virtualiza" resources
Security through isola" achieved	Security through node credential can be achieved
Initial capital cost for setup achieved	Initial capital cost for setup is very high
Security req. is very low	Security req. is very high
Requires low maintenance	Requires high maintenance
No h/w requirement physically	More h/w req. physically
Multiple ~~OS~~ OS runs in VM	Windows & Linux runs.
User mgmt is centralized or decentralized to vendor 3rd-party	User mgmt is centralized.
Scalability allowed	Scalability allowed limited
User chosen architecture is used	Cluster oriented architecture is used
Characteristics: Dynamic computing infra" / resources	Characteristics: Tightly coupled systems / resources.
In CC app" domain independent s/w	In CTC app" domain dependent s/w.
Example: Dropbox, email.	Eg: Sony playsta" clusters

Q9 Write a short note on cloud computing

CC refers to the use of hosted services such as data storage, servers, DB, networking & s/w over the internet. The data is stored on physical servers, which are maintained by a CSP. Computer system resources, especially data storage & computing power, are available on-demand, without direct mgmt by the user in CC

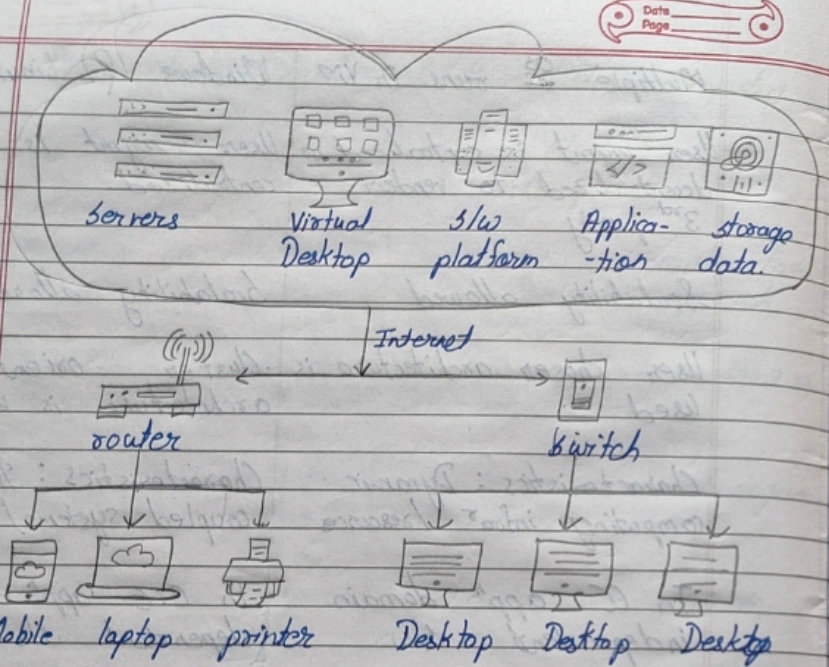
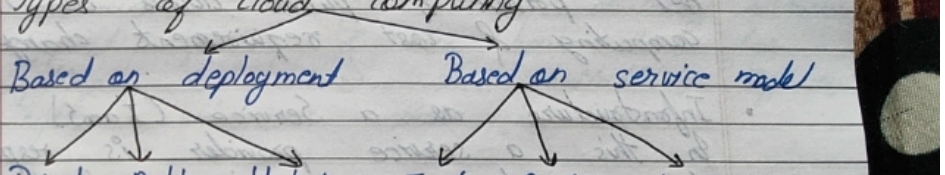


fig :- Cloud Computing architecture

Cloud can be divided into two diff layers namely front end & back-end. The layer with which users interact is called front end layer & this layer ~~with~~ enables user to access the data that has been stored in cloud through CC s/w

The layer made up of s/w & h/w, i.e, the computers, servers, central servers & DB is the back end layer. This layer is the primary component of cloud & is entirely responsible for storing informa^n securely. To ensure seamless connectivity bet^n devices linked via CC, the central servers use a s/w called middleware that acts as a bridge bet^n the DB & applica^n.

Types of Cloud computing



- Private Cloud.
In a private cloud, the computing services are offered over a private IT network for a dedicated use of single organiza^n. It is usually managed via internal resources & is not accesible to anyone outside the organiza^n. Private CC provide all the benefits of a public cloud, such as self-service, scalability & elasticity.

- Public cloud
It refers to the CS offered by 3rd party providers over the internet. Public clouds are available to anyone who want to use or purchase them. These services could be free or sold on demand where users only have to pay per usage for the CPU cycles, storage or bandwidth

the bandwidth they consume

- Hybrid cloud
  It is a combina^n of the public & private cloud features. The "best of both worlds" cloud model allows a shift of workloads bet^n private & public clouds as the computing & cost requirements change.

- Infrastructure as a Service (IaaS)
  In this, a service provider is responsible for providing servers, storage & networking over a virtual interface. Instead of the user, a 3rd-party vendor hosts the h/w, s/w, servers, storage & other infrastructure components.

- Platform as a service (PaaS)
  It provides a development environment in cloud that allows users to develop & run applications without the ~~no~~ complexity of building or maintaining the infrastructure.

- Software as a Service (SaaS)
  SaaS allows users to access a vendor's software on cloud on a subscription basis. In this, user don't need to install or download applica^ns on their local devices. Instead, the applica^ns are located on a remote cloud network that can be directly accessed through web or API

Q10. What are the advantages to adopting cloud computing?

1) Improved customer service
   Adopting cloud technology & solu^n can be instrumental in achieving to stay in touch with your company. Most of cloud based companies are proactive in resolving customer support queries & also have SLA's for uptime to ensure the availability of the system whenever there is need.

2) Cost-efficiency
   Moving to the cloud, on the contrary gives organiza^ns the benefit of eliminating the high cost of H/w & installations as it allows them to opt for a subscrip^n based model that suits their budget.

3) Faster implementa^n cycles
   Cloud solu^ns, enterprises enjoy the advantage of a quick implementation cycle where products usually go live within ~~two~~ weeks instead of months. Cloud technology improves collabora^n among teams to easily access, edit & share documents & data from anywhere at any time.

4) Promotes scalability
   CC can seamlessly accomodate changes such & respond to them adequatly. Once you move the to

cloud, you don't have to constantly change the whenever you scale up or down.

5) Upgrades & Maintenance.
With cloud there is no risk of the slw becoming absolute. The upgrades & maintenance in case of the cloud are seamless & frequent

6) Better security.
The cloud is generally more soft & secure as compared to an premises infrastructure. Moving to the cloud solu" makes sure that none of the confidential data is vulnerable to hackers or those who aren't authorised & saves it from comma. security threats.

7) Better document control.
By using cloud employees can send files to a central place where everyone can access them. Further with your app" & infrastructure hosted on the cloud you place yourself in an ecosystem where there is continuous innovation.

8) Gives multiple options.
CC offers business a host of applica"s under one of the below services.
i) SaaS ii) PaaS iii) IaaS.
Customers also have the option to create a private, public or protected hybrid nw access.

9) Environment- Friendly
Adopting cloud technology allows you to reduce your carbon foot print as you can easily scale up & down as per your specific business requirements. It gives you the benefit of only using the resources which you need & saving yourself from leaving oversized 'footprints'

10) Disaster Recovery
Regardless of the size, businesses often spend a huge chunk of their money on disaster recovery. CC can help organiza". especially small businesses to save their time resources, avoid high investment & get benefied from third-party expertise.