(A) Outline about the cloud services used in Google Colab.

Google Colab, short for "Colaboratory", is a free cloud service provided by Google Colab that allows users to write and execute python code in a web-based, interactive notebook environment.

1. Google Compute Engine (GCE) :-

* Function :- provides the virtual machines for running colab notebooks.
* Uses :- offers scalable and powerful Compute resources for executing code.

2. Google drive Integration :-

* Function :- Allows seamless access and storage of files.
* Uses :- Users can save and load notebooks and datasets directly from google Drive.

3. Google cloud storage :-

* Function :- provides durable and scalable Object Storage.
* Uses :- Storing large datasets and files accessible from cola

4. Tensor processing Units :-

* Function :- It is a specialized hardware for accelerating machine learning computations.
* Uses :- Running deep learning models with more efficiency in colab.

5. Google cloud AI platform :-

* Function :- provides tools for building, training and deploying machine learning models.
* Uses :- Enhances machine learning workflows with colab, integrating with Other AI services.

(7) Discover the location services used in Google maps.

=> main location services used in Google maps

1. Gps (Google positioning system):-

* Function :- provides precise location data by triangulating signals from multiple satellites.

* Uses :- determining exact geographic coordinates

=> enabling turn-by-turn navigation.

2. WiFi positioning system :-

* Function :- uses the proximity of wi-Fi networks to determine a device's location.

* Uses :- enhancing location accuracy indoors or in areas where Gps signals are weak.

=> providing location data in urban environments with dense WiFi networks.

3. Cell Tower Triangulation :-

* Function :- estimates a device's location based on its distace from multiple cell towers.

* Uses :- offering location data when Gps and WiFi signals are unavailable

4. Bluetooth Low Energy Beacons :-

* Function :- Uses Bluetooth signals from beacons for positioning

* Uses :- Indoor navigation and proximity-based services.

5. Crowdsource Data :-

* Function :- Aggregates anonymous location data from users to improve map accuracy and traffic predictions.

* Uses :- updating road conditions and maps

=> providing real-time traffic updates.

6. Offline maps and Local data Storage :-

* Function :- Stores map data locally on the device for use without an Internet Connection.

* Uses :- providing navigation and location services in areas with poor connectivity.

⑥ Analyze the cloud services used in E commerce applications.

cloud services play a critical role in the infrastructure of E-commerce applications.

1. Infrastructure as a Service (IaaS)

Examples :- Amazon web Services, microsoft Azure, Google Cloud platform.

Uses :- Scalability :- easily scale up or down based on demand

Flexibility :- Customize the infrastructure to meet specific requirements.

Cost management :- pay only for resources used.

2. platform as a Service (Paas)

Examples :- Heroku, Google App Engine, AWS, Elastik Beanstal

Uses :-

Development Efficiency :- provides a platform to develop, run and manage applications without worrying about the underlying infrastructure.

Integration :- Simplifies integration with other services and applications.

Speed to market :- Accelerates the development process by providing preconfigured environments.

3 Software as a Service : (Saas)

Examples :- Shopify, magento, Big Commerce.

Uses :- Ease of use :- Ready to use applications for various e-commerce functions.

maintenance :- The provider manages updates, security, maintenance

Accessibility :- Accessible from any device with internet Connectivity.

⑨ Predict the cloud services used in virtual meeting (Gmeet, Zoom, etc)

1. Compute and virtual machines :-

Function :- provide scalable computing resources to host meeting applications.

Examples :- Google Compute Engine, Amazon EC2, Azure Virtual machines

2. Real-Time Communication Services :-

Function :- Enable audio and video communication between participants in real-time.

Examples :- web RTC, Amazon Chime SDK, Twillo programmable Video.

3. Content Delivery Networks (CDNs) :-

Function :- Distribute audio and video streams efficiently to reduce latency.

Examples :- Google cloud CDN, Amazon cloud Front, Azure CDN

4. Storage services :-

Function :- store meeting recordings, chat logs and other data.

Examples :- Google cloud storage, Amazon S3, Azure Blob storage

5. Identity and Access Management (IAM) :-

Function :- manage user identities and control access to meeting resources securely

Examples :- Google Identity, AWS, IAM, Azure Active Directory.

(7) 3 physical servers

- with 16 cores
- 64 GB of RAM
- type A VM : 2 cores with 4GB of RAM
- type B VM : 4 cores with 8 GB of RAM.

Total = 3 x 16 = 48 cores

(a) type A vm no. of vms hosted = $\frac{\text{no. of cores per server}}{\text{No. of cores for type A VM}}$

$= \frac{16}{2} = 8$ VMs

(b) type A VM requires 4 GB of RAM

$\frac{64}{16}$ = 4 GB RAM Allocation for each core.

then for type B vm has 4 cores then

4x4 = 16 GB of RAM is required.

(b)

cores : 16

RAM : 64 GB

cores Allocation of type A VMs = $\frac{16}{2} = 8$ VMs

RAM Allocation of type A VMs = $\frac{64}{4} = 16$ GB.

(8)

SAN consists 10 storage Nodes

each node consists 100TB storage capacity

bandwidth = 8 Gbps Accessing time = 10ms

(a) Total storage capacity of the SAN

capacity per node x No. of nodes = 100 x 10

= 1000 TB.

(3) a) otp valid time = 30 sec

user access Cloud service every 5 min

no. of otps needed by 1 hour = $\frac{60 \text{ min}}{5 \text{ min}}$

= 12 otps

b)

Users = 100000

12 otps one in 1 hours. per 1 User

then

100000 x 12 = 12,00,000 otps are accessed

c) percentage of otp generation capacity utilized.

otp generation 1000 per sec.

otp generation for 1 hour = 1000 x 3600

= 36,00,000

percentage utilized = $\frac{1200000}{3600000} \times 100$

= 33.33

(4) a) 1TB data store for one node

There are 10 nodes

10 x 1TB = 10TB

3 x 10TB = 30TB.

b) 30% additional storage

$30 \times \frac{10}{100} = 3$ TB.

c) Each token = 1 KB. for one node

10 nodes = 10KB.

d)

33TB Total storage

10KB for security tokens.

Overall Ratio : $\frac{10}{(1024)^3} = 9.1 \times 10^{-12}$ TB.

① A Company is considering moving its entire data center infrastructure to a cloud provider offering Paas.

=) It has 50 physical servers

=) Utilization 30%.

=) The Company estimates that it can consolidate its workload onto virtual machines (VMs) with an average of 70% in the cloud.

CPU : 4 virtual cores

RAM : 16 GiB.

Storage : 200GiB.

VM cost = $0.05 per hour

Additional VM cost = $0.10/h

a) The total cost per hour to run the workload in cloud

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current setup in the data Center. :

- 50 physical servers
- Average utilization : 30%.

This means only 30% of resources are efficiently utilized.

- VM specifications
- CPU : 4 virtual cores
- RAM : 16GiB

The Company will Consolidate its workload onto VMs with an average utilization of 70% in cloud.

Core calculation:

50 × 32 = 1600 . [Assuming each server has 32 cores]

1600 × 0.30 = 480 cores.

480/4 = 120 VMs.