

# POORNIMA

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### DETAILED LECTURE NOTES

Service Level Agreement - Unit - IV

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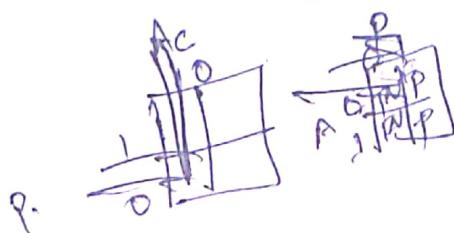
A formal contract between a Service Provider and a Service Consumer.

→ SLA is a foundation of the consumer's trust in the provider.

→ SLA contains Service Level Objectives (SLOs)

SLA contents -

- A set of services which the provider will deliver.
- A complete, specific definition of each service.
- A responsibilities of the provider and consumer.
- A set of metrics to measure whether the provider is offering the services as guaranteed.
- An auditing mechanism to monitor the services.
- The remedies available to the consumer and the provider if the terms are not satisfied.
- How the SLA will change overtime.





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#### Types of SLA -

There are two types of SLA -

- off the shelf SLA or Non-negotiable SLA or Direct SLA
  - Non conducive for mission critical data or applications.
  - Provider creates the SLA template and define all criteria viz. contract period, billing, response time, availability etc.
  - Followed by the present day state-of-the-art clouds.

#### Negotiable SLA -

- Negotiation via external agent.
- Negotiation via multiple external agents.

#### Service Level Objective -

- Objectively measurable conditions for the service.
- Encompasses multiple QoS parameters viz. availability, serviceability, billing, penalties, throughput, response time or quality.

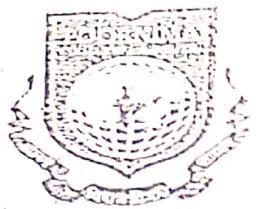
- Example -
- Availability of a service X is 99.9%.
  - Response time of a database query Q is between 3 to 5 seconds.
  - Throughput of a server S at peak load time is 0.875.

7 fundamentals of cloud security -

1. Understand what you are responsible for
2. Control user access
3. Data Protection
4. Secure Credentials
5. Implement multifactor authentication.
6. Increase visibility
7. Adopt a shift-left approach.

Shift left means is to take a task  
that's traditionally done at a later  
stage of the process and ~~be~~ perform  
that task at earlier stages.

Shift left is a practice intended to find and  
prevent defects early in the software delivery  
process.



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Risk Mitigation - It is a approach to mitigate cloud

Security threats and protect user data.

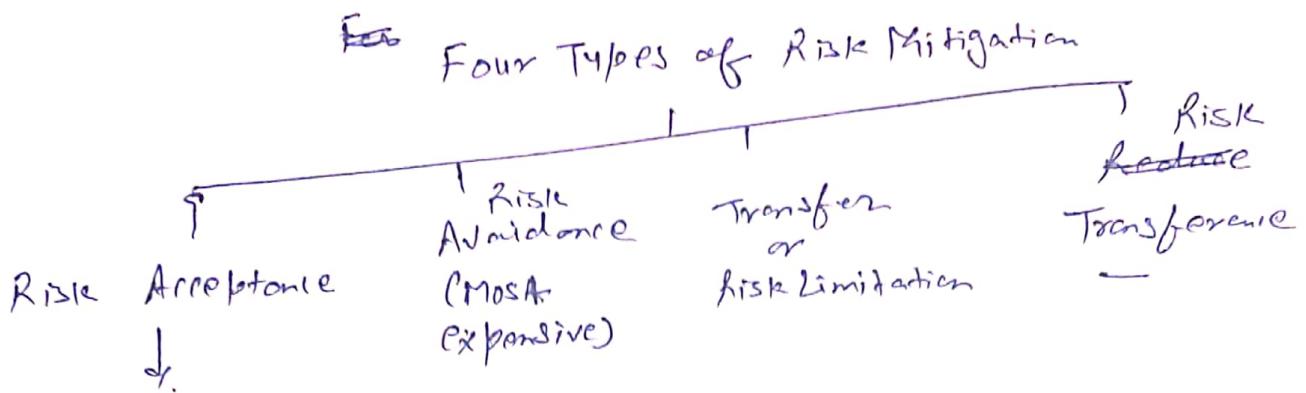
Risk Mitigation can be defined as taking steps to reduce adverse effects.

- Limit user access to Cloud Security
- Set up multi-factor authentication
- Regularly back up company data
- Conduct employee training workshops on cloud security.
- Increase network bandwidth to prevent DDoS attacks.
  - Businesses can also benefit from having a backup internet connection. If all else fails that would let users connect to the cloud through different IP addresses.

Strategies to Mitigate Cloud Risks-

- ① Data Encryption at Rest - Encryption at rest protects data that is not in use or in transit.
- ② Two factor authentication.
- ③ Eliminate shared Accounts
- ④ Insist on a well defined shared responsibility model.
- ⑤ use standardized Cloud Assessment Questions.

Types of Security policies for cloud computing -

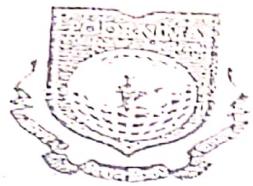


Types of Security policies for Cloud Computing -

- ① Secure cloud accounts and create groups.  
→ Ensure that the root account is secure.
- ② Check for free security upgrades.
- ③ Restrict infrastructure access via firewalls.
- ④ Tokenize the cloud.
- ⑤ Replace ~~passwords~~, passwords with keys.
- ⑥ Turn on auditing and system monitoring.

Cloud Security Challenges -

- ① Distributed Denial of Service and Denial of Service attacks.
- ② Data ~~breached~~ breaches.
- ③ Data loss
- ④ Insecure access control points.
- ⑤ Notifications and alerts



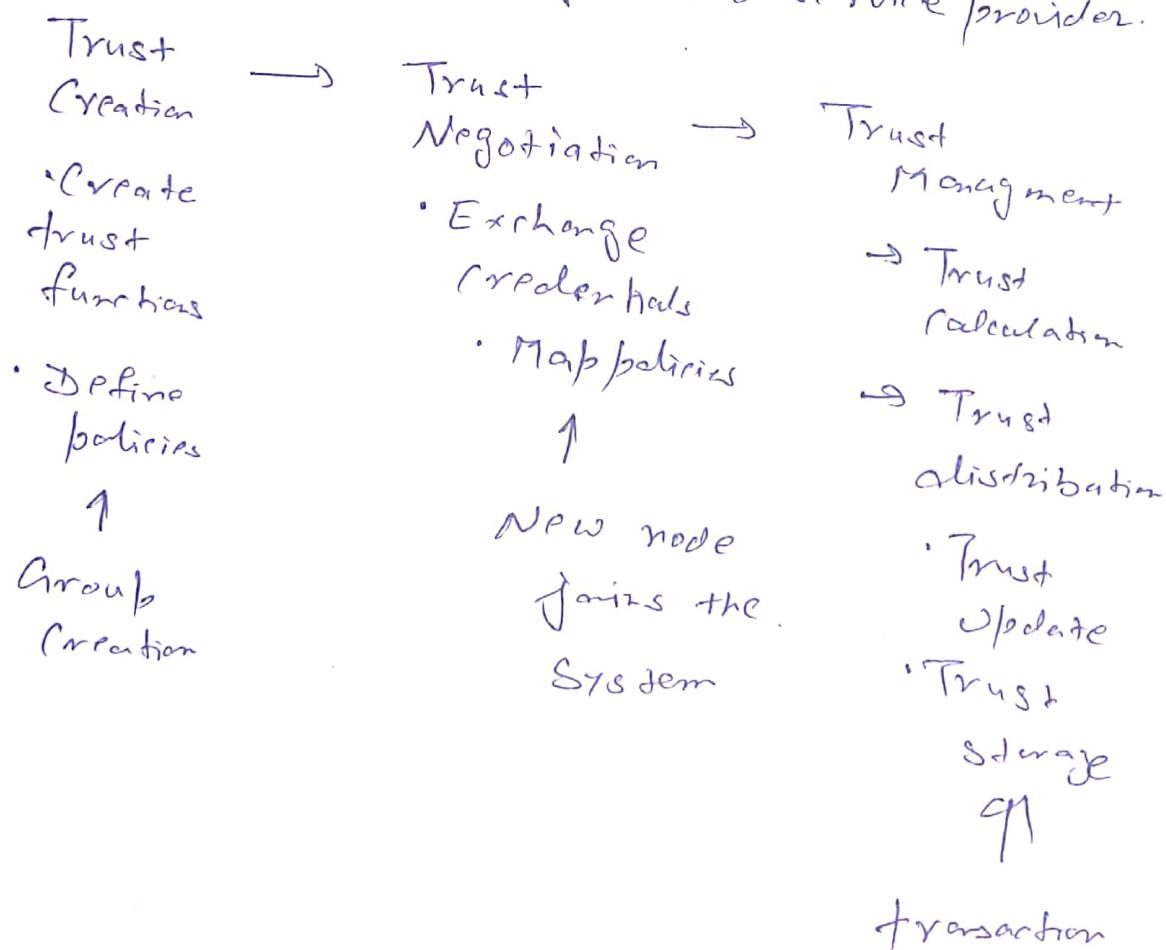
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Trust Management In cloud computing -

A system proposed that implements the trust management system for cloud computing, that assures secure data access through trustworthy cloud service provider.





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#### Business Continuity Plan (BCP)

Adapt and respond to risks with a business continuity plan.

A business continuity plan is a document that outlines how a business will continue ~~operations~~ operating during an ~~out~~ unplanned disruption in service. It contains contingencies for business processes, assets, human resources and business partners. - every aspect of the business that might be affected.

A key component of BCP is a disaster recovery plan that contains strategies for handling IT disruptions to networks, servers, personal computers, and mobile devices.

Key features of an effective BCP -

- ① Strategy - objects that are related to the strategies used by the business to complete day to day activities while ensuring continuous operations.

- ② Organization - objects that are related to the structure, skills, communication and responsibilities of its employees.
- ③ Applications and data - objects that are related to the software necessary to enable business operations, as well as the method to provide high availability that is used to implement that software.
- ④ Processes - objects that are related to the critical business process necessary to run the business as well as the IT processes used to ensure smooth operations.
- ⑤ Technology - objects that are related to the systems, network and industry specific technology necessary to enable continuous operations and backups for applications and data
- ⑥ Facilities - objects that are related to providing a disaster recovery site if the primary site is destroyed.



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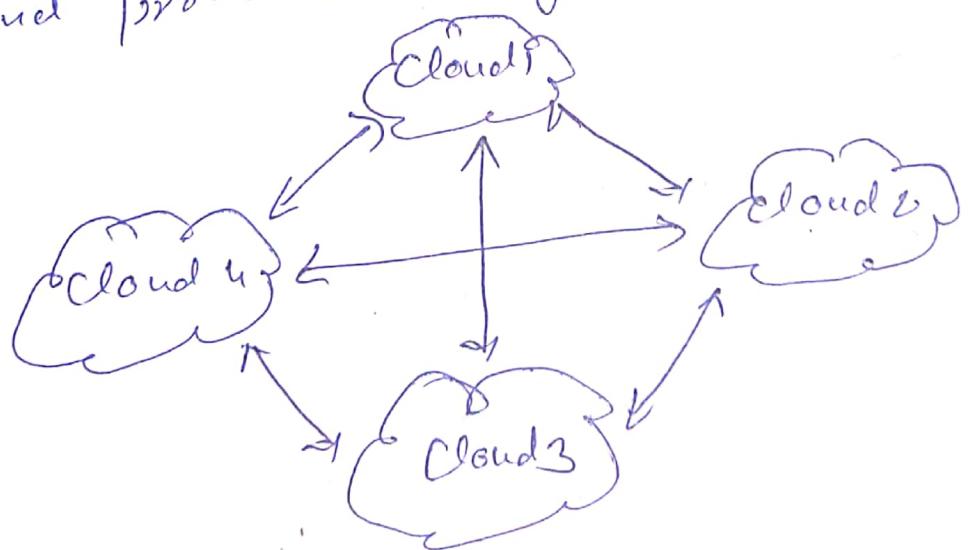
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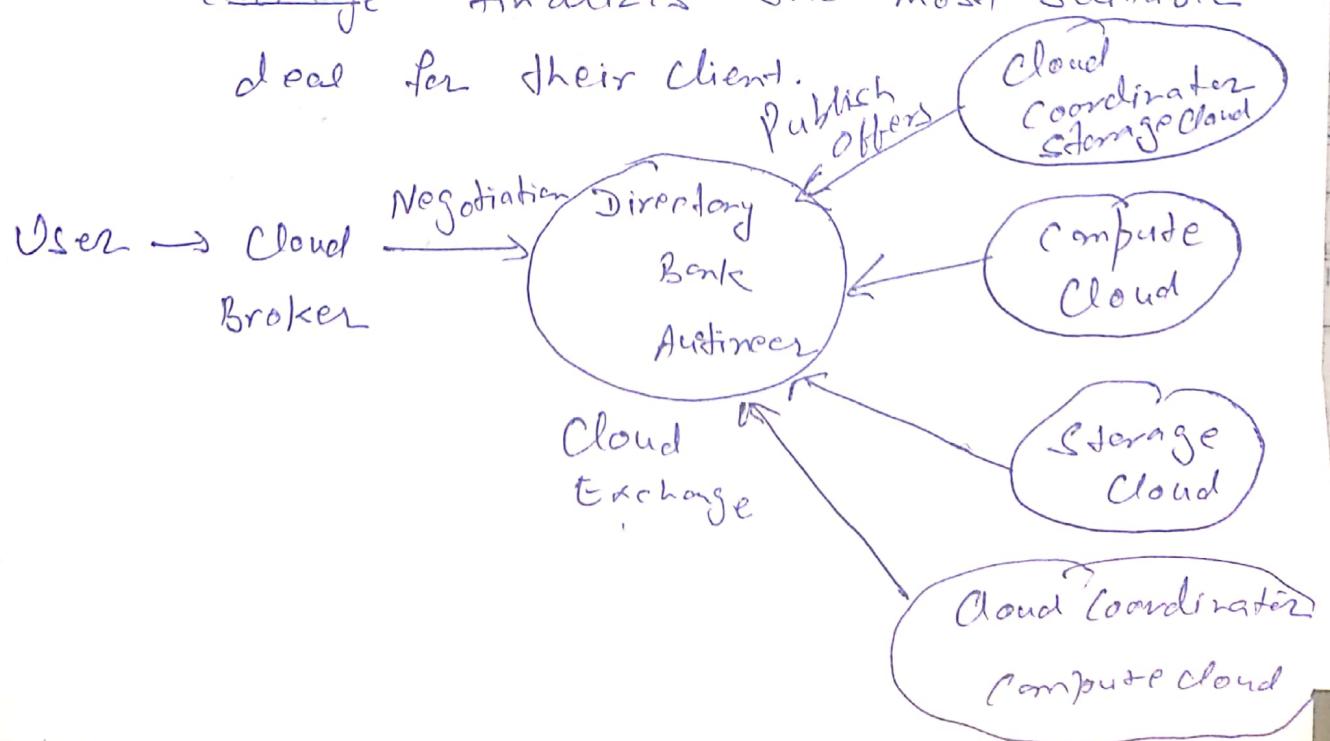
Unit - V

Cloud Federation - Is the deployment and management of several external and internal cloud computing services to match business needs. It is a multinational cloud system that integrates private, community and public clouds into scalable computing platforms. Federated clouds is created by connecting the cloud environment of different cloud providers using a common standard.



## The architecture of Federated cloud-

1. Cloud Exchange - The cloud exchange acts as a mediator between cloud coordinator and cloud broker.
2. Cloud Coordinator - The ~~Cloud~~ Cloud Coordinator assigns the resources of the cloud to the remote users based on the quality of service they demand and the credits they have in the cloud bank.
3. Cloud Broker - The cloud broker interacts with the cloud coordinator, analyzes the service level agreement and the resources offered by several cloud providers. In cloud exchange, cloud broker ~~exchange~~ finalizes the most suitable deal for their client.





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Benefits of federated cloud -

1. It minimizes the consumption of energy.
2. It increases reliability.
3. It minimizes the time and cost of providers due to dynamic scalability.
4. It provides easy scaling up of resources.
5. It connects various cloud service providers globally. The providers may buy and sell services on demand.

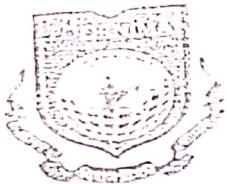
Chall. Challenges in federated Cloud -

1. In cloud federation it is common to have more than one provider for processing the incoming demands. In such cases there must be scheme needed to distribute the incoming demands equally among the cloud service providers.

2. The increasing requests in cloud federation have resulted in more heterogeneous infrastructure, making interoperability an area of concern. It becomes a challenge for cloud users to select relevant cloud service providers and therefore it ties them to a particular service provider.
3. A federated cloud means constructing a seamless cloud environment that can interact with people, different devices, several application interfaces and other entities.

Federated Cloud Technologies-

1. openNebula
2. Anetka Coordinator
3. Eucalyptus.



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#### Unit-IV

Google app engine is a platform as a service product that provides web app developers and enterprises with access to Google's scalable hosting and fast internet service. GAE requires that applications must be written in Java or Python, store data in Google BigTable and use the Google Query language.

GAE's key features -

API Selection - GAE has several built-in APIs including the following five -

- Blobstore for serving large data objects.
- GAE Cloud Storage for storing data objects.
- Page Speed Service for automatically speeding up webpage load times.
- URL Fetch Service to issue HTTP requests and receive responses for efficiency and scaling
- Memcache - for a fully managed in-memory data store.

Managed infrastructure - Google manages the back-end infrastructure for users. This ~~approach~~ approach makes GAE a serverless platform and simplifies API management.

Several programming languages - GAE supports Go, PHP, Java, Python, NodeJS, .NET and Ruby. It also supports custom runtimes.

Support for legacy runtimes - GAE supports legacy runtimes, which are versions of programming languages no longer maintained.

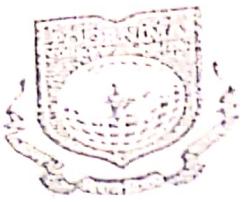
For ex. Python 2.7, Java 8 and Go 1.11.

Application diagnostics - GAE lets users record data and run diagnostic on applications to gauge performance.

Security features - GAE enables users to define access policies with the GAE firewall and managed Secure Sockets Layer/ Transport Layer Security certificates for free.

Traffic splitting - GAE lets users route requests to different application versions.

Versioning - Applications in Google App Engine function as a set of microservices that refer back to the main source code.



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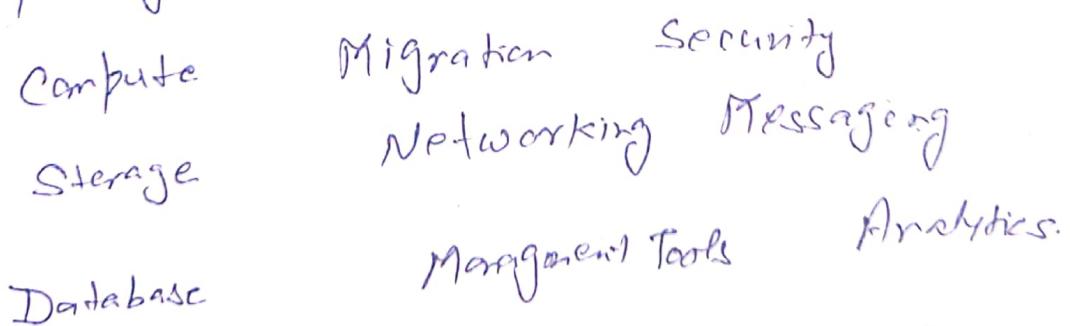
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Amazon cloud Services - It is a platform that offers flexible, reliable, scalable, easy to use and cost effective cloud computing solutions.

The platform is developed with a combination of infrastructure as a service (IaaS), PaaS, and SaaS.

AWS offers a wide range of different business purpose global cloud based products. The products include storage, databases, analytics, networking, mobile, development tools, enterprise applications, with a pay as you go pricing model.

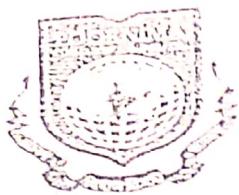


Ec2 (Elastic compute cloud) - Ec2 is a virtual machine in a cloud on which you have OS level control. You can run this cloud server whenever you want.

- LightSail - This cloud computing tool automatically deploys and manages the computer, storage and networking capabilities required to run your applications.
- Elastic Beanstalk - The tool offers automated deployment and provisioning of resources like a highly scalable production website.
- EKS (Elastic Container Service for Kubernetes) - The tool allows you to Kubernetes on Amazon Cloud environment without installation.
- AWS Lambda - The AWS service allows you to run functions in the cloud. The tool is a big cost saver for you as you to pay only when your functions execute.

Migration → Database Migration Service.  
→ Server Migration Service  
→ Snowball → It is a small application which allows you to transfer terabytes of data inside and outside of AWS environment.

Storage → Amazon Glacier  
Amazon Elastic Block Store  
Amazon Storage Gateway.



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#### Security Services -

- Identity and Access Management
- Inspector → It is an agent that you can install on your virtual machines, which reports any security vulnerabilities.
- Web Application Firewall
- Cloud Directory
- Key Management Service
- Shield → It is a managed DDoS protection service.
- Macie → It offers a data visibility security service which helps classify and protect your sensitive critical content.
- Guard Duty → It offers threat detection to protect your AWS accounts and workloads.

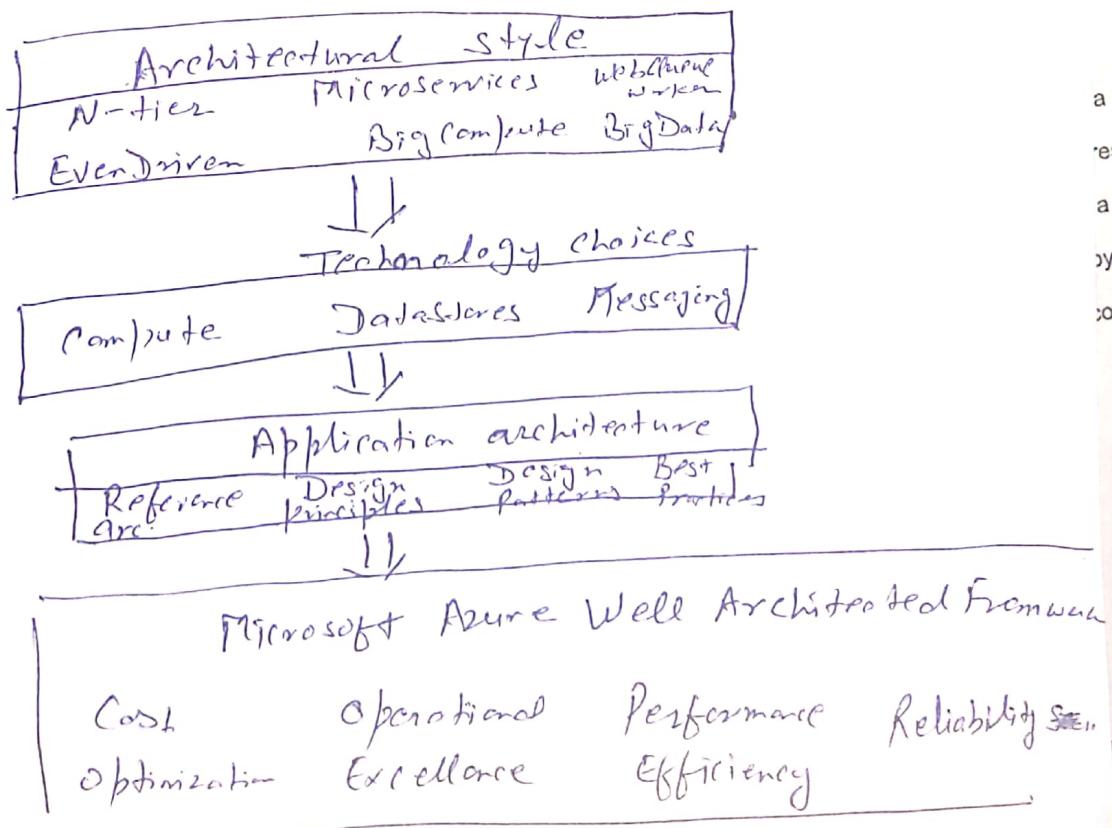
#### Database Services -

- Amazon RDS
- Amazon ~~DynamoDB~~ DynamoDB → NoSQL database service.
- Amazon Elastic Cache
- Neptune → Scalable Graph database service.
- Amazon Redshift

Microsoft Azure. It is a public cloud services platform where users could build, test, deploy and manage their applications using Microsoft cloud based data centers. Through Azure, Microsoft offers a host of services on different domains such as Compute, Database, Content Delivery and networking. It provides IaaS, PaaS, SaaS.

Ex. of Azure Solutions -

- App Development
- App Hosting
- Software Testing
- Virtual Machine Creation
- Virtual Hard Drives
- Integration and Synchronization
- Business Intelligence.



Aneka is a platform and a framework for developing distributed applications on the Cloud. It harnesses the spare CPU cycles of a heterogeneous network of desktop PCs and servers or datacenters on demand. Aneka provides developers with a rich set of APIs for transparently exploiting such resources and expressing the business logic of applications by using the preferred programming abstractions. System administrators can leverage on a collection of tools to monitor and control the deployed infrastructure. This can be a public cloud available to anyone through the Internet, or a private cloud constituted by a set of nodes with restricted access.

The Aneka based computing cloud is a collection of physical and virtualized resources connected through a network, which are either the Internet or a private intranet. Each of these resources hosts an instance of the Aneka Container representing the runtime environment where the distributed applications are executed. The container provides the basic management features of the single node and leverages all the other operations on the services that it is hosting. The services are broken up into fabric, foundation, and execution services. Fabric services directly interact with the node through the Platform Abstraction Layer (PAL) and perform hardware profiling and dynamic resource provisioning. Foundation services identify the core system of the Aneka middleware, providing a set of basic features to enable Aneka containers to perform specialized and specific sets of tasks. Execution services directly deal with the scheduling and execution of applications in the Cloud.

One of the key features of Aneka is the ability of providing different ways for expressing distributed applications by offering different programming models; execution services are mostly concerned with providing the middleware with an implementation for these models. Additional services such as persistence and security are transversal to the entire stack of services that are hosted by the Container. At the application level, a set of different components and tools are provided to: 1) simplify the development of applications (SDK); 2) porting existing applications to the Cloud; and 3) monitoring and managing the Aneka Cloud.

A common deployment of Aneka is presented at the side. An Aneka based Cloud is constituted by a set of interconnected resources that are dynamically modified according to the user needs by using resource virtualization or by harnessing the spare CPU cycles of desktop machines. If the deployment identifies a private Cloud all the resources are in house, for example within the enterprise. This deployment is extended by adding publicly available resources on demand or by interacting with other Aneka public clouds providing computing resources connected over the Internet.

