Module-03

Q.1) Write in brief about the types of cloud.

Ans)

1.) Public Clouds:-

- Public clouds are the first expression of cloud computing, offering services to anyone, anywhere and at any time via the internet.

- They are a distributed system, likely composed of one or more datacentres connected together, on top of which specific services are implemented.

- Public clouds were the first class of cloud implemented and offered, offering solutions for minimizing IT infrastructure costs and handling peak loads on local infrastructure.

- They are attractive for small enterprises, allowing them to start their businesses without large up-front investments.

- Public clouds are used to completely replace & extend enterprise IT infrastructure

- A fundamental characteristic of public clouds is multitenancy, serving a multitude of users, not a single customer.

- A significant portion of the software infrastructure is devoted to monitoring cloud resources, billing them according to the contract made with the users, and keeping a complete history of cloud usage for

each customer.

- Public clouds can offer any kind of service: infrastructure, platform or applications.

- from an architectural point of view, there is no restriction concerning the type of distributed system implemented to support public clouds.

- Public clouds can be composed of geographically dispersed datacentres to share the load of users & better serve them according to their locations.

2.) Private Clouds:

Public Private Clouds & their Advantages!-

- rely on a private infrastructure & provide dynamic provisioning of computing resources.

- they keep core business operations in-house, reducing the burden of maintaining it once the cloud is set up.

- Private clouds can provide services to a different range of users, allowing better utilization of existing IT resources

- Private clouds can be tested at a lower price than public clouds before deploying them on the public virtual infrastructure

Benefits of Private Clouds:-

- Customer information protection: in-house security is easier to maintain & rely on

- infrastructure ensuring Service Level Agreements (SLAs): Quality of service requires specific operations such as clustering &

failover, data replication, system monitoring & maintainance, & disaster recovery.

- compliance with standard procedures & operatns'- Organizations subject to third-party compliance standards need specific procedures when deploying & executing applications.

Architectural considerations:-

- Implemented on more heterogeneous h/w, relying on the existing IT infrastructure already deployed on the private premisis.
- Iaas or Paas solutn can be used to complement the physical layer.
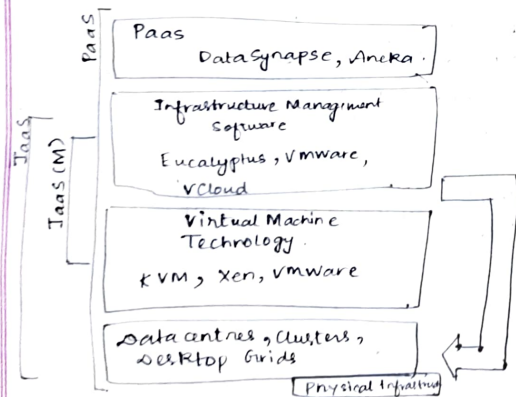
Private Cloud Implementation:-

- VMs such as Xen, KVM & VMware serve as the foundations of the cloud.
- VMM technologies like VMware vCloud, Eucalyptus, & Open Nebula can be used to control the virtual infrastrn & provide an IaaS solution.
- OpenPEX & InterGrid are web-based systems that allow the reservation of VM instances & manage multi-administrative domain clouds. Paas solutions can provide an additional layer and deliver a high-level service for private clouds.

3.) Hybrid Clouds:-

- Combination of public & private clouds, allowing enterprise to exploit existing IT infrastructures & manage sensitive info.
- addresses scalability issues by leveraging external resources for exceeding capacity demand, known as cloudbursting.
- concept applied to IT infrastructure rather than s/w server.
- dynamic provisioning refers to the ability to acquire on ~~distributed~~ & demand VMs to increase capability of resulting distributed system & then release them.
- Infrastructure management s/w & Paas are the building blocks for deploying & managing hybrid clouds.
- Ex: OpenNebula, InterGrid.

- Dynamic provisioning is implemented in PaaS solution supporting hybrid clouds, ensuring execution of applications under the agreed QoS.

- Aneka provides a provisioning service that leverages diff. IaaS providers for scaling the existing cloud infrastructure.
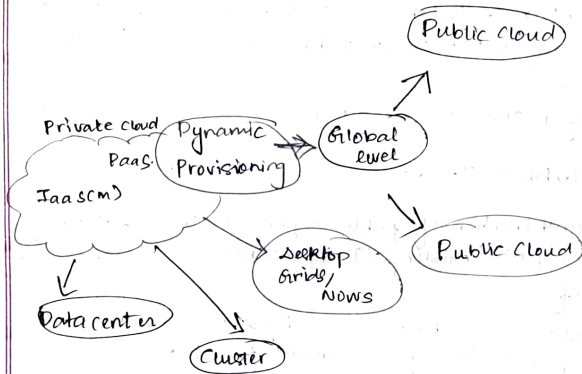

Figure:- Hybrid/Heterogeneous cloud overview

4) Community cloud:- A distributed system for Industry, Community & Business sectors.

Characteristics:

- infrastructure shared by several organizations & supports a specific community with shared concerns.

- users of a community cloud can be govt. bodies, industries, or simple users, all focusing on the same issues for their interaction with the cloud.

Case Studies:

- Media Industry:- shared environment for B2B collaboration & offer the necessary bandwidth, CPU & storage.

- Healthcare Industry:- global platform for sharing info. & knowledge without revealing sensitive data.

- Energy & other core industries:- bundle comprehensive solutions that address management, deployment & orchestration of services & operations.

- Public Sector:- Business-to-administration, citizen-to-administration. & B2B.

Benefits of Community Clouds:

- openness: open systems that allow fair competition b/w diff. solutions.

- community: infrastructure is scalable & grows simply by expanding its user base.

- convenience & control:- shared & owned by community, making all decisions through a collective democratic process.

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Module - 04

Q.) Write about Privacy Impact Assessment & why it is considered important in identifying & addressing privacy issues within information systems especially in context of evolving digital & cloud-based environments?

Ans) Definition & Rights of Privacy:-

- Privacy refers to the rights to keep personal or proprietary info. confidential.
- Many nation view privacy as human rights, with the Universal Declaration of Human Right stating that no one shall be subjected to arbitrary interference with their privacy, family, home, correspondence, or attack upon their honor & reputation.
- In UK, privacy is guaranteed by the Data Protection Act.

Challenges & Regulations:

- digital age has presented new threats related to privacy such as identity theft if personal info is voluntarily shared but stolen or misused.
- Some countries like European union in addressing new privacy concerns with strict laws governing handling of personal data in the digital age.
- New privacy rights "Right to be forgotten", is confirmed as part of a broad new proposed data protection against regulation in the EU.

Privacy Concerns in Public Clouds:

- services based on individual preferences, location of individuals, membership in social media networks or other personal info. present a special risk.
- Owner of data cannot rely on CSP to guar guarantee the privacy of the data.

Aspects Of Privacy:-

- **Lack of user control:-** Once data is stored on the CSP's servers, the user losses control of the exact locat and in some inst instances, the user could lose access to the data.

- **Potential unauthorized secondary use:-** A CSP may obtain revenues from anauthorized secondary usage of the information, eg. for targeted advertising.

- **Dynamic Provisioning:** Threats due to outsourcing, a range of issues are very fuzzy, such as how to identify the subcontractors of a CSP, what rights to the data they have, and what rights to data are transferable in case of bankruptcy or merger.

Need for Legislation:

- need for tools capable of identifying privacy issues in info. systems, so-called Privacy impact assessment
- An ab initio approach to embedding privacy rules in new

systems is preferable to painful changes that could affect the functionality of existing systems.

Q.2) How can we effectively address the security challenges posed by malicious mobile code & unauthorized access in open-platform OS, while ensuring the integrity of applications & data, and protecting against attacks that could compromise the entire system?

Ans). → OS are crucial in protecting applications from malicious attacks such as unauthorized access to privileged info., tempering with executable code & spoofing.

⇒ Mandatory OS security includes access control, authentication usage, and cryptographic usage policies.

⇒ Trusted applications perform security-related functions & should be allowed the lowest level of privileges required.

⇒ Solution to security problems is to decompose complex mechanisms into components with well-defined roles.

⇒ A trusted path mechanism is required to prevent malicious s/w from tampering with the attributes of the object & /or with the policy rules.

⇒ good security relies on the ability of the file system to preserve the integrity of Java class code.

- Specialized closed-box platforms could have embedded cryptographic keys that allow themselves to reveal their true identity to remote systems & authenticate the s/w running on them.

- Highly secure OS is necessary but not sufficient unto itself; application specific security is also necessary.

- Commodity OS offer low assurance due to their complexity & vulnerability to a wide range of malicious attacks.

- OS provide only weak mechanisms for applications to authenticate to one another and do not have a trusted path between users & applications.
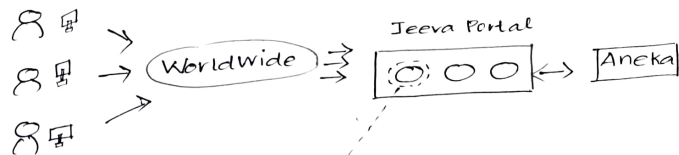
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Module- 05

Q.1) How can cloud computing be utilized to accelerate protein structure prediction, a computationally intensive task in bioinformatics?

Ans) Protein Structure Prediction in Biology:

i) biology applications often require high computing capabilities & large data sets, requiring supercomputing & cluster computing.

ii) Cloud computing technologies can leverage these capabilities dynamically, opening new opportunities for bioinformatics applications.

iii) Protein structure prediction is a computationally intensive task fundamental to life sciences research, including drug design.

iv) The geometric structure of a protein cannot be directly inferred from the sequence of genes, but is the result of complex computations.

v) Cloud computing grants access to computational power on a pay-per-use basis, eliminating the need for owning a cluster or navigating bureaucracy.

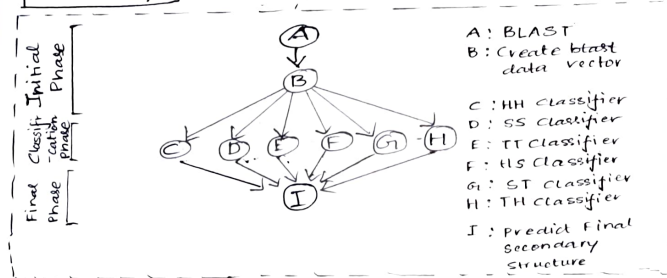Figure:- Architecture & overview of Jeeva Portal.

A : BLAST
B : Create blast data vector
C : HH classifier
D : SS classifier
E : TT classifier
F : HS classifier
G : ST classifier
H : TH classifier
J : Predict Final Secondary Structure

vi) Jeeva, an integrated Web Portal, uses cloud technologies for protein structure prediction, offloading the prediction task to a computing cloud based on Aneka.

vii) The prediction algorithm is translated into a task graph submitted to Aneka, which makes the results available for visualization.

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