



Road Map to India's Own Cloud Service Providers

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Abstract-- India's pursuit of digital sovereignty and the need for secure and locally governed cloud services have given rise to the development and implementation of India's own cloud service offerings. This abstract examines the emergence of India's indigenous cloud services and highlights their significance in promoting data localization, fostering innovation, and strengthening national cybersecurity.

In recent years, India has witnessed exponential growth in internet adoption, data generation, and digital transformation across various sectors. Recognizing the importance of data protection and control, the Indian government has encouraged the development of domestic cloud services to ensure that sensitive data remains within the country's borders.

This abstract delves into the motivations behind the establishment of India's own cloud services. It explores how these services promote data localization, enabling businesses and government entities to store and process data within India, thereby bolstering data security and privacy. Additionally, it discusses the role of domestic cloud services in complying with local regulations, addressing concerns related to cross-border data transfers, and fostering trust among Indian businesses and consumers.

In conclusion, these abstract highlights the emergence of India's own cloud services as a pivotal step towards achieving digital sovereignty and fostering domestic innovation. By promoting data localization, encouraging entrepreneurship, and bolstering cybersecurity, these services contribute to India's vision of becoming a digitally empowered nation. However, it also emphasizes the importance of a balanced approach, where collaborations and partnerships with global cloud providers can complement and augment the capabilities of India's indigenous cloud services, ensuring a robust and competitive cloud ecosystem in the country.

1. Introduction

The Cloud Computing Services has brought a transformational shift to the traditional way of how the businesses and the organization were used to work. The cloud computing services not only revolutionized the way of business but also opened many opportunities that were not possible earlier. Today there is a lot of development happening towards AI and ML. This is possible because of cloud computing services as it provides you with the resources to perform such a heavy workload that may be not possible on your system locally as it may require heavy resources (like: more storage, more ram, heavy duty processors, ...). Through cloud computing services you can easily get these resources to use as you required.

This technology has the potential to enhance the economy of our country as it provides a platform to the business to grow more.

1.1 What is General meaning of Cloud Computing Service

The Cloud Computing Service basically means accessing resources of another system or environment through your system via a specific networking method.

Simply, cloud computing is the delivery of online computing services like: Storage, Servers, Databases, Networking, Software, Analytics, Intelligence.

There are four main types of cloud computing:

1 Private Clouds[1]: Private clouds are briefly defined as cloud environments specially dedicated to a single end user. Organizations are now building private clouds on their own data centers. Private clouds are mostly used by governments as those data are not supposed to be accessed by general public.

2 Public Clouds[1]: Public clouds are cloud environment typically created from IT infrastructure not owned by an end user. Some of the public cloud providers are:

Alibaba Cloud, Amazon Web Services (AWS), Google Cloud Platform (GCP), IBM Cloud, Microsoft Azure. Some of these cloud service providers are available for a long time like Google Cloud Platform and Microsoft Azure and some are very newly established like IBM Clouds.

3 Hybrid Clouds: A hybrid cloud is a seemingly single IT environment created from multiple environments connected through various networks profiles like local area networks (LANs), wide area network (WANs), virtual private networks (VPNs).

4 Multi Clouds[2]: Multi clouds are a cloud approach that provides cloud services made from more than 1 cloud service, from more than 1 cloud vendor -public or private. So, we can say that all hybrid clouds are multi clouds but all multi clouds are not hybrid clouds.

1.2 What are the services the we are generally using based on cloud:

1. IaaS (Infrastructure as a Service):

[7] Infrastructure as a Service means a [2] cloud serviceprovider manages the infrastructure for you – the actual servers, virtualization, network and data storage through internet connections. This is basically used by those who wants to build their system or environment from scratch according to their own needs.

2. PaaS (Platform as a Service):

Platform as a Service means are managed the cloud service provider, but the user handles the apps running on the top of the platform and the data the apprelies on.

3. SaaS (Software as a Service):

SaaS or Software as a Service [2] is a cloud service that delivers a software application-which the cloud provider manage-to its users. Typically, SaaS apps are mobile applications or web applications that the users can accessvia a web browser. All the other stuffs like software maintenance, update, bud fix is taken care for the user. Some of the popular and mostly used SaaS services are Gmail, Slack, MicrosoftOffice 365, Netflix.

1.3 Architecture of Cloud Computing:

Current ongoing research on cloud computing helps in developing more features and solutions that is improving the quality of services provided by the cloud computing providers. Architecture of cloud computing is the combination of both Services oriented Architecture and Event Driven Architecture.

Cloud architecture refers to the design of systems, applications, and infrastructure that are built to operate in the cloud environment. Cloud architecture typically includesthe planning, design, and deployment of cloud- based solutions that are scalable, flexible, and reliable.

In cloud architecture, applications and systems are designedto operate in a distributed environment, where resources such as servers, storage, and network are provisioned and managed dynamically.

Cloud architecture also involves designing systems that are secure, with proper authentication, authorization, and access control mechanisms in place to protect sensitive data and ensure compliance with regulatory requirements.

Cloud architecture often involves the use of containerization and microservices architecture, which enables the creation of modular, loosely-coupled components that can beindependently deployed and managed. This approach allowsfor greater flexibility and agility in application developmentand deployment, as well as the ability to scale and update applications more easily.

Overall, cloud architecture plays a critical role in enabling organizations to take advantage of the benefits of cloud computing, including cost savings, scalability, flexibility, and reliability. By leveraging cloud architecture best practices, organizations can design and deploy cloud-based solutions that are optimized for performance, security, and cost-effectiveness.

In general Cloud Computing architecture is divides into 2 parts i.e.

- 1 Frontend: As name suggest, it refers to the client side of cloud computing system.
- 2 Backend: Refers to the cloud itself which is used by the services we are using.

1.4 Cloud Computing Data Centre GeographicLocation:

Cloud Service providers have large resources. These management is done through data centers. Data centershouse the hardware, plus other software that helps to manage our cloud services. Data centers are physical facilities located at a particular place on earth. They are mostly owned by big cloud service providers such Amazon (AWS), Google Cloud (GCP), Microsoft (Microsoft Azure), IBM Cloud, Alibaba Cloud, etc.

These geographic locations are divided in three location categories:

1. Region: Regions are geographic locations where the data centers owned by public cloud service providers reside. Regions basically denotes the bigger geographical areaunder which lots of Zones and Edges comes. It is bestto choose 'Region' near to your location. Some of the common regions are Africa, Europe, China, Asia Pacific, etc.
2. Zone: Zones or AZs (Availability Zones) is an isolated location within a geographic region that works as physical data center. If you are using IaaS (Infrastructure as a Service) then it is up to the user to choose the Availability Zones. However, it is advised to choose AZs near to your location or the place where you want to serve your purpose for fast process execution.
3. Edge: Edge locations basically means pacing computers, storage, database, and other select cloud services closer to the end-user. This is the new technology development, thatenables fast processing.

2 LITERATURE REVIEW

Research shows how Cloud Computing is big help in business growth and how India's pursuit of digital sovereignty and the need for secure and locally governed cloud services have given rise to the development and implementation of India's own cloud service offerings. This abstract examines the emergence of India's indigenous cloud services and highlights their significance in promoting data localization, fostering innovation, and strengthening national cybersecurity.

3 Problem faced in recent growth of online activities in India

[2] The act of stealing digital information from computers, servers, or other electronic devices in order to access sensitive information or violate privacy is known as data theft. Bank account information, online passwords, passport numbers, license numbers, social security numbers, health records, online subscriptions, and other data can all be stolen. [6] Without the owner's consent, an unauthorized individual can remove, edit, or prohibit access to personal or financial information once they have it. [2] Malicious actors that intend to sell the information or exploit it for identity theft are the main causes of data theft. If information thieves have enough data, they can use it to open secure accounts, open credit cards in the victim's name, or perform other unauthorized acts using the victim's identity. The act of stealing digital information from computers, servers, or other electronic devices in order to access sensitive information or violate privacy is known as data theft. Bank account information, online passwords, passport numbers, license numbers, social security numbers, health records, online subscriptions, and other data can all be stolen. [6] Without the owner's consent, an unauthorized access has been growing.

3.1 How the Other Country will data theft using another platform:

1 Under social Media Data Theft: Phishing is the most typical type of social media. When an attacker poses as a reliable source to trick a victim into opening an email text message, or instant messaging, this is called phishing. Data theft frequently results from users falling for phishing scams. User provide own details on social media platform those company's servers will take their information and provided to other organizations & Hackers for miss use of public data.

2 Insecure passwords Data Theft: A password that is simple to guess or using the same password across several accounts increases the risk of data breach. Data theft can also result through bad password practices, such as writing passwords down on paper or sharing them with others. Under Indian Government survey 50% people was make their password too easy (ex: 1234567890) any organization or hacker will configure this type of passwords and theft user data and sell it to other country or an organization for a money or organization benefits.

3 Insecure downloads Data Theft: A person might download software or data from hacked websites that have been contaminated with malware or viruses. This allows thieves to get unauthorized access to their devices and steal data from them. User was downloading unwanted Software from non-authorized platform after this malware or viruses was attack on systems and

then hacker will ask money for data or sell it to other country.

Government takes many initiatives to decrease the cybercrimes or Data Theft. Government Blocked many apps operated by foreign entities India has banned numerous well-known Chinese apps in the nation, including TikTok and WeChat Messenger, after political tensions with China began in 2020 as a result of a LAC conflict. Last year, the nation barred access to a number of Chinese mobile apps due to security concerns, and as a result, China expressed concerns about the two countries' commercial and trade ties.

One of the individuals claimed that the MHA had requested the measure on a "urgent and emergency" basis. The apps contained wrong content that was deemed to be detrimental to the sovereignty and integrity of the country, hence action was taken in accordance with Section 69A of the IT Act. As many as 232 apps run by foreign companies, many of them Chinese, have been blacklisted by the authorities of government because they offer unlicensed gambling, betting, and loan services using this activity they take user data and misuse these data after giving them loans, nagging the borrowers for money. According to the sources, there have been a lot of suicides as a result of this harassment in areas like Telangana. Many of the programs could be downloaded through specific links or websites, but many weren't offered in the app stores.

3.2 Indian Government establishing cloud storage in India can provide several advantages will happen for Indian internet users

Reduce Latency: Reduced latency is one of the most major benefits of having cloud storage in India. When data is kept in India, users in the nation may access it more quickly, resulting in improved speed and user experience. Now that cloud storage is available in India, individuals and enterprises in the nation may use cloud services more quickly and with less latency. This can result in increased performance and user experience, particularly for applications that demand rapid and reliable data access.

Data Localization rules: Several nations have data localization rules that force businesses to retain specific types of data inside their boundaries. Such rules exist in India as well, and having cloud storage in India can assist businesses in complying with these requirements avoid potential legal and regulatory concerns by using cloud storage in India.

Improved Data Security: Storing data on an Indian cloud infrastructure might offer an extra degree of security. Local legislation and security requirements apply to Indian cloud storage companies, which can assist secure the data stored in their infrastructure.

Increase Indian Economy: Increased Investment and Job possibilities in India's Technology industry the construction of cloud storage in India can lead to an increase in investment and job possibilities in the country's technology industry. This can assist to stimulate economic growth and development while also positioning India as a cloud computing and associated services powerhouse.

Cost Savings: Because of the country's reduced operational expenses, cloud storage companies in India may provide more competitive pricing. This might result in cost reductions for businesses that require huge volumes of data storage.

Enhanced Data Sovereignty: The introduction of cloud storage in India can improve data sovereignty, which refers to a country's ability to govern and secure the data of its population. This is especially true for sensitive data, such as personal information or government information.

Infrastructure and Connection: Infrastructure and connection remain issues in India, particularly in rural regions. To provide dependable and effective access to cloud services, installing cloud storage in India may necessitate considerable investment in infrastructure, such as high-speed internet connectivity, data centers, and power supply.

Overall, installing cloud storage in India can bring various benefits, including decreased latency, compliance with data localization rules, greater data security, cost savings, and enhanced data sovereignty. The implementation of cloud storage in India has the potential to have a substantial influence on the country's economy, technological industry, and data security environment. Users and organizations in India will benefit from greater access to cloud services, decreased latency, and improved data security with the introduction of cloud storage in the nation. This can assist to accelerate economic growth and development, establish India as a cloud computing and associated services powerhouse, and attract investment and job opportunities in the technology industry. Furthermore, the availability of cloud storage in India may assist businesses in complying with data localization rules, avoiding potential legal and regulatory concerns, and reducing the risk of data breaches and other cyber security risks. However, the installation of cloud storage in India may meet difficulties.

4 ADVANTAGES OF HAVING INDIA'S GOVERNED CLOUD SERVICES

4.1 The adoption of a homegrown cloud computing platform has several advantages for India. Firstly, it addresses concerns related to data sovereignty and security, as sensitive data can be stored and processed within the country's borders. This provides a sense of trust and reassurance to both Indian enterprises and government agencies.

Secondly, the establishment of an indigenous cloud computing platform fosters self-reliance and reduces dependence on foreign providers. This move aligns with the government's vision of building a robust digital infrastructure and promoting the "Digital India" initiative. It also stimulates the growth of the domestic technology sector, creating employment opportunities and encouraging innovation in cloud-based services.

4.2 Moreover, India's own cloud computing platform opens avenues for cost optimization and improved efficiency. Local data centers can reduce network latency and provide faster access to cloud services, resulting in enhanced user experiences. It also eliminates the need for cross-border data

transfers, reducing bandwidth costs and improving response times.

4.3 Additionally, the platform offers tailored solutions to cater to the unique needs of Indian businesses, government departments, and citizens. Customized applications and services can be developed to address specific challenges faced by various sectors, such as agriculture, healthcare, education, and e-governance. This targeted approach has the potential to drive digital transformation and improve service delivery across the country.

5 REQUIREMENTS TO SETUP INDIA'S GOVERNED CLOUD SERVICES

1 Government Support: A strong commitment and support from the government are essential. The government should provide policies and regulations that promote the development and adoption of a domestic cloud service platform. It should also allocate resources and invest in infrastructure development.

2 Infrastructure: Building a robust infrastructure is crucial. This includes establishing data centers equipped with state-of-the-art hardware, networking infrastructure, and power backup systems. The data centers should be strategically located to ensure optimal coverage and connectivity across the country.

3 Data Security and Privacy: Implementing stringent data security and privacy measures is paramount. The platform should comply with relevant data protection laws and regulations. Strong encryption, access controls, and regular security audits should be in place to safeguard user data.

4 Scalability and Reliability: The cloud service platform must be scalable and capable of handling increasing workloads and user demands. It should be designed with redundancy and failover mechanisms to ensure high availability and reliability.

5 Interoperability and Standards: Ensuring interoperability and adherence to industry standards is essential. The platform should support common protocols, APIs, and data formats to enable seamless integration with existing systems and facilitate data portability.

6 Service Offerings: The platform should provide a wide range of cloud services to cater to the diverse needs of businesses, government agencies, and individuals. This includes infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS), software-as-a-service (SaaS), and specialized services tailored to specific sectors. **Cost Competitiveness:** The platform should offer competitive pricing to attract users and businesses. The cost structure should be transparent and flexible, allowing users to choose and pay for the services they require without any hidden charges.

7 Skilled Workforce: Building and operating a cloud service platform requires a skilled workforce. Investments should be made in training programs to develop technical expertise in cloud technologies, data management, and cybersecurity.

8 Partnerships and Collaborations: Collaborations with technology companies, startups, research institutions, and industry associations can accelerate the development and adoption of the platform. Public-private partnerships can bring in expertise, funding, and innovation to support the growth of the ecosystem.

9 User Awareness and Adoption: But the most important is to creating awareness among potential users about the benefits and capabilities of the platform is crucial. Educational campaigns, training programs, and incentives can encourage users to adopt and utilize the services offered by the platform.

6 RECENT ADVANCEMENTS IN CLOUD COMPUTING SECTORS IN INDIA

1 Cloud Computing-India market: India's public cloud market was at \$5.6 billion in 2021. And the overall India cloud services is expected to climb up to total of \$13.0 billion by 2026. [4] Public cloud services will continue to grow in India as there is a wave in digital services. As the organizations have realized the power of the cloud to help them to transform their business digitally. [4] Because of the digital transformation happening everywhere, many big and small organizations are looking to increase their investments in technologies like AI/ML, IoT, blockchain and edge computing. All these services are mostly based on cloud services. So, it will be not wrong to say that the upcoming future hold a great need of cloud computing services in India.

2 Cloud roles in demand: Cloud Enterprise Architect, DevOps, Cloud Software Engineer & Cloud Infrastructure Engineer are one of the most growing sectors in IT field and providing lots of job opportunities. Top hiring companies include Microsoft, Wipro, HCL, IBM, Tech Mahindra are opening jobs roles related to Cloud Computing Sectors. Starting level salary for the cloud engineer is ₹6 lakh, Mid-level manager with 10-15 years' experience can earn up to ₹30 lakh. Orceel has been known to pay professional with 15-25 years' experience up to ₹1 crore.

3 Indian Companies Already Providing Cloud Service: There are many companies providing cloud services in India to some extent like providing online storage (SaaS). Some of these companies are private like Jio and some of the companies are governed by the Indian government. There are many governments initiative that is using cloud services and providing that facility to Indian citizens also. One such service is "Digi Locker", it aims at "Digital Empowerment" of the citizen by providing access to authentic digital documents to the citizen's digital document. Simply, it gives people a cloud space to store their important documents digitally so they can access them at any time required. Since this is governed by the Indian government itself, the sensitive data of the people are completely safe.

The Digital India campaign is one of the most important initiatives launched by the Indian government. It ensures that the Government's services are made available to citizens electronically through improved online infrastructure.

7 CONCLUSIONS

In conclusion, India's own cloud computing platform represents a significant step towards digital sovereignty, self-reliance, and technological advancement. With the right investments, policies, and collaborations, it has the potential to transform India's digital landscape and empower its citizens and businesses. By harnessing the power of cloud computing, India can accelerate its journey towards becoming globally competitive digital economy.

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