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Impact of Cloud Computing on Banking Sector and its Security

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Abstract: *A new form of computing known as "cloud computing" refers to the provision of virtualized resources as online services. The most significant element of today's world is cloud computing. It offers every industry a way to improve their work. It significantly revolutionises every aspect of e-business. These days, a lot of businesses and banks are turning to cloud computing as their preferred method for storing and analysing data that can be accessed from any location at any time. Many banks are now utilising cloud computing to meet their diverse needs. Banks may provide their customers with a quick and flexible environment by using cloud computing. In this research, we'll learn about cloud computing, its effects on the banking industry, and several factors that can aid.*

Keywords: Cloud Computing, Security, Data Security.

I. INTRODUCTION

Banks already use cloud computing extensively for non-core and non-critical uses like human resources, email, customer analytics, customer relationship management, and development and testing (88 percent of surveyed EU-based financial institutions were already using cloud based services), while a few smaller banks have already transferred or are currently transferring their entire core services (treasury, payments, retail banking, enterprise data, etc.) to the cloud.

1.1 What is Cloud Computing?

A system that enables easy on-demand network access to a pool of configurable computing resources (such as networks, servers, storage, applications, and services) that can be quickly supplied and released with little administration labour or service provider involvement is known as cloud computing. Cloud computing is a concept that serves as an internet-related comparison. The old cloud symbol, which was frequently used to symbolise the internet in flow charts, served as the inspiration for the word cloud. Information systems resources, such as application, data, network, storage devices, and servers, are made accessible and usable through the utilisation of the cloud. The term "cloud computing" refers to any activity that involves providing hosting services over the internet.

1.2 Type of Cloud Computing

There are 4 main types of cloud computing depending on the client's needs.

1. **Public Cloud:** Using a pay-per-use model, public clouds allow anybody to store and access data online. In a public cloud, the cloud service provider manages and controls the computer resources (CSP).
3. **Private Cloud:** A private cloud is created for a certain group or organisation and only allows members of that group to access it.
4. **Hybrid Cloud:** A hybrid cloud combines a private cloud and a public cloud.
5. **Community Cloud:** a communication cloud that is owned, run, and managed by one or more community-based organisations, a third party, or a mix of them.

1.3 Cloud Computing Service Provider

There are the following 4 types of cloud service models.

1. **Software as a Service (SaaS):** Applications like word processing, CRM (Customer Relationship Management), and ERP (Enterprise Resource Planning) are made available over the internet for the consumption of the end-

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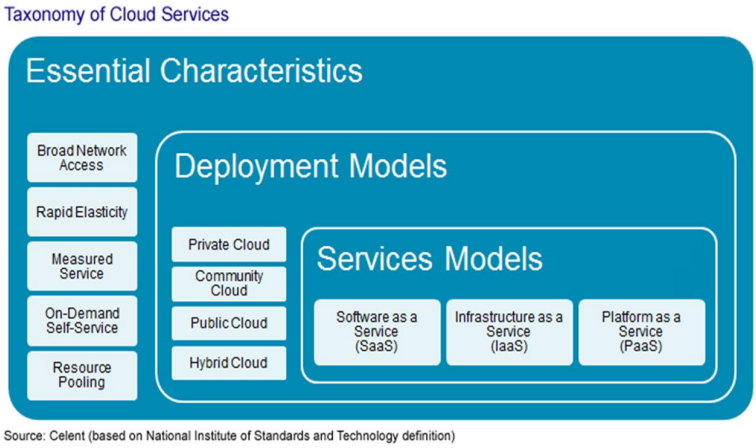
user instead of installing the software on the client's computer and updating it with frequent patches, frequent version upgrades, etc.

2. **Platform as a Service (SaaS)**: SaaS is another name for "on-demand software." It is software where a cloud service provider hosts the apps. Internet access and a web browser are required for users to access these applications. In this arrangement, the service provider hosts the business software and related data. Users use a web browser to access software and data.
3. **Infrastructure as a Service (IaaS):** As implied by the name, a computing infrastructure is the main topic of an IaaS agreement. The subscriber totally outsources the storage and resources, including the hardware and software, they require under an IaaS arrangement.
4. **Business Process-as-a-Service (BPaaS):** This approach is utilised for common business processes including billing, payroll, and human resources.

1.4 Types of cloud Operating Model

It serves as a guide for efficiently organising to produce the capabilities and results necessary to deliver value through cloud services following types of cloud operating models

1. **Outsourcing vendors:** In this strategy, workers from outside organisations and employees of a third-party vendor are used to manage cloud operations.
2. **Virtual captives:** To assist with cloud operations and satisfy demand, virtual captives have a dedicated staff or facilities.
3. **Staff Augmentation**: Organizations can increase their knowledge of the cloud by hiring cloud experts with the appropriate skill sets from cloud service providers. With this operational paradigm, organisations can select the appropriate resource for any given need.



Source: Celent (based on National Institute of Standards and Technology definition)

1.5 Characteristics of Cloud Computing

There are 5 essential characteristics of cloud computing:

1. **Wide Network Access:** Typically, conventional networks and heterogeneous services are used to deliver computer services.
2. **Measured Service:** An account of the resources that have been used is given to both the user and the resource provider. The resource utilisation is tracked for each application and occupant.
3. **Resource Pooling:** The available IT resources are distributed across several applications and occupied in an ad hoc way. From the same physical resource, services are given to numerous clients.
4. **Quick Elasticity:** The IT resources for the computing services should be able to scale up and down fast and according to demand. When a user requests a service, it is delivered to him, and after that service's demand is met, it is scaled out.
5. **Self-service on Demand:** Users of cloud computing services are able to provision, monitor, and manage computing resources as required without the assistance of human administrators.

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II. FACTORS INFLUENCING THE ADOPTION OF CLOUD COMPUTING IN BANKS

A banking institution's decision to use cloud computing technologies is influenced by a number of factors. Sensitive information in the banking industry is the first factor. The banking business must make sure the cloud computing solution they choose satisfies all the criteria and requirements. To do this, they must carefully assess their outsourcing practises and make sure they adhere to them strictly. The bank data contains sensitive information, so all banking sectors must protect it from a cyber-breach. The bankers who enable high quality and secure service to the users must take precautions.

III. IMPACT OF CLOUD COMPUTING ON BANKING SECTOR

App development and technology related to the banking sector work hand in hand. Banks and financial institutions are very interested in creating apps that convey important data to their end consumers. Global connectivity solutions offered by cloud computing enable seamless client experiences in both urban and rural areas.

1. **Ease of use:** Computing is easy to use and set up all the services without having to worry about managing resources or any other issues related to infrastructure setup and management.
2. **Lower infrastructure costs:** The absence of on-site hardware storage is a major benefit of cloud computing. For small businesses, the subscription model results in significant cost reductions. By utilising cloud services, banks are able to increase their product offerings right away while also making IT infrastructure modifications that are more manageable.
3. **Reliability:** Given that the service providers are experienced at managing the infrastructure, network and data access are guaranteed to be reliably maintained.
4. **Cloud security:** is advantageous since dangers are reduced thanks to authentication and encryption. For example, monitoring activity, recording transactions, granting users only limited access, and using strong passwords all help to increase security.
5. **More effective operations:** A banking institution's efficiency is multiplied when using a cloud environment. Banks can take advantage of advantages like flexibility and quality control by putting their services on the cloud risk control. The institutions can concentrate on reducing their fixed and variable costs by hosting banking gateways on the cloud.
6. **Access to software programmes:** Banking businesses that use cloud computing have access to CRM and ERP programmes that can help them improve their employee and customer experiences. Due to the fact that these applications are SaaS-based, the banks
7. **Streamline business processes:** Since computing can supply data whenever a client needs it, it can streamline business processes. A correct resource management is made possible by a much reduced technology workload between the processor and the server. It offers a high level of redundancy and backup at a price that is significantly less than that of conventional managed systems.
8. **Risk reduction:** The cloud can aid in reducing risks related to traditional technology, such as issues with capacity, redundancy, and resiliency. Additionally, the scalability of cloud computing can provide banks more control over matters like security.
9. **Increased Availability:** By making Virtual Machines more accessible, cloud computing has become more widely available than alternative in-house solutions. This improves an organization's capacity to build.

IV. CLOUD SECURITY IN BANKING TECHNOLOGY

Cloud security refers to a group of rules, controls, processes, and technologies that collaborate to safeguard infrastructure, data, and system-based cloud services. Security and regulatory compliance are the two main problems that must be solved when a bank adopts cloud computing. The cloud can provide many banks with extra controls targeted at enhancing data privacy and security, as well as tools and machine learning capabilities that can analyse and monitor data for anomalous activity, in comparison to the bank's pre-existing security architecture. The following factors are also taken into account for security in cloud computing:

1. **Data Security:** Data security refers to the fact that it can only be accessed, used, and processed by authorised individuals. Data security guarantees its accessibility, accuracy, and reliability. A data security plan guarantees that just the information that is necessary will be collected, that it will be protected, and that it will be destroyed once it is no longer required.

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2. **Information Privacy:** The desire of individuals to control or exert some degree of influence over data about themselves is referred to as information privacy most of today's communication mediums.
3. **System security:** refers to the capacity to defend against external threats. Secured systems that perform as intended without issues or delays aid financial sectors in achieving their goals. They are made available anytime needed thanks to Secure System.
4. **Data privacy:** Data privacy refers to the appropriate use of consumer data. Data gathered by customers should be sufficient to suit their needs and business requirements, and they should accept it and be given full disclosure of the data obtained

V. SECURITY RISK

Typical Gartner security concerns that cloud clients should be aware of are listed below [5]: Privileged user access: Because outsourced services avoid "physical and logical IT controls," sensitive data that is processed outside of the business is at danger of security.

1. **Regulatory compliance:** Customers are in charge of the data's security. External audits and security certifications are applied to conventional service providers.
2. **Data location:** Users of the cloud are unaware of the hosted data when using it. Distributed data storage is a major factor in cloud companies' ability to lose control, which puts customers at danger.
3. **Data segregation:** Since the cloud is frequently a shared environment, data sharing is possible. Thus, there is a chance.
4. **Recovery:** When an issue arises and a failure results, data recovery is crucial. So, the fundamental query here is whether or not a cloud service can fully restore data. This problem might lead to a security deadlock. o Support for investigative work: Cloud services are particularly challenging to look into because logging and data for numerous customers may be co-located as well as dispersed among a variety of hosts and data centres that are constantly changing.
5. **Long-term viability:** In a perfect world, a cloud computing provider would never go bankrupt or be bought out by a bigger organisation that might have different rules. Clients must be confident that their data will still be accessible even after such an incident, though.
6. **Data Leakage:** Since the data is not stored locally on the customer's machine.
7. **Database and server security for the system:** When adopting cloud computing, database and server security is essential on the front end. Only if security is not an issue may banks use a range of cloud computing services. This will allow the banks to remotely store their data without having to worry about hardware implementations.
8. **User authentication:** For all businesses, managing user accounts and the allowed access privileges associated with them is crucial and must be strictly regulated. The tales that accompany each person could be the same or different. Therefore, another crucial concern is how the administrator might effectively handle those users' identification accounts and the related passwords or reach the state of SSO.

VI. COMPARISON BETWEEN TRADITIONAL AND CLOUD BANKING

We've heard this news before: online banking are the future. Online banks appear to offer it all: competitive interest rates, excellent customer service, cheap fees, and the extra benefit of 24/7 online access to your funds. However, not everyone like online banking, and as more financial institutions increase their web presence to compete, the distinction between the two is getting increasingly hazy. To assist you in making a decision, we asked Richard Barrington, a senior financial analyst at MoneyRates.com, to outline the advantages and disadvantages of putting your money in an offline vs an online bank.

1. **Security:** Many consumers are deterred from doing their banking online by this problem, but Barrington argued this shouldn't be the case. Traditional banks also have all your monetary data kept in a huge data centre that could be open to hacking. Data theft is a very real issue these days, but regrettably, as a customer, it has nothing to do with your decision to do your banking online. You will be protected for losses up to $250,000 if you choose an online bank that is insured by the FDIC (use the FDIC's Bank Find tool to confirm). Additionally, keep in

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mind that using a public or shared WiFi connection for any online banking is never a good idea because that is when hackers can most readily access your information.

2. **Customer service:** Go digital if you prefer to communicate with the individuals in charge of handling your money via email or phone. If you'd like to talk things over with someone Stop meeting in person and remain with a traditional bank. Almost all banks have call centres and an online presence additionally message centres. When they do exist, online banks eternally, "closed."But if you choose to utilise a conventional use a bank to execute transactions or to ask inquiries to get questions personally answered, you must go to your bank during regular business hours, and confirm that it is not a public holiday.
3. **Deposits:** There are a number different ways to deposit actual checks with web-based banks. Even though you may always send them in, most online banks also allow "e deposits," which allow you to scan each check front and back and upload it to your account for deposit. Although the option exists, many customers still choose to deposit a check with a teller rather than through text. When it comes to depositing a check, people would much rather hand it to a teller, according to Barrington, who noted that most people check their balances and obtain information online.
4. **ATMs:** Getting cash when you need it is the whole point of banking, according to Barrington, who advised consumers to check the locations of a bank's ATMs before opening an account. Make sure the regional footprint of the bank's ATM network matches your typical travel patterns when choosing a bank, advised Barrington. In many major cities, traditional banks like Chase and Bank of America have ATMs spread out all throughout. With ATM networks like all point, online banks like Simple frequently have arrangements to provide surcharge-free withdrawals. And most others provide consumers with reimbursements for using ATMs outside of their network up to a specific amount. ATMs: Banking is important about receiving money when you need it, and Barrington advised clients to consider a bank's ATM locations

VI. SOLUTION TECHNIQUE

Solution Approach Bank would conduct transactions using a hybrid cloud. A private cloud for extremely secure transactions would be present. Additionally, the higher layer of its application would utilise a public cloud. Ticket-based architecture for a secure cloud for banking application authentication protocol that provides identification for safe authentication by which identity is proved by this protocol. When performing some authentication steps, Kerberos uses symmetric key cryptography and calls for the assistance of a reliable outside party.

VII. INFORMATION SECURITY MANAGEMENT IN BANKING SECTOR

While utilising the cloud computing architectural infrastructure, banking and financial services take into account the following steps for information security and privacy.

1. **Identity Access Management (IDM):** This system aids in user and service authentication based on credentials and traits. Credentials are "User Identity" (also known as a unique network ID and password), and characteristics are a set of rules for using cloud computing.
2. **Mechanism for Access Control and Access Logging:** The architecture of cloud service delivery models is complex. Access control interfaces that require a policy-neutral access specification and enforcement mechanism must be integrated with this complicated architecture. to regulate access In the banking industry, the Single Sign-On (SSO) approach is used to grant users access to numerous apps. this method uses the user ID and password to identify the user. This makes it easier to keep track of all the changes.
3. **Cloud computing and outsourcing:** Cloud infrastructure for banking is expected to fall under national law. For cost-effectiveness, users who manage cloud services and data might be outsourced. The user who is accessing the cloud may vary over time, resulting in several users having access to the system and data. The banking industry might not have control over the various users accessing the system and data. When there are system problems, banking and financial services companies follow the terms of their contracts with the companies that manage their cloud services and take the necessary measures.
4. **Secure Data Deletion:** The bank sector collects relevant data from clients for usage and deletes it once the requirement is met. In order to make room for new data, it must be deleted.

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VIII. CONCLUSION

This article provided a quick overview of cloud computing, its various forms, and its effects on the banking industry. Along with that, we also learnt about information security management, cloud computing security, and problem-solving techniques. By creating a solid and secure architecture, cloud computing has decreased the cost associated with managing IT infrastructure. Because the banking sector has an internal IT security team that creates and implements the security framework, this framework must constantly be evaluated and updated to reflect changing circumstances. Since there is always a potential of an outside attack, the financial industry continues to place a high importance on cloud security.

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