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Trust Issues in Cloud Computing

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Abstract*: Internet users are increasing at a logarithmic scale. Users are producing huge amount of data everyday across the world which is creating huge amount of data traffic. In this context data capturing , data analysis and the analysis sending it back to the stake holders is order of the day. In this scenario cloud plays an important role in big business. When cloud is playing an important role, users are using the cloud by generating data they are actually sending that data to the cloud. Here instantaneous information transformation from users to the cloud is one of the important component that is everyday happening today. Whatever data that is being produced should reside in the cloud. Whatever data which is available in the cloud should be available to the user back. This is the basic requirement as far as the users and maintainers of the cloud is concerned. In this context Trust plays an important role. In this paper we will address all the issues related to Trust, which are to be considered when someone wants to develop a trust model for cloud environment..

Keywords* : Trust, Trust Model, Cloud, Cloud Computing, Reputation and Security.

I. INTRODUCTION

Thousands of applications today rely on cloud computing to store important information and files for customers, but people still don't fully believe in the nature of the cloud. For example, consumers with iPhones may be reluctant to use Apple's cloud backup service to back up their most important information. Even business owners may resist adopting cloud-based solutions at work.

On the other hand, this does not seem to affect anything, just like dealing with personal data, whether to adopt a cloud solution depends on personal choice and efficiency. But as companies and consumers increasingly rely on data and digital services, it's increasingly important to use convenient, low-cost, and cost-effective tools on a regular basis[1,2].

Imagine working in a big company without cloud data, the efficiency of the processor itself is low, inevitably affecting the quality of our work. Furthermore, if you are responsible for developing or marketing cloud software, then trust in cloud computing will result in customers losing interest in your product. So why do many people not believe in the "cloud"?.

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A. Lack of deep understanding of "Cloud"

The first and most obvious reason is that people usually don't understand the true meaning of the "cloud". It became a buzzword that describes the pattern of access to all products and services from any device. The wrong impression is that

their data is processed and stored in a "cloud" way, and is accessible to anyone with access[3].

In fact, the cloud refers to services that run on the Internet, rather than relying on local software on the device. For example, your files are stored on the "cloud" side, which means they have a professional service (paid service) data center, and only you have permission. You can access files anytime, anywhere, and it looks like you're accessing them locally, which is actually calling the cloud's data center.

B. Encryption and Hacking

The If you store your files on the "cloud" - on someone else's hard drive, people may be concerned about the security of the files and worry that others will also access them[4].

This concern is not unreasonable, and cloud storage does face some potential security issues. Most cloud service companies, such as Google, have some basic encryption and protection measures for cloud-stored data. They use a robust firewall to physically protect the data center and encrypt the stored data to reduce the possibility of attack damage. Despite this, data breaches are unpredictable, and no system guarantees absolute security and is completely hacked.

In addition, even the most secure cloud services can be compromised once the user's authorization is compromised. For example, the file server you store cannot be hacked and compromised by itself, but hackers can easily access your files by illegally obtaining your username and password.

In fact, we are very clear that each system has inherent weaknesses. Files you save in cloud storage can be accessed, just like files on your local hard drive, and there is also the risk of username and password being compromised. Perhaps you can protect your data with an additional layer of encryption in the cloud of the cloud service and ensure that the best logic and rules are followed when setting, changing, or verifying passwords.

C. File Integrity and Accessibility

Data is becoming more and more important, and the storage or presentation of data is more diverse. It may be a spreadsheet that records the company's financial situation, a word document containing trade secrets, or a CRM platform that contains detailed information about all important customers. In any case, this is vital information, and once the consequences of the leak are unimaginable[4].

In addition to worrying that these files may be hacked or impersonated, people also want to possess control of these files. I always feel that it is more secure to have the files on my disk than to have access to the "cloud".

It is not easy to eliminate this kind of prejudice, but for worried business owners, in addition to being stored on the cloud, files can be stored on the local physical hard disk. This redundant backup is an effective and feasible method. Method to ensure that the file is not lost.

D. Universality of Cloud Services

Some people used to rely on the cloud to access their most important services because it requires an internet connection. Internet applications are now quite extensive. Even if you are experiencing a broken internet connection while working from home, you can use your smartphone as a hotspot or drive to a cafe or library to use their hotspots. But there are also unexpected situations, power outages near the community, which may make you unable to access cloud services[5,6]. Even so, most cloud platforms now offer offline versions, which can be used temporarily when the online version is inaccessible.

E. Cost

Cost often influence the development trend and application range of technology. If customers see the value of products and services beyond the price they are willing to pay, they are likely to buy more, thereby increasing demand and stimulating more companies to focus on the development of this technology/new product.

From the very beginning, cloud computing has generated enough appeal with fashionable names to support the development of thousands of different applications and services. However, there are still millions of consumers who don't understand the real difference between cloud computing and locally stored files. The best way to change this concept is to reaffirm the true benefits of cloud services, including redundancy, security, accessibility, and lower costs. If you consider these factors together, you should be able to objectively explain why cloud-based applications are better than native programs.

In the next few years, although we have not completely solved the trust problem in cloud computing, users' acceptance of cloud services is gradually increasing, especially in the era of big data, people have to face it correctly.

II. INTRODUCTION TO CLOUD COMPUTING

A. Definition and Characteristics of Cloud Computing

As of now, there is no standard in the academic world that can be widely accepted about the exact definition of cloud computing. The definition given by wikipedia is that "Cloud computing is the on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user". The definition given by the National Institute of Standards and Technology(NIST) is that “Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction”[7].

Cloud computing is a network access mode that uses a configurable resource pool to pay for on-demand and provide convenient and available resources. The available resources include application software,network and storage space services[8,9].

The cloud computing service described by IBM is a scalable service platform that can be dynamically allocated and configured on demand[10]. Physically, there are large number of server and hardware devices, composed of computing resources, storage networks, network auxiliary devices, and security devices. Its architecture is shown in Figure 1.

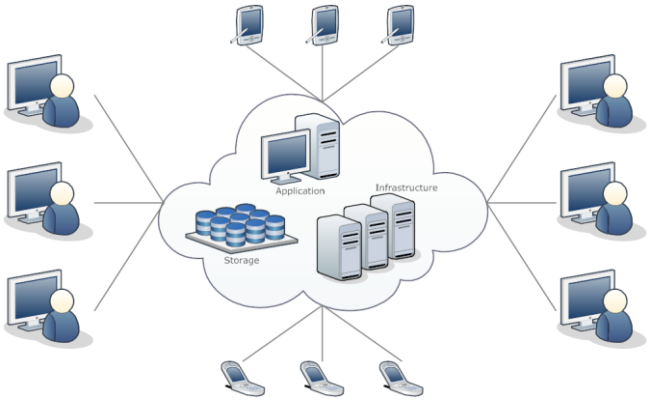

Figure 1. Cloud Architecture

National Institute of Standards and Technology(NIST) proposes five key features that cloud computing should include: Measured service, Resource Pooling, Broad Network Access, and On-demand Self- Service and Rapid Elasticity[7], as shown in Figure 2.

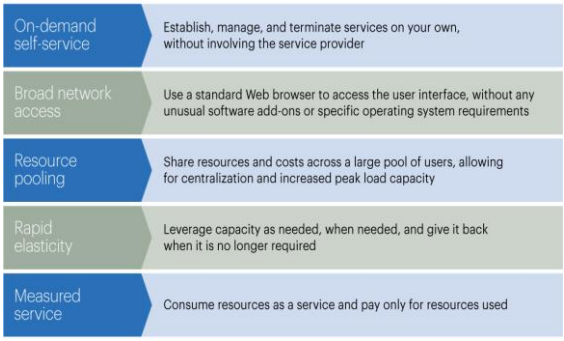

Figure 2. Cloud Characteristics

On-demand Self-service means that users and cloud service providers can obtain the requested computing and storage resources with only a small amount of interaction. Broad network access ensures that users can get higher transmission speed and lower price network access. The virtual resource pool means that the cloud computing platform can provide users with transparent and reliable resources. Users can apply or allocate as needed. The high-speed flexible architecture further defines the autonomy and scalability of users when using and configuring cloud computing resources.

Measured services provide solutions for optimizing the use of resources, providing measurement capabilities when using resources, and enabling automated control.

From the current research status, cloud computing should have the following characteristics.

- **Utra-Large Scale:** In order to ensure that "cloud" can provide sufficient computing power for all users, Google's cloud computing has more than 1 million servers, and AMAZON, IBM, Micorsoft, Yahoo, etc., already have hundreds of thousands of cloud Servers.
- **Virtualization:** Cloud users can obtain cloud services by accessing any network terminal at any time. Resources exist in a virtual manner in the cloud, and users do not need to pay attention to their specific storage forms .
- **High Reliability:** The cloud computing platform should ensure the security and reliability of user data through mechanisms such as access authentication, compute node isomorphism, and data multi-copy fault tolerance.
- **Universality:** Cloud should be scalable to ensure an increase in the number of users, and does not provide generic services for specific applications.
- **On-Demand Service:** Provide users with streaming resource services through their large resource pools like the way we get services like tap water, electricity and gas.
- **Low Price:** Provide users with superior cost performance through special fault-tolerant mechanisms, automated management, versatile resource reuse, and energy utilization.

III. TRUST IN CLOUD COMPUTING

Trust is originally a concept that emerges in sociology, and concepts in sociology are often vague. Trusted computing leads the concept of trust to the field of computer science. Trusted Computing Group (TCG) defines Trust as: An entity that can always achieve the desired goal in the expected way, then the entity is trustable. That is, trust emphasizes the expectation of the entity's behavior, while also paying attention to the security and reliability of the system[11,12].

Trust is a corresponding binary relationship. This relationship can be one-to-one, one-to-many, or many-to-one, many-to-many. There are several ways to gain trust: Direct trust, Recommended trust, Multi-level recommendation trust and Hybrid trust[12].

In online transactions (such as e-commerce transactions), trust is one party who believes the other is reliable and able to fulfill its promise. Only when the two parties trust each other the transaction proceed smoothly, so trust is the premise and customs of trading activities. In a complex network environment like cloud, trust between entities can be divided into direct trust and Indirect trust. Direct trust is a relationship established by two entities based on past experience. Indirect trust refers to relationship established by the recommendation of other entities. Therefore, trust has the following characteristics: asymmetry (if entity A trusts entity B but does not neccessary that B truts A, subjectivity (trust is the subjective judgment of the evaluator on the evaluation object), dynamic (trust may follow Change in time, environment or other factors) Multidimensionality (trust between entities is related to multiple attributes, such as historical trust value, social status, income level, etc.) Fuzziness and incomplete transferability (Entity A trust entity B, and entity B trusts entity C, but does not necessarily have A trust C).

A. Factors affecting trust

The In the complex network environments like cloud, there are many uncertain factors that will have an impact on the trust. In cloud environment, there are many uncertain factors that will have an impact on the trust. The main factors affecting user trust are:

- **User Feedback Evaluation:** In a complex network environment, the feedback evaluation of the other party's trust after the interaction between the entities (such as the evaluation of the quality of the goods after the e-commerce transaction, service, etc.) is subjective evaluation, if this evaluation is used as the trust value of the computing entity, it is subjective. To this end, many researchers uses the feedback evaluation of the entity as one of the reference indicators when calculating the trust value of the entity.
- **Historical Trust Value:** In auction, eBay and other trading websites, there will be such a phenomenon: after users accumulate a certain amount of trust, they may start to commit fraud. In order to resist this kind of deceptive behavior, when calculating the user trust value, the user historical trust value should be considered, which can motivate the user to maintain a certain reputation. Therefore, when calculating the trust value of the entity, the historical trust value of the entity is also used as a reference indicator.
- **Evaluator Trust Value:** Generally speaking, the more genuine a person's evaluation is, the more valuable it is. The current trading website does not consider the evaluator's trust, but uses a simple addition, subtraction or averaging method to calculate user trust. Providing opportunities for unscrupulous users to take credit hype and cycle fraud. In order to effectively prevent this kind of deceptive behavior, researchers will evaluate the trust value of the person as one of the reference indicators for calculating the trust value of the entity.
- **Value of Transaction Item:** Generally speaking, the value of goods is directly proportional to the risk, and the risk increases with the increase of the value of the traded goods. However, the current trading website simply adopts a method of increasing the trust value as long as successful trading, and the increase of the trust value. It is only related to the number of successful transactions, and has nothing to do with the value of the traded goods. This allows the fraudsters to take advantage of them. They use the successful small transactions to accumulate trust. When the trust value reaches a certain level, they can lie.

In order to effectively prevent credit hype, researchers considers the impact of commodity value on trust growth in trust evaluation, and takes the value of transaction items as one of the reference indicators for calculating entity trust value.

- **Evaluation Time Weight:** Generally speaking, trust is a process of accumulating over time. The recent evaluation is more convincing and reference value than the earlier evaluation. Therefore, when evaluating the user trust value, researchers consider the evaluation time weight and will evaluate it. The weight of time is one of the reference indicators for calculating the trust value of an entity.

IV. TRUST ISSUES IN CLOUD COMPUTING

One should address the following trust related issues whenever developing a trust model for cloud computing environment. The major issues of trust in cloud environment are listed below:

A. Security

Cloud security, otherwise called distributed computing security, comprises of a lot of procedures, controls, technologies, policies and advancements that work together to secure cloud-based infrastructure, data and systems[13]. These safety efforts are designed to secure information, bolster administrative consistence furthermore, ensure clients' privacy just as setting validation rules for singular clients and devices. From confirming access to sifting traffic, cloud security can be designed to the careful needs of the business[14]. Cloud security ensures of information put away online from leakage, theft and deletion. Strategies for giving cloud security incorporate firewalls, infiltration testing, tokenization, obfuscation, virtual private systems (VPN), and staying away from open web associations.

B. Dependability

Cloud security, otherwise called distributed computing security, Dependability of a system is regularly characterized as "the capacity of a framework to execute as and when required" [4].Dependability is a term used to depict the time-subordinate qualities related with the presentation of a system, it incorporates attributes, for example, reliability, availability and security under given states of utilization and upkeep support requirements[15].

Dependability advocates client trust and client certainty from a worth viewpoint in working together, it influences the primary concern of an association in product advancement or administration arrangement requesting regard for learn dependability performance value[16].

Cloud computing administrations in their present structure (where dependability mechanisms are implemented by service providers), and give a lot of confirmation procedures that approve, check and affirm constancy properties of administrations. Such affirmation systems enable clients to know about the Quality of Service (QoS) offered by a given service, and builds clients' certainty in regards to the dependability of their partner services.

The meaning of confirmation technique increasing users' confidence that a service complies with their dependability requirements is the fate of most extreme significance with regards to Cloud computing and web administrations.

C. Integrity

Integrity, with regard to personal computer systems, refers to techniques of guaranteeing that information is genuine, precise and defended from unapproved user modification.

Perhaps the greatest worry with cloud data storage is the verification of data integrity at untrusted servers, and how to manage sensitive information. It's not that easy task to keep up client's most sensitive data in cloud environment safely, which is required in numerous applications for clients[18].

Information that is put away in the cloud could experience the ill effects of the harm on transmitting to/from cloud data storage. Since data and computation are re-appropriated to a remote server, the data integrity ought to be kept up and checked continually so as to demonstrate that data and computations are flawless. Data Integrity implies information ought to be kept from unauthorized modification. Any alteration to the data ought to be distinguished. Calculation uprightness implies that program execution ought to be true to form and be kept from malware, an insider, or a noxious client that could change the program execution and render an off base outcome. Any deviation from normal computation ought to be identified. Integrity ought to be checked at the data and computation level. Data Integrity could help in getting lost data or telling if there is any unauthorized data manipulations [18,19].

D. Dynamacity

Dynamic cloud is the capacity for programming and administrations to develop with your business. Here and there that implies consequently modifying itself to conform to changes sought after or workloads[20].

Dynamic cloud enables business to be progressively agile by the way it reacts to changes in the market. It enables a business to rapidly grow through making new applications utilizing prebuilt components.

The dynamic cloud is described by applications that utilization just the assets they need at that given moment in time. They allocate and de-allocate resources dynamically on the fly, and the allocation and de-allocation of those assets is a basic building block of the application architecture. Resources are allocated, they're consumed, then they're de-allocated,all under the influence of the application and the application environment[21].

E. Safety

The term safety is generally used to express the condition of being protected from the aspects that are probably going to cause harm. Moreover, the term safety can be utilized to refer to the state at which one has the control of the hazard causing aspects hence ensuring oneself against risk that is completely unintended [22].

F. Scalability

Scalability in cloud computing is the capacity to rapidly and effectively increase or decrease the size or power of an IT solution.

Cloud computing offers various significant advantages to organizations, yet maybe the greatest advantage of all is the capacity to scale your cloud on-demand. Scalability with regards to cloud computing can be characterized as the ability to handle growing or diminishing resources to meet business demands in a capable way[16,28].

Fundamentally, scalability is a planned level of capacity that can grow or shrink according to the need.

G. Availability

Availability, with regards to personal computer systems, refers to the capacity of a client to get data or resources from a specified location and in the correct format. Availability is the proportion of time a system or segment is functional to the total time it is required or expected to function [23]. This can be described as a direct proportion (for example, 9/10 or 0.9) or as a percentage (for example, 90%). It can likewise be communicated in terms of average downtime per week, month or year or as absolute downtime for a given week, month or year. Further, availability is expressed in qualitative terms, indicating the extent to which a system can continue to work when a significant component or set of components goes down.

It can similarly be imparted as normal personal time every week, month or year or as outright vacation for a given week, month or year. To a great extent availability is imparted in abstract terms, demonstrating how much a system can continue functioning when a huge part or set of components goes down.

The availability of a system at time 't' is referred to as the likelihood that the system is up and utilitarian accurately at that instance in time. Cloud administrations is fundamental for keeping up customer's trust and preventing revenue losses due to service level agreement (SLA) violation penalties.

H. Confidentiality

Confidentiality can be defined as protecting data from being accessed by unauthorized parties. At the end of the day, just the individuals who are authorized to do so can gain access to sensitive data.

It is also known as Data Confidentiality, which means whether the data stored on a system is protected against unintended or unauthorized access[24]. Data Confidentiality is often defined as a measure of the ability of the system to protect its data. Accordingly, this is a necessary part of Security.

I. Reliability

The term reliability in the context of personal computer systems refers to the capacity of a computer-related hardware or software component to consistently perform as indicated by its specifications. In principle, a reliable product is thoroughly free of technical errors. Practically speaking, sellers normally express product reliability as a percentage.

Cloud reliability implies how the cloud is accessible to provide the services even when a few of its component fails. A cloud will be more reliable if it is more fault-tolerant and increasingly versatile to changing situations[17,25]. It is difficult to have a cloud that is totally free from failures.

Reliability is one of the major issue in the cloud computing.

V. CONCLUSION

In this paper we have discussed an overview of Trust management, types of trust and factors effecting trust. Further we have discussed in detail all trust related issues which are to be considered whenever developing a trust model for cloud computing environment. The lack of efficient and reliable trust evaluation model is still a major concern. We conclude by saying there is no such generic trust model for cloud computing environment which addressed all the issues involved in trust.

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