iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 **Issue:** VIII **Month of publication:** August 2016

DOI:

www.ijraset.com

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Volume 4 Issue VIII, August 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

A review on Cloud Computing Security issues and Threat

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Abstract: ***Cloud computing is a combination of traditional technology of computing and various other technologies such as parallel computing, distributed computing etc. The major goal is to achieve a complete system having capabilities of computing by providing low cost computing environment. Different organizations get virtual space to deploy applications or run operations over it. Various services of cloud are given by some third party who possesses the arrangement. As this environment is totally based on third party so its difficult to maintain data security, confidentiality, availability of resources, so if in any case some live attack occurs like DDoS attack, then it is very difficult to cope up. In this research we are going to discuss various types of vulnerabilities and threats to cloud computing environment, also the methods to mitigate those security issues.***
Keywords: Cloud Computing, Security issues, Threats of Cloud computing, Attacks cloud computing.

I. INTRODUCTION

Privacy is gaining in importance across the globe, often involving laws and regulations, relating to the acquisition, storage and use of personally identifiable information (PII). Typically, privacy implies limitations on the use and accessibility of PII, with associated requirements to tag the data appropriately, store it securely and to permit access only by appropriately authorized users. This requires appropriate controls to be in place, particularly when the data is stored within a cloud provider's infrastructure. The ISO 27018 standard (in preparation) addresses the controls required for PII. In many countries, numerous laws, regulations and other mandates require public and private organizations to protect the privacy of personal data and the security of information and computer systems. When data is transferred to a cloud computing environment, the responsibility for protecting and securing the data typically remains with the consumer (the *data controller* in EU terminology15), even if in some circumstances, this responsibility may be shared with others. When an organization relies on a third party to host or process its data, the data controller remains liable for any loss, damage, or misuse of the data. It is prudent, and may be legally required, that the data controller and the cloud provider enter into a written (legal) agreement that clearly defines the roles, expectations of the parties, and allocates between them the many responsibilities that are attached to the data at stake.

It is critical that privacy issues are adequately addressed in the cloud contract and service level agreement (SLA). If not, the cloud consumer should consider alternate means of achieving their goals including seeking a different provider, or not putting sensitive data into the cloud computing environment. For example, if the consumer wishes to place HIPAA-covered information into a cloud computing environment, the consumer must find a cloud service provider that will sign a HIPAA business associate agreement or else not put that data into the cloud computing environment. Enterprises are responsible for defining policies to address privacy concerns and raise awareness of data protection within their organization. They are also responsible for ensuring that their cloud providers adhere to the defined privacy policies. Consumers have an ongoing obligation to monitor their provider's compliance with its policies. This includes an audit program covering all aspects of the privacy policies including methods of ensuring that corrective actions will take place

II. RELATED WORK

Many researchers have conducted work related to the security and privacy problem in cloud computing [6, 22, 39-43, 55, 59-64]. We summarize this work here: In [6] Popovic et al. presented some standards that can be used to address security issues in cloud computing such as: Information Technology Infrastructure Library (ITIL), International Organization for Standardization (ISO 27001/27002) and Open Virtualization Format (OVF). In [22] Ramgovind et al. presented guidelines for managing cloud security which include: cloud governance, cloud transparency and cloud computing security impacts. In [39] the authors proposed an Effective Privacy Protection Scheme (EPPS) to provide the appropriate privacy protection for cloud services. EPPS satisfies users' privacy requirements and maintains system performance simultaneously. First, they analyzed the privacy level users require and quantified the security degree and performance of encryption algorithms. Then, an appropriate security composition is derived by

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the results of analysis and quantified data. Their simulation results showed that the EPPS not only fulfils users' privacy requirements but also maintains the cloud system performance in different cloud environments. The execution results show that EPPS outperforms other security schemes by 35% to 50%. In [40] in order to satisfy the assurances of cloud data integrity and availability and enforce the quality of cloud storage services for users, the authors proposed a highly efficient and flexible distributed storage verification scheme with two salient features. By utilizing a homomorphic token with distributed erasurecoded data, their scheme achieves the integration of storage correctness insurance and data error localization, i.e., the identification of misbehaving server(s). Unlike most prior work, the new scheme further supports secure and efficient dynamic operations on outsourced data, including: block modification, deletion and appending. Extensive security and performance analysis showed that the proposed scheme is highly efficient and resilient against Byzantine failure, malicious data modification attacks, and even server collusion attacks. The work in [41] studied the problem of ensuring the integrity of data storage in Cloud Computing. In particular, the authors considered the task of allowing a third party auditor (TPA), on behalf of the cloud client, to verify the integrity of the dynamic data stored in the cloud. The introduction of TPA eliminated the involvement of the client through the auditing of whether his data stored in the cloud are indeed intact, which can be important in achieving economies of scale for cloud computing. They stated that a significant step toward practicality is the support for data dynamics via the most general forms of data operation, such as block modification, insertion, and deletion, since services in cloud computing are not limited to archive or backup data only. While prior work on ensuring remote data integrity often lacks support for either public auditability or dynamic data operations, this work achieves both. The authors showed how to construct an elegant verification scheme for the seamless integration of these two salient features in their protocol design. In particular, to achieve efficient data dynamics, they improved the existing proof of storage models by manipulating the classic Merkle Hash Tree construction for block tag authentication. To support efficient handling of multiple auditing tasks, they explored the technique of bilinear aggregate signature to extend their main result into a multiuser setting, where TPA can perform multiple auditing tasks simultaneously. Extensive security and performance analysis showed that the proposed schemes are highly efficient and provably secure.

Most of the work mentioned above seem to focus on certain aspects of the security and privacy problem in cloud computing. In this work we provide a framework for security and privacy that serves as a comprehensive guidance for achieving higher security level in the clouds. The framework gives guidelines on most of the aspects of secure clouds including: security and privacy requirements, attacks and threats that clouds are vulnerable to and risks and concerns about cloud security. Moreover, we propose a generic security model for cloud computing that helps satisfy its security requirements and protect the clouds against various malicious behaviors.

III. FRAMEWORKS FOR SECURE CLOUD

It consists of three essential security components; each of them includes important challenges related to cloud security and privacy. These components are: Security and privacy requirements: identifies security and privacy requirements for the cloud such as authentication, authorization, integrity, etc. Attacks and threats: warns from different types of attacks and threats to which clouds are vulnerable. Concerns and risks: pay attention to risks and concerns about cloud computing.

IV. SECURITY AND PRIVACY

Security concerns confidentiality, availability and integrity of data or information. It also includes Authentication, Authorization and Access control (AAA). On the other hand, privacy concerns the adherence to various legal and non legal norms. It includes: consent, purpose restriction and legitimacy which all ensure that a cloud deployment meets the requirements imposed by law. It may also include transparency, governance and compliance. The International Standards Organization (ISO), in ISO 7498-2 [21, 23], suggested a number of information security requirements.

There are a number of security risks associated with cloud computing that must be adequately addressed.

A. Loss of governance

For public cloud deployments, consumers necessarily cede control to the cloud provider over a number of issues that may affect security. At the same time, cloud service level agreements (SLA) may not offer a commitment to provide such capabilities on the part of the cloud provider, thus leaving gaps in security defenses.

B. Responsibility ambiguity

Given that use of cloud computing services spans across the consumer and the provider organizations, responsibility for aspects of security can be spread across both organizations, with the potential for vital parts of the defenses to be left unguarded if there is a

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Volume 4 Issue VIII, August 2016
ISSN: 2321-9653

failure to allocate responsibility clearly. The split of responsibilities between consumer and provider organizations is likely to vary depending on the model being used for cloud computing (e.g. Iaas versus SaaS).

C. Isolation failure

Multi-tenancy and shared resources are defining characteristics of public cloud computing. This risk category covers the failure of mechanisms separating the usage of storage, memory, routing and even reputation between different tenants (e.g., so-called guest-hopping attacks).

D. Vendor lock-in

Dependency on proprietary services of a particular cloud provider could lead to the consumer being tied to that provider. Services that do not support portability of applications and data to other providers increase the risk of data and service unavailability.

E. Compliance and legal risks

Investment in achieving certification (e.g., industry standard or regulatory requirements) may be put at risk by migration to use cloud computing if the cloud provider cannot provide evidence of their own compliance with the relevant requirements or if the cloud provider does not permit audit by the cloud consumer. It is the responsibility of the cloud consumer to check that the cloud provider has appropriate certifications in place, but it is also necessary for the cloud consumer to be clear about the division of security responsibilities between the consumer and the provider and to ensure that the consumer's responsibilities are handled appropriately when using cloud computing services.

F. Key Steps to ensure that data involved in cloud computing activities is properly secured

Controls	Descriptions
Create a data asset catalog	A key aspect of data security is the creation of a data asset catalog, identifying all data assets, classifying those data assets in terms of criticality to the business (which can involve financial and legal considerations, including compliance requirements), specifying ownership and responsibility for the data and describing the location(s) and acceptable use of the assets. Relationships between data assets also need to be cataloged. An associated aspect is the description of responsible parties and roles, which in the case of cloud computing must span the cloud service consumer organization and the cloud service provider organization.

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Apply confidentiality, integrity and availability	• The key security principles of confidentiality, integrity and availability are applied to the handling of the data, through the application of a set of policies and procedures, which should reflect the classification of the data. • Sensitive data should be encrypted, both when it is stored on some medium and also when the data is in transit across a network - for example, between storage and processing, or between the provider's system and a consumer user's system. o An extra consideration when using cloud computing concerns the handling of encryption keys - where are the keys stored and how are they made available to application code that needs to decrypt the data for processing? It is not advisable to store the keys alongside the encrypted data, for example. • Integrity of data can be validated using techniques such as message digests or secure hash algorithms, allied to data duplication, redundancy and backups. • Availability can be addressed through backups and/or redundant storage and resilient systems, and techniques related to the handling of denial-of-service attacks. There is also a need for a failover strategy, either by using a service provider who offers this as part of their service offering, or if the provider does not offer resiliency as a feature of their services the consumer may consider self provision of failover by having equivalent services on standby with another provider.

V. VARIOUS TYPES OF ATTACKS AND THREATS

Attacks and Threats Before defining types of attacks in clouds, we must identify the attackers themselves and their impact on the security of cloud systems. Cloud attackers may be categorized as follows:

A. Random

The most common type of attackers uses simple techniques to randomly scan the internet in order to find vulnerable computers. They deploy well known tools that should be easily detected.

B. Weak

Weak attacks are semi-skilled attackers who target specific cloud providers by customizing publicly available tools for specific targets.

C. Strong

These are organized, skilled and well financed groups of attackers who target particular applications and users of the cloud. Generally, they form criminal groups specialized in large scale attacks.

D. Substantial

These are motivated, highly skilled attackers who can't be easily detected either by the organizations they attack or by the law enforcement and investigative organizations specializing in e-Crime or cyber security. Attacks on cloud computing can be classified according to cloud service models and they are described below [24, 25,101]: In SaaS the most common attacks are.

E. Wrapping attacks

These attacks occur between the web browser and the server by altering the Simple Object Access Protocol (SOAP) messages for two persons, the user and the attacker. When using XML signatures for authentication or integrity, the most well known attack is XML Signature Element Wrapping.

F. Browser-based attacks

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A browser attack alters the signature and encryption of SOAP messages. The security of Web browsers is defended against some types of attack such as phishing attack, SSL certificate spoofing, and attacks on browser caches. In PaaS there are some types of attack such as:

1) *Cloud injection attacks:* It attempt to create malicious service implementation modules or virtual machine instances for the opponent to be executed against intention. Examples for these modules are SQL injection, OS command injection and cross site scripting [64]. The threat occurs when considering the new instance to be a valid instance. To avoid this attack, a hashing algorithm should be used.
2) *Metadata spoofing attacks:* include reengineering Web Services' metadata descriptions. To defend against this threat, verification techniques should be used.

In IaaS, the most important attack is the flooding attack that is represented as:

a) *Denial of service attacks:* occur when an attacker sends a lot of malicious requests to the server and consumes its available resources, CPU and memory. When the server reaches its maximum capacity, it offloads the received requests to another server. In cloud computing, due to the large number of cloud users (multitenancy) who share the cloud infrastructure the problem of Distributed DoS (DDoS) attacks becomes of much greater impact than that in single tenant architecture. The problem is further magnified when the cloud has no sufficient resources to provide customers with services [65]. The cloud system works against the attacker by providing more computational power.
b) *Buffer overflow attacks:* when buffer overflow occurs, the attacker is able to overwrite data specialist in program execution to execute his malicious program. Privilege escalation: utilizes a vulnerability that comes from any programming errors and aims to access the protected resources without permission.

VI. SUMMARY FOR CLOUD COMPUTING AND THEIR COUNTERMEASURES

Attacks and threats	Mitigation
Wrapping attacks	Increase security during message passing from the web server to the web browser by using the SOAP message
Cloud injection attacks	Use hash algorithms
Metadata spoofing attacks	Use verification techniques
Denial of Service (DoS)	Provide more computational power and resources
Abuse and Nefarious Use of Cloud Computing	Improve credit card fraud detection-Apply strict registration and validation rules-Perform extensive examination of network traffic
Insecure Interfaces	Analyse the security model of the API- Employ strong authentication, access control and encryption techniques- Understand the dependency chain of the API
Malicious Insiders	Require transparency in all information security issues- Define security breach notification processes- Enforce strict hiring requirements and HR assessment
Shared technology	Conduct vulnerability scanning

VII. CONCLUSION

In this paper, we reviewed the literature for security challenges in cloud computing and proposed a framework that identifies security and privacy requirements, attacks, threats, concerns and risks associated to the deployment of the clouds. We believe that more effort should be exerted by both cloud vendors and organizations to provide a highly protected, safe and sound cloud computing environment. On the other hand, we suggest that future research should be directed towards the management of risks

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associated with cloud computing. Developing risk assessment helps organizations make an informed decision as to whether cloud computing is currently suitable to meet their business goals with an acceptable level of risks. However, managing risks in cloud computing is a challenging process that entails identifying and assessing risks, and taking steps to reduce it to an acceptable level. We plan to pursue research in finding methods for qualitative and quantitative risk analysis in cloud computing. These methods should enable organizations to balance the identified security risks against the expected benefits from cloud utilization.

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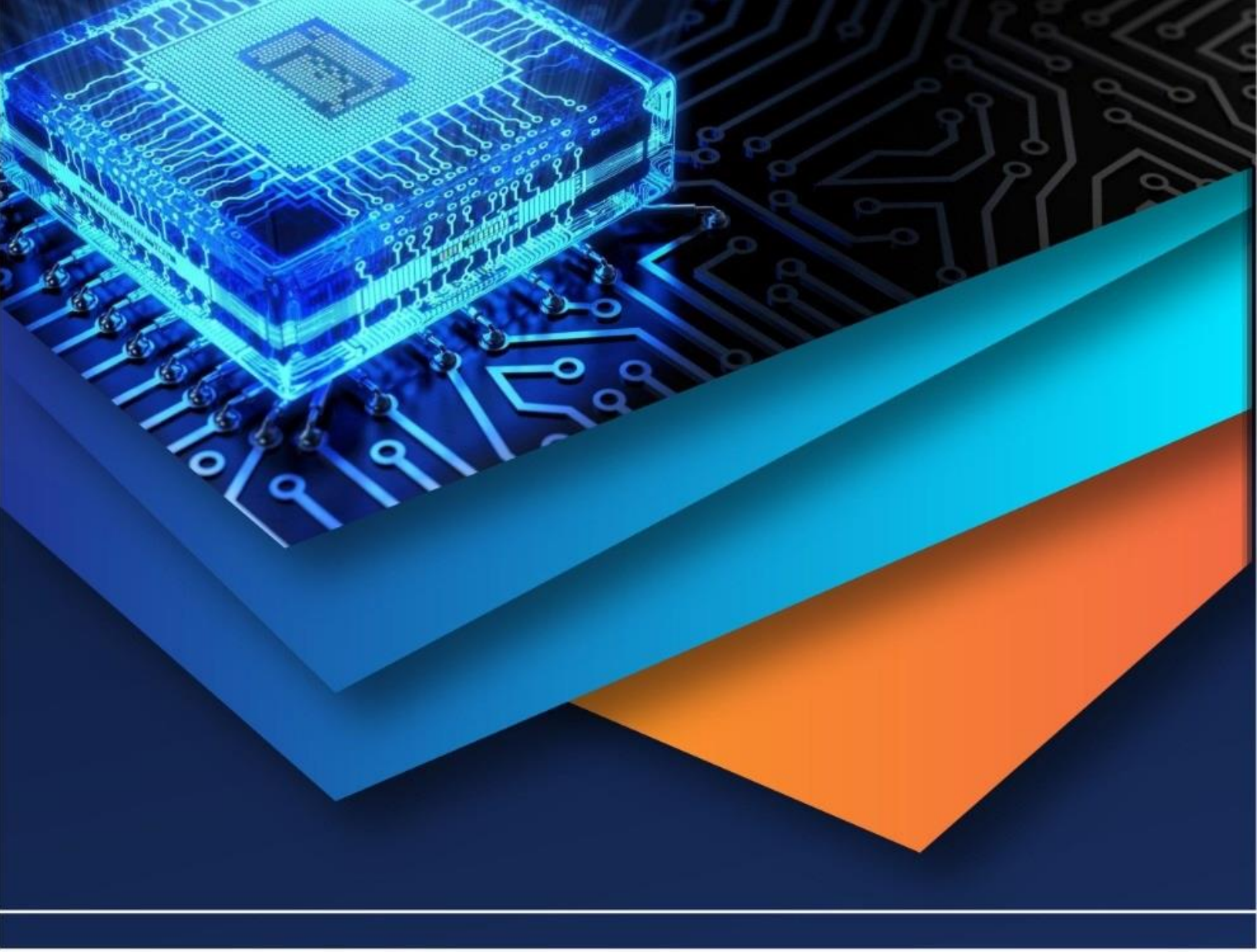
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