



Security in Hybrid Cloud

By Anukrati Dubey, Gunjita Shrivastava & Sandeep Sahu

University of RGPV, India

Abstract - As the cloud computing is spreading around the world, need of inter cloud communication is becoming a growing in the organizations. It is causing the researchers to focus on first, making it possible to communicate between two or more clouds and second security of communication is to considered up to utmost level. With emergence of cloud computing, the term "Hybrid Topology" or "Hybrid Deployment" is becoming more and more common. Definition of "Hybrid Topology" is when you join different cloud deployments into one connected cluster. Another area of research is to focus on communication between a cloud and non cloud computing system. Hybrid Cloud computing mainly deals with working of data centers where different software are installed with huge of growing data to provide information to the users of the system.

The techniques which can be used in hybrid cloud securities can be built around the encryption and decryption of data, key based security algorithms which are mainly oriented on authentication and authorization techniques as in wired and wireless networks. One such mechanism is to share the challenge text between the clouds before actual communication should start for authentication. The various works done in this area till date are oriented on other techniques of security between the two or more clouds in a hybrid cloud.

Keywords : cloud computing; hybrid cloud; challenge text; security.

GJCST-B Classification : C.1.3



Strictly as per the compliance and regulations of:



Security in Hybrid Cloud

Anukrati Dubey^α, Gunjita Shrivastava^ο & Sandeep Sahu^ρ

Abstract - As the cloud computing is spreading around the world, need of inter cloud communication is becoming a growing in the organizations. It is causing the researchers to focus on first, making it possible to communicate between two or more clouds and second security of communication is to considered up to utmost level. With emergence of cloud computing, the term "Hybrid Topology" or "Hybrid Deployment" is becoming more and more common. Definition of "Hybrid Topology" is when you join different cloud deployments into one connected cluster. Another area of research is to focus on communication between a cloud and non cloud computing system. Hybrid Cloud computing mainly deals with working of data centers where different software are installed with huge of growing data to provide information to the users of the system.

The techniques which can be used in hybrid cloud securities can be built around the encryption and decryption of data, key based security algorithms which are mainly oriented on authentication and authorization techniques as in wired and wireless networks. One such mechanism is to share the challenge text between the clouds before actual communication should start for authentication. The various works done in this area till date are oriented on other techniques of security between the two or more clouds in a hybrid cloud.

Keywords : cloud computing; hybrid cloud; challenge text; security.

I. INTRODUCTION

Cloud computing is becoming a buzz word in computer industry and everyone is looking to associate in one way or other with this brand new concept. Cloud computing is a very current topic and the term has gained a lot of traction being sported on advertisements all over the Internet from web space hosting providers, through data centers to virtualization software providers.

Such complex technology and business models setting entails an extensive research and provides the motivation towards writing this paper. The main goal is to "clear the air on hybrid cloud computing security" and provide an unbiased and independent, albeit critical outlook of the technology.

Special emphasis is put on the critical examination of each strategy as now more than ever in the face of the global economic crisis, companies face higher refinancing and investment costs and as any company thinking about adopting or moving to cloud

computing technology would do in practice; short-to-medium term disadvantages of the technology have to be pragmatically and carefully weighted out against any hyped long-term potential efficiency achievements, be it strategic, technical or cost related. [1]

In order to understand the vision, goals and strategy behind cloud computing, two key concepts that form its foundations need to be explained first.

1. Autonomic Computing.
2. Utility Computing.

Autonomic computing, the term initially being introduced by IBM's Senior Vice President Paul Horn to the National Academy of Engineers at Harvard University in 2001, represents a research aim towards achieving self-managing computing systems, whose components integrate effortlessly.

Utility computing is the second key concept that one encounters in all cloud computing models. It is by no means a new concept as articulated in one form or another as early as the 1960s and implies that it is only natural that at some point computing power will be offered as a standardized service billed on actual usage with very limited or no upfront set-up charges.

a) Cloud Computing – Definitions

A scientific definition is proposed by the GRIDS Lab at the University of Melbourne:

"A Cloud is a type of parallel and distributed system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements established through negotiation between the service provider and consumers."

Berkeley's defines it as:

"Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services (Software as a Service - SaaS). The datacenter hardware and software is what we will call a Cloud. When a Cloud is made available in a pay-as-you-go manner to the public, we call it a Public Cloud; the service being sold is Utility Computing." [1]

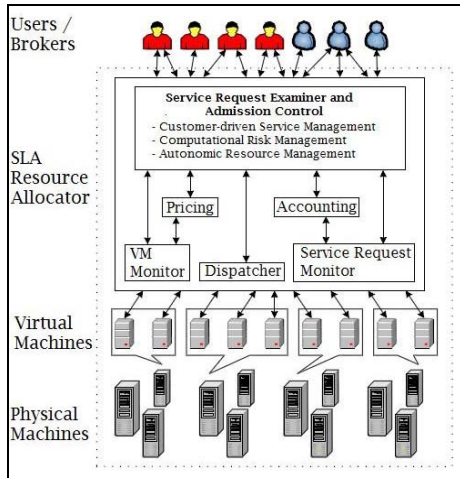
Building blocks of cloud computing:

- Storage-as-a-Service
- Database-as-a-Service
- Information-as-a-Service
- Process-as-a-Service
- Application-as-a-Service

Author α ο : M.Tech. Scholar S.R.I.T. Jabalpur, University of RGPV Bhopal Madhya Pradesh India. E-mails : anukrati_dubey@yahoo.com, gunjita.shrivastava@yahoo.com

Author ρ : Assistant Professor in Computer Science Dept. from S.R.I.T. Jabalpur, University of RGPV Bhopal Madhya Pradesh India. E-mail : sndeep.sahu12@gmail.com

- Integration-as-a-Service
- Security-as-a-Service
- Management/Governance-as-a-Service
- Testing-as-a-Service



b) *Hybrid Cloud Computing*

1. A hybrid cloud is a composition of at least one private cloud and at least one public cloud. A hybrid cloud is typically offered in one of two ways: a vendor has a private cloud and forms a partnership with a public cloud provider, or a public cloud provider forms a partnership with a vendor that provides private cloud platforms.
2. A hybrid cloud is a cloud computing environment in which an organization provides and manages some resources in-house and has others provided externally. For example, an organization might use a public cloud service, such as Amazon Simple Storage Service (Amazon S3) for archived data but continue to maintain in-house storage for operational customer data. Ideally, the hybrid approach allows a business to take advantage of the scalability and cost-effectiveness that a public cloud computing environment offers without exposing mission-critical applications and data to third-party vulnerabilities. This type of hybrid cloud is also referred to as hybrid IT.

c) *Challenges in Hybrid Cloud Computing*

Here are some challenges to consider when setting up hybrid clouds:

i. *On Demand Startup and Shutdown*

Your infrastructure must be able to start up and shutdown cloud nodes on demand. Usually you should have some policy implemented which listens to some of your application characteristics and reacts to them by starting or stopping cloud nodes. In simplest case, you can react to CPU utilization and start up new nodes if main cloud gets overloaded and stop nodes if it gets under loaded.

ii. *Cloud-based Node Discovery*

The main challenge in setting up regular discovery protocols on clouds is that IP Multicast is not enabled on most of the cloud vendors (including Amazon and Go Grid). Your node discovery protocol would have to work over TCP. However, you do not know the IP addresses of the new nodes started on the cloud either. To mitigate that, you should utilize some of the cloud storage infrastructure, like S3 or Simple DB on Amazon, to store IP addresses of new nodes for automatic node detection.

iii. *One-Directional Communication*

One of the challenges in big enterprises is opening up new ports in Firewalls for connectivity with clouds. Quite often you will only be allowed to make only outgoing connections to a cloud. Your middleware should support such cases. On top of that, sometimes you may run into scenario of disconnected clouds, where cloud A can talk to cloud B, and cloud B can talk to cloud C, however cloud A cannot talk to cloud C directly. Ideally in such case cloud A should be allowed to talk to cloud C through cloud B.

iv. *Latency*

Communication between clouds may take longer than communication between nodes within the same cloud. Often, communication within the same cloud is significantly slower than communication within local data center. Your middleware layer should properly react to and handle such delays without breaking up the cluster into pieces.

v. *Reliability and Atomicity*

Many operations on the cloud are unreliable and non-transactional. For example, if you store something on Amazon S3 storage, there is no guarantee that another application can read the stored data right away. There is also no way to ensure that data is not overwritten or implement some sort of file locking. The only way to provide such functionality is at application or middleware layers.

II. *EXISTING SYSTEM*

Paper [4] states that Cloud computing is setting off great changes in the IT industry. There are more and more researches on cloud computing. And this paper focuses on cloud computing too. At the beginning this paper describes the characteristics and definitions of cloud computing, and then introduced its services patterns (including SaaS, PaaS and IaaS) and deployment patterns (including public cloud, private cloud and hybrid cloud), at the end lists the cloud security challenges that cloud computing faces.

Security problems faced by the cloud system about in the following five aspects:

- First, face more security attacks: due to the vast amounts of user data stored in the cloud system, for

attackers there has greater allure. If the attacker in some way successfully attack cloud systems, it will bring devastating disaster for both cloud providers and users; On the other hand, in order to ensure flexibility and versatility services of the cloud, cloud systems provide users with more open access interfaces, which also bring greater security threats.

- Second, virtualization technology: it not only brings cloud computing platform flexibly resources configured, but also brings new security challenges. There is a need to solve the problem that secure deployment of cloud platform based on the virtual machine architecture. In a virtualized environment, the server is like a file which is taken away easily, so the risk of disclosure increases. The introduction of the virtualization platform has become new security vulnerabilities. Once be hacked, all the virtual machines running on the virtualization platform will be under control of attackers. By that time, the cloud providers and users will suffer huge loss.
- Third, ensure continuity of the cloud platform services and high availability of user data and business: Amazon data center downtime event, Google's Gmail failing to use event and so on are associated with cloud computing availability. To a certain extent, the events above discourage the enthusiasm of the enterprise to use public cloud. Cloud computing service need to provide a fault tolerant mechanism to backup user data to reduce the impact in application when the original data is destroyed. In addition, the software itself may have loopholes and a large number of malicious attacks happen, all these above greatly increase the possibility of service interruption. How to protect the high availability of software services and user application and how to provide convenience security management to the thin-client user have become one of the biggest challenges of cloud security.
- Fourth, ensure the safety and privacy of user data: user data stored in the cloud system, for malicious attacks, the primary purpose is to get user privacy, and then to obtain economic benefits. In this case, laws, regulations and processes are the problems that are the most urgent to be solved, and relevant laws and regulations should be established and improved to protect third-party security, to meet requirements listed by companies, especially to clear responsibility division when problems arise and to provide protection mechanisms as cloud service providers exit.
- Fifth, perfect the cloud standards: Interest-oriented IT development process leads to cloud standards exist everywhere. Many manufacturers have defined their own application standards and data formats, forcing the user deploying IT system and their own

business in accordance with the framework set by different service provider. Ultimately, all of this leads to business fragmented and chaotic system which are adverse to users' application. In cloud computing, cloud computing security standards and evaluation system provides an important technical and management support. And interoperability between varieties of cloud services is essential to ensure the cloud not to fall into isolated development situation and then promote common progress. To a certain extent, the establishment of cloud standards decides the future evolution of cloud computing. [4]

In the conclusion the authors say that as a new technology is expected to significantly reduce the cost of existing technologies, cloud computing is the development trend of IT industry. For information security, there are both favorable factors and negative factors brought by cloud computing. The final effect depends on whether we can develop its strengths and avoid its disadvantages. Only in this way, the cloud can become a real cost savings, improving productivity efficiency and secure platform.

Not much of the work has been done in the field of security of the hybrid cloud computing and sharing between them. Various research are done but are focused on how to achieve the hybrid clouds working together. Some of researches done by the researchers are listed herewith for references.

With the advance of cloud computing, hybrid cloud that integrate private and public cloud is increasingly becoming an important research issue. Migrating cloud applications from a busy host to an idle host needs an efficient way to guarantee the performance in the geographical heterogeneous cloud environment. This paper we propose an automatic, intelligent service migration framework on a hybrid cloud based on agent technology. We build a prototype that integrated our private cloud with public cloud. In the prototype, mobile agent technique is exploited to manage all resources, monitor system behavior, and negotiate all actions in the hybrid cloud, in order to achieve automatic, intelligent service migration between the clouds. We demonstrate the service migration mechanism on Hadoop platform between our platform and ITRI public cloud [1].

In the recent era, cloud computing has evolved as a net centric, service oriented computing model. Consumers purchase computing resources as on-demand basis and get worry free with the underlying technologies used. Cloud computing model is composed of three service models Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) and four deployment models Public, Private, Community and Hybrid. A third party service provider, stores & maintains data,

application or infrastructure of Cloud user. Relinquishing the control over data and application poses challenges of security, performance, availability and privacy. Security issues in Cloud computing are most significant among all others. Information Technology (IT) auditing mechanisms and framework in cloud can play an important role in compliance of Cloud IT security policies. In this paper, we focus on cloud security audit mechanisms and models [1].

It is found that the research into the use of multi-cloud providers to maintain security has received less attention from the research community than has the use of single clouds. This work aims to promote the use of multi-clouds due to its ability to reduce security risks that affect the cloud computing user.

For data security and privacy protection issues, the fundamental challenges are separation of sensitive data and access control. Our objective is to design a set of unified identity management and privacy protection frameworks across applications or cloud computing services. From the studies of various research papers and works done by various researchers it has been found that following are the major areas of focus in the field of cloud computing:

1. Defining Architecture: on the basis of the application areas.
2. Security of communication over the cloud.
3. Integration of services on various layers.
4. Inclusion of Various network and communication devices being developed rapidly. [1]

III. PROPOSED ALGORITHM

Cloud computing is a buzz word today and it allows to provide interruption free services to the customers. In one hand public clouds, provides services for external customers, on the other hand private clouds provide services for specific group of customers who are interconnected with one another.

Hybrid cloud, in this way is more useful as they are combination of public and private clouds. Such a system is obviously going to very less secured and will face more and more security challenges. Primary security goal found in hybrid clouds is to provide secured sharing of data between the public and private clouds i.e. secured intra cloud communication.

This work proposes a secured intra cloud communication mechanism in which it is being tried to keep the data more secured over the intra cloud communication using a challenge text based communication. Various Steps involved are as follows:

Step 1: Cloud 'A' has to communicate with Cloud 'B'. (Both 'A' and 'B' may be public, private or combination). Both have a trusted environment already created between them using SLA.

Step 2: Cloud 'A' sends a data request (DRQ) to Cloud 'B'.

Step 3: Cloud 'B' receives the DRQ and sends a challenge text (RID) encrypted using RSA algorithm, to Cloud 'A'.

Step 4: Cloud 'A' receives the RID and decrypts the same using its public key. The decrypted text (VID) is sent to the Cloud 'B'.

Step 5: Cloud 'B' if finds that the key is matching, it will send the encrypted data to Cloud 'A' as desired by the Cloud 'A'.

Step 6: Cloud 'B' if finds that the key is not matching, it will reject the request instantly.

DRQ- Data Request
RID-Reveal Identification
VID – Verify Identity

IV. RESULTS

The algorithm is expected to perform better in all situations such as a cloud is performing mal activities, cloud become malicious after a while or a cloud is not at all malicious. Algorithm will also give good results even in case of the infecting clouds found in the network.

The proposed work in implementation and it is being found to be secured and useful for processing of hybrid cloud computing.

V. CONCLUSION AND FUTURE WORK

Since cloud connects to thousand and thousand people over internet or intranet on pay per basis, therefore security of the cloud is a focused are for researchers and with the growth of the cloud computing and hybrid computing, requirements for security are increasing heavily. The proposed work is expected to provide a good security infrastructure over cloud.

One mechanism is to share the challenge text between the clouds before actual communication should start for authentication. The various works done in this area till date are oriented on other techniques of security between the two or more clouds in a hybrid cloud.

Cloud Computing is facilitating users around the world for the best of the services available across the world on their machines through web. It is beneficial for both the service providers (they get huge clientele) and clients (they get all available services).

For data security and privacy protection issues, the fundamental challenges are separation of sensitive data and access control. Our objective is to design a set of unified identity management and privacy protection frameworks across applications or cloud computing services. As mobility of employees in organizations is relatively large, identity management system should achieve more automatic and fast user account provisioning and de-provisioning in order to ensure no un-authorized access to organizations' cloud resources by some employees who has left the organizations.

REFERENCES RÉFÉRENCES REFERENCIAS

1. Safwan Mahmud Khan and Kevin W. Hamlen, "Hatman: Intra-cloud Trust Management for Hadoop", 2012 IEEE Fifth International Conference on Cloud Computing, 978-0-7695-4755-8/© 2012 IEEE DOI 10.1109/CLOUD.2012.64.
2. Mohammed A. AlZain, Eric Pardede, Ben Soh, James A. Thom, "Cloud Computing Security: From Single to Multi-Clouds" 2012 45th Hawaii International Conference on System Sciences 978-0-7695-4525-7/12 © 2012 IEEE DOI 10.1109/HICSS.2012.153.
3. Deyan Chen, Hong Zhao, "Data Security and Privacy Protection Issues in Cloud Computing" 2012 International Conference on Computer Science and Electronics Engineering 978-0-7695-4647-6/12 © 2012 IEEE DOI 10.1109/ICCSEE.2012.193.
4. Zhang Yandong, Zhang Y ongsheng, "Cloud Computing and Cloud Security Challenges" 2012 International Symposium on Information Technology in Medicine and Education.
5. Fan, Chih-Tien; Wang, Wei-Jen; Chang, Yue-Shan; High Performance Computing and Communications (HPCC), 2011 IEEE 13th International Conference on Publication Year: 2011, Page(s): 887 – 892.
6. Gul, I.; ur Rehman, A.; Islam, M.H.; Next Generation Information Technology (ICNIT), 2011 The 2nd International Conference on Publication Year: 2011, Page(s): 143 – 148.
7. Mazhelis, Oleksiy; Tyrvaïnen, Pasi; Software Engineering and Advanced Applications (SEAA), 2011 37th EUROMICRO Conference on Digital Object Identifier: 10.1109/SEAA.2011.29 Publication Year: 2011, Page(s): 138.
8. Research on Cloud Computing Security Problem and Strategy Wentao Liu Department of Computer and Information Engineering, Wuhan Polytechnic University, Wuhan Hubei Province 430023, China 978-1-4577-1415-3/©2012 IEEE.
9. Pengfei You, Yuxing Peng, Weidong Liu, Shoufu Xue "Security Issues and Solutions in Cloud Computing" 32nd International Conference on Distributed Computing Systems Workshops, 1545-0678 © 2012 IEEE DOI 10.1109/ICDCSW.2012.20.
10. Chunqing Chen, Shixing Yan, Guopeng Zhao, Bu Sung Lee, "A Systematic Framework Enabling Automatic Conflict Detection and Explanation in Cloud Service Selection for Enterprises", 2012 IEEE Fifth International Conference on Cloud Computing, 978-0-7695-4755-8 © 2012 IEEE DOI 10.1109/CLOUD.2012.95.
11. Jianyong Chen, Yang Wang, and Xiaomin Wang "On-Demand Security Architecture for Cloud Computing ", 0018-9162 © 2012 IEEE.
12. Iliana Iankoulova, Maya Daneva, "Cloud Computing Security Requirements: a Systematic Review", 978-1-4577-1938-7 ©2011 IEEE.
13. Eman M.Mohamed, Hatem S. Abdelkader, Sherif El-Etriby, "Enhanced Data Security Model for Cloud Computing", The 8th International Conference on INFormatics and Systems (INFOS2012) - 14-16 May, 2012.



This page is intentionally left blank