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EVALUATION AND IMPLEMENTATION OF SECURITY ALGORITHM IN CLOUD COMPUTING INFRASTRUCTURE

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ABSTRACT

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Cloud computing is one of the growing domain in which remote resources are used on demand basis without having the physical infrastructure at the client end. In cloud computing, the actual resources are installed and deployed at remote locations. These resources are accessed remotely with different network based protocols. Cloud Computing technology is considered as a metaphor for Internet or simply Web Based Services in which there is the provision of Computational Resources On-Demand and hides end-user knowledge of the physical location and configuration of server. This manuscript underlines various aspects and dimensions of cloud computing and key technologies with the simulation aspects used in cloud computing. In this paper, a the implementation of secured algorithm for cloud infrastructure is highlighted with the simulation results and found that the dynamic hash key based approach can secure the cloud infrastructure to a huge level.

Keywords - Cloud Computing, Cloud Simulation

INTRODUCTION

Now days, Cloud computing [1] is one of the famous research domains in the academics as well as corporate community for multiple applications. Currently, many computing services are provided and hosted on cloud platforms. A number of cloud service providers are providing the computing resources in different domains as well as contours to the world. Cloud computing refers to the delivery of computing resources to cloud users as a service rather than a product. Here, the computing power, devices, resources, software and information is delivered to the clients as a utility. Classically these services are delivered or transmitted to the client end by making use of a specialized network infrastructure or Internet.

CLOUD BASED SERVICE MODELS

Cloud computing services are delivered by the service providers using different specific models

Infrastructure as a service (IaaS) - IaaS [2] cloud includes the delivery of computing infrastructure such as a virtual-machine disk image library, raw block storage, object storage, firewalls, IP addresses, load balancers, virtual local area networks and other services on-demand from the large stacks installed in data centers. The cloud service providers charge and bill for their services on a utility computing basis. The cost for these services reflects the amount of resources allocated and consumed by the user.

Platform as a service (PaaS) - PaaS [1] model integrates the delivery of assorted cloud services including operating system, programming language execution environment, integrated development environment for software development, web server, database server and other related technologies. The system developers can easily develop and execute the corporate technology solutions on cloud platform without any specific cost or complexity of purchasing and managing the complex hardware and software layers. Famous PaaS implementations including Microsoft Azure and Google App Engine, the key computing and storage resources are scaled automatically to meet the application demand so that the cloud user does not have to allocate resources manually.

Software as a service (SaaS) – In case of software as a service (SaaS) [1] also known as On-Demand Software, the cloud users are delivered the access to application software and databases. Cloud service providers attempts to manage the platforms and infrastructure that execute the applications. SaaS is also known as "On-Demand Software" and usually priced on a pay-per-use basis. The cloud service providers in this model charge the clients using some specific subscription fee. In this model, the cloud providers install and manage the application software in the cloud and cloud users access the software from cloud clients. The cloud users in this model manage software and the services rather than the cloud infrastructure and platform where the application runs.

Metal as a Service (MaaS) - Metal-as-a-Service or simply MAAS [3] is a provisioning construct that is developed by Canonical, the developers of the Ubuntu to support and integrate the deployment and dynamic provisioning of hyperscale computing environments including big data workloads and cloud services. MAAS act a layer underneath IaaS and executes in parallel with Juju with the applications and workloads, deploying hardware and services. MaaS is used to bring the language of cloud to the physical servers. It helps in making simple to setup the hardware where to deploy the service that needs to scale up and down dynamically.

Virtualization Technology and Cloud

Virtualization [4] is the major technology that works with cloud computing. Actual cloud is implemented with the use of virtualization technology. In Cloud computing, the dynamic virtual machines are created to provide the access of actual infrastructure to the end user or developer at other remote location.

A virtual machine or simply VM is the software implementation of any computing device or machine or computer that executes the series of instructions or programs as a physical (actual) machine. When a user or developer works on a virtual machine, the resources including all programs installed on the remote machine are accessible using a specific set of protocols. Here, for the end user of the cloud service, the virtual machine acts like the actual machine.

The term VM was originally proposed and defined by Popek and Goldberg as "an efficient, isolated duplicate of a real machine".

Virtual machines are identified into two major classifications, depending on their use and degree of correspondence to any real machine:

- **System Virtual Machine** – System Virtual Machine provides a complete system platform that supports the execution of a complete operating system (OS). These emulate an existing system architecture, and are built with the purpose of either providing a platform to run programs where the real hardware is not available for use or of having multiple instances of virtual machines leading to more efficient use of computing resources, both in terms of energy consumption and cost effectiveness (known as hardware virtualization, the key to a cloud computing environment), or both.

- **Process Virtual Machine (Language Virtual Machine)** – This type of virtual machine is designed to execute a single program which means that it supports a single process. Such virtual machines are closely suited to one or more programming languages and built with the purpose of providing program portability and flexibility (amongst other things). An essential characteristic of a virtual machine is that the software running inside is limited to the resources and abstractions provided by the virtual machine - it cannot fragment or break out its virtual environment.

A hypervisor or virtual machine monitor (VMM) is a software component that creates and executes the virtual machines [5].

A hypervisor or virtual machine monitor (VMM) is a piece of computer software, firmware or hardware that creates and runs virtual machines. A computer on which a hypervisor is running one or more virtual machines is defined as a host machine. Each virtual machine is called a guest machine. The hypervisor presents the guest operating systems with a virtual operating platform and manages the execution of the guest operating systems. Multiple instances of a variety of operating systems may share the virtualized hardware resources.

In the implementation and deployment of the cloud service, type 1 hypervisors are used. Hypervisors of type 1 are associated with the concept of bare metal installation. It means there is no need of any host operating system to install the hypervisor. By this technology, there is no risk of getting the host operating system corrupt. These hypervisors are directly installed on the hardware without need of any other operating system. On this hypervisor, multiple virtual machines are created.

A Type-1 hypervisor is a type of client hypervisor that interacts directly with hardware that is being virtualized. It is completely independent from the operating system, unlike a Type-2 hypervisor, and boots before the operating system (OS). Currently, Type-1 hypervisors are being used by all the major players in the desktop virtualization space, including but not limited to VMware, Microsoft and Citrix.

The classical virtualization software or type 2 hypervisor is always installed on any host operating system. If host operating system gets corrupt or crashed by any reason, the virtualization software or type 2 hypervisor will also be crashed and obviously all virtual machines and other resources will be lost. That's why the technology of hypervisor or bare metal installation is very famous in the cloud computing world.

Type 2 (Hosted) hypervisors execute within a conventional operating-system environment. With the hypervisor layer as a distinct second software level, guest operating-systems run at the third level above the hardware. A Type-2 hypervisor is a type of client hypervisor that sits on top of an operating system. Unlike a Type-1 hypervisor, a Type-2 hypervisor relies heavily on the operating system. It cannot boot until the operating system is already up and running and, if for any reason the operating system crashes, all end-users are affected. This is a big drawback of Type-2 hypervisors, as they are only as secure as the operating system on which they rely. Also, since Type-2 hypervisors depend on an OS, they are not in full control of the end user's machine.

Hypervisors in Industry

Hypervisor	**Cloud Service Provider**
Xen	Amazon EC2 IBM SoftLayer Fujitsu Global Cloud Platform Linode OrionVM
ESXi	VMWare Cloud

KVM	Red Hat HP Del Rackspace
Hyper-V	Microsoft Azure

Data Centers and Uptime Tier Levels

As virtual machine is one of the mandatory aspects of the cloud computing, the term data center is also essential part of the technology. All the cloud computing infrastructures are located in the remote data centers that used to keep all the resources including computer systems and associated components, such as telecommunications and storage systems. Data centers classically includes redundant or backup power supplies, redundant data communications connections, environmental controls, air conditioning, fire suppression as well as security devices.

Tier level is considered as the rating or evaluation aspects of the data centers. Large data centers are used for industrial scale operations using as huge electricity consumption such as a small town. The standards are comprised of a four-tiered scale, with Tier 4 being the most robust and full featured.

Cloud Service Providers and their Services

Currently, numbers of cloud service providers are in the global market. Following is the list of cloud service providers in the domain of storage -

- JustCloud
- Zipcloud
- Dropbox
- Zoolz
- Livedrive
- Carbonite
- Backblaze
- 4shared
- Sosonlinebackup.com
- Mozy.com
- Crashplan.com
- Sugarsync.com
- Spideroak.com
- Mega.co.nz
- Google.com
- Onedrive.com
- Safecopybackup.com
- Bitcasa.com

In terms of Infrastructure as a Service (IaaS), following are the key players in the global market of cloud computing -

- Amazon Web Services
- AT & T Cloud Computing Services

- ca Technologies
- CloudScaling
- DataPipe
- ENKI
- Enomaly
- Eucalyptus Systems
- GoGrid
- HP
- Joyent
- LayeredTech
- LogicWorks
- NaviSite
- OpSource
- Rackspace
- SAVVIS
- Terremark
- Verizon

CLOUD SIMULATIONS

To get access to cloud services, the cloud service providers charge depending upon the space or service provided to the client.

In research and development, it is not always possible to have the actual cloud infrastructure for performing the experiments. For any research scholar, academician or scientist, it is not feasible every time to hire the cloud services and then executing their algorithms or implementations.

For the purpose of research, development and testing, the open source libraries are available using which the feel of the cloud services and executions can be experienced. Now days, in research market, the cloud simulators are widely used by the research scholars and practitioners without paying any amount to any cloud service provider.

Using cloud simulators, the researchers can execute their algorithmic approaches on a software based library and can get the results in different parameters including energy optimization, security, integrity, confidentiality, bandwidth, power and many others.

The tasks performed by using the Cloud Simulators includes the Modeling and simulation of large scale Cloud computing data centers, Modeling and simulation of virtualized server hosts, with customizable policies for provisioning host resources to virtual machines, Modeling and simulation of energy-aware computational resources, Modeling and simulation of data center network topologies and message-passing applications, Modeling and simulation of federated clouds, Dynamic insertion of simulation elements, stop and resume of simulation and User-defined policies for allocation of hosts to virtual machines and policies for allocation of host resources to virtual machines

CloudSim - CloudSim is one of famous simulator for cloud parameters developed in the CLOUDS Laboratory, at the Computer Science and Software Engineering Department of the

University of Melbourne. The operations which are performed using CloudSim Library includes the scaling of Cloud computing data centers, Virtualization of Server Hosts with customizable policies, Support for modeling and simulation of large scale Cloud computing data centers, Support for modeling and simulation of virtualized server hosts, with customizable policies for provisioning host resources to virtual machines, modeling and simulation of energy-aware computational resources, modeling and simulation of data center network topologies and message-passing applications, modeling and simulation of federated clouds, dynamic insertion of simulation elements, stop and resume of simulation, user-defined policies for allocation of hosts to virtual machines and policies for allocation of host resources to virtual machines, Energy-aware computational resources, modeling of data center network topologies and message-passing applications, dynamic insertion of simulation elements, stop and resume of simulation and User-defined policies for allocation of hosts to virtual machines

The major limitation with CloudSim is the lack of Graphical User Interface (GUI). Despite of this limitation, CloudSim is still used in the universities and industry for the simulation of cloud based algorithms.

CloudAnalyst Cloud Simulator

CloudAnalyst is another cloud simulator that completely GUI based and support evaluation of social networks tools according to geographic distribution of users and data centers. Communities of users and data centers supporting the social networks are characterized and based on their location; parameters such as user experience while using the social network application and load on the data center are obtained or logged.

CloudAnalyst is used to model and analyze the a real world problem through a case study of a social networking application deployed on the cloud.

GreenCloud Cloud Simulator - GreenCloud is also getting fame in the international market as the Cloud Simulator that can be used for energy-aware cloud computing data centers with the main focus on cloud communications. It providers the features for detailed fine-grained modeling of the energy consumed by the data center IT equipment including servers, communication switches, and communication links. GreenCloud simulator allows researchers to investigate, observe, interact and measure the cloud performance for multiple parameters. The maximum code of GreenCloud is written in C++. Inclusion of TCL is also there in the library of GreenCloud.

GreenCloud is an extension of the network simulator ns2 that is widely used for creating and executing network scenarios. It provides the simulation environment that enable energy-aware cloud computing data centers. GreenCloud mainly focus on the communications within a cloud. Here all of the processes related to communication are simulated on packet level.

After execution of the code in Eclipse, following output will be generated. It is evident from the following output that the integration of dynamic key exchange is implemented with the CloudSim Code.

```
--------------------------------------------------------------------------------
Starting Cloud Simulation with Dynamic and Hybrid Secured Key
--------------------------------------------------------------------------------
```

Initialising...

Security Key Transmitted =>

ygcxsbyybpr4¢- ª¢£?¡®-£

Starting CloudSim version 3.0

CloudDataCenter-1 is starting...

CloudDataCenter-2 is starting...

Broker is starting...

Entities started.

0.0: Broker: Cloud Resource List received with 2 resource(s)

0.0: Broker: Trying to Create VM #0 in CloudDataCenter-1

0.0: Broker: Trying to Create VM #1 in CloudDataCenter-1

[VmScheduler.vmCreate] Allocation of VM #1 to Host #0 failed by MIPS

0.1: Broker: VM #0 has been created in Datacenter #2, Host #0

0.1: Broker: Creation of VM #1 failed in Datacenter #2

0.1: Broker: Trying to Create VM #1 in CloudDataCenter-2

0.2: Broker: VM #1 has been created in Datacenter #3, Host #0

0.2: Broker: Sending cloudlet 0 to VM #0

0.2: Broker: Sending cloudlet 1 to VM #1

0.2: Broker: Sending cloudlet 2 to VM #0

160.2: Broker: Cloudlet 1 received

320.2: Broker: Cloudlet 0 received

320.2: Broker: Cloudlet 2 received

320.2: Broker: All Cloudlets executed. Finishing...

320.2: Broker: Destroying VM #0

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320.2: Broker: Destroying VM #1

Broker is shutting down...

Simulation: No more future events

CloudInformationService: Notify all CloudSim entities for shutting down.

CloudDataCenter-1 is shutting down...

CloudDataCenter-2 is shutting down...

Broker is shutting down...

Simulation completed.

Simulation completed.

============================== OUTPUT ================== ========

Cloudlet ID	STATUS	Data center ID	VM ID	Time	Start Time	Finish Time
1	SUCCESS	3	1	160	0.2	160.2
0	SUCCESS	2	0	320	0.2	320.2
2	SUCCESS	2	0	320	0.2	320.2

Cloud Simulation Finish

Simulation Scenario Finish with Successful Matching of the Keys

----

Simulation Scenario Execution Time in MillSeconds => 4489

```
Execution Time=> 5843     Dynamic MulLayered Hybrid Encrypted Key :
sjkxibwcyqa4??¬±¯¦?«²§£   TimeStamp :2015-04-28 11:36:28.993     Attempt Flag : 1
```

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```
Execution Time=> 41406    Dynamic MulLayered Hybrid Encrypted Key
caelarjqlpp4¬ ¬º¢?¡¦®«¦   TimeStamp 2015-04-28 11:38:31.878      Attempt Flag : 0

Execution Time=> 12442    Dynamic MulLayered Hybrid Encrypted Key:
mniuymxttrp4 ¯?¢§¥®?-?º   TimeStamp :2015-04-28 11:39:59.239     Attempt Flag : 1

Execution Time=> 8586     Dynamic MulLayered Hybrid Encrypted Key
wkdmthgcwjn4?º¦¤³«º¥±²¤   TimeStamp 2015-05-12 16:27:53.842      Attempt Flag : 0

Execution Time=> 31601    Dynamic MulLayered Hybrid Encrypted Key:
rkewnapjwnu4 ¤ ²« ³®ª??   TimeStamp :2015-05-16 12:55:08.477     Attempt Flag : 1

Execution Time=> 10023    Dynamic MulLayered Hybrid Encrypted Key
udnsktujyps4¨¤§¦??????¬   TimeStamp 2015-05-16 12:56:22.974      Attempt Flag : 0
```

Research Areas in Cloud Computing

Cloud computing and related services are very frequently taken as the research domain by the research scholars as well as academic practitioners. As cloud services are having number of domains, deployment models and respective algorithmic approaches, there are huge scope of research.

Following topics can be worked out by the research scholars as well as practitioners in the domain of cloud infrastructure -

- Energy Optimization
- Load Balancing
- Security and Integrity
- Privacy in Multi-Tenancy Cloud
- Virtualization
- Data Recovery and Backup

- Data Segregation and Recovery
- Scheduling for Resource Optimization
- Secure cloud architecture
- Cloud Cryptography
- Cloud access control and key management
- Integrity assurance for data outsourcing
- Verifiable Computation
- Software and data segregation security
- Secure management of virtualized resources
- Trusted computing technology
- Joint security and privacy aware protocol design
- Failure detection and prediction
- Secure data management within and across data centers
- Availability, recovery and auditing
- Secure computation outsourcing
- Secure mobile cloud

CONCLUSION

The cloud based simulators accelerate the research and development process for analyzing and deep investigation of different parameters including security, energy, integrity, power and related aspects. Research scholars, scientists as well as engineers can analyze the simulated cloud to compare the impact of their experiments on the infrastructure rather than using the actual resources. Using a wide variety of free and open source cloud simulators, the engineers and trainees can work freely with their ideas and algorithms without affecting the actual cloud infrastructure.

REFERENCES

[1] Mell, Peter, and Tim Grance. "The NIST definition of cloud computing." (2011).

[2] Dawoud, Wesam, Ibrahim Takouna, and Christoph Meinel. "Infrastructure as a service security: Challenges and solutions." In *Informatics and Systems (INFOS), 2010 The 7th International Conference on*, pp. 1-8. IEEE, 2010.

[3] URL - http://www.ubuntu.com/cloud/tools/maas Last Accessed - 25-September-2014

[4] Uhlig, Rich, Gil Neiger, Dion Rodgers, Amy L. Santoni, Fernando CM Martins, Andrew V. Anderson, Steven M. Bennett, Alain Kagi, Felix H. Leung, and Larry Smith. "Intel virtualization technology." *Computer* 38, no. 5 (2005): 48-56.

[5] Szefer, Jakub, Eric Keller, Ruby B. Lee, and Jennifer Rexford. "Eliminating the hypervisor attack surface for a more secure cloud." In *Proceedings of the 18th ACM conference on Computer and communications security*, pp. 401-412. ACM, 2011.