

Execution of Cloud using Freeware Technology

^[1]Dr. Vijay Dhir, ^[2]Er. Gagandeep Kaur

^[1]Professor, Dept. of CSE, ^[2] Assistant Professor, Dept. of ECE

^[1]^[2]St. Soldier Institute of Engineering & Technology, Jalandhar

Abstract:-- Cloud may be a metaphor for the net known as cloud computing where internet is cloud. In simplest words, cloud computing means that keeping and retrieving data and programs over the web rather than our secondary memory of hardware and software package facilities by creating them elastic instead of ascendible. The system may be scaled up or down in keeping with a user's want. The utilization of open source technology is a turning purpose in providing cloud computing infrastructure to cut back the value by an outsized magnitude. We will build our own personal clouds and share resources viz. hardware and software while not creating any investment. During this work, we tend to present EUCALYPTUS – computer. Cloud Computing offers a brand new view to our an open source software framework for cloud computing that implements what's normally stated as Infrastructure as a Service (IaaS); systems that offer users the flexibility to run and management entire virtual machine instances deployed across a range physical resources.

Index Terms—Cloud Computing, Eucalyptus, IaaS

I. INTRODUCTION

Cloud Computing [1, 2] is a technology for storage that uses net and central remote servers to keep up personal or skilled knowledge and applications. Cloud computing permits customers to use applications without installation also as access to their personal files at any pc with web access. This computing technology permits for far more economical computing by centralizing knowledge storage, process and information measure. in the simplest terms, cloud computing means that accessing and storing knowledge and programs over the web rather than your computer's disk drive. The cloud is simply a trope for the web. A straightforward example of cloud computing is Ymail, Gmail, or Hotmail etc. All you would like is simply a web affiliation and you'll begin causing emails by virtual surroundings. The server and email management software system is all on the cloud (internet) and is completely managed by the cloud service supplier Yahoo , Google etc.

II. PROPOSED SYSTEM ARCHITECTURE

A. Public Cloud:

A public cloud is established wherever many organizations have similar necessities and obtain to share infrastructure and information thus on appliance. additionally, it is economically engaging because the resources used and shared within the community are already exploited. this is often the cloud computing model wherever service suppliers build their computing resources out there on-line for the public[8]. It permits the users to

access numerous vital resources on cloud, such as: computer code, Applications or keep knowledge. a number of the foremost vital ones square measure mentioned here:

1. Economical storage and computing service [2,3]
2. Cheap, since all the virtual resources whether or not application, hardware or knowledge square measure coated by the service supplier. \
3. give simple property to servers and data sharing.
4. Assures acceptable use of resources because the users square measure needed to pay just for the services they need.
5. Extremely reliable and redundant.
6. Widespread availableness regardless of geographical precincts.
7. Sets the business individuals free from the hassles of shopping for, managing and maintaining all the virtual resources at their own finish, the cloud server will it all.
8. Public cloud, in today's advanced geographic point, empowers workers and alter them to become productive even once outside the workplace.

B. Non-Public Cloud:

A personal cloud may be a set of hardware, networking, storage, services, applications, and interfaces closely-held and operated by a company for the employment of its workers, partners, and customers. a personal cloud is created and managed by a 3rd party[9] for the exclusive use of 1 enterprise. The non-public cloud may be an extremely controlled environment not open for public consumption. Thus, a personal cloud sits behind a firewall. The non-public cloud is extremely machine-driven with attention on governance, security, and compliance. Automation replaces additional manual processes of managing IT services to support customers.



Fig.1: Public cloud, non-public cloud and Hybrid cloud

C. Hybrid cloud:

A hybrid cloud may be a combination of a personal cloud and public cloud services wherever one or many services exist between the environments. The goal is to mix services from each the clouds and knowledge from a range of cloud models to computing environment. Combining public services for clouds that square measure out there with non-public clouds and knowledge center as a hybrid.

III. PROBLEMS WITH CLOUD COMPUTING

Cloud computing has sure problems, issues & risk [10,11,12,13] related to it. Some issues with clouds are info Security, Compatibility, Standardizing Cloud Technology, and observation.

Information Security is one amongst the foremost major problems with cloud computing. it's utterly based on the net that makes it in danger of hack attacks. however it's also true that now a days all the trendy IT systems are connected to the net. In cloud computing it's easier for companies to quickly endure such attacks due to its distributed network system.

Compatibility with all IT systems during a company is another issue with cloud computing. Cloud Computing is most value economical choice for firms.

however drawback is to switch a lot of of its existing IT infrastructures so as to create the system compatible on the cloud. Hybrid cloud is one amongst answer for this problem.

Lack of standardization within the system is another issue of cloud computing. There is no correct standards for cloud computing are set yet so it's virtually not possible for an organization to search out out the standard of services.

All the information is handled by service supplier once cloud computing responsibility is taken by service supplier. monitoring of processes is another issue of cloud computing.

IV. STACK OF CLOUD COMPUTING

A. Software as a Service (SaaS):

This type of cloud computing is additionally mentioned as software on demand. a well-liked example of SaaS is Google docs. SaaS permits individuals to access the functionality of a particular software without fear regarding storage or different problems.

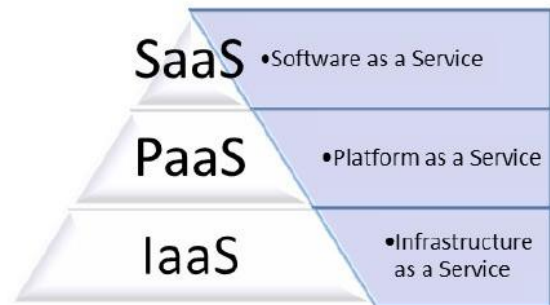


Fig.2: Stack of Cloud Computing

B. Platform as a Service (PaaS):

With this, organizations will run their own software system while not having to worry regarding maintaining hard drives and servers. Instead, they'll run their own applications on the cloud service's platform.

C. Infrastructure as a Service (IaaS).

With IaaS, organizations have access to the unlimited storage potential of the cloud. they'll grow and shirk their storage space as required. this implies that they do not need to worry regarding having dedicated servers on web site. It also means that they can weather increased use of their sites or applications as needed.

D. Network as a Service (Naas):

The least common model, wherever the user is given network connectivity services, like VPN and information measure on demand. Amazon, Microsoft, Google, IBM are biggest leaders of cloud services. Amazon is providing Infrastructure as a Services, info and Content Distribution since 2006 as Amazon net Services. Microsoft is providing Application Platform as Services like .net, SQL data Services since 2009 as Windows Azure however from third Gregorian calendar month 2014 it's renamed as Microsoft Azure. Google is providing net Application Platform as Services since 2008 as Google App. Engine. IBM Salesforce.com is providing Proprietary 4GL net Application as a requirement platform since 2008 as Blue Cloud Force.com.

million in 2016 and it'll bit 1300 million in 2017. So, we are able to see market growth of cloud computing goes to be terribly high. According to International information Corporation, Indian Cloud Computing market was estimated at \$535 million in 2011, is probably going to grow by mote the 70th. Cloud computing refers to pay-per-use model of computing wherever applications and software system area unit accessed over the net and not owned by users. analysis firm Zinnov has estimated market growth can reach \$1.8 billion by 2015. software system as a Services (SaaS) is anticipated to achieve \$650 million of that revenue rest will be achieved by Infrastructure as a Services (IaaS) and Platform as a Services (PaaS).

V. RELATED WORK

Machine virtualization projects producing Virtual Machine (VM) hypervisor software [14,15,16,17] have enabled new mechanisms for providing resources to users. In particular, these efforts have influenced hardware design [18,19,20] to support transparent operating system hosting. The "right" virtualization architecture remains an open field of study [21]): analyzing, optimizing, and understanding the performance of virtualized systems [22,23,24,25,26] is an active area of research. Grid computing [3,4,5,7] must be acknowledged as an intellectual sibling of, if not ancestor to, cloud computing [27,28,29,30]. While grid computing (for e.g. Nimble@ITCEcnoGrid) [4] and cloud computing share a services oriented approach [31,32] and may appeal to some of the same users (e.g., researchers and analysts performing loosely-coupled parallel computations), they differ in two key ways. First, grid systems are architected so that individual user requests can (and should) consume large fractions of the total resource pool [33]. Cloud systems often limit the size of an individual request to be tiny fraction of the total available capacity [34] and, instead, focus on scaling to support large numbers of users.

In addition to the commercial cloud computing offerings mentioned above (Amazon EC2/S3, Google AppEngine, Salesforce.com, etc.), which maintain a proprietary infrastructure with open interfaces, there are open source projects aimed at resource provisioning with the help of virtualization. Usher [35] is a modular open source virtual machine management framework from academia. Enomalism [36] is an open-source cloud software infrastructure from a start-up company. Virtual Workspaces [37] is a Globus-based [38] system for provisioning workspaces (i.e., VMs), which leverages

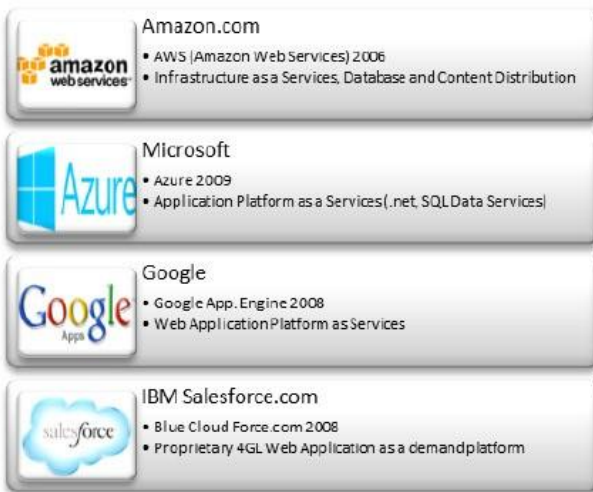


Fig.3: Leaders of Cloud Computing

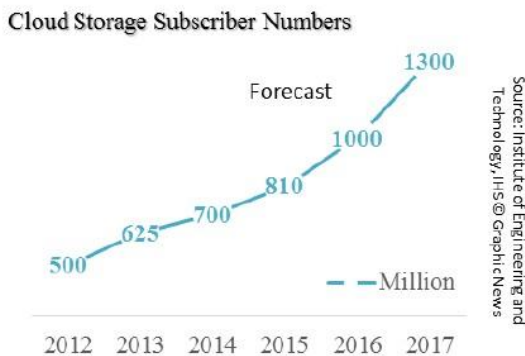


Fig.4: Cloud Storage Subscriber Numbers

Fig. 4 is showing cloud storage subscriber numbers. In 2012 it had been five hundred million subscriber, in 2013 it had been 625 million, and there's a chance to be 700 million subscriber in 2014. Forecast of Institute of Engineering and Technology is that it's progressing to be 810 million in 2015, one thousand

several pre-existing solutions developed in the grid computing [3,5,6,7] arena. The Cluster-on-demand [39] project focuses on the provisioning of virtual machines for scientific computing applications. oVirt [40] is a Web-based virtual machine management console.

VI. IMPLEMENTATION OF PRIVATE CLOUD USING EUCALYPTUS OPEN SOURCE

Generically, open source refers to a program or a software in which the source code is available to the general public for use and/or modification from its original design free of charge, i.e., open to use and customize [41]. Open source software is by definition software for which users have access to the source code. This distinguishes it from the recent common practice of commercial software publishers by only releasing the binary executable versions of the software. Most open source software is also distributed at no cost with limited restrictions on how it can be used; hence the term free when used to describe open source carries two meanings:

- 1) Free of cost and
- 2) Free to do with the software as you wish (i.e., most importantly free to read and customize the code)[42].

Open source code is typically created as a collaborative effort in which programmers improve upon the code and share the changes within the community. Software is protected using the copyright system. Relying on the same protection as on books, music or film, the buyer of software is licensed the use of a copy of the product. Open Source also allows free redistribution of software and allows us to customize it to meet our needs eg. UEC, EUCALYPTS, UBUNTU.

VII. UBUNTU ENETRPRISE CLOUD AND ITS ELEMENTS

Ubuntu Enterprise Cloud, UEC for short, is a stack of applications from Canonical included with Ubuntu Server Edition. UEC includes Eucalyptus along with a number of other open source software. UEC makes it very easy to install and configure the cloud. Canonical also provides commercial technical support for UEC[43]. The figure shows a Private cloud implemented with Eucalyptus.

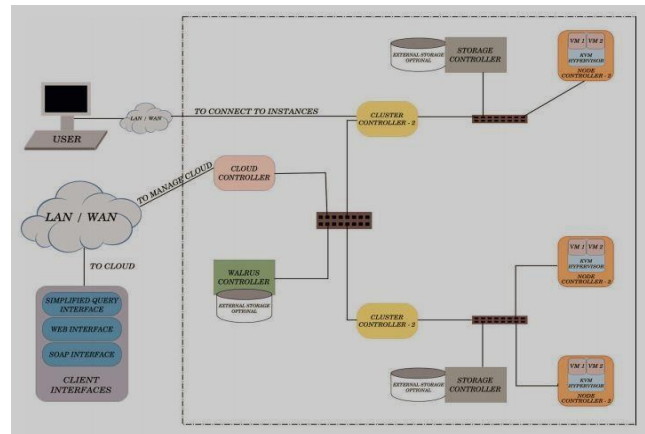


Fig.5: Private Cloud based on Eucalyptus [43]

A. Eucalyptus

Eucalyptus stands for “Elastic Utility Computing Architecture for Linking Your programs to Useful Systems”. Eucalyptus is a research project under direction of Prof. Rich Wolski, Computer Science Department at the University of California, Santa Barbara, USA[44]. Eucalyptus is a software available under GPL that helps in creating and managing a private or even a publicly accessible cloud. It provides an EC2-compatible cloud computing platform and S3-compatible cloud storage platform. The Eucalyptus Cloud maintains its compatibility with the Amazon EC2 cloud.

- ❖ Node Controller controls the execution, inspection, and terminating of VM instances on the host where it runs.
- ❖ Cluster Controller gathers information about and schedules VM execution on specific node controllers, as well as manages virtual instance network.
- ❖ Storage Controller (Walrus) is a put/get storage service that implements Amazon’s S3 interface, providing a mechanism for storing and accessing virtual machine images and user data.
- ❖ Cloud Controller is the entry-point into the cloud for users and administrators. It queries node managers for information about resources, makes high-level scheduling decisions, and implements them by making requests to cluster controllers[45].

- ♣ A CLC manages the whole cloud and includes multiple CC's. There will be a WS3 attached to a CLC. A CC can contain multiple NC's and SC's. Ultimately the VM's will be running in the NC making use of its physical resources.
- ♣ Eucalyptus is a platform for providing scalable internet service [45]. Eucalyptus allows to scale the cluster to multiple machines. Thus the resources can be easily added to the cloud eg. Node Controllers can be added to the cluster in the cloud.

VIII. CONFIGURING AND INSTALLING THE PRIVATE CLOUD

The UEC setup in Includes two servers (Server 1 and Server 2) which will run a Ubuntu 10.04 server version and the third system which will run a Lucid Desktop 64-bit version (Client 1)[11].

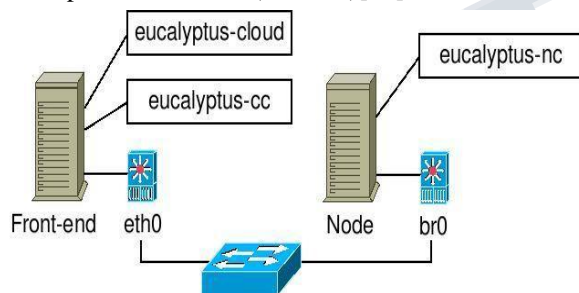


Fig.6: Private Cloud Setup Overview[40]

A. Server 1 Install

1. Insert ubuntu 10.04 server edition cd
2. Select "Install ubuntu enterprise cloud"
3. Configure the network: select "configure network manually" address 192.168.6.22 gateway 192.168.0.1 netmask 255.255.255.0 name server 121.242.xxx.xxx
4. Host name for this system: host1
5. Cloud controller address: leave it blank
6. Cloud installation mode:
Select following Cloud controller, Walrus storage service, Cluster controller, Storage controller
7. Partition disks select "Guided-use entries disk and set up LVM"
8. Full name for new user and username for account : gagan
9. Select no automatic updates
10. Eucalyptus cluster name : cluster1

11. Pool of IP addresses that can be dynamically assigned as public IP's of virtual machines: 192.168.6.70-192.168.6.80
12. Install grub boot loader to master boot loader: yes[10]
Make sure you have latest version of eucalyptus \$sudo apt-get upgrade eucalyptus

B. Server 2 Install

1. Insert ubuntu 10.04 server edition cd
2. Select "Install ubuntu enterprise cloud"
3. Configure the network: select "configure network manually"
address 192.168.6.23
gateway 192.168.6.22 (IP of cloud controller)
netmask 255.255.255.0 nameserver 121.242.xxx.xxx
Here Cloud controller is detected automatically
4. Host name for this system: host2
5. Cloud installation mode: Node controller
6. Partition disks select "Guided-use entire disk and set up LVM"
7. Full name for new user and username for account : gagan
8. Select no automatic updates
9. Install grub boot loader to master boot loader: yes[47]

C. Client 1 Install

The purpose of Client1 machine is to interact with the cloud setup, for bundling and registering new Eucalyptus Machine Images (EMI).

1. Boot the Desktop off the Ubuntu Desktop 10.04 CD and install. The Desktop will be on the enterprise network and will obtain an IP address through DHCP.
2. Install KVM to help us to install images on KVM platform and bundle them:
\$sudo apt-get install qemu_kvm
3. Install euca2ools to manage the cloud from it
\$sudo apt-get install euca2ools[43].
Note: 1. we can also install KVM on Server1 to bundle our images.
2. The Client1 is connected to CLC.

D. Exchange of Public SSH Keys

- Note: This is needed only when the node controller is not discovered in the cloud:
1. On node controller set a temporary password
\$ sudo passwd eucalyptus
 2. On cloud controller
\$ sudo -u eucalyptus ssh-copy-id -i /var/lib/eucalyptus/.ssh/id_rsa.pub eucalyptus@192.168.6.22

3. On node controller remove temporary password
\$ sudo passwd -d eucalyptus

E. Get credentials

1. On cloud controller: install credentials which consist of x.509

Certificates and environment variables. Open web browser and enter following url: <https://192.168.6.22:8443/#login> and click on credentials tab Download the credentials euca2-admin-x509.zip on cloud controller.

2. Alternatively, if you are on the command line of the Cloud

Controller, you can run:

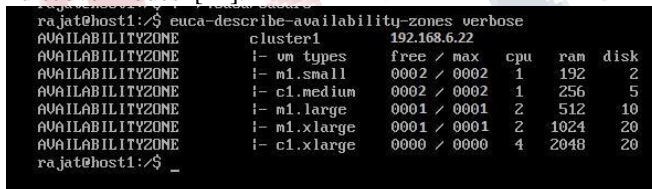
```
mkdir -p ~/.euca chmod 700 ~/.euca cd ~/.euca
sudo euca_conf --get-credentials mycreds.zip
unzip mycreds.zip
```

```
ln -s ~/.euca/eucarc ~/.eucarc cd-
```

In the above steps we make a folder ~/.euca and download the credentials and unzip the credentials after changing their permissions.

To validate that everything is working correctly, get the local cluster availability details:

```
~/.euca/eucarc euca-describe-availability-zones
verbose[46] If you see the free/max VCPUs as 0 in the
above list, it means the node did not get registered
automatically. Please use the following on Server1 and
approve when prompted to add
192.168.6.23 as the Node Controller:$sudo
euca_conf
--discover-nodes [44].
```



```
ra_jat@host1:~$ euca-describe-availability-zones verbose
AVAILABILITYZONE      cluster1      192.168.6.22
AVAILABILITYZONE      i- vn types   free / max    cpu    ram    disk
AVAILABILITYZONE      i- m1.small   0002 / 0002   1      192    2
AVAILABILITYZONE      i- c1.medium  0002 / 0002   1      256    5
AVAILABILITYZONE      i- m1.large   0001 / 0001   2      512   10
AVAILABILITYZONE      i- m1.xlarge  0001 / 0001   2     1024   20
AVAILABILITYZONE      i- c1.xlarge  0000 / 0000   4     2048   20
ra_jat@host1:~$ _
```

Fig.7: Screenshot of available resources.

IX. LIMITATIONS AND CHALLENGES OF CLOUD COMPUTING

In comparison to the previous traditional computing paradigms, Cloud computing provides varied blessings to each service suppliers and users however it's also some limitations and challenges.

i) Security and Privacy: data security is major problems connected with personal data and confidential data of organizations. User needs to fully depend on the cloud service supplier for his or her data privacy and security.

ii) Technical Issues: High speed web connectivity demand makes the system complicated. Varied technical problems arise throughout high load.

iii) data lock-in: the lack of normal apis restricts the migration of applications and services between clouds. With the increase of cloud the issues of data movability, migration and merchant lock-in scenario will increase.

iv) data segregation: principally data segregation problem arises within the multi-tenant usage mode, where the various users' virtual machines square measure co-located on constant hard disks or same server. Here the risks includes to properly separate storage or memory between different users.

v) data location: The geographic location of the info is also vital to secure the info and knowledge of client. Rules and regulation for sure forms of data is {different|totally different|completely different} within the different countries. A client can be concerned in illegal problems without even noticing.

X. CONCLUSION

The future of cloud computing is bright for the businesses that implement the technology currently however, like everything else, cloud computing too has its professionals and cons. whereas the technology will prove to be a good plus to corporations, it may additionally cause hurt if not understood and used properly. permanently service it need technology to confirm time period, and strong in different word additional powerful & healthy. Centralization of data is needed with additional capability. Hybrid Cloud Computing, commodity hardware, low power processors, and standard and social software are about to be solutions to extend efficiency of cloud computing. right away we are within the early days of cloud computing, with several organizations taking their initial, tentative steps. however by 2020 cloud goes to be a significant and permanent a part of the enterprise computing infrastructure. It opens doors by creating applications and technology additional accessible than in previous years. Companies need huge amounts of startup capital may solely want a fraction of what was previously required to succeed. Cloud computing could be a large field, with that we will share our resources and couple them as within the non-public cloud. we've scan several analysis papers, articles, internet discussion regarding

configuring a personal cloud within the type of IaaS and managed to seek out some way of building it using open supply software's like UEC, eucalyptus. within the cloud we will share the hardware and different resources of an organization. the use of Open supply Technology makes our move very economical. the assorted software's and in operation systems used are open supply and may be customized to meet our needs viz. Eucalyptus, Ubuntu Server10.04 etc.

Future Scope

In the coming back years something that can either collect or show info ,will this may open a world of opportunities to attach something and everything to the cloud. Look to Sub-Saharan Africa and Asian markets like China and Asian country to steer the means within the use and adoption of cloud technology. These markets are uniquely positioned in that they have green field opportunities with a lack of legacy infrastructure in place. This lack of a gift infrastructure creates the best environment to skip the technologies of the past and move on to the additional economical cloud-centric ones of the long run. Sometimes, one cloud isn't enough. Sometimes, you need the entire sky. That's why variety of researchers are developing tools to federate clouds, an architectural concept dubbed "sky computing". The Sky Computing model allows the creation of large scale infrastructure victimization resources from multiple cloud providers. These infrastructures are able to run embarrassingly parallel computation with high performance. Developing a way to join many cloud infrastructures along into one large cloud would be particularly helpful to educational researchers UN agency utilize open large-scale compute resources

REFERENCES

[1] How cloud computing is changing the world-businessweek.com

[2] A.K. Chakraverti, V. Dhir, and S. Chakraverti, "Architectural and Qos Issues in Mobile Cloud Computing Environment for Real-Time Video Streaming", International Journal of Advanced Computer Science and Applications, Vol. 7, No. pp: 355-366, January2016

[3] Vijay Dhir, Dr. Rattan K Datta, Dr. Maitreyee Dutta

"Grid Job Scheduling - A Detailed Study" published in International Journal of Innovative Research in Science, Engineering & Technology Vol:2, Issue: 10, October 2013

[4] Vijay Dhir, Dr. Rattan K Datta, Dr. Maitreyee Dutta "Nimble@ITCEcnoGrid Novel Toolkit for Computing Weather Forecasting, Pi and Factorization Intensive Problems " published in International Journal of Computer Engineering & Technology (IJCET) ISSN PRINT: ISSN 0976 – 6367 ISSN ONLINE: ISSN 0976 – 6375 Vol:3 Issue:3 Dec 2012
<http://www.iaeme.com/Journalissue.asp?Type=3&IType=3&JType=IJCET&PageNumber=2>

[5] Vijay Dhir, Dr. Rattan K Datta, Dr. Maitreyee Dutta "Nimble@ITCEcnoGrid: A Grid in Research Domain for Weather Forecasting" published in International Journal of Grid Computing & Applications (IJGCA) ISSN :0976-9404 [Online]; 2229-3949, Dec 2011

[6] Vijay Dhir,Dr. Rattan K Datta,Dr.Maitreyee Dutta "Nimble@ITCEcnoGrid vs Alchemi.NET: A Performance Comparison" published in International Journal of Distributed and Parallel systems (IJDPS) ISSN: 0976 - 9757[Online] ; 2229 - 3957 Nov 2011

[7] A Handbook at International level, "Nimble: An Intergrid for Weather Forecasting" by Lambert Publishing.

[8] Scott Tilley,TauhidaParveen, —Migrating Software Testing to the Cloud, IEEE International Conference on Software Maintenance (ICSM), Timisoara, 12-18 Sept. 2010, pp 1,Print ISBN: 978-1-4244-8630-4, DOI:10.1109/ICSM.2010.5610422.

[9] Wei Hao, I-Ling Yen, BhavaniThuraisingham, —Dynamic Service and Data Migration in the Clouds, 33rd Annual IEEE International Computer Software and Applications Conference, Seattle, WA,20-24 July 2009, pp 134-139,Print ISBN: 978-0-7695-3726-9, DOI: 10.1109/COMPSAC.2009.127.

[10] Cloud Computing Issues and Impacts by Ernst & Young [11] Research Paper: Threats to Cloud Computing Security. By: Harsal Mahajan Information Technology Department Dr. Nupur Giri Computer Department of Vivekanand Education Society's Institute of Technology

- [12] Research Paper: Cloud Computing - Issues, Research and Implementations. by: Mladen A. Vouk - Department of Computer Science, North Carolina State University, Raleigh, NC 27695, USA
- [13] Research Paper: Performance Evaluation of Dynamic Routing Protocols using Firewall and VPN_Firewall under Cloud Computing. by: Kimmy, Shivani Khurana - Computer Science Department - CT Institute of Engineering, Management, Jalandhar, India
- [14] P. Barham, B. Dragovic, K. Fraser, S. Hand, T. Harris, A. Ho, R. Neugebauer, I. Pratt, and A. Warfield. Xen and the art of virtualization. In SOSP '03: Proceedings of the nineteenth ACM symposium on Operating systems principles, pages 164–177, New York, NY, USA, 2003. ACM.
- [15] F. Bellard. QEMU, a Fast and Portable Dynamic Translator. Proceedings of the USENIX Annual Technical Conference, FREENIX Track, pages 41–46, 2005.
- [16] Hyper-v home page - <http://www.microsoft.com/hyperv>.
- [17] Vmware home page - <http://www.vmware.com>.
- [18] Advanced Micro Devices, AMD Inc. AMD Virtualization Codenamed “Pacifica” Technology, Secure Virtual Machine Architecture Reference Manual. May 2005.
- [19] R. Hireman. Intel Virtualization Technology for Directed I/O (Intel VT-d). Technology@Intel Magazine, 4(10), May 2007.
- [20] Intel. Enhanced Virtualization on Intel Architecture-based Servers. Intel Solutions White Paper, March 2005
- [21] K. Adams and O. Agesen. A comparison of software and hardware techniques for x86 virtualization. In ASPLOSXII: Proceedings of the 12th international conference on Architectural support for programming languages and operating systems, pages 2–13, New York, NY, USA, 2006. ACM.
- [22] W. Huang, M. Koop, Q. Gao, and D. Panda. Virtual machine aware communication libraries for high performance computing. In Proceedings of Supercomputing 2007.
- [23] W. Huang, J. Liu, B. Abali, and D. K. Panda. A case for high performance computing with virtual machines. In ICS '06: Proceedings of the 20th annual international conference on Supercomputing, pages 125–134, New York, NY, USA, 2006. ACM.
- [24] A. Menon, A. Cox, and W. Zwaenepoel. Optimizing Network Virtualization in Xen. Proc. USENIX Annual Technical Conference (USENIX 2006), pages 15–28, 2006.
- [25] M. F. Mergen, V. Uhlig, O. Krieger, and J. Xenidis. Virtualization for high-performance computing. SIGOPS Oper. Syst. Rev., 40(2):8–11, 2006.
- [26] L. Youseff, K. Seymour, H. You, J. Dongarra, and R. Wolski. The impact of paravirtualized memory hierarchy on linear algebra computational kernels and software. In HPDC, pages 141–152. ACM, 2008.
- [27] F. Berman, G. Fox, and T. Hey. Grid Computing: Making the Global Infrastructure a Reality. Wiley and Sons, 2003.
- [28] I. Foster and C. Kesselman, editors. The Grid – Blueprint for a New Computing Infrastructure. Morgan Kaufmann, 1998.
- [29] NSF TeraGrid Project. <http://www.teragrid.org/>.
- [30] T. Tannenbaum and M. Litzkow. The condor distributed processing system. Dr. Dobbs Journal, February 1995.
- [31] Hyper-v home page - <http://www.microsoft.com/hyperv>.
- [32] Intel. Enhanced Virtualization on Intel Architecture-based Servers. Intel Solutions White Paper, March 2005.
- [33] J. P. Ostriker and M. L. Norman. Cosmology of the early universe viewed through the new infrastructure. Commun. ACM, 40(11):84–94, 1997.
- [34] Amazon Web Services home page. <http://aws.amazon.com/>.
-

[35] M. McNett, D. Gupta, A. Vahdat, and G. M. Voelker. Usher: An Extensible Framework for Managing Clusters of Virtual Machines. In Proceedings of the 21st Large Installation System Administration Conference (LISA), November 2007.

[36] Enomalism elastic computing infrastructure. <http://www.enomaly.com>.

[37] K. Keahey, I. Foster, T. Freeman, and X. Zhang. Virtual workspaces: Achieving quality of service and quality of life in the grid. *Sci. Program.*, 13(4):265–275, 2005.

[38] I. Foster and C. Kesselman. Globus: A metacomputing infrastructure toolkit. *International Journal of Supercomputer Applications*, 1997.

[39] J. Chase, D. Irwin, L. Grit, J. Moore, and S. Sprenkle. Dynamic virtual clusters in a grid site manager. *High Performance Distributed Computing*, 2003. Proceedings. 12th IEEE International Symposium on, pages 90–100, 2003.

[40] oVirt home page. <http://ovirt.org/>.

[41] Open Source, <http://www.webopedia.com>.

[42] The Open Source Software Development Phenomenon: An Analysis Based On Social Network Theory by Greg Madey, Vincent freeh, Eighth American Conference on Information Systems (2002)

[43] Eucalyptus Beginner's Guide-UEC Edition (Ubuntu Server 10.04-Lucid Lynx) v1.0 by Johnson D, Kiran Murari, Murthy Raju Suseendran RB, Yogesh Girikumar, 25 May 2010.

[44] Dr G.R.Karpagam and J.Parkavi, Setting Up of an Open Source Based Private Cloud, *IJCSI*, vol.8, Issue 3, May 2011. [45] Daniel Nurmi, Rich Wolski, Chris Grzegorzczak, Graziano Obertelli, Sunil Soman, Lamia Youseff, Dmitrii Zagorodnov –The Eucalyptus Open-source Cloud-computing System (2009)

[46] <https://help.ubuntu.com/community/UEC>

[47] Louis Danuser (AT&T Labs, Inc.) Deploying an Open Source Private Cloud On a Shoe String Budget Presentation, <http://www.oscon.com/>, 2010
