Efficient Virtual Machine Migration for Related and Non-Related VMs

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Abstract

Cloud computing is now not a new word or concept in the industry. But it is still a word of attention for the researchers as with the expansion of the cloud computing and new device support problems related with cloud are increasing day by day. The problems faced in cloud computing are majorly 1) Security 2) Compatibility with various heterogeneous devices 3) Handling of Virtual Machines 4) Migration of Virtual Machines 5) Resource Management etc. Various migration techniques has been discussed including first come first serve, shorted job first and other algorithms. It is found that discussion on migration of relation VM and non-Related VM has not been discussed in depth. This work is providing a migration technique by considering the two separate categories of VMs i.e. Related Virtual Machines & Non-Related Virtual Machines, where related virtual machines are considered to be related with each other in respect of inter dependency between them such as database sharing, VMs of the same user/company, VMs sharing applications etc., whereas non-related VMs are the VMs which are not having any such relations between them.

Keywords: *Natural Language Processing, Parser, Object Oriented Programming, Object Oriented Design & Diagrams.*

I. INTRODUCTION

Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction [1].

Cloud Computing becomes the next generation architecture of IT Enterprise. In contrast to traditional solutions, Cloud computing moves the application software and databases to the large data centers, where the management of the data and services may not be fully trustworthy [2].

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.

Cloud computing is based on five attributes: multi-tenancy (shared resources), massive scalability, elasticity, pay as you go, and self-provisioning of resources, it makes new advances in processors, Virtualization technology, disk storage, broadband Internet connection, and fast, inexpensive servers have combined to make the cloud a more compelling solution.

Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centres that provide those services (Software as a Service – SaaS)

A. CHALLENGES IN CLOUD COMPUTING

New paradigm of cloud computing provides a number of benefits and advantages over the previous computing paradigms and many organizations are adopting it. However, there are still a number of challenges, which are currently addressed by researchers and practitioners in the field (Leavitt, 2009). They are briefly presented below [4].

Performance

The major issue in performance can be for some intensive transaction-oriented and other data-intensive applications, in which cloud computing may lack adequate performance. Also, users who are at a long distance from cloud providers may experience high latency and delays [4].

Security and Privacy

Companies are still concerned about security when using cloud computing. Customers are worried about the vulnerability to attacks, when information and critical IT resources are outside the firewall. The solution for security assumes that that cloud computing providers follow standard security practices [4].

Control

Some IT departments are concerned because cloud computing providers have a full control of the platforms. Cloud computing providers typically do not design platforms for specific companies and their business practices [4].

Bandwidth Costs

With cloud computing, companies can save money on hardware and software; however they could incur higher network bandwidth charges. Bandwidth cost may be low for smaller Internet-based applications, which are not data intensive, but could significantly grow for data-intensive applications [4].

Reliability

Cloud computing still does not always offer round-the-clock reliability. There were cases where cloud computing services suffered few-hours outages. In the future, we can expect more cloud computing providers, richer services, established standards, and best practices [4].

B. CLOUD ARCHITECTURE

Cloud Architectures are designs of software applications that use Internet-accessible on-demand services. Applications built on Cloud Architectures are such that the underlying computing infrastructure is used only when it is needed (for example to process a user request), draw the necessary resources on-demand (like compute servers or storage), perform a specific job, then relinquish the unneeded resources and often dispose themselves after the job is done. While in operation the application scales up or down elastically based on resource needs [9].

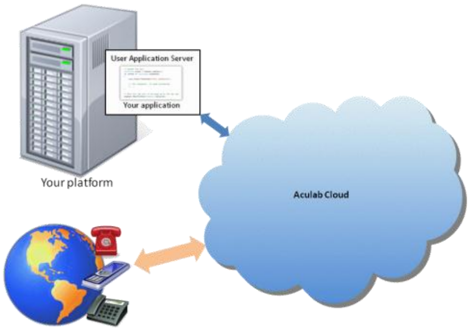

Figure 1: Architecture of Cloud.

Cloud architecture, the systems architecture of the software systems involved in the delivery of cloud computing, typically involves multiple cloud components communicating with each other over a loose coupling mechanism such as a messaging queue. Elastic provision implies intelligence in the use of tight or loose coupling as applied to mechanisms such as these and others [9].

Cloud Engineering

Cloud engineering is the application of engineering disciplines to cloud computing. It brings a systematic approach to the high-level concerns of commercialization, standardization, and governance in conceiving, developing, operating and maintaining cloud computing systems. It is a multidisciplinary method encompassing contributions from diverse areas such as software, web, performance, information, security, platform, risk and quality engineering.

The Cloud Computing Architecture of a cloud solution is the structure of the system, which comprises of on-premise and cloud resources, services, middleware, and software components, their geo-location, their externally visible properties and the relationships between them.

A cloud computing architecture consists of a front end and a back end. They connect to each other through a network, usually the Internet. The front end is the side the computer user, or client, sees. The back end is the "cloud" section of the system.

Front End of Cloud Computing Architecture

The front end of the cloud computing system comprises of the client's devices (or it may be a computer network) and some applications are needed for accessing the cloud computing system. All the cloud computing systems do not give the same interface to users. Web services like electronic mail programs use some existing web browsers such as Firefox, Microsoft's internet explorer or Apple's Safari. Other types of systems have some unique applications which provide network access to its clients [9].

Back End of Cloud Computing Architecture

Back end refers to some physical peripherals. In cloud computing, the back end is cloud itself which may encompass various computer machines, data storage systems and servers. Groups of these clouds make a whole cloud computing system. Theoretically, a cloud computing system can include practically any type of web application program such as video games to applications for data processing, software development and entertainment. Usually, every application would have its individual dedicated server for services [9].

A central server is established which is used for administering the whole system. It is also used for monitoring client's demand as well as traffic to ensure that everything of system runs without any problem. There are some set of rules, generally called as protocols which are followed by this server and it uses a special type of software known termed as middleware. Middleware allow computers that are connected on networks to communicate with each other. If any cloud computing service provider has many customers, then there's likely to be very high demand for huge storage space. Many companies that are service providers need hundreds of storage devices.

C. VARIOUS CLOUD ARCHITECTURE AVAILABLE

There are plenty of examples of applications that could utilize the power of Cloud Architectures. These range from back-office bulk processing systems to web applications. Some are listed below: [9]

- Processing Pipelines
  - Document processing pipelines – convert hundreds of thousands of documents from Microsoft Word to PDF, OCR millions of pages/images into raw searchable text
  - Image processing pipelines – create thumbnails or low resolution variants of an image, resize millions of images
  - Video transcoding pipelines – transcode AVI to MPEG movies
  - Indexing – create an index of web crawl data
  - Data mining – perform search over millions of records
- Batch Processing Systems
  - Back-office applications (in financial, insurance or retail sectors)

- Log analysis – analyze and generate daily/weekly reports
- Nightly builds – perform nightly automated builds of source code repository every night in parallel
- Automated Unit Testing and Deployment Testing – Test and deploy and perform automated unit testing (functional, load, quality) on different deployment configurations every night

- Websites
  - Websites that ―sleep at night and auto-scale during the day
  - Instant Websites – websites for conferences or events (Super Bowl, sports tournaments)
  - Promotion websites

Seasonal Websites - websites that only run during the tax season or the holiday season.

II. RELATED WORK

"Energy-efficient and fault tolerant methods for message delivery in Internet of Things," Pop, F.; Bessis, N.,

The Internet of Things is an emerging paradigm shaping our current understanding about the future of Internet. Most of today's inter-enterprise applications follow the distributed computing paradigm in which parts of the application are executed on different network-interconnected computers.

"On the optimal allocation of virtual resources in cloud computing networks," Papagianni, C.; Leivadeas, A.; Papavassiliou, S.; Maglaris, V.; Cervello-Pastor, C.; Monje, A.,

Cloud computing builds upon advances on virtualization and distributed computing to support cost-efficient usage of computing resources, emphasizing on resource scalability and on demand services. Moving away from traditional data-center oriented models, distributed clouds extend over a loosely coupled federated substrate, offering enhanced communication and computational services to target end-users with quality of service (QoS) requirements, as dictated by the future Internet vision.

"High Performance Resource Allocation Strategies for Computational Economies," Chard, K.; Bubendorfer, K.,

Utility computing models have long been the focus of academic research and with the recent success of commercial cloud providers, computation and storage is finally being realized as the fifth utility. Computational economies are often proposed as an efficient means of resource allocation; however adoption has been limited due to a lack of performance and high overheads.

"Virtual Memory Streaming Technique for virtual machines (VMs) for rapid scaling and high performance in cloud environment," Moniruzzaman, A.B.M.; Nafi, K.W.; Hossain, S.A.,

This paper addresses the impact of Virtual Memory Streaming (VMS) technique in provisioning virtual machines (VMs) in cloud environment. VMS is a scaling virtualization technology that allows different virtual machines rapid scale, high performance, and increase hardware utilization.

"Advanced user-based interaction model in cloud," Xu Yingying; Ao Naixiang; Huang Dan; Zhao Yongxiang; Chen Changjia,

With the increasing popularity of cloud computing, there is an increased demand for cloud resources in cloud. It has become even more urgent to find solutions to improve resource utilization. From the perspective of a cloud consumer, a cloud application processes a large information flow involving user actions that access resources, but little work has so far been devoted to research from the perspective of the interaction between the user and the cloud application.

"Cloud Analytics for Capacity Planning and Instant VM Provisioning," Yexi Jiang; Chang-Shing Perng; Tao Li; Chang, R.N.,

The popularity of cloud service spurs the increasing demands of virtual resources to the service vendors. Along with the promising business opportunities, it also brings new technique challenges such as effective capacity planning and instant cloud resource provisioning. In this paper, we describe our research efforts on improving the service quality for the capacity planning and instant cloud resource provisioning problem.

"A Two-Tiered On-Demand Resource Allocation Mechanism for VM-Based Data Centers," Ying Song; Yuzhong Sun; Weisong Shi,

In a shared virtual computing environment, dynamic load changes as well as different quality requirements of applications in their lifetime give rise to dynamic and various capacity demands, which results in lower resource utilization and application quality using the existing static resource allocation.

"Dynamic Optimization of Multiattribute Resource Allocation in Self-Organizing Clouds," Sheng Di; Cho-Li Wang,

By leveraging virtual machine (VM) technology which provides performance and fault isolation, cloud resources can be provisioned on demand in a fine grained, multiplexed manner rather than in monolithic pieces. By integrating volunteer computing into cloud architectures, we envision a gigantic self-organizing cloud (SOC) being formed to reap the huge potential of untapped commodity computing power over the Internet.

"RLC - A Reliable Approach to Fast and Efficient Live Migration of Virtual Machines in the Clouds," Kashyap, S.; Dhillon, J.S.; Purini, S.,

Today, IaaS cloud providers are dynamically minimizing the cost of data centers operations, while maintaining the Service Level Agreement (SLA). Currently, this is achieved by the live migration capability, which is an advanced state-of-the-art technology of Virtualization. However, existing migration techniques suffer from high network bandwidth utilization, large network data transfer, large migration time as well as the destination's VM failure during migration.

III. PROPOSED WORK

Cloud Computing has become a buzz word in the current industry and all major players in the industry have either already accepted it or have started accepting it. The problems faced in cloud computing are majorly

- Security
- Compatibility with various heterogeneous devices
- Handling of Virtual Machines
- Migration of Virtual Machines
- Resource Management etc.

Researchers are focusing in these problems and finding solutions. Many solutions have already been provided and discussed vastly.

A major problem of migration of VM over the cloud hosts has been addressed thoroughly by Rajkumar Buyya et. al.

Various migration techniques has been discussed including first come first serve, shorted job first and other algorithms. It is found that discussion on migration of relation VM and non Related VM has not been discussed in depth. This work is providing a migration technique by considering the two separate categories of VMs i.e.

- Related Virtual Machines
- Non-Related Virtual Machines

Where related virtual machines are considered to be related with each other in respect of inter dependency between them such as database sharing, VMs of the same user/company, VMs sharing applications etc., whereas non-related VMs are the VMs which are not having any such relations between them.

Allocation of new VM with migration: In this work we are going to enhance the performance of the cloud by allocating resources (VM) on the same host.

The various algorithmic steps of the proposed work have been summarized in the following diagrams:

Scenario I:

IF VM is NOT Related Then

IF desired host is having space then

Allocate VM on it.

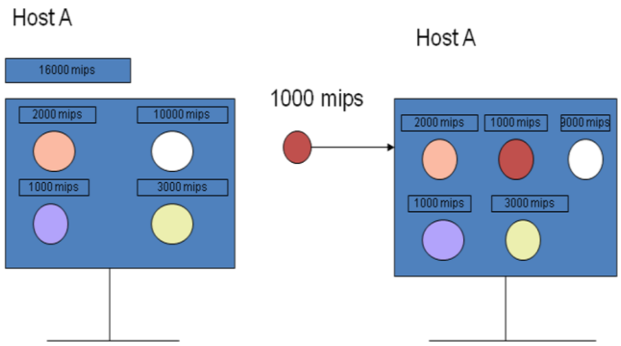

Figure 2: Proposed Work Scenario I.

Scenario II:

IF VM is NOT Related Then

IF desired host is NOT having space then

Allocate VM on First Host Having Space Available on it.

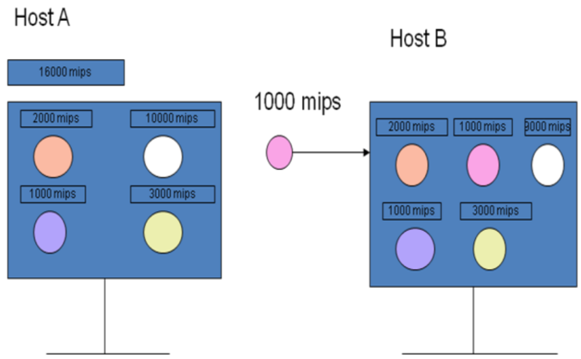

Figure 3: Proposed Work Scenario II.

Scenario III:

IF VM is Related Then

IF desired host is having space then

Allocate VM on Desired Host

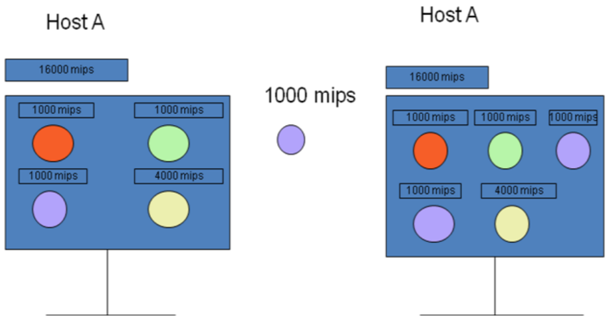

Figure 4: Proposed Work Scenario III.

Scenario IV:

IF VM is Related Then

IF desired host is NOT having space then

If there is no non related VM for Migration Then

Migrate Related VM (of new) on Other Host

Allocate New VM on Other Host

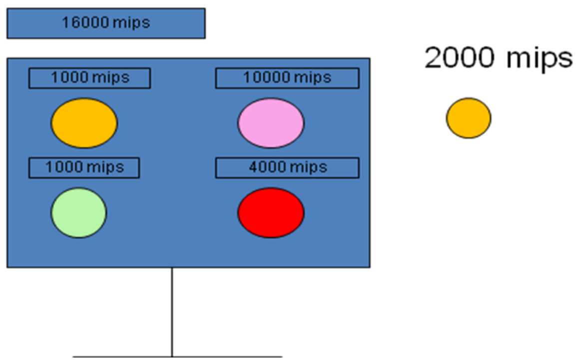

Figure 5: Proposed Work Scenario IVa.

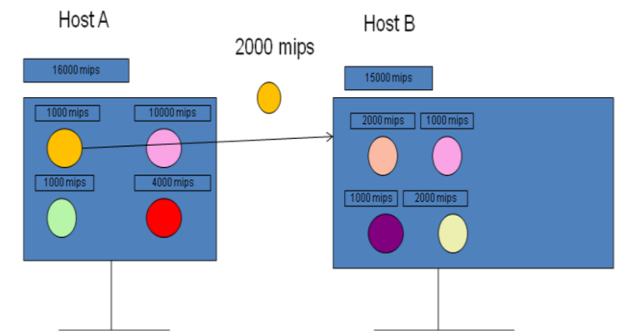

Figure 6: Proposed Work Scenario IVb.

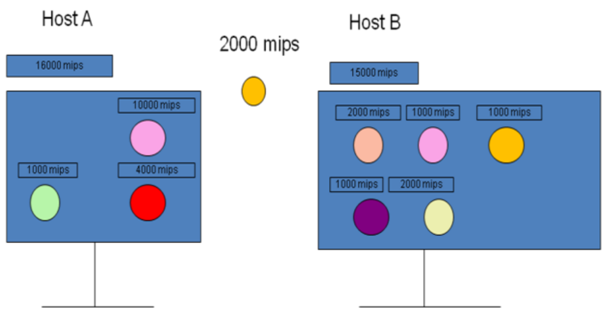

Figure 7: Proposed Work Scenario IVc.

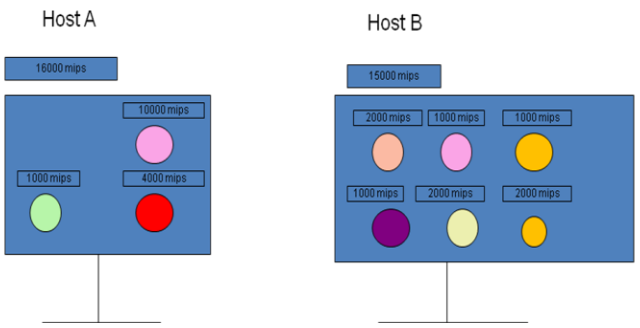

Figure 8: Proposed Work Scenario IVd.

Scenario V:

IF VM is Related Then
IF desired host is NOT having space then
if there is a Non related VM for Migration Then
Migrate Not Related VM on Other Host
which frees sufficient space on the
Desired Host to accommodate new VM.
Allocate New VM on Desired Host

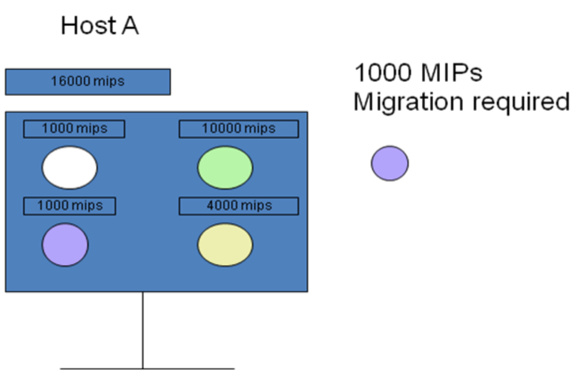

Figure 9: Proposed Work Scenario Va.

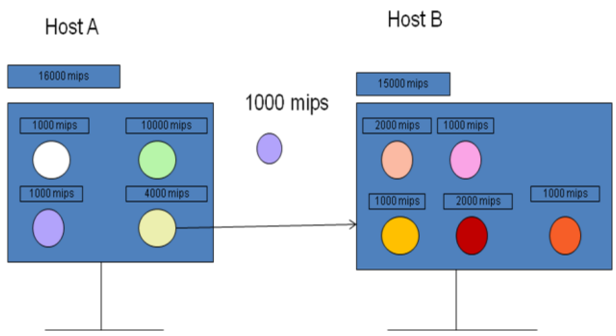

Figure 10: Proposed Work Scenario Vb.

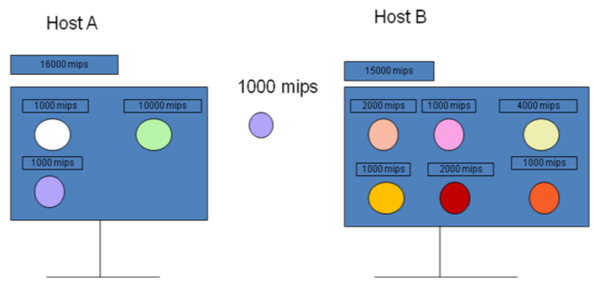

Figure 11: Proposed Work Scenario Vc.

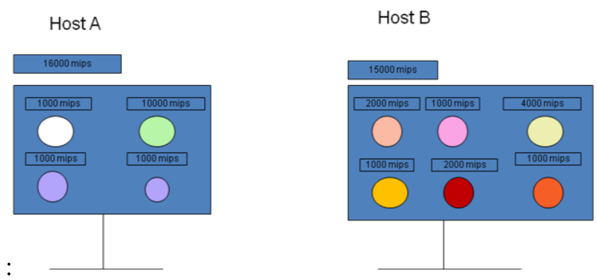

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Figure 12: Proposed Work Scenario Vd.

IV. RESULTS & DISCUSSION

A simulation system has been developed for the proposed work in this paper and virtual machines are used from existing vmware tools available online for deployment of the simulator.

From various executions of the created simulators various reading has been generated to measure the various status added Virtual Machines have achieved.

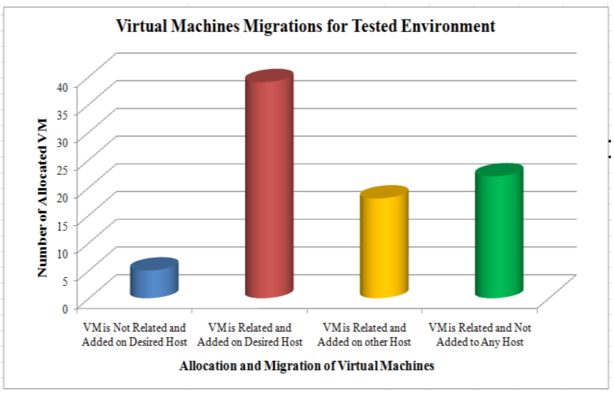

Figure 13: Virtual Machine Migrations for Proposed Implementation

Inference: From the above graph it is seen that the migration process is smooth and due to related and non-related VM Migration requirements, number of migrations done are less. From the graph it is clear that when the VMs are related then migration is respectively less than the addition of VM on same desired host. This is done through best – fit method hence the migration strategy applied in this proposed work is better and required.

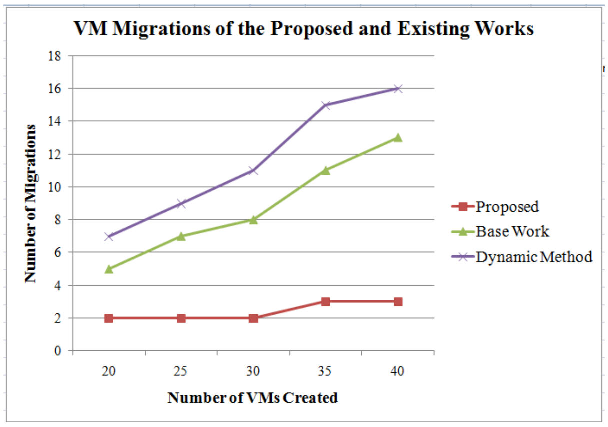

Figure 14: Virtual Machine Migrations for Proposed Implementation

Inference: From the above graph it is seen that the number of migrations in proposed system are less than the existing work in base paper (Base Work) and their counterpart (dynamic method). This has been achieved due to best fit method applied for related and non-related VMs. The graph also shows that number of migration in the proposed implementation are not increasing with a rapid rate as in the other two implementations, hence the proposed work is applying least load on the system related with migration overheads.

Comparison with Existing works:

In existing works no considerations have been given to related or non-related VMs. whereas in the proposed system related and non-related VMs have been considered.

Numbers of migrations in existing systems are higher than the proposed system, which leads to least load on the server hosts and overall cost of the systems shall be reduced.

From the results obtained in the proposed implementation the VM migration is less and hence the reliability of the VMs shall be increased as they are supposedly working on the same resources and hence their crash rate is reduced. (VMs crash rate is increased with the number of migrations.

V. CONCLUSION

Studies of the various papers and works done by authors have been done to find out the problem and it is found that the cloud computing is apparently a new technology which is growing very fast and provides new horizons to the computing world. It is a technique where implementations are not too many and the major players in industry are very few. The situation is so because a lot of structural, architectural and security work in various applications of the cloud is still to be done. This work selects a similar problem of Cloud Computing related with Virtual Machine Migrations of related and non-related virtual machines. It is always better to keep related virtual machines on same host to avoid the delays and get high performance.

The results obtained in the process of virtual machine migration for related and non-related virtual machines are showing that the delays in such processing is not too much and the time requirement decreases by the increase of number of virtual machines. In this work results have been obtained and compared with the existing work and found to be better. The implementation scenario has been generated using Microsoft Azure platform.

The proposed implementation uses best fit method to migrate the virtual machines between the hosts. In future, the proposed work can be tested using other different strategies.

The proposed work is being implemented on simulation environment using standard machines, in future the same can be deployed over the real cloud environment and test it for its accuracy and performance.

REFERENCES

[1] Qi Zhang · Lu Cheng · Raouf Boutaba, “Cloud computing: state-of-the-art and research challenges” , Springer, J Internet Serv Appl (2010) 1: 7–18 DOI 10.1007/s13174-010-0007-6

[2] 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

[3] http://www.cloudcomputinginsights.com/management/cloud-computing-advantages-and-disadvantages/?mode=featured

[4] Borko Furht, Armando Escalante, “Handbook of Cloud Computing,” ISBN 978-1-4419-6523-3, e-ISBN 978-1-4419-6524-0, DOI 10.1007/978-1-4419-6524-0, Springer

[5] Manop Phankokkruad, “Implement of Cloud Computing for e-Leaming System” 2012 International Conference on Computer & Information Science (ICCIS), 978-1-4673-1938-6/12 ©2012 IEEE

[6] Mingwei Wang, Jingtao Zhoul, Shikai Jing, “Cloud Manufacturing: Needs, Concept and Architecture” Proceedings of the 2012 IEEE 16th International Conference on Computer Supported Cooperative Work in Design, 978-1-4673-1212-7112 ©2012 IEEE

[7] Yangpeng Zhu, Jing Zhang, “Research on Key Technology for SaaS” The 7th International Conference on Computer Science & Education (ICCSE 2012) July 14-17, 2012. Melbourne, Australia, 978-1-4673-0242-5/12 ©2012 IEEE

[8] Chunming Rong, Son T. Nguyen, Martin Gilje Jaatun, “Beyond lightning: A survey on security challenges in cloud computing,” 0045-7906

[9] Jinesh Varia, “Cloud Architectures,” June 2008, Technology Evangelist Amazon Web Services

[10] Zhang Yandong, Zhang Y ongsheng, “Cloud Computing and Cloud Security Challenges” 2012 International Symposium on Information Technology in Medicine and Education

[11] Pop, F.; Bessis, N., "Energy-efficient and fault tolerant methods for message delivery in Internet of Things," Roedunet International Conference (RoEduNet), 2013 11th , vol., no., pp.1,6, 17-19 Jan. 2013 doi: 10.1109/RoEduNet.2013.6511735

[12] Papagianni, C.; Leivadeas, A.; Papavassiliou, S.; Maglaris, V.; Cervello-Pastor, C.; Monje, A., "On the optimal allocation of virtual resources in cloud computing networks," Computers, IEEE Transactions on , vol.62, no.6, pp.1060,1071, June 2013 doi: 10.1109/TC.2013.31