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Application of Improved K-Medians for VM Migration

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***Abstract*—** Use of Data mining techniques for managing Virtual Machine migration has been used in the past. Many researchers have applied different data mining techniques for the same and has been proven to be encouraging. Specially in cloud environment where thousands of virtual machines are employed at a time. For this proactive evaluation methods has been used by many researchers In this paper, such methods have been studied and improved k-median technique has been proposed for such migration. The results obtained discussed are showing better accuracy and performance.

Keywords: Cloud Computing, Fault Tolerance, Virtual Machines Migration, Resource Management

I. INTRODUCTION

Simply put, cloud computing is the delivery of computing services—servers, storage, databases, networking, software, analytics, intelligence and more—over the Internet ("the cloud") to offer faster innovation, flexible resources and economies of scale. You typically pay only for cloud services you use, helping lower your operating costs, run your infrastructure more efficiently and scale as your business needs change.

Cloud computing is shared pools of configurable computer system resources and higher-level services that can be rapidly provisioned with minimal management effort, often over the Internet. Cloud computing relies on sharing of resources to achieve coherence and economies of scale, similar to a public utility.

Third-party clouds enable organizations to focus on their core businesses instead of expending resources on computer infrastructure and maintenance. Advocates note that cloud computing allows companies to avoid or minimize up-front IT infrastructure costs. Proponents also claim that cloud computing allows enterprises to get their applications up and running faster, with improved manageability and less maintenance, and that it enables IT teams to more rapidly adjust resources to meet fluctuating and unpredictable demand. Cloud providers typically use a "pay-as-you-go" model, which can lead to unexpected operating expenses if administrators are not familiarized with cloud-pricing models.

The availability of high-capacity networks, low-cost computers and storage devices as well as the widespread adoption of hardware virtualization, service-oriented architecture, and autonomic and utility computing has led to growth in cloud computing.

Characteristics:

Cloud computing exhibits the following key characteristics:

- Agility for organizations may be improved, as cloud computing may increase users' flexibility with re-provisioning, adding, or expanding technological infrastructure resources.
- Cost reductions are claimed by cloud providers. A public-cloud delivery model converts capital expenditures (e.g., buying servers) to operational expenditure. This purportedly lowers barriers to entry, as infrastructure is typically provided by a third party and need not be purchased for one-time or infrequent intensive computing tasks. Pricing on a utility computing basis is "fine-grained", with usage-based billing options. As well, less in-house IT skills are required for implementation of projects that use cloud computing. The e-FISCAL project's state-of-the-art repository contains several articles looking into cost aspects in more detail, most of them concluding that costs savings depend on the type of activities supported and the type of infrastructure available in-house.
- Device and location independence enable users to access systems using a web browser regardless of their location or what device they use (e.g., PC, mobile phone). As infrastructure is off-site (typically provided by a third-party) and accessed via the Internet, users can connect to it from anywhere.
- Maintenance of cloud computing applications is easier, because they do not need to be installed on each user's

computer and can be accessed from different places (e.g., different work locations, while travelling, etc.).

- Multi-tenancy enables sharing of resources and costs across a large pool of users thus allowing for:
- Centralization of infrastructure in locations with lower costs (such as real estate, electricity, etc.)
- peak-load capacity increases (users need not engineer and pay for the resources and equipment to meet their highest possible load-levels)
- utilisation and efficiency improvements for systems that are often only 10–20% utilised.
- Performance is monitored by IT experts from the service provider, and consistent and loosely coupled architectures are constructed using web services as the system interface.
- Productivity may be increased when multiple users can work on the same data simultaneously, rather than waiting for it to be saved and emailed. Time may be saved as information does not need to be re-entered when fields are matched, nor do users need to install application software upgrades to their computer.
- Reliability improves with the use of multiple redundant sites, which makes well-designed cloud computing suitable for business continuity and disaster recovery.
- Scalability and elasticity via dynamic ("on-demand") provisioning of resources on a fine-grained, self-service basis in near real-time (Note, the VM startup time varies by VM type, location, OS and cloud providers), without users having to engineer for peak loads. This gives the ability to scale up when the usage need increases or down if resources are not being used.

II. RELATED WORK

1. Using WorkFlowSim Simulator for implementation
2. Create 1-10 Hosts and allocate Virtual Machine on the different hosts using load balancer
3. Create 1-3 Data Centre to execute the various processes
4. Create a process generator which will generate process with Random amount of RAM and fixed CPU usage. Each process will run for a random amount of time assigned initially
5. Create a Broker service which will submit the process to Data Center
6. Broker Service will use mining algorithm to allow processes and VMs to migrate if required to increase the performance
7. Data mining will be based on live data generated by the processes, VMs and migrations of the processes and VMs
8. For mining association rule mining, k-means and k-median mechanism shall be applied for comparison.
9. Application of the one of the mining algorithm selected dynamically will be applied based on the process time, migration time and size.

System shall be evaluated at the end:

1. Using current System

In this, following modules shall be used during implementation and testing:

- Datacenter
- Datacenter Broker
  - Will Decide whether a new VM is required or not
  - Will submit the VM & Processes to the Data Center
  - Will Generate Results
2. Process Generator
3. Virtual Machine Generator

III. CLOUD COMPUTING

Cloud computing is a collection of technologies that allow IT resources to be virtualized, used on an on-demand basis and delivered via the Internet as services. Cloud computing can be considered a new computing paradigm in so far as it allows the utilization of a computing infrastructure at one or more levels of abstraction, as an on-demand service made available over the Internet or other computer network. It is sold on demand, typically by the minute or the hour; it is elastic -- a user can have as much or as little of a service as they want at any given time and the service is fully managed by the provider. Because of the it's features of greater flexibility and availability at lower cost, cloud computing is a subject that has been receiving a good deal of attention

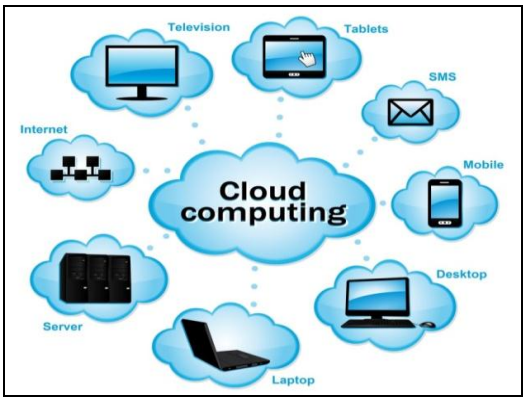

Figure 1: CLOUD COMPUTING

Cloud Computing can be classified into 4 types on the basis of location where the cloud is hosted:-

- Public Cloud: A public cloud is one in which the infrastructure and other computational resources that it comprises are made available to the general public over the Internet. It is owned by a cloud provider selling cloud services and, by definition, is external to an organization..

- Private Cloud: A private cloud a proprietary network or a data center that supplies hosted services to a limited number of people. It may be managed either by the organization or a third party, and may be hosted within the organization's data center or outside of it.
- Community Cloud: A community cloud is somewhat similar to a private cloud, but the infrastructure and computational resources are shared by several organizations that have common privacy, security, and regulatory considerations, rather than for the exclusive use of a single organization.
- Hybrid Cloud: A hybrid cloud is a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables interoperability.

Cloud computing utilizes three delivery models by which different types of services are delivered to the end user. The three delivery models are the SaaS, PaaS and IaaS which provide infrastructure resources, application platform and software as services to the consumer.

1) Software-as-a-Service: SAAS is defined as a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network. Also known as "on demand" software, it is the most mature type of Cloud Computing because of its high flexibility, proven support services, enhanced scalability, reduced customer maintenance, and reduced cost due to their multi-tenet architectures. It is a model of software deployment whereby one or more applications and the computational resources to run them are provided for use on demand. Its main purpose is to reduce the total cost of hardware and software development, maintenance, and operations. Security provisions are carried out mainly by the cloud provider. The cloud subscriber does not manage or control the underlying cloud infrastructure or individual applications, except for preference selections and limited administrative application settings.

2) Platform-as-a-Service: PAAS provides infrastructure on which software developers can build new applications or extend existing applications without requiring the need to (purchase development, QA, or production server infrastructure. It is a model of software deployment where the computing platform is provided as an on-demand service upon which applications can be developed and deployed. Its main purpose is to reduce the cost and complexity of buying, housing, and managing the underlying hardware and software components of the platform, including any needed program and database development tools. The cloud subscriber has control over applications and application environment settings of the platform. Security provisions are split between the cloud provider and the cloud subscriber.

3) Infrastructure-as-a-Service: Infrastructure-as-a-Service (IaaS) is a model of software deployment whereby the basic computing infrastructure of servers, software, and network equipment is provided as an on-demand service upon which a platform to develop and execute applications can be established. Its main purpose is to avoid purchasing, housing, and managing the basic hardware and software infrastructure components, and instead obtain those resources as virtualized objects controllable via a service interface. The cloud subscriber generally has broad freedom to choose the operating system and development environment to be hosted Security provisions beyond the basic infrastructure are carried out mainly by the cloud subscriber.

The cloud platform is used in this project is IBM Bluemix. It is an open standard, cloud based platform for building, managing and running applications of all types (web, mobile, big data, new smart devices, so on).

This work is providing solution for following main issues in the constrained devices over IoT:

- The main objective of this work is to discuss, analyze & provide high security in Internet of Things in order to make the data and devices attached to the IoT.
- It provides the detailed discussion of the security issues might be caused on the Internet of the things and devices attached.
- It also discusses the problem faced in providing security over the IoT as the devices connected to it are mostly resource constrained.
- The dissertation is oriented majorly on the security of IoT and performance degradation caused due to application of the security measures.

It also considers the various security algorithms applied over IoT devices their pros & cons, issues raised and discussed and provide a high performance solution to the problems raised.

IV. RESULTS AND DISCUSSION

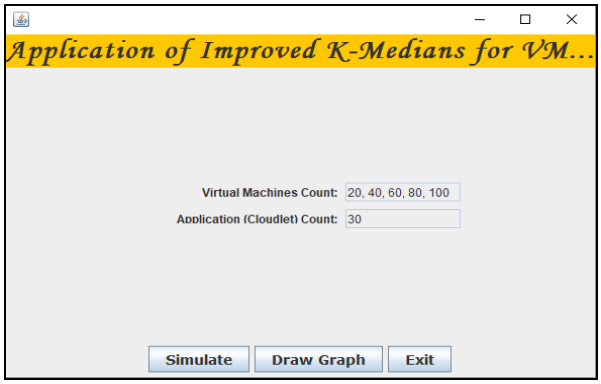

Figure 2: Interface showing control panel for the simulation in CloudSim

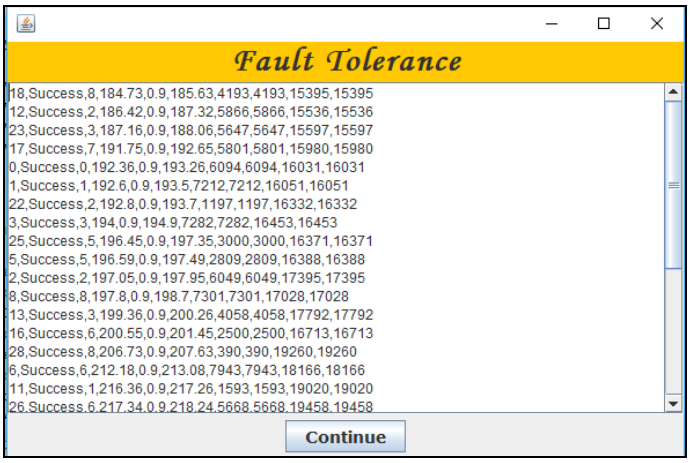

Figure 3: Results obtained from the simulation

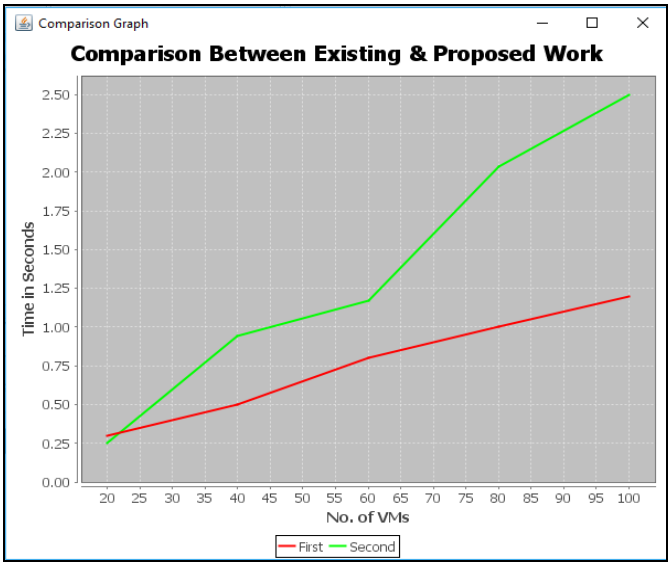

Figure 4: Graph showing comparative between existing work in base paper and implementation of proposed system using CloudSim simulator

V. VIRTUAL MACHINE MIGRATION IN CLOUD

Virtual machine migration is the task of moving a virtual machine from one physical hardware environment to another. It is part of managing hardware virtualization systems and is something that providers look at as they offer virtualization services.

Virtual machine migration is also known as teleportation.
In hardware virtualization, physical hardware pieces are carved up into a set of virtual machines — logical hardware pieces that do not have a physical shell or composition, which are essentially, just programmed pieces of an overall hardware system. In a virtualization setup, a central hypervisor or another tool allocates resources like CPU and memory to virtual machines. For instance, in older networks, most of the individual elements were physical workstations, such as desktop PCs, which were connected by Ethernet cabling or other physical connections. By contrast, virtual machines do not have a physical interface. They do not have a box or shell or anything to move around. But they can be connected to the same keyboards, monitors and peripherals that humans have always used to interact with personal computers.

In virtual machine migration, system administrators move these virtual pieces between physical servers or other hardware pieces. In an effort to facilitate this, a new kind of migration has evolved called "live virtual machine migrations." Live migration involves moving these virtual machines without shutting down a client system. Modern services often provide live migration functionality to make it easier to move virtual machines without doing a lot of other administrative work.

VI. EXISTING SYSTEM

Cloud computing is a distributed commodity system. Authorized users can get access to the virtualized resources on demand over the internet. It refers to the utility computing model. Cloud computing virtualizes system by pooling resources from commodity hardware and supports multi tenancy. It is a highly scalable and flexible virtualized technology is flexible and scalable virtualized technology. Cloud computing provides services on demand over the internet. Users can acquire the required services in a very short time from the cloud. Services provided by the cloud are categorized based on purpose. The cloud provides services like Software as a service (SAAS), Platform as a service (PAAS), and Infrastructure as a service (IAAS). Virtual machines are employed as computing resources for high-performance computing in IAAS. Scheduling of virtual resources and virtual machines (VMs) is the key issue to be handled. Efficient virtual machine allocation is essential for effective utilization of cloud computing infrastructure and increasing resource utilization and efficient deployment of applications in the virtual machine. In this paper performance evaluation of various clustering algorithms for dynamic VM allocation is discussed. The results are verified by simulating the model in workflowsim. [1]

Cloud computing allows users to migrate their calculations to distributed environment which will utilize more number of resources to complete execution quickly. Virtualization means multiple virtual machines (VM) on single physical machine. During process of migration, VM move one physical machine to another. In offline migration, process is stopped till the virtual machine can continue on target machine, while in live migration process can execute without interrupted. Live migration is a migration during which the VM seems to be responsive all the time from clients'

perspective. In Data centre, live migration of virtual machine performs important role. Live migration has been extensively used in load balancing, energy reduction and dynamic resizing to increase availability and hardware maintenance. Which cause transferring huge number of unnecessary memory pages resulting into increase in the total migration time and downtime? Proposed approach of modifying optimized pre-copy will reduce unnecessary transfer of pages and its combination with Characteristic Based Compression (CBC) algorithm will handle two factors viz. (i) total migration time and (ii) total downtime and make migration process more effective. [2]

In the growing age of cloud computing, shared computing and storage resources can be accessed over the Internet. Conversely, the infrastructure cost of the cloud reaches an incredible limit. Therefore, virtualization concept is applied in cloud computing systems to help users and owners to achieve better usage and efficient management of the cloud with the least cost. Live migration of virtual machines (VMs) is an essential feature of virtualization, which allows migrating VMs from one location to another without suspending VMs. This process has many advantages for data centers such as load balancing, online maintenance, power management, and proactive fault tolerance. For enhancing live migration of VMs, many optimization techniques have been applied to minimize the key performance metrics of total transferred data, total migration time and downtime. This paper provides a better understanding of live migration of virtual machines and its main approaches. Specifically, it focuses on reviewing state-of-the-art optimization techniques devoted to developing live VM migration according to memory migration. It reviews, discusses, analyzes and compares these techniques to realize their optimization and their challenges. This work also highlights the open research issues that necessitate further investigation to optimize the process of live migration for virtual machines. [3]

Virtualization techniques effectively handle the growing demand for computing, storage, and communication resources in large-scale Cloud Data Centers (CDC). It helps to achieve different resource management objectives like load balancing, online system maintenance, proactive fault tolerance, power management, and resource sharing through Virtual Machine (VM) migration. VM migration is a resource-intensive procedure as VM's continuously demand appropriate CPU cycles, cache memory, memory capacity, and communication bandwidth. Therefore, this process degrades the performance of running applications and adversely affects efficiency of the data centers, particularly when Service Level Agreements (SLA) and critical business objectives are to be met. Live VM migration is frequently used because it allows the availability of application service, while migration is performed. In this paper, we make an exhaustive survey of the literature on live VM migration and analyze the various proposed mechanisms. We first classify the types of Live VM migration (single, multiple and hybrid). Next, we categorize VM migration techniques based on duplication mechanisms (replication, de-duplication, redundancy, and compression) and awareness of context (dependency, soft page, dirty page, and page fault) and evaluate the various Live VM migration techniques. We discuss various performance metrics like application service downtime, total migration time and amount of data transferred. CPU, memory and storage data is transferred during the process of VM migration and we identify the category of data that needs to be transferred in each case. We present a brief discussion on security threats in live VM migration and categories them in three different classes (control plane, data plane, and migration module). We also explain the security requirements and existing solutions to mitigate possible attacks. Specific gaps are identified and the research challenges in improving the performance of live VM migration are highlighted. The significance of this work is that it presents the background of live VM migration techniques and an in depth review which will be helpful for cloud professionals and researchers to further explore the challenges and provide optimal solutions. [4]

In the IT industry Cloud Computing is an emerging area. Now a day's whole the IT business migrated to the usage of the cloud. Cloud Computing provides access to computing resources for a fee or pay as per usage model. Client applications and services can be hosted in cloud. Number of user increase to the usage of cloud services, so at availability of the resources and based on the demand of resources to satisfy the user requirement Virtual Machine Migration is necessary. In cloud computing, Virtual Machine Migration is a useful tool for migrating Operating System instances across multiple physical machines. It is used to load balancing, fault management, low-level system maintenance and reduce energy consumption. There are various techniques for Virtual Machine Migration. This paper surveys the various Virtual Machine Migration techniques. [5]

Cloud computing is an emerging computing technology that maintains computational resources on large data centers and accessed through internet, rather than on local computers. VM migration provides the capability to balance the load, system maintenance, etc. Virtualization technology gives power to cloud computing. The virtual machine migration techniques can be divided into two categories that is pre-copy and post-copy approach. The process to move running applications or VMs from one physical machine to another, is known as VM migration. In migration process the processor state, storage, memory and network connection are moved from one host to another.. Two important performance metrics are downtime and total migration time that the users care about most, because these metrics deals with service degradation and the time during which the

service is unavailable. This paper focus on the analysis of live VM migration Techniques in cloud computing. [6]

VI. CONCLUSION AND FUTURE SCOPE

Dynamic provisioning of VM's is required to handle instant application requirements. VM allocation is key functionality in IAAS provisioning. Service providers are not aware of application resource requirements. Allocated VM's geographical location also plays key role in the performance. In these paper researches of the various authors on performance evaluation of various clustering algorithms for scheduling and dynamic allocation of VM's is evaluated. The experimental results show that the performance is high with improved K-median clustering algorithm.

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