# An Energy-Efficient VM Prediction and Migration Framework for Overcommitted Clouds

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***Abstract***

Propose an included, energy efficient, resource allocation framework for overcommitted clouds. The concord makes massive energy investments by 1) minimizing Physical Machine overload occurrences via virtual machine resource usage monitoring and prophecy, and 2) reducing the number of active PMs via efficient VM relocation and residency. Using real Google data consisting of a 29 day traces collected from a crowd together contain more than 12K PMs, we show that our proposed framework outperforms existing overload avoidance techniques and prior VM migration strategies by plummeting the number of unexpected overloads, minimizing migration overhead, increasing resource utilization, and reducing cloud energy consumption.

**Keywords:** Energy efficiency, VM migration, workload prediction, cloud computing.



## INTRODUCTION

Reducing the energy consumption of datacenters has received a great attention from the academia and the industry recently. Recent studies indicate that datacenter servers operate, most of the time, at between 10 and 50 percent of their maximal utilizations. These same studies, on the other hand, also show that servers that are kept ON but are idle or lightly utilized consume significant amounts of energy, due to the fact that an idle ON server consumes more than 50 percent of its peak power. It can therefore be concluded that in order to minimize energy consumption of datacenters, one need to consolidate cloud workloads into as few servers as possible.Cloud computing is a distributed computing paradigm in which a pool of computing resources such as virtualized physical machines which host applications, shared storage devices like NFS (Network File Storage), backup servers. In a virtualized environment, Server Consolidation and Load balancing are some of those techniques which have gained premier importance for on-the-Ày resource management. In a virtualized environment, many applications run on a virtual machine (VM) and one or more VMs are mapped onto each physical machine (PM) of the datacenter. Due to the capacity to host various applications onto same PM while also being able to migrate them seamlessly across different PMs,various challenges cropped up. The challenges involve balancing load amongst all PMs, determining which VMs to place on which PMs and managing unexpected escalation in resource demands and so the focus is on the problem of energy- efficient VM placement and resource management in Cloud datacenter, by ensuring that computing resources are efficiently utilized to serve application workloads to minimize energy consumption.

**ALGORITHM**

- ❖ Resource Allocation Algorithm

**EXISTING PROCESS**

In existing System upon receiving a client request, the cloud scheduler creates a virtual machine (VM), allocates to it the exact amounts of CPU and memory resources requested by the client, and assigns it to one of the cluster's physical machines (PMs) is complicated process.In current cloud resource allocation methods, these allocated resources are reserved for the entire lifetime of the VM and are released only when the VM completes.

**DISADVANTAGE**

- High energy consumption
- High overload occur (Scheduling is complicated)
- High Complexity
- Performance degradation on Scheduling process

**PROPOSED PROCESS**

Predicts future resource utilizations of scheduled vms, and uses these predictions to make efficient cloud resource over commitment decisions to increase utilization. Predicts PM overload incidents and triggers VM migrations before overloads occur to avoid SLA violations. It performs energy-efficient VM migration by determining which vms to migrate and which pms need to host the migrated vms such that the migration energy overheads and the number of active pms are minimized.

**ADVANTAGE**

- VMs are not likely to utilize their reserved resources fully. Therefore, it has a great potential for saving energy in cloud centers, as VMs can now be hosted on fewer ON PMs
- Minimize energy consumption of datacenters
- Resource allocation framework that improves resource utilization, reduces energy consumption
- Numbers of active PMs are minimized.

**Algorithm:**

- Optimal online deterministic algorithms
- Cost Optimization Based Scheduling Algorithms.

**RELATED WORK**

**C. Weng, M. Li, Z. Wang, and X. Lu, "Automatic Performance Tuning for the Virtualized Cluster System," in Proc. of the 29th IEEE "VMware DRS - Dynamic Scheduling of System Resources," www.vmware.com/products/drs/overview.html, Oct. 2009.**

System virtualization can collective the functionality of various separate computer systems into a single hardware computer. It is significant to virtualize the computing nodes with multi-core processors in the cluster system, in order to promote the usage of the hardware while decrease the cost of the power. In the virtualized cluster association, various virtual equipment are running on a computing node. However, it is a challenging issue to involuntarily balance the workload in virtual machines on each physical computing node, which is different from the traditional cluster system's load balance. In this process, propose a management framework for the virtualized cluster system, and present an automatic performance tuning strategy to balance the workload in the virtualized cluster system. We implement a working prototype of the management framework (VEMan) based on Xen, and test the performance of the tuning strategy on a virtualized heterogeneous cluster system. The experimental result indicates that the management framework and tuning strategy are feasible to improve the performance of the virtualized cluster system.





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**C. Clark, K. Fraser, S. Hand, J. G. Hansen, E. Jul, C. Limpach, I. Pratt, and A. Warfield, "Live Migration of Virtual Machines," in Proc. of the 2nd Symposium on Networked Systems Design & Implementation, Boston, MA, May 2005.**

Migrating operating system instances across distinct physical hosts is a useful tool for administrators of data centers and clusters: It allows a clean separation between hardware and software, and facilitates fault management, load balancing, and low-level system maintenance. By carrying out the majority of migration while OSes continue to run, we achieve impressive performance with minimal service downtimes; we demonstrate the migration of entire OS instances on a commodity cluster, recording service downtimes as low as 60ms. We show that that our performance is sufficient to make live migration a practical tool even for servers running interactive loads. In this paper we consider the design options for migrating OSes running services with liveness constraints, focusing on data center and cluster environments. We introduce and analyze the concept of writable working set, and present the design, implementation and evaluation of highperformance OS migration built on top of the Xen VMM.

**Z. Liu, W. Qu, W. Liu, and K. Li, "Xen Live Migration with Slowdown Scheduling Algorithm," in Proc. of the 2010 Int. Conf. on Parallel and Distributed Computing, Applications and Technologies, ser. PDCAT '10, Wuhan, China, Dec. 2010, pp. 215–221.**

With the increasing number of technology areas using Virtual Machine (VM) platforms, challenges exist in Virtual Machine migrating from one physical host to another. However, the complexity of these virtualized environments presents additional management challenges. Unfortunately, many traditional approaches may be either not effective well for reducing downtime or migration time, or not suitable well for Xen VMs platforms. This paper presents the design and implementation of a novel Slowdown Scheduling Algorithm (SSA) for Xen live VM migration. In our SSA methodology, the CPU resources which have been assigned to migration domain are decrease properly. That is, the dirtying page rate is reduced according to the decrease of CPU activity. Experimental results illustrate that our SSA approach can shorten both the total migration time and downtime obviously under high dirty page rate environment.

**W. Voorsluys, J. Broberg, S. Venugopal, and R. Buyya, "Cost of Virtual Machine LiveMigration in Clouds: A Performance Evaluation," in Proc. of the 1st Int. Conf. on Cloud Computing (CloudCom'09), Beijing, China, Dec. 2009.**

Virtualization has become commonplace in modern data centers, often referred as "computing clouds". The capability of virtual machine live migration brings benefits such as improved performance, manageability and fault tolerance, while allowing workload movement with a short service downtime. However, service levels of applications are likely to be negatively affected during a live migration. For this reason, a better understanding of its effects on system performance is desirable. In this paper, we evaluate the effects of live migration of virtual machines on the performance of applications running inside Xen VMs. Results show that, in most cases, migration overhead is acceptable but cannot be disregarded, especially in systems where availability and responsiveness are governed by strict Service Level Agreements. Despite that, there is a high potential for live migration applicability in data centers serving modern Internet applications. Our results are based on a workload covering the domain of multi-tier Web 2.0 applications.

**Y. Luo, B. Zhang, X. Wang, Z. Wang, Y. Sun, and H. Chen, "Live and IncrementalWhole-System Migration of Virtual Machines Using**

**Block-Bitmap," in Proc. of IEEE Int. Conf. on Cluster Computing, Tsukuba, Japan, September 2008.**

In this paper, we describe a whole-system live migration scheme, which transfers the whole system run-time state, including CPU state, memory data, and local disk storage, of the virtual machine. To minimize the downtime caused by migrating large disk storage data and keep data integrity and consistency, we propose a three-phase migration algorithm. To facilitate the migration back to initial source machine, we use an incremental migration algorithm to reduce the amount of the data to be migrated. Block-bitmap is used to track all the write accesses to the local disk storage during the migration. Synchronization of the local disk storage in the migration is performed according to the block-bitmap. Experiments show that our algorithms work well even when I/Ointensive workloads are running in the migrated VM. The downtime of the migration is around 100 milliseconds, close to shared-storage migration. Total migration time is greatly reduced using IM. The block-bitmap based synchronization mechanism is simple and effective. Performance overhead of recording all the writes on migrated VM is very low.

**R. Bradford, E. Kotsovinos, A. Feldmann, and H. Schi ¨oberg, "Live Wide-Area Migration of Virtual Machines Including Local Persistent State," in In VEE '07: Proc. of the 3rd Int. Conf. on Virtual Execution Environments, San Diego, CA, June 2007.**

So far virtual machine migration has focused on transferring the run-time memory state of the VMs in local area networks. However, for wide-area network migration it is crucial to not just transfer the VMs image but also transfer its local persistent state (its file system) and its on-going network connections. In this paper we address both: by combining a blocklevel solution with pre-copying and write throttling we show that we can transfer an entire running web server, including its local persistent state, with minimal disruption three seconds in the LAN and 68 seconds in the WAN; by combining dynDNS with tunneling, existing connections can continue transparently while new ones are redirected to the new network location. Thus we show experimentally that by combining well-known techniques in a novel manner we can provide system support for migrating virtual execution environments in the wide area.

## PROCESS

- MANAGEMENT PROCESS
- SECURE KEY GENERATION
- CLIENT PROCESS
- RESOURCE PROVISIONING

## MANAGEMENT PROCESS

Management process is a process of setting goals, planning and/or controlling the organizing and leading the execution of any type of activity, such as: a project (project management process) or. a process (process management process, sometimes referred to as the process performance measurement and management system).In the admin module they are various purposed to be done

### i) UPLOAD FILES TO SERVER

The problem scales up, VMs are allocated to lower ranked servers and their happiness decreases, and servers are allocated with higher ranked VMs, due to the increased competition among VMs. Also note that Multistage DA is only able to improve the matching. In the upload a file in the cloud the admin can process the files.

### ii) VIEW FILES

In the admin uploading and the user downloading the files, the admin are going to upload file between them. They can share the uploaded files. User for download files. System showed very good Performance in terms of speed, accuracy, and ease



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of use. The downloaded files can be automatically stored.

### iii) DOWNLOAD A FILE (FILE RETRIVEL ACCUARCY)

The user can download a file details can be viewed by the admin

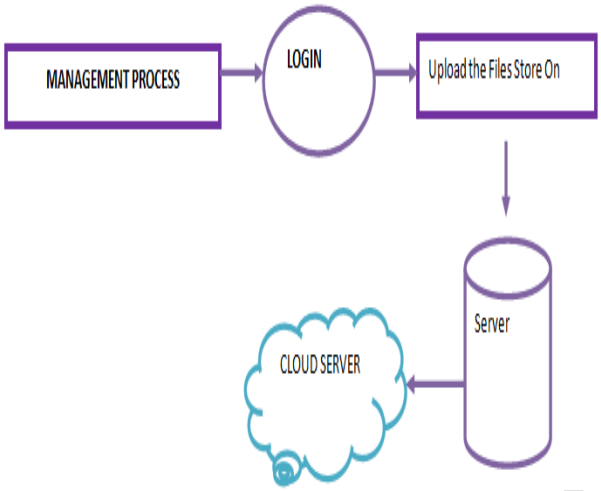


**Fig 1 Download a File**

### SECURE KEY PROCESSING AND VERIFICATION

Secure Key Processing module generates the random keys to the users and send those keys to the user's respective mail, whenever the user get the key the system asks for the submission of those keys. After submitting the key to the system it checks the identities of the users whether they are authorized user or not.

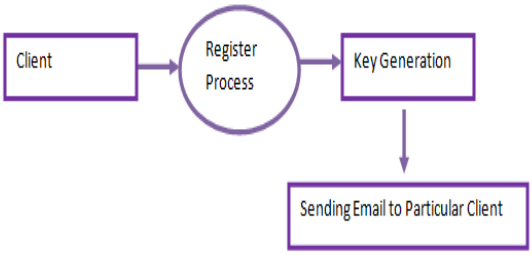


**Fig 2 Secure Key Processing and Verification**

### CLIENT PROCESS

### i) SEARCH A FILE

The Admin Process can upload a file, the user can search the files .Based on User requirements the admin can upload the files the user can search the files from the admin upload the files,

### ii) DOWNLOAD

The search time includes fetching the posting list in the index, ordering each entries. Our focus is on top-k retrieval. As the, server can process the top-k retrieval almost as fast as in the plaintext domain. Note that the server does not have to traverse every posting list for each given trapdoor, but instead uses a tree-based data structure to fetch the corresponding list. Therefore, the overall search time cost is almost as efficient as on data.

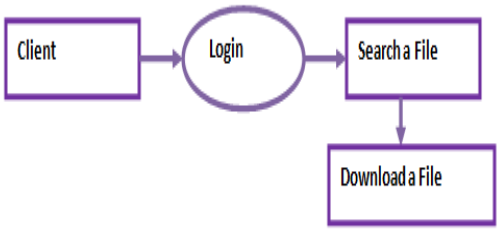


**Fig 3 Download**

### RESOURCE PROVISIONING

An aggressive resource provisioning strategy which encourages SPRNT to substantially increase the resource allocation in each adaptation cycle when workload increases. These strategy first provisions resources which are possibly more than actual demands, and then reduces the over-provisioned resources if needed this paper proposes SPRNT, a system that dynamically adjusting the number of virtual machine (VM)

instances to ensure the QoS by accelerating the resource provisioning in virtualized cloud computing environments. The key idea behind SPRNT is exploiting an aggressive strategy, which likely provisions resources that may exceed the actual needs, satisfies the performance requirement at the very beginning of the adaptation process, and then decreases the over provisioned resources if needed. The amount of the resources to be allocated is determined during runtime according to the workload intensity and the amount of provisioned resources rather than a fixed number.

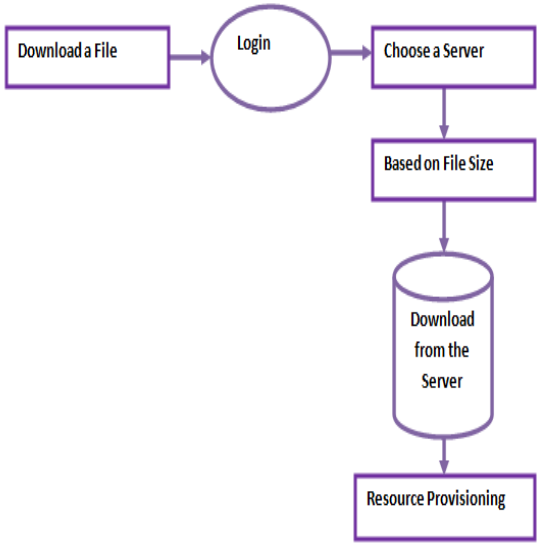


**Fig 4 Resource Provisioning**

## ALGORITHM DESCRIPTION

## MULTISTAGE DA ALGORITHM

Multistage DA algorithm iteratively finds a better weakly stable matching with respect to jobs. The blocking job is removed from its previous machine, so that it can make new offers to machines that have rejected it before. This ensures that the algorithm does not produce new type with blocking pairs. At each stage, we Revised DA is proposed with the selected set of proposing jobs and the entire set of machines with updated capacity.

## ONLINE ALGORITHM

In online scheduling the decisions regarding how to schedule tasks are done during the runtime of the system. The scheduling decisions are based on the tasks priorities which are either assigned dynamically or statically. Static priority driven algorithms assign fixed priorities to the tasks before the start of the system. Dynamic priority driven algorithms assign the priorities to tasks during runtime. An online algorithm is forced to make decisions that may later turn out not to be optimal, and the study of online algorithms has focused on the quality of decision-making that is possible in this setting. Online VM placement develops systems to predict the dynamic resource demand of VMs and guide the placement process considers minimizing the long-term routing cost between VMs.

## CONCLUSIONS

Migrating VMs in live fashion is of key importance to IaaSclouds as it helps accomplish major operational and administrative objectives including effective load-sharing and improved utilization of physical machinery. The movement of VMs over the network inevitably consumes significant cloud resources, thus such tasks should be scheduled during periods of low load. In this work, we focus on emerging highly-scalable share-nothing cloud installations and employ on-demand virtual disk synchronization across PMs to attain live migration under explicit time-constraints. Our approach is empowered by the combined use of a network of Brokers and the MigrateFS file system. MigrateFS effectively synchronizes disk images between physical computing systems, while the Brokers manage the resources of the share-nothing cloud elements. The joint objective of the two components is to offer a scheme that gracefully

deals with time-constrained VM migration requests and at the same time, does not deplete cloud resources.

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**BIOGRAPHICAL NOTES**

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