ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization) Vol.2, Special Issue 1, March 2014

Proceedings of International Conference On Global Innovations In Computing Technology (ICGICT'14)

Organized by

Department of CSE, JayShriram Group of Institutions, Tirupur, Tamilnadu, India on 6th & 7th March 2014

K-Tier Computation of Parallel Workload in Cloud

P.Karthikeyan[1], R.Sudhakar[2]

P.G Scholar, Department of CSE, Nandha College of Technology, Erode, Tamil Nadu[1]

Assistant Professor, Department of CSE, Nandha College of Technology, Erode, Tamil Nadu[2]

Abstract: Cloud computing model attracts many complex applications that run on data centers. Complex applications often require parallel processing capabilities. By using virtualization technologies the computing capacity of each node is divided into K-Virtual Machines (KVMs). Attaining KVMs are based on the available resources of physical machine. Collocation of virtual machines on each node will run multiple jobs simultaneously. Running parallel jobs on each node would increase resource utilization on each physical machine. Job management is the key role in cloud computing systems, parallel job scheduling problems are main which relate to the efficiency of the whole cloud computing. Here, the Virtual Machines (VMs) are of two types, foreground VM and background VMs. Foreground VM will have high priority whereas background VMs has low priority. By Modifying Conservative Migration Supported Backfilling algorithm, we can run parallel jobs on each node with K-VMs to improve utilization of available resource.

Keywords: Parallel Scheduling, K-Tier Computation, Cloud Computing.

I. INTRODUCTION

Cloud computing is a long dreamed vision of computing as a utility, where cloud customers can enjoy the on-demand high quality applications and services from a shared pool of configurable computing resources. Cloud computing is the use of computing resources hardware and software, that are delivered as a service over a network typically the Internet. The cloud computing paradigm promises a cost-effective solution for running business applications through the use of virtualization technologies, highly scalable distributed computing and data management techniques as well as a pay-as-you-go pricing model. In recent years, it also offers high performance computing capacity for applications to solve complex problems.

Many companies built their own customized data processing architectures such as Google's Map Reduce, Microsoft's Dryad or Yahoo's Map-Reduce-Merge. It can be classified as high throughput computing (HTC) or many-task computing (MTC), depending on the number of tasks involved in the computation. Almost all processing frameworks that exist today assume resources are static set of homogeneous compute nodes. Even though it designed to deal with individual node failures, available machines are to be constant while scheduling jobs.

1.1 Virtualization

Virtualization broadly describes the separation of a resource or request for a service from the underlying physical delivery of that service. Virtualization can be defined as the ability to run multiple operating systems on a single physical system and share the underlying hardware resources. Virtual server seeks to encapsulate the server software away from the server hard ware. The virtual server consists of the operating system, the storage and the application. If virtual servers are maintained, these servers are serviced by one or more hosts and on host can maintain more than one virtual server. Same as traditional servers these also named according to their usage. By maintaining the Virtual servers it is possible to reduce their services providing for them if the administrator feels that services providing by them crosses its limit then they will reduce it to certain level. And they will adjust them. In order to develop virtual servers, there are several

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization) Vol.2, Special Issue 1, March 2014

Proceedings of International Conference On Global Innovations In Computing Technology (ICGICT'14)

Organized by

Department of CSE, JayShriram Group of Institutions, Tirupur, Tamilnadu, India on 6th & 7th March 2014

templates so, that it is possible to built multiple and identical virtual servers. The main advantage of virtual servers is, they can be transitioned from one host to another host.

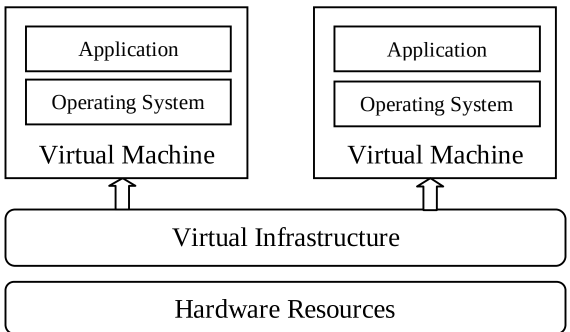

Figure: Virtualization

1.2 Virtual Machine Monitor

A virtual machine monitor is a host program that allows a single computer to support multiple, identical execution environments. All the users see their systems as self-contained computers isolated from other users, even though every user is served by the same machine. In this context, a virtual machine is an operating system (OS) that is managed by an underlying control program. For example, IBM's VM/ESA can control multiple virtual machines on an IBM S/390 system.

1.3 Parallel Computation

The most basic but popular batch scheduling algorithm for parallel jobs is first come first serve (FCFS). Each job specifies the number of nodes required and the scheduler processes jobs according to the order of their arrival. When there, is a sufficient number of nodes to process the job at the head of the queue, the scheduler dispatches the job to run on these nodes otherwise, it waits till jobs currently running finish and release enough nodes for the job. FCFS may cause node fragmentation and methods such as backfilling and Gang scheduling were proposed to improve it. However, they do not target on the utilization degradation caused by parallelization itself. In this paper, we focus on improving resource utilization for data centers that run parallel jobs particularly we intend to make use of the remaining computing capacity of data center nodes that run parallel processes with low resource utilization to improve the performance of parallel job scheduling.

II. RELATED WORK

Many efforts have been taken on scheduling mechanisms to improve resource utilization on parallel computation. Batch scheduling mechanisms such as FCFS have been used extensively. Later, to move small jobs to the head of queue instead of waiting when they have enough number of nodes, a Backfilling algorithm developed as EASY for IBM SP1. Even though backfilling improves node utilization it requires a job to specify its maximum execution time. Though it addresses low utilization it does not deal with low resource utilization caused by parallel jobs.

Gang scheduling shares resources among multiple parallel jobs through time slices. It makes all the process to progress together so, there is no processes on sleep mode while other process waiting for it. Paired gang scheduling schedules a process to CPU when the host program performs I/O operation. Gang scheduling shares computing capacity

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization) Vol.2, Special Issue 1, March 2014

Proceedings of International Conference On Global Innovations In Computing Technology (ICGICT'14)

Organized by

Department of CSE, JayShriram Group of Institutions, Tirupur, Tamilnadu, India on 6th & 7th March 2014

equally thus in turn reduce opportunity to run some priority jobs. Even though it improves utilization up to certain degree, individual jobs execution time is stretched.

III. K TIER COMPUTATION

3.1 Construction of K-Tier Infrastructure

Construction of cloud architecture consists of cloudlet, data centers, virtual machines, etc. Here each node will have k-VMs according to the capacity physical machine. There will be one foreground VM and number of background VMs. Foreground virtual machine will have high priority among the all other virtual machines on the node.

3.2 Selecting Virtual Machine

Parallel application with dependency among its parallel processes, achieving high utilization on the nodes on which these processes run is often difficult. For a cloud service provider that runs this kind of applications, how to address this issue is important for its competitiveness in the market. The very first step is to select nodes which are all having free VMs on it. By selecting these nodes, we can check CPU utilization of foreground virtual machine and if it is lower than a threshold then the incoming job to background virtual machine of the respective node. It also provides an opportunity to change jobs which are running on the background to foreground when there is enough resource to run.

3.3 Scheduling Jobs to VM

There have been many scheduling polices intended to schedule jobs on virtual machines but many follows First Come First Serve (FCFS) basis but here the requirement is different from the traditional FCFS scheduling. There is a need for backfilling to improve utilization nodes in data center. So, Conservative Migration Supported BackFilling (CMBF) algorithm can be modified to schedule jobs for KVMs.

Algorithm: Basic CMBF

Input: Q: incoming job queue;
M: a map between jobs and nodes;
Output: M`: the updated job allocation map;
Begin
J→ get the first job in Q;
While j≠null do
N_j ← the number of nodes need by j;
N_{idle} ← the number of idle nodes;
If $N_j < N_{idle}$ then
Remove j from Q and dispatch it to any idle N_j idle nodes;
Update M accordingly;
If j is not at the head of Q then
Insert j into $Q_{backfill}$;
else
$N_{backfill}$ ← the number of nodes running jobs arriving later then j;
If $N_j < (N_{backfill} + N_{idle})$ then
Suspend jobs in $Q_{backfill}$ that arrive later than j and move them back to Q according to descending order of their

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization) Vol.2, Special Issue 1, March 2014

Proceedings of International Conference On Global Innovations In Computing Technology (ICGICT'14)

Organized by

Department of CSE, JayShriram Group of Institutions, Tirupur, Tamilnadu, India on 6th & 7th March 2014

arrival time until the number of idle nodes is greater than N_j;
Remove j from Q and dispatch it to N_j idle nodes;
Update M;
j ← get the next job from Q;

CMBF schedules jobs to run according to their arrival time when there is enough number of nodes. When the number of idle nodes is not sufficient for a job, another job with a later arrival time but smaller node number requirement may be scheduled to run via backfilling. To avoid starving a preempted job, CMBF uses the following policy:

- Incoming job is scheduled to run when it have required number of nodes idle or occupied by jobs with later arrival time.
- Jobs arriving later being scheduled to run on some nodes and it instructs these jobs to save states, suspends its execution and moves back to queue.

Virtual Machines are parallelized into Foreground and Background. There is only one foreground VM and there will be more than one background VMs that run parallel. When foreground VM cannot utilize all the available resource the background virtual machines are allocated to utilize the available resource.

IV. CONCLUSION AND FUTURE WORK

As an increasing number of complex applications leverage the computing power of the cloud for parallel computing, it becomes important to efficiently manage computing resources for these applications. Due to the difficulty in realizing parallelism, many parallel applications show a pattern of decreasing resource utilization along with the increase of parallelism. Scheduling parallel jobs for both efficient resource use and job responsiveness is challenging. Workload consolidation supported by virtualization is commonly used for improving utilization in data centres. Modifying CMBF algorithm will provide efficient computation of parallel nodes and it will utilize the nodes resource effectively. In future, job scheduling can be made to virtual machines that are close to each other to reduce communication cost.

REFERENCES

[1] Anton Beloglazov and Rajkumar Buyya "Energy Efficient Allocation of Virtual Machines in Cloud Data Centers", 10th IEEE/ACM International Conference on Cluster, Cloud and Grid Computing, 2010.

[2] Bernardetta Addis, Danilo Ardangna, Barbara Panicucci, Mark S Squillante, "A Hierarchical Approach for the Resource Management of Very Large Cloud Platforms", IEEE Transactions on Parallel and Secure Computing, volume 10, no.5, 2013.

[3] Chase J, Irwin D, Grit L, Moore J, and Sprenkle S, "Dynamic Virtual Clusters in Grid Site Manager", 12th IEEE Symposium on High Performance Distributed Computing, 2003.

[4] Daniel Warneke and Odej Kao "Exploiting Dynamic Resource Allocation for Efficient Parallel Data Processing in the Cloud" Ieee Transactions On Parallel And Distributed Systems, 2011.

[5] Daniel Warneke and Odej Kao "Nephele: Efficient Parallel Data Processing in the Cloud" MTAGS '09, 2009.

[6] DAngelo G, "Parallel and Distributed Simulation from Many Cores to the Public Cloud" Proceedings of the International Conference on High Performance Computing and Simulation (HPCS '11), pp. 14–23, IEEE, Istanbul, Turkey, 2011.

[7] Feitelson D, Rudolph L, Schwiegelshohn U, Sevcik K, and Wong P, "Theory and Practice in Parallel Job Scheduling," Job Scheduling Strategies for Parallel Processing, pp. 1–34, Springer, 1994.

[8] Fujimoto R, Malik A, and Park A, "Parallel and Distributed Simulation in the cloud", Simulation Magazine, Society for Modeling and Simulation, volume 3, 2010.

[9] Iosup A, Ostermann S, Yigitbasi N, Prodan R, Fahringer T and Epema D "Performance analysis of cloud computing services for many-tasks scientific computing", IEEE Transactions on Parallel and Distributed Systems, volume 22, pp.931–945, 2011.

[10] Lee C Y and Zomaya Y A, "Energy efficient utilization of resources in cloud computing systems", Journal of Supercomputing, pp. 1–13, 2010.

[11] Lifka D, "The anl/ibm sp scheduling system", Job Scheduling Strategies for Parallel Processing, pp. 295–303, Springer, 1995.

[12] Raicu I, Foster I, Zhao Y, "Many-Task Computing for Grids and Supercomputers", Workshop on Many-Task Computing on Grids and Supercomputers, 2008.

[13] Ruth P, McGache P, and Xu D, "Vio Cluster: Virtualization for Dynamic Computational Domains", IEEE International Conference on Cluster Computing, 2005.

[14] Xiaocheng Liu, Chen Wang, Bing Bing Zhou, Junliang Chen, Ting Yang and Albert Y.Zomaya, "Priority-Based Consolidation of Parallel Workloads in the Cloud", IEEE Transactions on Parallel and Distributed Systems, volume 24, no.9, 2013.