© 2017 IJSRSET | Volume 3 | Issue 3 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

Dynamic Load balancing in Cloud Computing Using Ant Colony Optimization

Samriddhi Gupta[1], Abhishek Bajpai[2], Dr. Neeraj Kumar Tiwari[3]

[1]Department of Computer Applications, ShriRamswaroop Memorial University (SRMU ,UGC Affiliated), Lucknow, Uttar Pradesh, India
[2] Assistant Professor Computer Applications, ShriRamswaroop Memorial University (SRMU ,UGC Affiliated), Lucknow Uttar Pradesh, India
[3] Head Of Department Computer Application, ShriRamswaroop Memorial University(SRMU ,UGC Affiliated), Lucknow, Uttar Pradesh, India

ABSTRACT

As the cloud computing is a new style of computing over internet. It has many advantages along with some crucial issues to be resolved in order to improve reliability of cloud environment. These issues are related with the load management, fault tolerance and different security issues in cloud environment. In this paper the main concern is to prevent bottleneck in cloud computing. The load can be CPU load, memory capacity, delay or network load. Load balancing is the process of distributing the load among various nodes of a distributed system to improve both resource utilization and job response time while also avoiding a situation where some of the nodes are heavily loaded while other nodes are idle or doing very little work. Load balancing ensures that all the processor in the system or every node in the network does approximately the equal amount of work at any instant of time. Many methods to resolve this problem has been came into existence like Particle Swarm Optimization, hash method, genetic algorithms and several scheduling based algorithms are there. In this paper we are proposing a method based on Ant Colony optimization to resolve the problem of load balancing in cloud environment

Keywords : Cloud computing, Advantages and Disadvantages , Ant Colony Optimization, Swarm intelligence

I. INTRODUCTION

Individual ants are behaviorally much unsophisticated insects. They have a very limited memory and exhibit individual behavior that appears to have a large random component. Acting as a collective however, ants manage to perform a variety of complicated tasks with great reliability and consistency.

Although this is essentially self organization rather than learning, ants have to cope with a phenomenon that looks very much like overtraining in reinforcement learning techniques.

II. CLOUD COMPUTING

Cloud Computing is a general term used to describe a new class of network based computing that takes place over the Internet, Basically a step on from Utility Computing, A collection/group of integrated and networked hardware, software and Internet infrastructure (called a platform).Using the Internet for communication and transport provides hardware, software and networking services to clients. These platforms hide the complexity and details of the underlying infrastructure from users and applications by providing very simple graphical interface or API (Applications Programming Interface).In addition, the platform provides on demand services, that are always on, anywhere, anytime and anyplace. Pay for use and as needed, elastic scale up and down in capacity and functionalities. The hardware and software services are available to general public, enterprises, corporations and businesses markets. Cloud computing is an umbrella term used to refer to Internet based development and services . A number of characteristics define cloud data, applications services and infrastructure:

Remotely hosted: Services or data are hosted on remote infrastructure.
Ubiquitous: Services or data are available from anywhere.

Commodified: The result is a utility computing model similar to traditional that of traditional utilities, like gas and electricity - you pay for what you would want!

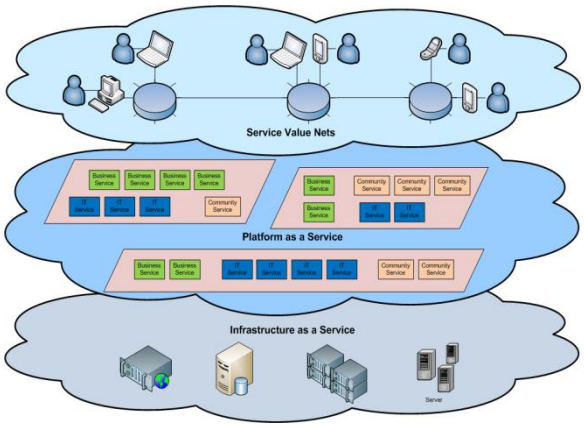

Figure 1: Cloud Architecture

III. CLOUD SERVICE MODELS

Cloud service delivery is divided into three models. The three service models are:

1.2.1 Cloud Software as a service (Saas)
The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a web browser. The consumer does not manage the underlying cloud infrastructure.

Application Service (SaaS)	MS Live/ExchangeLabs, IBM, Google Apps; Salesforce.com Quicken Online, Zoho, Cisco
Application Platform	Google App Engine, Mosso, Force.com, Engine Yard, Facebook, Heroku, AWS
Server Platform	3Tera, EC2, SliceHost, GoGrid, RightScale, Linode
Storage Platform	Amazon S3, Dell, Apple, ...

Figure 2: Software as a service (Saas)

1.2.2 Cloud Platform as a Service (Paas)
The capability provided to the consumer is to deploy onto the cloud infrastructure consumer created or acquired applications created using programming languages and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure, but has control over the deployed applications and possibly application hosting environment configurations.

1.2.3 Cloud Infrastructure as a Service (Iaas)

The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, deployed applications, and possibly limited control of select networking components.

IV. VIRTUALIZATION

Virtual workspaces: An abstraction of an execution environment that can be made dynamically available to authorized clients by using well-defined protocols, Resource quota (e.g. CPU, memory share), Software configuration (e.g. O/S, provided services). Implement on Virtual Machines (VMs): Abstraction of a physical host machine, Hypervisor intercepts and emulates instructions from VMs, and allows management of VMs, VMWare, Xen, etc. Provide infrastructure API: Plug-ins to hardware/support structures

Advantages of virtual machines: Run operating systems where the physical hardware is unavailable, Easier to create new machines, backup machines, etc., Software testing using "clean" installs of operating systems and software, Emulate more machines than are physically available, Timeshare lightly loaded systems on one host, Debug problems (suspend and resume the problem machine), Easy migration of virtual machines (shutdown needed or not). Run legacy systems!

V. ADVANTAGES

- **Lower Computer Costs:**

You do not need a high-powered and high-priced computer to run cloud computing's web-based applications. Since applications run in the cloud, not on the desktop PC, your desktop PC does not need the processing power or hard disk space demanded by

traditional desktop software. When you are using web-based applications, your PC can be less expensive, with a smaller hard disk, less memory, more efficient processor. In fact, your PC in this scenario does not even need a CD or DVD drive, as no software programs have to be loaded and no document files need to be saved.

- **Improved performance:**

With few large programs hogging your computer's memory, you will see better performance from your PC. Computers in a cloud computing system boot and run faster because they have fewer programs and processes loaded into memory

- **Reduced software costs:**

Instead of purchasing expensive software applications, you can get most of what you need for free-ish! most cloud computing applications today, such as the Google Docs suite. Better than paying for similar commercial software which alone may be justification for switching to cloud applications.

- **Instant software updates:**

Another advantage to cloud computing is that you are no longer faced with choosing between obsolete software and high upgrade costs. When the application is web-based, updates happen automatically

- **Available the next time you log into the cloud**.

When you access a web-based application, you get the latest version without needing to pay for or download an upgrade.

- **Improved document format compatibility.**

You do not have to worry about the documents you create on your machine being compatible with other users' applications or OSes . There are potentially no format incompatibilities when everyone is sharing documents and applications in the cloud.

- **Unlimited storage capacity:**

Cloud computing offers virtually limitless storage. Your computer's current 1 Tbyte hard drive is small compared to the hundreds of Pbytes available in the cloud.

- **Increased data reliability:**

Unlike desktop computing, in which if a hard disk crashes and destroy all your valuable data, a computer crashing in the cloud should not affect the storage of your data. In a world where few individual desktop PC users back up their data on a regular basis, cloud computing is a data-safe computing platform!

- **Universal document access:**

That is not a problem with cloud computing, because you do not take your documents with you. Instead, they stay in the cloud, and you can access them whenever you have a computer and an Internet connection . Documents are instantly available from wherever you are

- **Latest version availability:**

When you edit a document at home, that edited version is what you see when you access the document at work. The cloud always hosts the latest version of your documents

Disadvantages of Cloud Computing

- **Requires a constant Internet connection:**

Cloud computing is impossible if you cannot connect to the Internet. Since you use the Internet to connect to both your applications and documents, if you do not have an Internet connection you cannot access anything, even your own documents. A dead Internet connection means no work and in areas where Internet connections are few or inherently unreliable, this could be a deal-breaker.

- **Does not work well with low-speed connections:**

Similarly, a low-speed Internet connection, such as that found with dial-up services, makes cloud computing painful at best and often impossible.

Web-based applications require a lot of bandwidth to download, as do large documents.

- **Features might be limited:**

This situation is bound to change, but today many web-based applications simply are not as full-featured as their desktop-based applications.

- **Can be slow:**

Even with a fast connection, web-based applications can sometimes be slower than accessing a similar software program on your desktop PC. Everything about the program, from the interface to the current document, has to be sent back and forth from your computer to the computers in the cloud. If the cloud servers happen to be backed up at that moment, or if the Internet is having a slow day, you would not get the instantaneous access you might expect from desktop applications.

- **Stored data can be lost:**

Theoretically, data stored in the cloud is safe, replicated across multiple machines. But on the off chance that your data goes missing, you have no physical or local backup.

- **HPC Systems:**

Not clear that you can run compute-intensive HPC applications that use MPI/OpenMP! Scheduling is important with this type of application

- **General Concerns:**

Each cloud systems uses different protocols and different APIs. Amazon has created its own DB system (not SQL 92), and workflow system (many popular workflow systems out there) so your normal applications will have to be adapted to execute on these platforms.

VI. LOAD BALANCING IN CLOUD

Load Balancing is a method to distribute workload across one or more servers, network interfaces, hard drives, or other computing resources. Typical datacenter implementations rely on large, powerful (and expensive) computing hardware and network infrastructure, which are subject to the usual risks associated with any physical device, including hardware failure, power and/or network interruptions, and resource limitations in times of high demand.

Load balancing is used to make sure that none of your existing resources are idle while others are being utilized. To balance load distribution, you can migrate the load from the source nodes (which have surplus workload) to the comparatively lightly loaded destination nodes.

When you apply load balancing during runtime, it is called dynamic load balancing — this can be realized both in a direct or iterative manner according to the execution node selection:

VII. SWARN INTELLIGENCE

"Swarm intelligence (SI) is artificial intelligence based on the collective behaviour of decentralized, self-organized systems". Collective system capable of accomplishing difficult tasks in dynamic and varied environments without any external guidance or control and with no central coordination. Achieving a collective performance which could not normally be achieved by an individual acting alone . Constituting a natural model particularly suited to distributed problem solving

VIII. ANT COLONY OPTIMIZATION

Individual ants are behaviorally much unsophisticated insects. They have a very limited memory and exhibit individual behavior that appears to have a large random component. Acting as a collective however, ants manage to perform a variety of complicated tasks with great reliability and consistency.

Although this is essentially self- organization rather than learning, ants have to cope with a phenomenon that looks very much like overtraining in reinforcement learning techniques

Proposed Work

Ant Colony Optimization For The QAP (HAS-QAP)

Generate m initial solutions, each one associated to one ant
  Initialize the pheromone trail
  For Imax iterations repeat
    For each ant k = 1,..., m do
      Modify ant k;s solution using the pheromone trail
      Apply a **local search** to the modified solution
      new starting solution to ant k using an **intensification** mechanism
    End For
    Update the pheromone trail
    Apply a **diversification** mechanism
End For

Ant based control system was designed to solve the load balancing in cloud environment. Each node in the network was configured with:

1) Capacity that accommodates a certain.
2) Probability of being a destination.
3) Pheromone (or probabilistic routing) table.

Each row in the pheromone table represents the routing preference for each destination, and each column represents the probability of choosing a neighbor as the next hop. Ants are launched from a node with a random destination.

In this approach, incoming ants update the entries the pheromone table of a node. For instance, an ant traveling from (source) to (destination) will update the corresponding entry in the pheromone table in. Consequently, the updated routing information in can only influences the routing ants and calls that have as their destination. However, for asymmetric networks, the costs from to and from to may be different. Hence, In this approach for updating pheromone is only appropriate for routing in symmetric networks.

If an ant is at a choice point when there is no pheromone, it makes a random decision However, when only pheromone from its own colony is present there is a higher probability that it will choose the path with the

higher concentration of its own pheromone type. In addition, due to repulsion, an ant is less likely to prefer paths with (higher concentration of) pheromone from other colonies. Moreover, it is reminded that the degrees of attraction and repulsion are determined by two weighting parameters.

The way ants find their food in shortest path is interesting. Ants secrete pheromones to remember their path. These pheromones evaporate with time. Whenever an ant finds food ,it marks its return journey with pheromones. Pheromones evaporate faster on longer paths.

Shorter paths serve as the way to food for most of the other ants. The shorter path will be reinforced by the pheromones further. Finally , the ants arrive at the shortest path.

IX. CONCLUSION

Till now we have discussed on basic concepts of Cloud Computing.

In addition to that, the load balancing technique that is based on Swarm intelligence has been discussed. We have discussed how the mobile agents can balance the load of a cloud using the concept of Ant Colony Optimization. The limitation of this technique is that it will be more efficient if we form cluster in our cloud.

So, the research work can be proceeded to implement the total solution of load balancing in a complete cloud environment.

Our objective for this paper is to develop an effective load balancing algorithm using Ant Colony Optimization technique to maximize or minimize different performance parameters like CPU load, Memory capacity, Delay or network load for the clouds of different sizes.

In this paper, a heuristic algorithm based Ant Colony Optimization has been proposed to initiate the service load distribution under cloud computing architecture.

The pheromone update mechanism has been proved as an efficient and effective tool to balance the load. This modification supports to minimize the make span of the cloud computing based services and portability of servicing the request also has been converged using the ant colony optimization technique. This technique does not consider the fault tolerance issues. Researchers can proceed to include the fault tolerance issues in their future researches.

X. REFERENCES

[1]. Wayne Jansen, Timothy Grance, "Guidelines on Security and Privacy in Public Cloud Computing", National Institute of Standards and Technology Gaithersburg, January 2011.

[2]. Jeep Ruiter, MartijnWarnier, "Privacy Regulations for Cloud Computing", Faculty of Sciences, VU University Amsterdam International Journal of Web & Semantic Technology (IJWesT) Vol.3, No.2, April 2012

[3]. DanchoDanchev,"Building and Implementing a successful Information Security Policy windowsecurity.com-WindowsSecurity Resources for IT admins.

[4]. David Escalante and Andrew J. Korty, Cloud Services: Policy and Assessment,EDUCAUSE Review,vol. 46, no. 4 (July/August 2011)

[5]. Richard N. Katz, "Looking at Clouds from All Sides Now", EDUCAUSE Review,vol. 45, no. 3 (May/June 2010): 32-45

[6]. Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Cloud Computing A Practical Approach, TATA McGRAW-HILL Edition 2010.

[7]. Martin Randles, David Lamb, A. Taleb-Bendiab, A Comparative Study into Distributed Load Balancing Algorithms for Cloud Computing, 2010 IEEE 24th International Conference on Advanced Information Networking and Applications Workshops.

[8]. Mladen A. Vouk, Cloud Computing Issues, Research and Implementations, Proceedings of the ITI 2008 30th Int. Conf. on Information Technology Interfaces, 2008, June 23-26.

[9]. Ali M. Alakeel, A Guide to Dynamic Load Balancing in Distributed Computer Systems, IJCSNS International Journal of Computer Science and Network Security, VOL.10 No.6,June 2010.

[10]. ibm.com/press/us/en/pressrelease/22613.wss

[11]. http://www.amazon.com/gp/browse.html?node=201590011

[12]. Martin Randles, EnasOdat, David Lamb, Osama Abu-Rahmeh and A. Taleb-Bendiab, "A Comparative Experiment in Distributed Load Balancing", 2009 Second International Conference on Developments in eSystems Engineering.

[13]. Peter S. Pacheco, "Parallel Programming with MPI", Morgan Kaufmann Publishers Edition 2008

[14]. MequanintMoges, Thomas G.Robertazzi, "Wireless Sensor Networks: Scheduling for Measurement and Data Reporting", August 31, 2005

[15]. Ali M. Alakeel, A Guide to Dynamic Load Balancing in Distributed Computer Systems, IJCSNS International Journal of Computer Science and Network Security,VOL.10 No.6, June 2010.

XI. AUTHOR'S PROFILE

Samriddhi Gupta Pursuing M.Tech from Shri Ramswaroop Memorial University (SRMU) Lucknow Completed B.tech from Institute of Technology,Gida, Gorakhpur(Affiliated with AKTU).Area of interest is Cloud Computing.