Comparison of Various Techniques for Load Balancing in Cloud Computing

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Abstract— Cloud computing is innovative technology that provide various applications and services to users. Cloud services are offered to user on the basis of utility, users have to pay only that amount for which they have used the services. Many challenges are there for cloud computing include virtual machine migration strategy fault tolerance, availability, scalability, load balancing and security. An optimal solution for load balancing is to manage proper resource utilization, minimum consumption of resources, minimum fail over, proper scaling etc[1]. Static load balancing algorithm does not adaptive quality of load balancing at run time while dynamic load balancing work dynamically at run time for better result. All nodes with its details properties are required in advance to handle traffic load balancing. Software requires for operating, handling, and integrating the services of various applications over the cloud. Comparison of static and dynamic load balancing done on various parameters analyzed in this paper that includes overhead incurred, support fault tolerance, proper resource management, scalable property etc.

Keywords—Cloud computing, Fault tolerance, Virtualization, Static load balancing, Dynamic load balancing

I. INTRODUCTION

Cloud computing is a type of computing in which demand services of client like network, computing and storage etc. are offered dynamically with the help of internet. A group of distributed servers are used to fulfill the demand of cloud users. Service provided by cloud computing includes shared resources, information, software, and applications etc. as per user requirements.

Conventional computer system that we are using is having a single operating system and all is system centric. Cloud computing uses standard and protocols of network. It provides services that actually run on distributed computing server.

Normally resources of cloud computing are virtual in nature. Mainly three types of services are provided by providers they are software as a service, platform as a service and infrastructure as a service.

Cloud delivered application as service to the end user with the help of internet and also offer hardware and platform in the datacenters for providing that services. Every service is on metered basis and users have not to invest more capital to get this service. Interface used for accessing the services is web browser. Single hardware resource is easily accessible and shared by more than one user using virtualization software. This virtualization technology is used for better and full resource utilization. Figure 1 shows an overview of

cloud computing where various cloud users can avail the services of cloud system simultaneously which consists of services like applications and platform, hardware resources, database, storage devices etc.

With very minimum effort large or even small size business can take ubiquitous services of cloud computing. Service level agreement (SLA) define various parameters of services which are going to delivered to the cloud users which are discussed between cloud provider and user before using any type of service. Service usage conditions are also expressed in SLA. Omnipresent storage and compute power on demand basis is the main reason for popularities of cloud computing. Computing resources that are easily accessible through cloud computing are networks, servers, storage, application etc.[1]

Cloud computing system consists of basis components as:-

- •   Cloud consumers
- •   Datacenter
- •   Servers.

Cloud Consumers
Cloud users can use any of the interfaces to interact with cloud for managing and fetching various information and data. Generally users can use interface using Mobile, thin and thick client.

Mobile smart phone can be used by the cloud users which make cloud accessing easy with the presence of many tools to access the information. Thin clients can be used to display the information. These types of clients have no primary memory. Thin client is not very costly and consume very less power also. Thick clients can use various browsers for connecting with cloud.

Party those who are provided cloud services are called cloud providers and the user who consume that services are called cloud user or cloud client or cloud consumer. Cloud computing provide scaling feature to its users that means it is having the capability to increase or decrease IT resources as per the user need or demands.

An organization or an individual can be cloud consumers that have taken permission and have a formal agreement to remotely access the cloud IT resources from the cloud providers. Service providers have cloud consumers of organization 1 and organization 2 who are using cloud services provided by cloud provider.

Data Center
Data Center is a storehouse consists of various IT and non IT equipment for providing services over cloud computing. IT and non IT equipment's consists of servers, routers, switches, firewalls, storage and backup devices, fire control system and air conditioning for cooling.

Datacenter is actually consists of resources and servers for hosting various applications, services etc. For using services and application cloud users have to connect with the data center which are generally kept distant from the users. As due to large or small size organization migrated to the cloud computing right now data center are consuming a large amount of energy, for providing users better service 24 hours in a day, is a challenge for cloud providers. Emission of carbon dioxide from these data center causes disturbance in the ecological balance, which also causes human hazards.

Servers
Servers are used for hosting various applications over cloud. Users of cloud have not to worry about the complexity of servers they feel that they are accessing the local host while using cloud environment for various applications.

Apart from various services provided by cloud computing it is having some important benefits like:-

1. Data and documents can easily be accessible from anywhere, anytime and many compatible devices are available in market to support the applications.

2. As organization always tries to concentrate on their business logic but some time they are helpless while handling complexity of infrastructure. So, with the help of cloud computing they can handle their business and all complexity related to computing will be handled by cloud providers experts.

3. Protocols and standards exist that allow computers to communicate with each other.

4. Cloud computing reduces initial cost of infrastructure which is huge investment for an organization or company who are going to setup their business. All services related to software, hardware and platform are easily available on cloud and users can avail those services on pay per uses basis.

5. Cloud computing reduces the problem of updating of software's and hardware as cloud users have not be bothered about the software and hardware updating because updated version is made available by cloud providers. Cloud users are also not to worry about the complexity of infrastructure and hardware.

Cloud computing is having some security boundary, as IT resources are sharing by multiple cloud consumers so sometime trust boundaries between them are overlapped. Due to geographical location of data center that are generally very distant from the users, resources are not controlled directly by cloud consumers. There is interference of third party in handling the data over cloud environment.

Cloud computing becomes an attractive and innovative technology for many organizations nowadays. More and more companies start to migrate in Cloud computing. Amazon, Google, Microsoft, Sales Force and Rackspace are the major cloud service providers in the market today. However, we cannot say that all are perfect for all services. The prime factor of today attention about cloud security is for the protection of the user's private data and it's important to safe user's personal and sensitive information.

Privacy threats in cloud vary according to scenario, as some clouds and services face a very low privacy threats as compared to the others one, the public cloud that is accessed through the Internet by everyone is one of the most sensitive area for threats of the privacy concern. Load balancing in the Cloud computing environment is different from the other load balancing. As architecture of cloud load balancing is using a number of resources to perform the load balancing.

Technology used in Cloud Computing
Cloud services are perhaps a quickly growing and developing approach for delivering services from anywhere any time to the customer, on various type of device. Basically Cloud computing uses these technologies:

• Grid computing
• Virtualization
• Utility Computing
• Autonomic computing

Grid Computing
Computer resources dispersed on various locations can be used for a purpose using grid computing. Grid computing can be used for many purposes. General purpose software's can be used to make grid computing.

Virtualization
Virtualization is the strength for any computing and it initiates a layer between Hardware and operating system. Virtualization is the foundation of cloud technology. Users can use services like accessing servers or storage without worrying about server and storage and complexity details. The virtualization layer provides service to users by executing user request for computing resources and accessing proper resources. Resource utilization is also enhanced with virtualization technology.

Utility Computing
Utility computing define billing model of computing resource like electricity bill etc. Based on the utilization users have to pay bill to the provider. Billing for utility computing protocol is already making clear to the cloud users.
Different billing models are there, some of them are:

• Day /hour basis billing- Users have to pay for how many hours or how many days they have used the resource of computing.

• No. of users basis- This type of billing is based on how much users have used this service in an organization or company and for how time.

• On the basis of Data used- In this type of billing users have to pay for how much data or computing resource like storage space they are used.

Autonomic Computing
Computing model with self managing capabilities without any external intervention is called Autonomic computing. It is inspired and works like working of human body nervous system.

Cloud Infrastructure
Cloud infrastructure mainly consists of network, database, server and storage.

Network
For connecting cloud resources over internet and providing seamless services and applications to the cloud users network play a vital role in cloud computing. Cloud users can even customize the services of cloud computing. Network is the key component of cloud infrastructure. It allows connecting cloud services over the Internet. It is also possible to deliver network as a utility over the Internet, which means, the customer can customize various services.

Server
Server is another important component in cloud computing for providing services to the user like resource monitoring, resource granting, and also offers security services over the cloud. Virtual instances of the physical server are available for cloud users.

Virtualization Software
For offering various instance of a physical resource to cloud users as a virtual resource, virtualization software is required. It permits various users to share a single physical resource. There is a virtual machine manager to handle the management of resources.

Software for Managing cloud
Apart from the infrastructure various software are required for managing cloud like infrastructure configuration etc.

Operational Software
Software requires for operating, handling, and integrating the services of various applications over the cloud.

Storage
For keeping data safe and secure from malicious user, storage are replicated at different storage devices for fast accessing and recovering purpose also at the time of failure. Cloud storage devices are available for remote accessing so there is need of security and integrity. Third party involvement is there for handling large amount of data which is a risky part of cloud storage. There is also need for amendment in legal and regulatory issues for accessing of data across national boundary.

Commonly used cloud storage technologies for accessing logical unit are:-

• File access – Data are grouped into files
• Block access- Smallest unit of data that can be accessed individually
• Object access- Metadata and data are arranged as web base
• Dataset access-Data are arranged or organized as table or record form
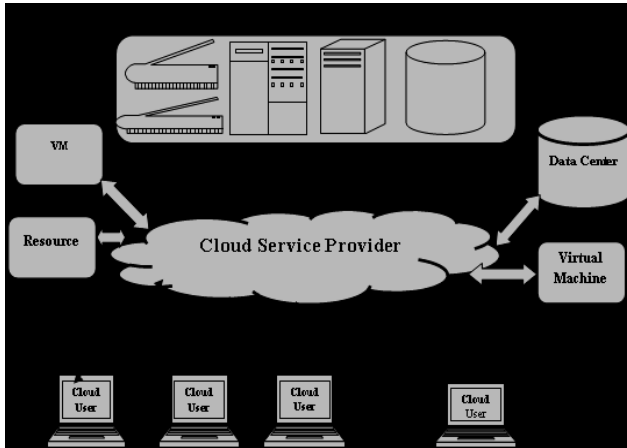
Figure 1 Resource management and scheduling in cloud environment [1]

Charges Monitoring (On the basis of pay per use) – For availing various IT services from cloud computing users have to pay charges, therefore there are mechanisms used for monitoring services provided to users. For evaluating various IT resource usages parameters are always keep in log file for future reference and for billing. Some of them are:-

• Amount of data to be uploaded or downloaded
• Quality of message
• Storage required
• Bandwidth required

For handling all the above monitoring parameters there is a management system that actually calculate the charges that users have to pay and cloud environment also offered independency to users and there is no need to use application on a particular device, so it is an age of technology that support technologies of today time.
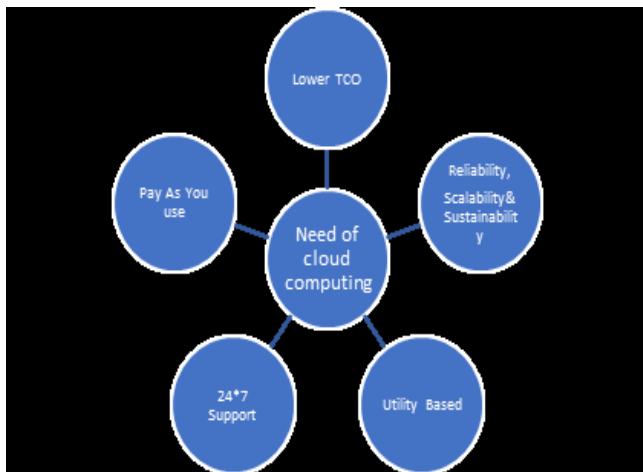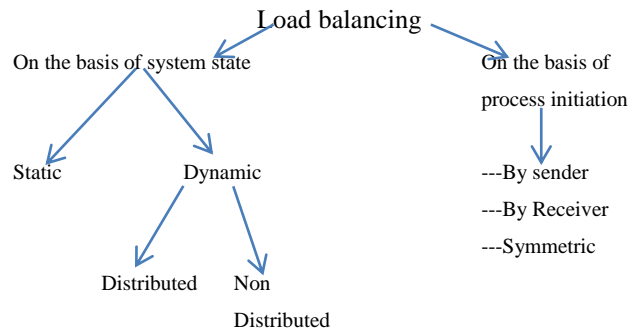

Figure 2 Need of cloud computing[13]

Load balancing in cloud computing classified on basis of various parameter like shown in chart.

There are basically two types of load balancing techniques in cloud computing static and dynamic load balancing.

1. Static load balancing – All nodes with its details properties are required in advance to handle traffic load balancing. This method is easy to implement, because dynamic routing is not required in it.

2. Dynamic load balancing – In this technique, nodes information need to be known in advance and traffic can be handled dynamically with the known current conditions and load status of nodes. It is complex to implement but more effective than static load balancing.

II. LITERATURE REVIEW

Static methods include:[5,6]
Round robin
Static load balancing
Merit – Use of balanced resource
-   Generally allocation of virtual machines to nodes is equal.

Demerit-This method is static that distribute load that known in advance.

Opportunistic load balancing algorithm (OLB)
Static load balancing
Merit- Task assigned randomly to each node, to ensure fair selection.
Demerit- Not to ensure for better result because it is slow process that work on prior knowledge of node status.

Min Min algorithm algorithm
Static load balancing
Merit – Better result with jobs having more execution time.
Demerit- Some lead to the problem of starvation.

Max min algorithm

Static load balancing

Merit – Large tasks get first priority.

Demerit- Large tasks executed first sometime create mode delay time for small tasks.

OLB+LBMM- Two phase scheduling load balancing.

Static load balancing

Merit- Better resource utilization and so enhance efficiency.

Demerit- Does not support fault tolerance.

Table.1- Comparative chart (Static load balancing)

	Overhead incurred	support fault tolerance	Proper resource management	scalable property
Round robin	Y	N	Y	Y
Opportunistic load balancing algorithm (OLB)	N	N	Y	N
Min Min algorithm algorithm	Y	N	Y	N
Max min algorithm	Y	N	Y	N
OLB+LBMM	N	N	Y	N

Dynamic load balancing[5,6]

ACCLB

Merit – Support fault tolerance

Demerit- Better scalability

Honeybee foraging

Merit –Support load balancing globally

Demerit- Addition overhead and workload.

Biased random sampling

Merit – Performance is best with known resources.

Demerit-Addition overhead increases and performance degradation with increased work load.

Active clustering

Merit – High resource availability

High throughput.

Demerit- System not performing well in all situation of system diversity.

Table.2-Comparative chart (Dynamic load balancing)

	Overhead incurred	support fault tolerance	Proper resource management	scalable property
ACCLB	N	N	Y	N
Honeybee foraging	Y	N	Y	N
Biased random sampling	Y	N	Y	N
Active clustering	N	Y	Y	Y

III. CONCLUSIONS

Dynamic load balancing is an adaptive mechanism that evenly distributed work load to the entire node that maintain resource utilization ratio. Existing techniques mainly focused to reduce overhead associated due to load balancing, response time, minimum fail over , proper scaling etc. [9]Static and dynamic load balancing have its own merit and demerits. So, there is scope to minimize demerit after analyzing the research paper based on comparison of static and dynamic load balancing done on various parameters analyzed that includes overhead incurred, support fault tolerance, proper resource management, scalable property. Due [12] to popularity of cloud computing requirement of proper load balancing and resource scheduling and that can be achieved by methods like configuring scheme as per requirement, self optimization techniques etc.

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