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An Proficient Algorithm for Resource Provisioning in Fog Computing

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***Abstract*—Cloud computing means sharing of computing resources throughout any communication network by employing virtualization. Virtualization permits a server to be sliced in virtual machines. Every virtual machine has its own applications/operating system that quickly adjust resource distribution. Cloud computing provides several advantages, one of them is flexible resource distribution. To satisfy the needs of clients, cloud environment should be elastic in nature and can be obtain by effective resource allocation. Resource allocation is the phenomenon of allocating existed resources to clients throughout the internet and plays critical role in Infrastructure-as-a-Service (IaaS) model of cloud computing. Flexible resource allocation is needed to optimize the assignment of resources, reducing the response time and increasing the throughput to enhance the cloud computing performance. Enough solutions have been introduced for cloud computing to enhance the performance but for fog computing still effective solution have to be discovered. Fog computing is the virtualized intermediary layer between cloud and clients. It is a highly virtualized technique which is same as cloud and offer computation, data, storage, and networking facilities between cloud servers and end users. This paper presents an effective algorithm and architecture for resources provisioning in fog computing environment by employing virtualization technology**.

***Index Terms*—Cloud Computing, resource Allocation, Fog Computing, virtual machine and virtualization

I. INTRODUCTION

Today, cloud computing is a developing technology that can be described as a tool which offers tremendous advantages to their end subscribers. It is an on-demand service model which is remotely exist to subscribers, highly scalable and assigns resources to the subscribers in pay as-you-go way. Cloud computing provides several facilities as on-demand self service, resource polling, broad network access, rapid flexibility and evaluated service. Cloud computing is composed of four deployment models. 1).Public cloud 2). Private cloud
3). Hybrid cloud 4). Community cloud [1]. Public cloud offers facilities for general subscribers throughout the internet. Private cloud is ruled by some private organization for their private utilization. Hybrid cloud is combination of private cloud and public clouds. Community cloud is a type of private cloud which is shared by some organization having similar needs and targets. Cloud computing provides service models are Platform-as-a-service (PaaS), Software-as-a-service (SaaS), and Infrastructure-as-a-service (IaaS) model. The integration of above three models is known as XaaS that refers anything-as-a-Service. By SaaS service cloud provides readymade applications and need software to the end subscribers throughout the web. PaaS offers platform to make coding or formulate own software and application for the end subscribers. IaaS provides virtual software and hardware i.e. storage, computing resource, networks and operating systems to the client machine.

Cloud computing has numerous advantages i.e. increased storage, reduced cost, flexibility, decreased time for implementation and reduced time life cycle. Fig.1. illustrates the features of cloud applications.

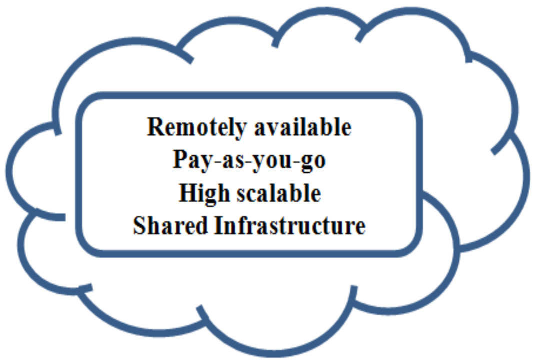

Fig.1. Characteristic of Cloud Application

II. RELATED WORK

This section is about to study and survey the work of other writers. In resource assignment, many writers already have been introduced their work in cloud computing environment. In our work, we are considering an intermediary layer of fog to build the architecture more effective. Fog is carried out nearer to the end subscribers. Hence fog computing offers better quality of service i.e. power consumption, network bandwidth, throughput and response time as well as it decreases the traffic throughout the internet. There are various resource allocation mechanisms in cloud computing. Network resource allocation techniques and how these techniques can be carried out in cloud computing environment talked about in [3]. There are several scheduling algorithms for resource assignment, but there is a need of efficient resource allocation technique for satisfying the need of users and reduce overall cost for the subscribers as well as for cloud servers. The primary aim of resource allocation algorithm is to organize the VMs on the server that places in the data centers. There is a small review of resource allocation strategy based on market, optimized resource scheduling algorithm, resource allocation rule based model, scheduling with multiple SLA parameters, congestion control resource allocation model, scalable computing resource allocation and service request prediction model.

III. PROPOSED ARCHITECTURE

In cloud computing, the effective resource assignment is the primary aim to achieve the economic advantages. Resource allocation plays a significant part to improve the performance of the whole system and enhances the customer satisfaction level. Server virtualization is an inherent part of resource assignment. Server virtualization improves the resource usage of the system, entire response time and total measured cost. The work depends on cloud computing technique combined with fog computing technology. The primary characteristics of fog computing is mobility, location awareness, distributed geographically and low latency. Fog computing is not the substitute of cloud computing, but it decreases the limitations of cloud computing and build it effective. Our paper stresses on the effective resource allocation algorithm and its availability in fog environment [16]. We first examines the several available algorithms of resource assignment after that we have planned the framework to formulate this algorithm. This introduced architecture is carried out for solving the problem related to resource overflow and underflow, fault tolerance as shown in fig 3. To cover the resource allocation problem in fog environment, we have introduced a design model.

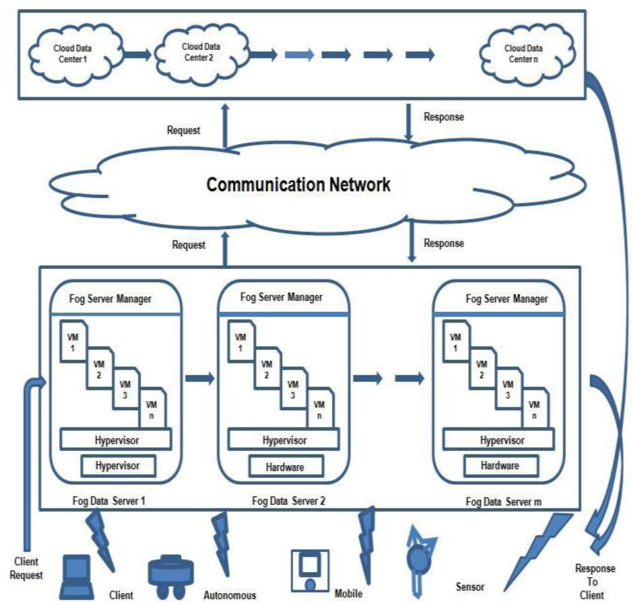

Fig. 2 Three Layer Architecture for Resource Allocation in Cloud-Fog System

This model is built in a cloud-fog environment. So, the model has three layers i.e. client layer, fog layer and cloud layer. First, we carry out the algorithm in client and fog layer to satisfy the need of resources for clients. If no resource is present in fog layer then request move to cloud layer.

Step 1. All the data centers will be scheduled in cloud layer and in fog layer. Every fog layer has no. of fog data server (FS) and cloud layer has no. of cloud data center (CS).

Step 2. Every fog data server (FS) will consist fog server manager (FSM) which will examine the existence of the processor and have the responsibility to maintain the VM’s.

Step 3. In starting, any client will present their request to any fog data server (FS), and then fog data server submits the request to its fog server manager (FSM).
Step 4. Fog server manager (FSM) will process the service request in following situations.

I. If all the requesting processors are existed to first fog data server, then it submits the result to the client and client forwards an acknowledgement to its fog server manager to manage the list status.
II. If only some requesting processors are existed to fog data server, then total task is classified into no. of subtasks as per existence.
III. If fog data server is in assignment but early release state, then client will wait for minimum time constraint; then submits the request to fog data server.
IV. If all processors obtain at one fog data server but some are failing during processing, then it will again process the request as in II situation.
V. If no processor is existed in fog data servers within its fog cluster, then the request is forwarded to cloud data server.
Step 5. If the sender has not obtained the result of their request within maximum assigned time, then client will wait for processing.
Step 6. For further processing client request is forwarded to cloud data server (CS).
Step 7. The cloud data server will offer the processor to client directly to enhance the response time and forwards an acknowledgement to respective fog server manager.

B. Functional Components

Role of FSM: To enlist all the processors existed to the client.
Role of VMs: To manage the fog data server request and processed the request then offer the result to fog server manager.
Role of FS: It consist one fog server manager and no. of virtual machines to manage the request by utilizing the server virtualization technology.

IV. SIMULATION SETUP AND EXPECTED RESULTS

A. Simulation Tool (CloudAnalyst)

The introduced algorithm and architecture is modeled on Cloud Analyst software. To find out the cloud model performance, modeling and simulation is the significant tool to examine and formulate the performance of introduced architecture [17]. The important application of Cloud Analyst is to measure the distributed cloud system performance and provides the result in the chart and table [18]. Cloud Analyst is an inherent part of Cloud Sim framework and made on Cloud Sim tool kit [19]. Cloud Analyst developers can find the best method for resource assignment of existed data center and mechanisms to choosing data centers to serve requests and cost related to these operations [20]. Cloud Analyst is utilized for two policies: service broker policy and Load balancing policy. We have employed this Cloud Analyst tool to measure the performance of the introduced algorithm and architecture.

B. Description for Simulation

To measure the performance of the introduced architecture and its algorithm, the Cloud Analyst tool parameters required to be set. The aim of this tool is to compare the available algorithms. We have adjust the parameters in the configure simulation menu from the Cloud Analyst tool window as per our introduced architecture. We adjust the parameters for the introduced architecture in two phases and as well as we consider the same parameters for other available algorithms. We consider the simulation tile as 40 minutes. Every data center having 8 VM's, Xen VMM, Linux operating system, 0.1 is cost per VM $/Hr and 0.1 is data transfer cost $/Gb. These parameters are adjusted for all the configuration setup in first and second phase. In first phase we adjust the parameters for client-fog layer in nearest data center service broker policy, in this we have considered three user bases (UB1, UB2, UB3) and data centers (DC1, DC2, DC3). The position of subscribers has been defined in three different regions (4, 2 and 1) of the world. One data center is positioned in region 2, second is positioned in region 1 and third is located in region 4. This is the parameters adjusted for fog layer and client layer. Now, in second phase we adjust the parameters for fog-cloud layer in nearest data center service broker policy. But now cloud layer become data centers and the fog layer becomes the user base. In fog layer there is one data center (DC1) and one user base UB1 because only one closest fog server is chosen by client if no processor is existed to fog layer. There is only one data center in second phase because one fog server forwards its request to its closest cloud server. Position of users has been defined in only one region 1 of the world and one data center is positioned in region 0. In the third phase, we adjust parameters for client-cloud layer and not taking the middle layer, in arrange dynamically with load balancing policy and in analyze response time. In client layer there are three data centers (DC1, DC2, DC3) and three user bases (UB1, UB2, UB3). Position of users has been defined in three different regions (4, 2 and 1) of the world.

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One data center is positioned in region 0, second is located in region 3 and third is located in region 5.
In the4 figure 3 and 4 compare throughput data and delay in fog computing with virtualization and fog computing without virtualization using cloud analyst tool with Riverbed. In this the blue line indicates fog with virtualization and red line indicate the fog computing without virtualization in both bar the throughput value flow in bit per second.

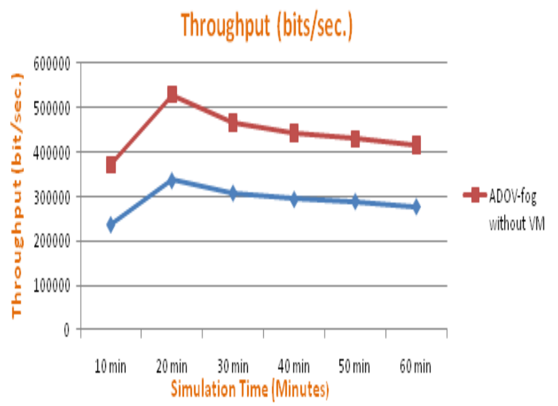

Fig. 3- Throughput of fog computing with & without VM

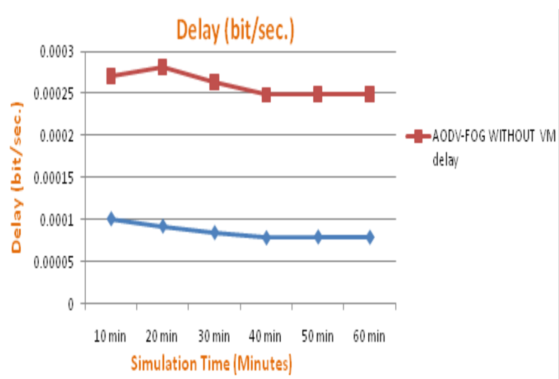

Fig. 4 – Delay of fog computing with & without VM

V. CONCLUSION

Fog computing is employed in our work because it enhance efficiency of cloud computing and decrease the amount of data that requires to be propagated to the cloud for data storage and processing. It is ineffective to transmit all the sensors to the cloud and data of Internet of Thing (IoT), fog computing cover this problem. So fog refers to deliver the idea that the advantages of cloud computing can be brought nearer to the client. This paper provides the concept about the importance of effective resource assignment and its related ideas. Cloud computing is complicated to understand without resource assignment because it offers decreased infrastructure cost and flexible scalability. We review several available algorithms regarding to optimal resource assignment and many scheduling methods. In this paper, an effective resource allocation architecture and algorithm (ERA) has been suggested and carried out on cloud analyst tool to examine the performance of the suggested method in the fog environment.

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