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Performance Evaluation of the Dynamic Resource Allocation in Fog Computing

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ABSTRACT— Virtual Machine (VM) technology has matured, computational resources in Fog systems may be partitioned in fine granularity and allocated on demand, resulting in three technologies: Formulating a deadline-driven resource allocation problem using the Fog environment and VM resource isolation technologies, as well as reducing user payment. It also offered an error-tolerant strategy to ensure task completion within the deadline by analysing the upper bound of task execution length based on the possible inaccurate workload prediction. Validating its efficacy in a genuine VM-enabled cluster setting with various levels of competition. Fog computing makes it incredibly difficult to investigate both Fog and fog resource scheduling strategies in order to optimise resource utilization efficiency. users' Quality of Service requirements are met, and both resource suppliers and user's profit is maximized. The Cost Optimization Algorithm with Fog Management requires an economy that efficiently handles the service of several users while also being resource-efficient and profitable. It mixes long-term and short-term rentals, which cannot only meet quality-of-service standards in the face of fluctuating system workload. The system proposes a resource-renting model called Double-Quality- Guaranteed (DQG), which mixes long- term and short-term rentals.

IndexTerms—Fog,Cloud,VM,Resourceallocation

I. INTRODUCTION

In Federated Vehicular Cloud Computing (FVCC), dynamic resource allocation having many problems like operating cost will be very high and delayed user requests and QoS also not that much good. Federated Vehicular Cloud Computing doesn't support IoT applications.

Fog computing is a kind of network architecture that connects cloud computing with the Internet of Things .It is used to enhance the system efficiency and security. Fog computing is useful for when only selected data is required to send to the cloud. The selected data is useful for long term storage. Fog computing plays a vital role in IoT devices. It will allow the data transmission among IoT devices and cloud services. Always data transmission will be very faster because data will be stored in the network edge. Examples include Car to Car Consortium, Devices with Sensors, Cameras. So, in fog computing, dynamic resource allocation having many be good. Cost and Time will be less.

Fog computing moves computing systems and storage very closest to the devices,applications, components. Because of this latency is greatly reduced. Generally, IoT devices will produce huge data.

These devices are having less latency in fog computing. Since those are very nearest to the data source. Fog computing goal is to lower the latency and increase efficiencies.

Advantages:

Minimize the latency:Since it isvery nearest to the data source, prevents system failures, manufacturing line shutdowns. It will do the quick alerts and reduce the danger for users.

Reduce the operating costs:Because of processing data in local, operating costs will be less.

Enhance security: Since fog nodes are deployed using same policies, it will provide enhanced security.

Fog Computing Applications

Smart/Connected car manufacturers: Fog computing plays a major role in connected vehicles. This feature will reduce the accidents and enhance the safe driving.

Industrial IoT (IIoT): All manufacturing plants relies on the fog computing to get and process the huge amount of data in the local instead of cloud. It will increase the good data accuracy.

Smart cities and grids: Accurate data is essential in all the systems which are available in smart cities. Using fog computing, sensor data will travel faster.

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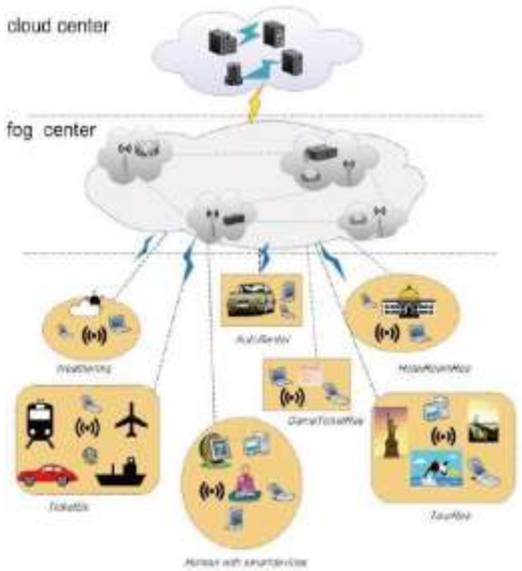
Fog computing is a kind of network architecture that connects cloud computing with the Internet of Things .It is used to enhance the system efficiency and security. Fog computing is useful for when only selected data is required to send to the cloud. The selected data is useful for long term storage. Fog computing plays a vital role in IoT devices. It will allow the data transmission among IoT devices and cloud services. Always data transmission will be very faster because data will be stored in the network edge. Examples include Car to Car Consortium, Devices with Sensors, Cameras. So, in fog computing, dynamic resource allocation having many advantages like resource utilization and Quality of Service will

Fig.1 Fog CloudActivation



II. LITERATURE SURVEY

EXISTING SYSTEM

The demerit of dynamically allocatingresource in FVCC (Federated Vehicular Cloud Computing)doesn't support wide range of IoT applications and cost of the system is very high and doesn't provide better QoS.It does not handle more requests with lower cost.

A. Pricing-Based Strategic

FogPrime performs theexisting methods in termsofutilization of resource and the cost.Due to the limitation of resources sub applications not served. Proposedschemewill serve all the services.

B. Resource Aware Cost-Efficient Scheduler

A Resource Aware Scheduler (RACE) performs for all work loadsby means of minimum time execution, lower bandwidth, and less cost monetary. Here the challenge isbandwidth consumption and costwill be high when fog devices getting increased. This scheme will resolve bandwidth consumption and monetary cost issues.

C. Dynamic Resource Allocation and Computation Offloading for IoT

The average execution cost of the fog computing system can be minimized. The disadvantage here is the fog node will load the data to the cloud center if it does not have sufficient computational resources. Theresultshowsthattheproposedschemehandle its own even if it does not have enough computational resources.

D. A Contract-Matching Approach

Using Contract-Matching mechanism vehicles will share their resources and resolve the task assignment problem. Here the challenge is when the knowledge of channel and vehicle states are unknown, performance will not be good. In this scheme even if vehicle states are unknown, performance will be good.

E. Reinforcement Learning methodusing Heuristic Information

Here VFC algorithm is efficiently loading services to VFs in the long term. But the major problem with this approach is the Internet of Vehicle won't give service reliability for applications. Proposed scheme will give service reliability.

F. Predictive Offloading and Resource Allocation

Here the resource allocation not handled properly when wireless channel states are unknown. That causes stopping the entire decision-making process. Proposed scheme handles the decision making wisely even though wireless channel states are unknown.

G. Dynamic Energy Efficient Resource Allocation methodor Load Balancing

Here using Dynamic Energy Efficient Resource Allocation (DEER)strategy is an good resource allocation method for load balancing in fog environments for reducing the consumption of energy and cost. Here the challenge is Fault-

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tolerant resource allocation method is not available in fog environments. Proposed scheme will handle Fault-tolerant based issues.

H. Resource Management using a Novel Bio-Inspired Hybrid Algorithm (NBIHA)
This paper talks about the effective utilization of resources in fog-IoT using a novel hybrid resource management approach (NBIHA). But No facility available to avail the reinforcement learning techniques to managethe resources in the fog-IoT environment. Proposed scheme will support for organizing resources in the fog-IoT environment.

III. PROPOSED METHOD

In fog computing, dynamic resource allocation method using Resource Allocation Algorithm to increase the utilization of fog resources and provide better Quality of Service requirements.
This technique used to predict task completion time and allocate fog resources dynamically.
The important benefit of this resource allocation method is that the resources will be allocated without any error and resources will be allocated in less time and less cost.

The Cost Optimization Algorithm with Fog Management requires an economy that efficiently handles the service of several users while also being resource-efficient and profitable. It mixes long-term and short-term rentals, which cannot only meet quality-of-service standards in the face of fluctuating system workload. The system proposes a resource-renting model called Double-Quality- Guaranteed (DQG), which mixes long- term and short-term rentals.

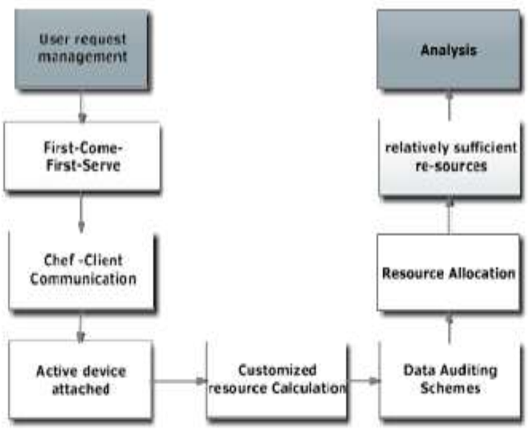

Fig.2ArchitectureDiagram.

UserRequestManagement

The cloud proxy receives and replies to user requests (or tasks) with tailored requirements on a continuous basis in cloud systems (or virtual machines).
When jobs have the same priority, they will be processed according to their priorities (like task scheduler) or
according to the First-Come-First-Serve (FCFS) policy. The execution of each task may require several resources, such as CPU and disc I/O.

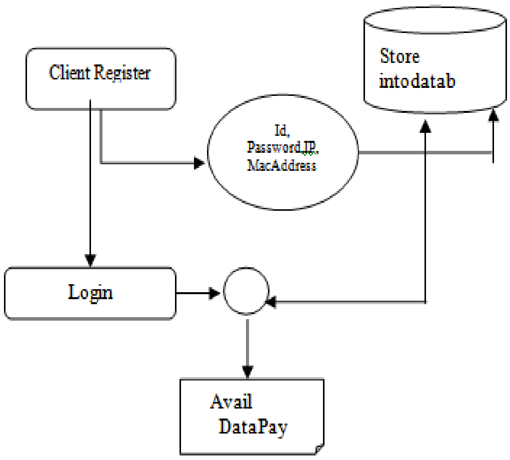

Fig.3 BlockDiagram of user request management.

Send to CloudSerer
2BlockDiagramofProposedmethod.

Chef–ClientCommunication
A physical node can be a server or avirtual machine, but it can also be anyactive device connected to a networkthatcansend,receive,andforwarddataacrossa communicationschannel. To put it another way, a physical nodeisanyactivedeviceconnectedtoanetwork that can execute a chef-clientandcommunicatewithaserver.

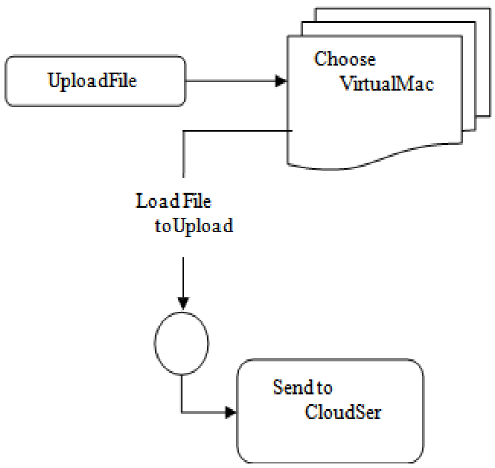

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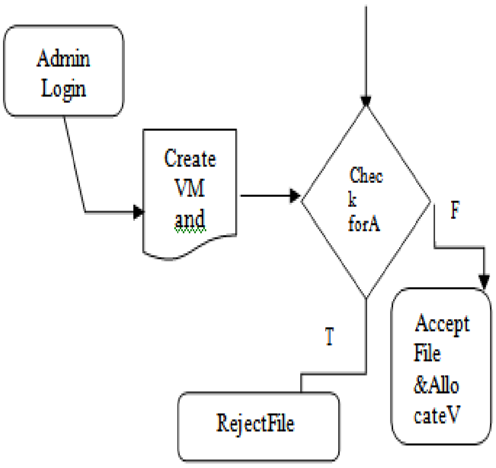
Fig.4BlockDiagram of Chef-Client communication.

CustomizedresourceCalculation

Any work will be conducted on one or more virtualmachineswithuser-totheprotectionofdataauditingsystems,thecloudserverwillnotdeliberatelydestroyormodifyuserdata but will attempt to understand thesubstance of the stored data as well astheidentitiesofcloudusers.

Fig.5 BlockDiagram of customized resource calculation



DataAuditingSchemes

Inthislesson,localcloud will be setupandofferreasonablypricedstorage.Userscanuploadtheirinformation to the cloud. Thismoduletomakecloudstoragesafer. Users, on the other hand, do not fully trust the cloud because CSPsareverylikelytobeoutsideofthetrusteddomainof cloudusers.Thatis,due totheprotectionofdataauditingsystems,thecloudserverwillnotdeliberatelydestroyormodifyuserdata but will attempt to understand thesubstance of the stored data as well astheidentitiesofcloudusers.

ResourceAllocation

Although this module demonstrated tobe the most cost-effective for lowering payment costs within the deadline for their assignment, thedeadline may not be guaranteed due totwo factors: limited resources availability or faulty workload vector informationaboutthetask.
Proposed effectivetechniquethat guaranteesthetask'sdeadlineunderthe necessary and sufficient conditionsof accurate forecast and comparativelysufficientresources.

TheAlgorithms

Theallocationtechniqueallowsforresourceprovisioningtobeautomated. The difficulty that the FogCloud operator has is determining themost appropriate physical and virtualresourcestoservetheseapplicationswhileadheringtothepreviouslyagreed-uponparameters.Thiscloudsystemresourceallocation techniquesupports Virtual Machine multiplexingtechnology, which seeks to reduce taskpaymentbyusers.AccordingtotheAlgorithm,the mostimportantaspectis the local optimal resource allocationforexecutiononaspecificnode.
Inreality,theentirealgorithm'sultimate outputted resource allocation solution will be globally optimal over the entiresystem as long as each local process onagivennodecanbeproventobeoptimalresourceallocation.Asaresult, by selecting a specific executionnode,thiswillgooverthelocaldivisible-resourceallocationindepth.

Algorithm1:Optimal allocation algorithm

Optimal allocation algorithm

- Input: $D(t_i)$; Output:execution node p_s, $r^*(t_i)$
- $\Gamma = \Pi$, $C = D(t_i)$, $r^* = \phi$ (empty set);
- Repeat
- $r_\Gamma^*(t_i, p_s)$ = CO-STEP (Γ,c);
- on Γ^*
- $\Omega = d_k / d_k \in \Gamma \; \& \; r_k^{(*)}(t_i, p_s) > a_k(p_s)\}$;
- $\Gamma = \Gamma \setminus \Omega$/*$\Gamma$ take away Ω* /
- $C = C - \theta \sum_{d_k \in \Omega} \frac{f_k}{a_k}$ /* Update C* /
- $r^*(t_i, p_s) = r^*(t_i, p_s) \cup (r_k^{(*)} = a_k(p_s) | d_k \in \Omega \; \& \; a_k(p_s)$
- is d_k's upper bound};
- until ($\Omega = \phi$);
- $r^*(t_i, p_s) = r^*(t_i, p_s) \cup r_\Gamma^*(t_i, p_s)$
- end for
- Select the smallest p(ti) by traversing the candidate solution set;
- Output the selected node ps and resource allocation r*(ti,ps);

Fig.6PseudocodeofAllocation mechanism

Algorithm2:PredictionfortheTask'sCompletion Time(PTCT)

Input:APT PNTask.Output:Thetimecostτ(σ)ofasequenceσ.
1:constructanewPetrinetwhichonly hastheplacesandtransitionsofPT PNT ask based onPTPNTask
2:foreach transitiontmin sequenceσdo
3:if thearcassociated with tidoesnotin thePetrinetthen4:addthearc tothenet
5:endif
6:endfor
7:achievea subnetofPT PNTask

8:denotethisnewPetrinetmodelasSPTPNT askwhichdoesnotexistconflicttransition
9:foreachbasicsequential,concurrentandloopstructuresinSPT PNTask do
10:repeat
11:conductthesimplificationprocessesinaccordance withFig.10(a), (b),(c)respectively
12: until the resulted non-conflict structured net illustrated inFig.11isobtained
13:endfor
14:thetimecostofsequenceσ isτ(σ)15:returnτ(σ)

Fig.7DataFlowDiagram of proposedmethod.

IV. RESULT AND ANALYSIS

Intermsofusertaskcompletionprobability,comparedouralgorithm MFR to the standard multi-user work scheduling methods MinminandMaxmin[7].Thenumbersinparenthesis on the graph represent thealgorithm's average performance. MFRhas a mean of 0.986, with Minmin andMaxmin both at 0.938. As seen in thegraph, our method MFR has a higherlikelihood of finishing tasks than theothertwoalgorithms,andinmostcasesitissuperiorto them.

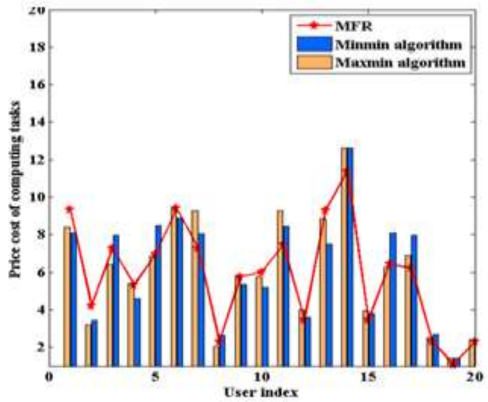


Fig. 8 shows the comparison between PredictionfortheTask'sCompletionTimealgorithm MFR,

In terms of the cost of accomplishing a user job, Minmin and Maxmin are the best options. As can be seen from the graph, the pricing cost of MFR to accomplish the task for any user is lower than the other two algorithms in all but a few cases (user1, user2, and user13).
MFR, Minmin, and Maxmin had mean values of 5.85, 6.08, and 6.03, respectively.

Fig. 9 Resource allocation output

V. CONCLUSION

The workexaminesthepractical problem ofdynamic resource allocation strategy for vehicular cloud computing, having many problems like operating cost will be very high and delayed user requests and QoS also not that much good. Federated vehicular cloud computing does not support IoT applications. Fog Computing provides the option to improve the resource utilization efficiency, better user's Quality of Service requirements increase the profit of both resource providers and users. A resource allocation algorithm has the good error tolerance ability, also reducing users payment within the deadlines. Moreover, this method used to predict task completion time, compute resources evaluation and allocate fog resources dynamically. This scheme can provide good resource selection for user's task scheduling and enhance the utilization of fog resources.The idle physical resources can be arbitrarily partitioned and allocated to new tasks; the VM-based divisible resource allocation could be very flexible.

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