Policy Based Load Distribution Algorithm in Fog Layer

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Abstract: To minimize tasks migration from a virtual machine to another, PBLB first adds the cost of arrival to the complete load of the scheme and verifies whether the scheme is maintained or not. In this thesis, the author implements Policy Based Load Balancing (PBLB) to reduce the workload. In order to minimize the overall power usage while finishing calculation activities within a certain time limit is optimized the job distribution for computational loading to distinct download locations. To solve the problem of computer offload, we first define the calculation energy efficiency and divide the problem into four sub problems based on calculating energy efficiency and the maximum tolerable delay of the different types of computer offloading. Policy Based Load Balancing (PBLBs) is spread in the environment like Join Idle Queue (JIQ) because there are several planners present. Minimum Completion Time (MCT) and Join the Shortest Queue (JSQ) are not dispersed in nature in other integrated methods.

Keywords: Load balancing, policy based, fog computing, offloading,

I. INTRODUCTION

The Internet of Things (IoT) is a fresh technological paradigm that in recent years has gained considerable attention from large areas of research was highlighted by Hamilton, J (2009) [1] and Henning, JL (2006)[2]. The IoT will link topics and medical practitioners seamlessly in the future health care circumstances. According to Gope and Hwang (2016)[3] Wireless Body Area Network (WBAN) becomes an evolving study field globally by advancing wearable detectors, integrated circuits (IC) and wireless communication techniques. WBAN is a wireless network that allows health surveillance anywhere around the human body, which is also recognized as the Body Sensor Network (BSN) explained by Gravina (2017)[4] and Poon *et al.* (2015)[5].

This can be used for e-Health apps, including computerized recovery, early identification of medical problems and warning of emergency. Mobile phones have been nearly essential to everyday lives, particularly smartphones, in latest years. As this can be shown in the Figure 1, the WBAN and IoT cloud can be used.

Data about wearable medical detectors are being collected and transferred by IoT healthcare systems. This information is personal and sensitive and therefore the safety of intelligent health devices is a major issue. Data are further prone to leakage, interception and alerting the patient attender. It is essential to guarantee that distant centres to which the information is sent are authenticated and authorized to observes the data. Various policies for safety in healthcare apps have been proposed by Yuce (2010)[6], Fortino *et al.* (2014)[7] and Aloi *et al.*(2017)[8].

Intelligent health study relies mainly on defining profitable company sectors whereas technology's social factors are ignored. A technique for implementing moral, ethical, legal and cultural measures appropriate to a specific health framework was proposed. First, in the form of propositional statements, we convey ethics that are applicable to a intelligent medical system. Then it is defined with different device operations situations that may contribute to ethical infringements and develop the necessary ethical reaction.

Consider an intelligent medical device that controls a patient's pulse rate, warns near relatives and a licensed physician when an emergency occurs. Only selective data must be communicated with family members and physicians in accordance with ethical norms of the region. For example, in case of emergency the economic costs for a health condition such as a loan etc. shall only be disclosed to a certain relative / guardian. The state also values strongly the lives of its people and applies a rigorous law requiring the complete obligation of healthcare suppliers to provide emergency SOS to close families / physicians. Failure to fulfill these circumstances will result in heavy penalties. If the scheme provides fake urgent warnings, similar laws apply. Medical legislation also needs that intelligent healthcare suppliers cancel the identification of personal information after 5 years of mortality, and non-compliance leads to okay.

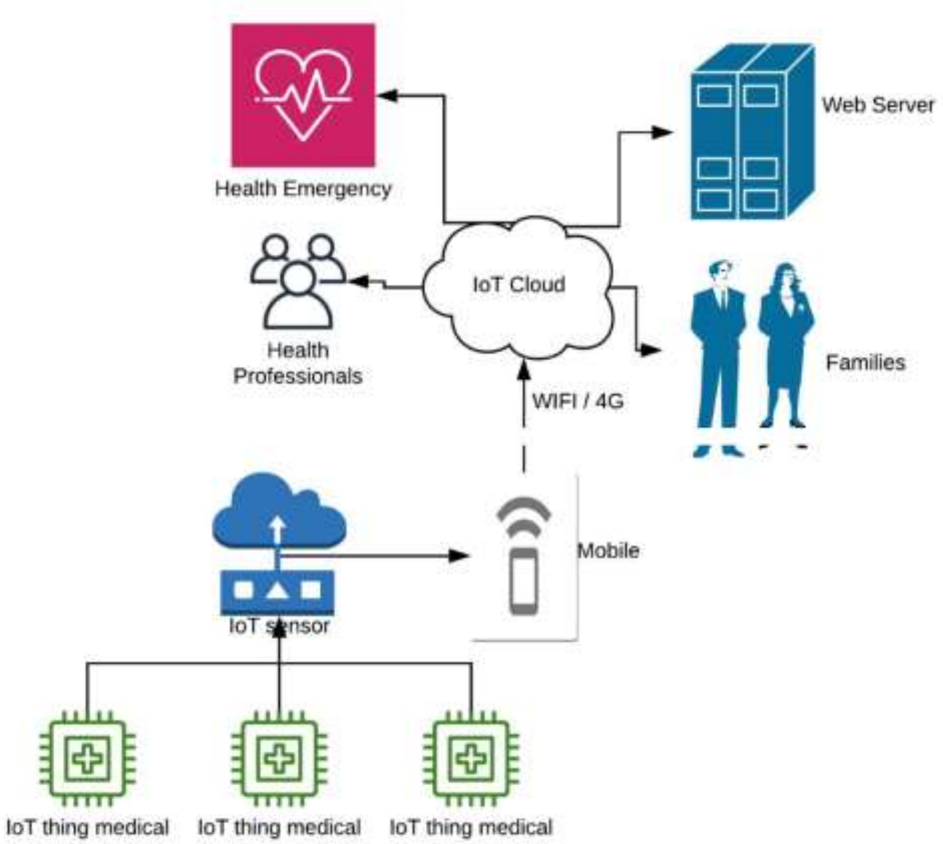

Figure 1: Healthcare Environment

II. RELATED WORK

The literature has shown a very limited effort towards the efficient use of IoT cloud services, particularly cloud resource management, to address evolving requirements in health care. The model described by Atif *et al.*

(2017)[9] indicates the distinction between sequential and simultaneous task performance using a cloud-based model. Finally, the relationship between implementation moments, input and output file dimensions is provided. The vibrant resource allocation was carried out through easy heuristic modeling by Sonoda *et al.* (2013)[10]. Scaling the virtual machines significantly decreased ECG data analysis services reaction and execution time. K. Kadarla *et al.* (2017)[11] implemented the master-slave model for parallel processing and evaluation of ECG results.

Each node carries out several functions including pre-processing of information, extraction of functions, report generation and implemented the above functions with Windows Azure and Blob. Henian Xia *et al.* (2010)[12] presented a model for uploading ECG information into the cloud to be processed. But there is no method to display Amazon Web Services resource allocation for them. The mobile cloud strategy for uploading and analysis of ECG information from mobile device to cloud also exhibited by Kwak *et al.* (2017)[13]. Both mobile and cloud are educated on the design of the Artificial Neural Networks (ANN) using different diagnostic precision, implementation and effectiveness parameters. This strategy still lacks the virtual resource allocation technique on the cloud.

In view of the computing and communicating capacities of common items in everyday life, IoT is expected to be the most important technology in the millennium. In actual moment, a individual has been monitored by the Body Sensor Network (BSN) technique and a large number of initiatives and scientists were suggested. The internet of stuff in the sports field is not a fresh idea. The IoT participation in the area of sport is explained by value and team was highlighted by Vogt *et al.* (2016)[14], Seeger (2015)[15]. It includes a scheme that can monitor soccer players in real time and proposed a IoT oriented safety surveillance in sport, IoT oriented safety surveillance in sport, Dixit *et al.*(2015)[16] put forward a multilayer architecture. It is focused on distinct levels in which sensor measurements can be generated, processed and monitored. The significance of the layered notion, which can be used in an effective IoT healthcare system, was obviously stated. In this paper the difficulties encountered in the design of these schemes are also highlighted. Zeng *et al.* (2015)[17] offers an architecture based on gateways which is included in our system design. This article highlights the significance of a prevalent portal for sensor measurements to be captured and evaluated and the effectiveness of the entire scheme improved. The proposal was made for a multi-threaded treatment algorithm that specifies extract from information in real time.

More serious is the fact that funds are not allocated in accordance with information requirements. Workloads between patient and cloud are however mainly significant and need to be taken care of immediately. In this work, we intended to study the effect of cloud reaction moment on clients during a wide range of workload conditions owing to mass information generated. Due to the patient's seriousness, irregular virtual funds may be required to instantly tackle the patient's issues, unlike ordinary health circumstances[18]. The complexity of patient health status is equal to the workload in the WBAN scheme and the need for digital funds thereafter. This leads to the development of a relationship with a HealthRate on the seriousness of patient safety. The health level is immediately equal to the patient's health status depending upon a variety of parametric measures such as temperature, blood pressure, heart rate, ECG measurement, EEG measurements, blood glucose and cell counts[11].

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TABLE I: DIFFERENT HEALTH SEVERITY LEVELS[11]

HEALTH STATE	TEMP (◦F)	HEART RATE(/min)	BP(mmHg)
Normal	98-100	65-85	101-104
Low Severiety	97, 101	85-100, 50-65	141-170, 71-100
Abnormal	96, 102	100-110, 40-50	171-200, 40-70
Critical	95,103	110-120, 30-40	200-220, 20-40

In the proposed method, the experimental parameters are dynamically simple, with a temperature, cardiac ranking, blood stress of 20%, 20% and 60%. However, a consistent and simplified framework may be specified. A person is healthy if the heart rhythm falls between 65-85 per minute between 98-100 daF and 101-140 mmHg in blood pressures. Likewise, a individual may typically enter a low severity or serious disease. Table 1 displays the related set values. The safety status in Equation (1) is dependent on the patient's situation. Because of different safety metrics such as temperature, pulse rate and blood pressure, this quality standard depends on separate rates.

$$T_\alpha = (200 - 40 * |99 - T|) \qquad (1)$$

where T in F reflects the patient's present temperature. Here, T rate value varies from 0 to 200 with 99 as the patient's default temperature value. Anything above or below (e.g. 99+T) (99-T) is anomalous. Thus, we have taken the complete (99-T) value to show an anomaly. A 40 factor is used to normalize the frequency at a proportion of 20%, with two additional parameters. In the line of 0 and 200 using Equation (2), a rate (called "T") is described.

$$HR_\alpha = (200 - 4 * |75 - HR|) \qquad (2)$$

where HR_α, per minute, is cardiac rates. Here, the recommended normal heart rate is between 20 and 200, and 75. A multiplication factor of 4 as shown in Equation (3) is used in this notation.

$$BP_\alpha = (600 - 6 * (120 - BP|) \qquad (3)$$

Blood stress in mmHg where BP_α is. Here, the BP frequency varies from 0 to 600, with a limit of 120 as the default value of ordinary blood stress and 6 as shown in Equation (3).

$$HealthRate = a * T_\alpha + b * HR_\alpha + c * BP_\alpha \qquad (4)$$

Here the weight for a further adjustment of prices to the user's requirements is a=[0,1], b=[0,1] and c=[0,1] connected with the measuring health parameter. In order to show disease level, variants of these parameters was selected. The amount of HealthRate attained in the range of 20 and 1000 by distinct combinations of three parameters. This range values for health rates are presented in separate pairs.

III. FOG ASSISTED IOT BASED MEDICAL CYBER SYSTEM

The workload in the cloud with popular scheduler algorithms such as First-Come-First-Serve (FCFS) and Round Robin for the virtual funds accessible[21]. Because these are static methods, the demands can improve dramatically over moment and the amount of Virtual Machines(VMs) stays continuous. Such a circumstance may cause a danger to the patient because of delays in the provision of facilities for the patient because the funds are unavailable. This lack of availability causes the response time to rise and thus the system overloads. On the contrary, the requests may be very limited at one point in time, and so some VMs may be idle and cost the patient huge cloud services[22].

These IoT-activated phones are typically used in the body of traditional diabetes, cardiac patients, etc. For eg, a patient with sufficient resources often requires milliseconds of response time. A standard is set to reduce the customer's expenses, which will maybe make life simpler for the consumer even with gaps in operation and resources[23].

In such cases, the cost reduction for the patients is affected by effective use of cloud resources. In addition in such an setting, reaction times can differ, which is an extremely essential consideration for a critically ill person to live. The primary objective of the work is to explore the response time for standard methods.

The differentiated service was given to customers of the IOT implementation through a new policy-based entry mechanism into the Fog Computing Field. The consumers may access customer support from Fog to operate their critical data faster on their edge network instead of having the consumer in the cloud environment. The software strengthens the strengths of the ISP and Cloud platform at the peak of the network. This extension of service enables vibrant resource provisioning dependent on policies through the virtualization edge network feature. The virtualization idea will contribute to the creation of a versatile and managed network setting based on policy as shown in Fig.2, by implementing new techniques such as "Software Defined Network (SDN)" and "Network function virtualization (NFV)". Figure 2 illustrates how the regulation scheme is built into the IoT framework. A master control server is the code repository in Figure 2, which contains all the rules and guidelines for running an IoT program. The user service management cabinet for storage and legislation such as routing, QoS, resource allocation and business decision-making[24]. All policy decisions are applied in the Political Decision Point (PDP) section, which supplies Master Control Server(MPS) material.

The policy choices are transferred to the policy manager of Fog. Second, the domain policy server has been provided for Fog routers. The domain server Fog had the Domain Manager for MPS, routing, QoS, stability, and smart decision-making. In order to apply the Fog policy option in decision-making and interference, the Fog domain control servers with such domain managers were assigned the Control Compliance Level. Therefore, the Fog Domain Administrator had the authority within the system of execution to pass domain control steps. The Fog Manager will also query the Fog routers regarding tool usability before being submitted for regulation analysis and intervention assessment. Any irregularities on the Fog router were identified to the Fog network policy manager. Fourth, the wireless mesh routers may be linked to the Domain policy application.

Domain policy managers were assigned to the Domain Manager by the Fog Manager who has a law that applies QoS, routing and protection guidelines for wireless routers.

In Figure 2, R1, R2, R3….. Rn representes the local router within the local network which form the cluster. And all these routers are connected to Cluster Head (CH). These cluster head are responsible for transferring data to higher level for either processing or for storing.

Finally, the domain policy server would be informed of any anomalies in the wireless router. Policies that are delegated to the applications below the structure of the corresponding executives in the policy oriented design for the IoT scheme and assign strategies to a realm below its structure. These policymakers have the power to make strategies complementary, delete and alter and report back to executives above the structure. Each domain device and router would speak for intervention to the corresponding executives. These executives would then informs the supervisor above the structure via the system router and then go over to the MPS supervisor who would connect to the Cloud server via a grid network. Domain to access communication would also take place via the domain router.

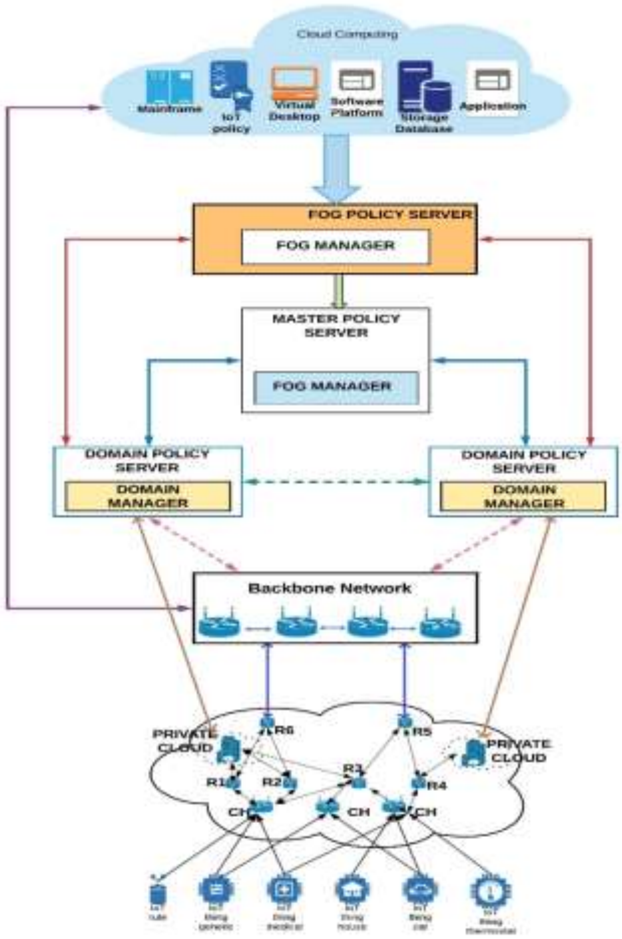

Figure 2: Fog Assisted IoT Based Medical Cyber System

$B_{i,j}$ shows the fraction of usable bandwidth of path 'j' allocated to the IOT device's healthcare sessions on fog sheet, while we say that the healthcare session 'i' is allocated to Path 'j'. The band-width of the health care session is therefore $B_{i,j}x_{i,j}$,, in which xi is identical to a binary variable of 1 if the usable direction is allocated to the healthcare demand session flow, and 0. Then the healthcare session i is assigned to path j, then $C_{i,j}$ denotes the fraction of the available bandwidth of path j allocated to healthcare session from fog layer to backbone network. Thus, the medical bandwidth is $C_{i,j}y_{i,j}$, where $y_{i,j}$ are equal to 1 when the flow of the demand session for the healthcare is allocated to the direction, 0 if not. And the healthcare session i is assigned to path j, then $D_{i,j}$ denotes the fraction of the available bandwidth of path j allocated to healthcare session from backbone network to cloud layer. The medical session bandwidth is then $D_{i,j}z_{i,j}$, in which $z_{i,j}$ is a binary vector of 1 if the demand direction in the health session is reserved, and otherwise 0. We describe U_i as the utility function of healthcare session i until it reaches cloud it took time T_c to get processed.

So, Total Response time is

$$T_c = \sum_{k=1}^{n} B_{i,j}x_{i,} + C_{i,j}y_{i,j} + D_{i,j}z_{i,j} + T_{i,j} \quad (5)$$

If the processing happens in fog layer as per the proposed algorithm, the total response time for utility function of healthcare session i when it reaches fog it took time T_f to get processed.

Finally, Response time is

$$T_f = \sum_{k=1}^{n} B_{i,j}x_{i,} + T_{i,j} \quad (6)$$

The decision making will take T_c period to execute the at cloud layer which is much higher compared to T_f period which gets executed in fog layer.

IV. POLICY BASED LOAD BALANCING (PBLB)

Incorporating the finest features of minimum closure time strategy and enter the longest queue method, the two-tier scheduler designated Policy Based Load Balancing (PBLB) has been suggested. The Policy Based Load Balancing (PBLB) strategy has also incorporated a previous inspection system, which utilizes a number of schedulers instead of a centralized scheduler, is shared in essence.

A. Delay Analysis for Fog Computation Offloading

In initial stage evaluation of the time statement for the fog calculation discharge is considered before addressing the issue of optimization. Unlike the offload of cloud computers, which usually has only one offload destination, the offloading of fog computers requires a certain number of fog computer servers. Because the Multi-Tenant (MT) only has a single radio interface, calculation tasks information should be transferred in a divided moment. The complete delay has distinct meanings based on the connection between communication and computing delays[25].

If the time for the calculation is sufficiently lengthy, the complete time relies primarily on the delay. In the limited situation, the limit to fog computations is the delay in transmitting MT demand emails to all the fog servers, the delay in managing a single-fog server computing job and the delay in returning one of the fog signal to the MT.

If the time to calculate is brief, the complete time relies primarily on the interaction time(horizontal line) as shown in Figure 3 (a), 3(b). The time for fog-computing offloading in the communication-limited situation is the delay in delivering the MT demand emails to all the fog servers and the delay in delivering the reaction emails to the MT from all the fog servers as

$$z_2 = z_{fog}^{(req)} + z_{fog}^{(rsp)} \qquad (11)$$

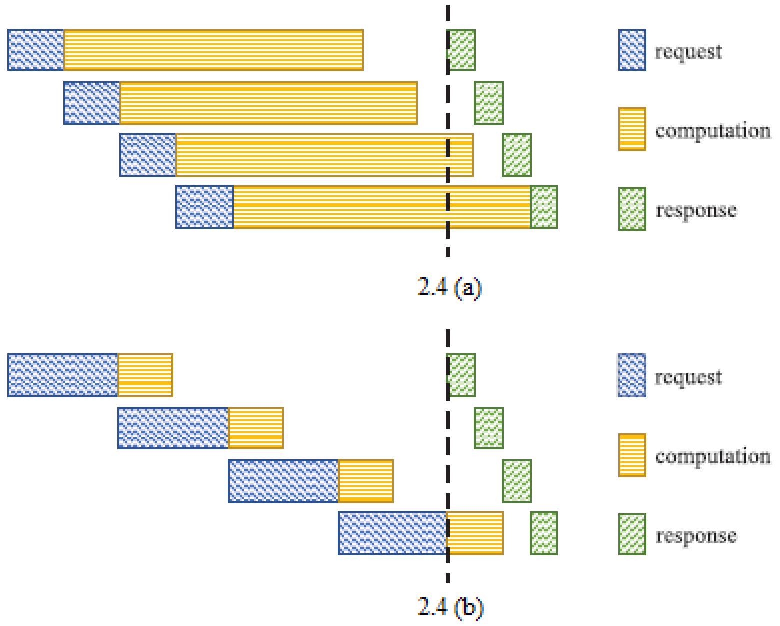

Figure 3:a) Computation – Limited Delay, b) Communiation – Limited Delay

B. Scheduling For Computation Offloading : Communication-Computation

The delay to meet Z, Z_{max}'s late computing limit can be reduced by adjecting the work distribution of both kinds of offloading in the first-time cloud computing and first-in-computing offloading subproblems. The particular alternative relies heavily on interaction and calculation schedules for downloading the computer to various download locations. We bring the first computer-offloading cloud issue as an instance in this chapter to address the remedy of the issue of communication-computing schedules. Similar approaches can be used to analyze the first fog offloaded computation problem and we omit the information for brevity.

This issue planned communication and computing components for separate offloading locations, aimed at reducing the complete delay by exchanging communication and computing components with the following limitations:

delay limit: $Z \leq Zmax$;

Order limit: For a particular location, the system order of the downloading of the computing assignment must include request-computing-response;

Communication limitation: At the most one communications link can be enabled on the same moment owing to the single radio interface of the MT.

Instead of minimizing overall energy consumption E, we attempt to maximize the quantity of cloud computations that load X_{cloud}.

As a consequence of a decrease in the total delay by that the device amount of fog offload and the MT only has one radio protocol, details for cloud and fog computing transfer can not be transmitted concurrently. Additional processing activities can be done as quickly as possible by combining the programming portion of the offloading fog machine and the contact segment of cloud storage offloading and of the programming portion of cloud computing. We list 4 seasons for both styles of computations according to demand order and answer as,

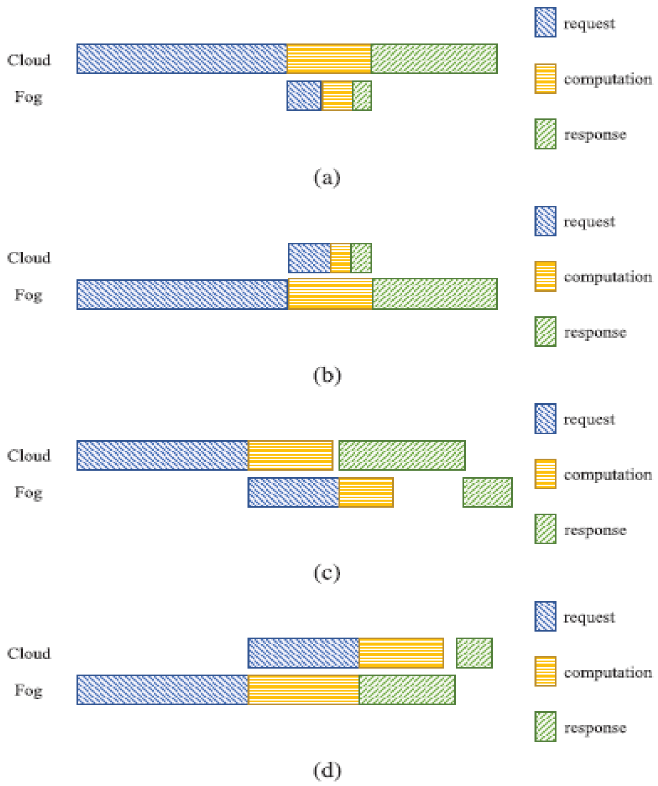

Figure 4: Illustration of different Scheduling cases a) CASE 1. b) CASE 2. c) CASE 3. d) CASE 4

CASE 1 (cloud's request first, fog's response first): The cloud downloading computing portion of the algorithm and the complete fog downloading method are overlapped.

CASE 2 (fog's request first, cloud's response first): The calculation portion of the fog calculation is discharged and the whole cloud calculation method is overlaid.

CASE 3 (cloud's request first, cloud's response first): The calculation component of the offloading of cloud computing and the demand portion of the fog calculation are superimposed. The cloud computing reaction portion and the fog computing portion are overlapped.

CASE 4 (fog's request first, fog's response first): The calculation portion of the fog calculation download and the cloud computing download portion are overlapped. The reaction portion of fog download and the computing portion of the cloud download are overlapped.

The above four scheduling instances are seen in Figure 4. We then evaluate for each situation the feasible domain and the optimum update solution.

The findings of the simulation reveal that if the suggested hybrid computer discharge of $\eta < 1$, the energy requirement is as much as fog computer discharge and $\eta < 1$ is as efficient as cloud computing discharge. This means that hybrid downloading allows a great decision between cloud downloading and fog downloading.

Note that the better choice is only assumed to be big enough for Z_{max}. Without cloud downloading or fog offloading the suggested hybrid computation downloading may finish the calculation duties in tiny Z_{max}.

C. Communication-Computation Parameter Regions for Subproblems

The importance of η is focused on the ability to communicate and compute cloud offloading and fog offloading, e.g. ., e_{cloud} ; e_{fog}; μ_{cloud} and μ_{fog}. Since the cloud and fog computational offloading effect factors are independent, the fog computing download parameters when evaluating them.

The Figure 3(a) shows e_{cloud} and μ_{cloud} impacts. The flat line implies that cloud and fog computing offloading receive the same quantity of energy to perform the same calculation activities as η = 1. The flat line is a horizontal line because μ_{cloud} does not appear in the expression of η, The inclined line offers a limit to determine whether cloud download can finish the computing duties, which is the answer to the cloud-only download issue. The entire area is divided into three areas by these two lines. Fog offloading uses less energy than cloud offloading in the" Fog-only & Fog-first' area. In the' cloud-first' region, offloading the cloud computation consumes less energy than offloading the fog. However, to fulfill the tasks at a time constraint both types of offloading are essential. Cloud offload is sufficiently capable of performing the computation duties in the" Cloud only" region.

V. RESULT AND DISCUSSION

The impacts of of e_{fog} and μ_{fog} are demonstrated by Figure 5(b). In Figure the flat line is the same. The green curve gives a limit for evaluating whether fog-only offloading computation can finish the calculation duties that solve the fog-only offloading subproblem. Just like fig. Like fig. 5(a), the room is divided into three areas by two bends. Cloud computing discharge consumes less energy than fog computing offloading in the' Cloud-only & Cloud-first' area. Fog offloading consumes less power than fog offloading, but both computing kinds are essential to finish the activities of the area "Fog-first" Fog offloading In the area the delay constraint. Fog only offloading in the region has sufficient ability to perform the computer duties. In the region Fog only.

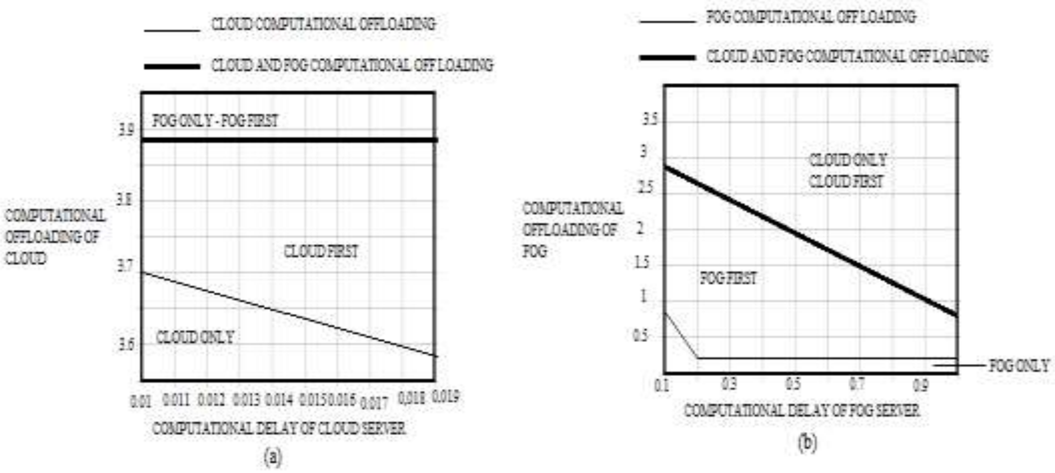

Figure 5a) shows e_{cloud} and μ_{cloud} impacts b) The impacts of of e_{fog} and μ_{fog}

On the cloud analyst simulator for environment setup stated in chapter 2.4.1, a Policy Based Load Balancing (PBLB) method was evaluated. Figures 2.8, 2.9 and 2.10 illustrate that in 5 distinct simulation settings

Policy Based Balancing efficiency has been shown, which takes into account the three parameters respectively response time, information time, and price.

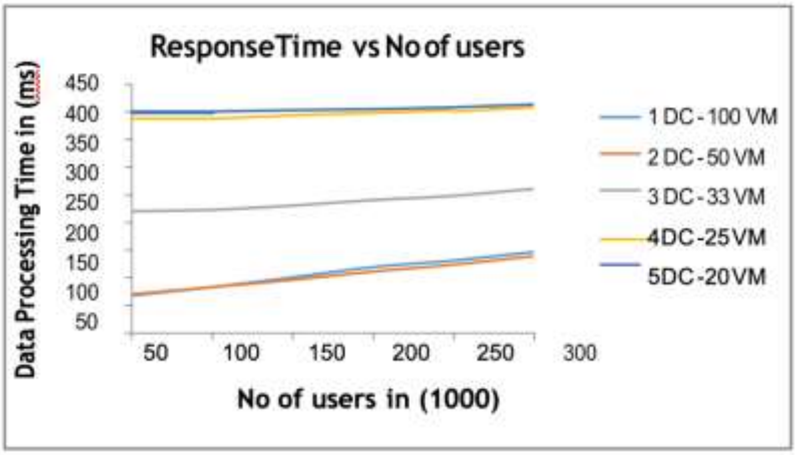

Figure 6: data processing time with number of users

In Figures 6, 7, 8 the moment, response time and price of handling can be evaluated as the amount of customers increases. There is a progressive and exponential increase in information handling moment, response time and price. This gradual increase shows that the strategy is robust. Here Data Center(DC) and it Virtual Machine(VM) were grouped.

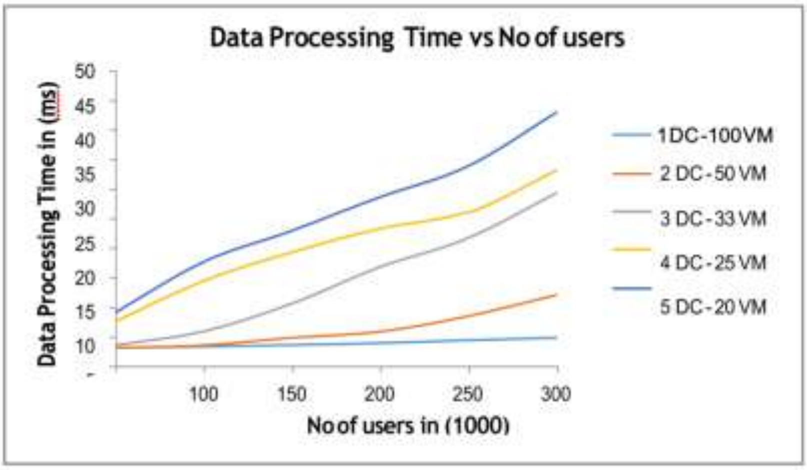

Figure 7: response time with DC Configuration

In addition, as the amount of data centers and VMs in a data-center reduces while the overall number of VMs stays the same, the increasing number of users may be measured in order to maximize information processing speed, response time and expense. It is how the job is moved from one data center to another in order to avoid the function from getting overwhelmed in a data center. Many users will switch from one data center to the next. That amounts of individuals, which decreases the expense and the moment that information is delivered and stored.

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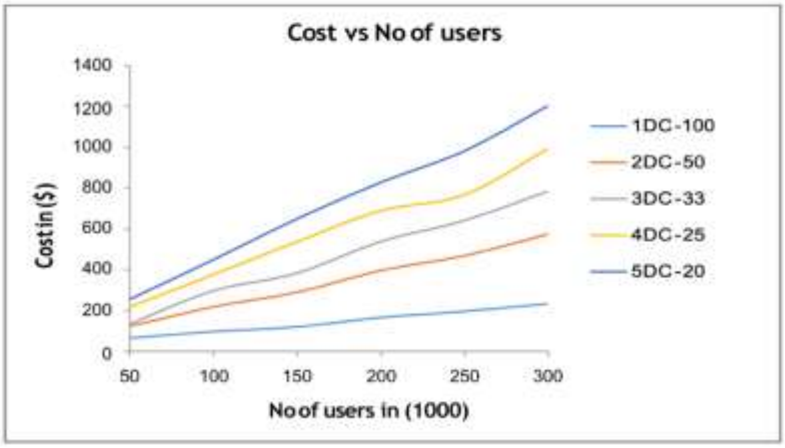

Figure 8: response time with number of users

The efficiency of all methods is similar for a tiny amount of consumers. However, with the increasing amount of users, their output is no longer similar. The performance of Policy Based Load Balancing (PBLB), JIQ, MCT and JSQ are comparable for all load balancing metrics, but the round robin, equally stretched and throbbed, is very poor. This shows Policy Based Load Balancing (PBLB) and JIQ methods ' stability and skilfully structured nature.

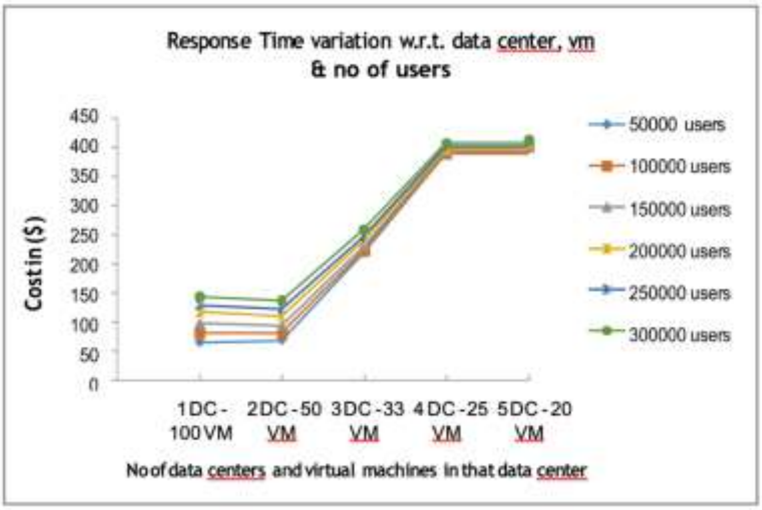

Fig 9: cost with Response Time

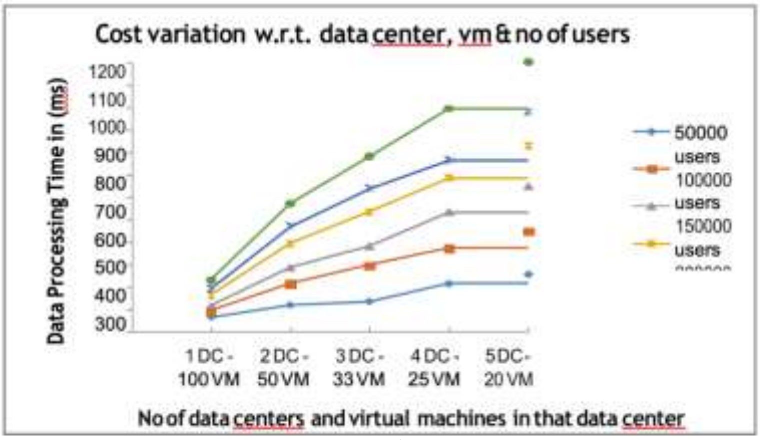

Figure 10: analysis of cost with DC

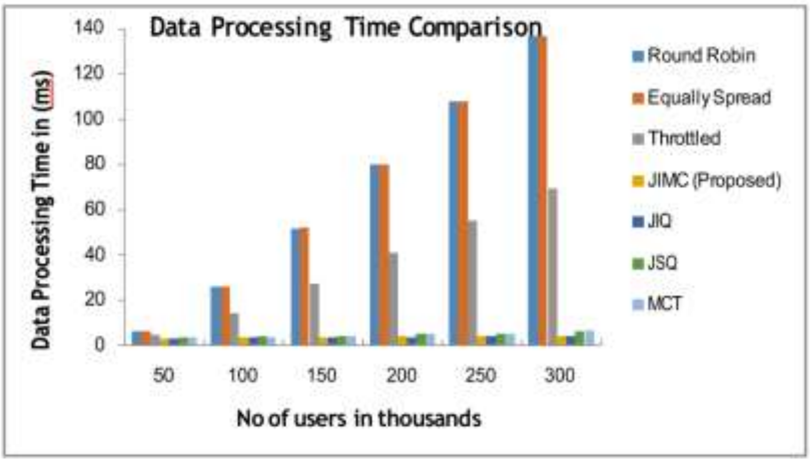

Figure 11: Data processing time analysis

Figures 11 and fig 12 show that reaction times and handling times are initially similar. But the double or triple amount of customers is no longer similar with their results. The fundamental nature of this strategy has made it happen. The strategy that takes all variables into account such as VM ability, queue duration, queue size and arrival job requirements during VM mapping work is superior. Due to all these variables, Policy Based Load Balancing (PBLB) showed improved outcomes on the reaction moment and information handling time scale in contrast to current ones. Policy Based Load Balancing (PBLB) performance has not been affected by the increase in the number of users.

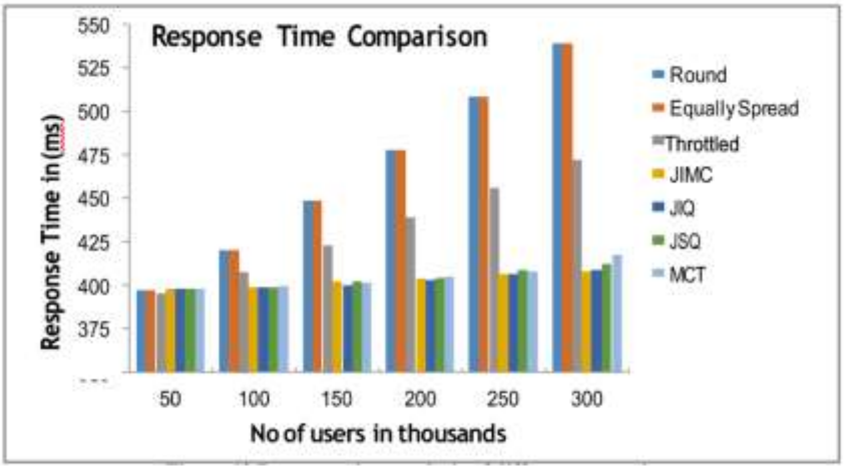

Figure 12 Response time analysis

The expenses connected with the use of RAM, storage unit, job migration are engaged in the simulation setting. This will also lead to a higher handling expense if a planning strategy creates more time for a job. In comparison to the other Policy Based Load Balancing (PBLB), the response time and data processing time are also much less than other Policy Based Load Balancing's (PBLB) costs.

The PBLB offers the previous overload check function which cannot be used in any other strategy. PBLB provides an additional overload monitoring function. There is no benefit of job mapping with this scheme when a machine is already overloaded.

VI.CONCLUSION

The hybrid network dilemma with two forms with locations: cloud data servers and fog database servers for uploading. The job allocation for the measurement transfer to different loading locations is tailored in order to reduce the overall energy usage when the work is done in a limited period. In order to address the question of the offloading of the device, we first define the energy output of the machine by splitting the issue into four separate subsets depending on the energy capacity and the lowest tolerable period of the measurement. In order to provide a closed-form offloading solution for all subproblems, we give an assessment for the coordination estimates under the delay cap. The figures demonstrate that the suggested method of offloading equations, thus performing the calculation activities within a timeline, decreases the energy usage relative to the conventionally organized device discharge.

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