NOVEL ENHANCED INTELLIGENT SYSTEM FOR OPTIMAL SELECTION OF VM IN CLOUD USING APSO (ANALOGOUS PARTICLE SWARM OPTIMIZATION)

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ABSTRACT:

Cloud computing is one of the foremost feature in Healthcare Services. It can be used to retrieve information about patients, their records related to diagnosing, treatment taken and other medical information in less amount of time. In this field choosing of an optimal VM is a challenging and more interesting in Healthcare services. The approach to choose the best optimal VM helps in increasing the performance of healthcare services thereby reducing the running time to execute the request. This paper propose a novel and enhanced version of PSO called Analogous Particle Swarm Optimization (APSO). The performance is compared with Genetic Algorithm and PSO. The evaluation is done by considering three parameters such as waiting time, utilization of CPU and turnaround time. The results clearly states that the APSO approach performs well when compared to other models. The overall execution time for each particle is computed as 1s and efficiency is seen to be improved by 5.6%.

Keywords: ***Genetic algorithm, Healthcare Services, Particle Swarm Optimization***

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INTRODUCTION

Legacy systems are those that are used mainly to meet the needs that are specific to hospitals. These sort of systems were designed for the purpose healthcare providers internally to meet the needs of the clinic which are superseded and now not that much needed as they lack in meeting the needs of external things of patients and local bodies. Therefore it prolongs in the way so as to improve care for patient and in providing range of services which are broader that supports medical area which

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results in increased cost and sometimes negligence too. But the scope and future of health information systems mainly targets at interoperability, intelligence, integration and innovation so that resources [11] can be shared. To support this HIE (Health Information Exchange) flawlessly made great impact towards bringing in medical standards [16] which provides unified approach to this field and information exchange. Inspite of these features it has not been welcomed and executed without interruption due to its local constraints. To quote an example, a study [21] was conducted which was able to highlighted that EHR's acceptance which was due to data interoperability challenges that was initiated by Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009. Added to this another study benevolences the major issues faced technically in healthcare that includes security, privacy, quantity and execution of Electronic Medical Records.

Furthermore, issues of economic and political healthcare providers of liable factors need to be considered for upcoming progress of medical sharing of information. Very enormous providers in medical field seems to be very lethargic and disinclined to share data of their patients with other providers in healthcare [23]. They just like to exchange within themselves internally and not that much interested with other outside their network [22]. Hence in the current state scheming and mounting a health care information system which is interoperable is still non-trivial task. The reason of this struggle is due to the complexity in acquiring data, communication, storing and manipulation of these data. The most challenging is that there is lack of involvement or coordination among the health care providers for connecting the information. The features that are to be supported by these providers includes various parameters such as data exchange direct means, by means of query related to patients in case of emergency situation: history of medications, diseased person history and managing data by patients themselves. These sort of interoperable systems to support all the above said features need to be wide ranging and multilayered approach so that issues related to technical and non-technical can be resolved. Either of healthcare systems which are self-directed are not subjected to these consideration while development. The authorities in concern are also not willing to apprise their systems, whether it may be centers which are functioning as a whole with liberated electronic health records. It will be remarkable that in case if two or more than hospitals take part then they should be willing to have their settings as such, distributed information is needed for managing patient care effectively and intensively though the patients like to switch their healthcare providers due to various reasons. Health care systems are considered to be the foremost needs and interest for research in medical domain at present. Hence if there system supports multidimensional then the optimal utilization will result in saving the public from death.

Older versions include taking information to be taken from patient records to identify the condition of the patient which includes the diagnosis time to be longer. But when considered these new approaches such as cloud services that enables the time to be reduced and cost is also less. By using these cloud services it makes the transmission of medical records within a second over internet. Additionally provides supports dynamically for requirement change, also to transfer applications thereby supporting infrastructure services to a large healthcare providers. The services include datacenters, layered servers, VMs, resources etc. The data centers holds a

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variety of information that are to be exchanged and consists of many VMs that helps in storing the resources of medical records needed to stakeholders. These systems suffers issues occasionally when there is time delay in request in cloud environment. The reason to these type of issues depends on various reasons and such are time of execution (make span), wastage of resources that are utilized. In order to resolve these constraints we propose approaches that are related to solve these challenges and provide a novel health information exchange system which is considered to have wide implications. A novel intelligent algorithm is used to identify optimal VMs that supports to reduce the time taken for execution of medical request received through cloud environment thereby maximizing the utilization of resources. To bring in the quality initially three algorithms are taken and comparison is done in cloud environment. By the end of comparison we are identifying the algorithm that enhances the quality of health care system. Added to this ensemble approach is done which enhances and bring up the proposed algorithm. The algorithm is said to be optimal based on execution time and speed. First part is to select the optimal VMs that plays a significant role to Health care system thereby by minimizing time and maximizing utilization. Second part includes taking the best algorithm and ensembling it to produce higher efficiency compared to the existing algorithms.

2 LITERATURE SURVEY

There are various advancements that are will in general be the vital highlights of virtual machines, for example, security innovation, virtualization, movement, execution assessment and asset planning. In this part itemized perspective on these innovations that are in presence are dissected alongside issues that are winning.

A. Virtualization

IBM made changed into the same old assignment to broaden this idea in 1960. It on a big stage targeted in on pulling out joined expert pc similarly to fashions with the goal that it'll have the choice to execute on credible device which pass approximately as host. While considering day rapid progression this has introduced up at an enthusiastic price in like way standing enough remote to be visible for deciding on. Simply, it is before lengthy verified to be a key structure block for the modern-day supervising. The virtualization layer is the issue at hazard for interfacing with and dealing with all virtual machines on virtual gadget screen. At the present time, virtualization tactics use both an invigorated, or hypervisor plan [24]. Systems which oblige regulating hazardous and bewildering norms the credible possessions are investigated as tails:

1) Whole virtualization:

Here in this the codes manages the components manages are recommended in for of non virtualizable form since the framework holding the top solution have a major effect in selection of VM. The guest OS does not have any team up with its miles being virtualized and requires no change. In complete virtualization, the i/o devices are allotted to the guest machines with the aid of rehashing the assured gadgets in the virtual machine display screen; help out those devices within the digital air are then predicted to the certifiable valid gadgets either with the aid of the host working structure motive force or by the "hypervisor driving force [25]". From this time ahead, full virtualization can offer the excellent PC.

2) Paravirtualization:

In this part the information from other end of user need to be mentioned and modified as it should be dynamic. When compared to the previous technique here it enables the process of layering the concept of virtualization. This type of approach enables an interface to be

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present that act as an environment of providing tools. Xen [24] put in implementation the concept of this technique that makes the processor to be virtualized and I/O drivers to be enabled with efficiency.

3) Hardware assisted virtualization:

In like manner, the hardware maintain up virtualization arranging makes a relied on "root mode" and an untrusted "non-root mode". [26] On this mode there may be a model AMD-v [27] which maintains up equipment helped virtualization.

4) Aid virtualization:

[29] There are various tactics to control administer manage carry out aid virtualization. As an example, specific elements may also accrued into a more conspicuous aid pool and a single aid, for example, plate area can celebrated into variety of extra unassuming and sensibly open resources of same sort. Trust it or not, restriction virtualization is such a useful resource virtualization, wherein a steady dealing with is made by using abstracting all of the actual celebration sources which might be disseminated over the association. First the affirmed assembling sources are introduced some distance pool which by using then shapes the affordable dealing with. This reasonable gathering that's the assortment of dispersed actual assets sends an effect of being a single strong conglomerating contraption to the consumer. Diverse resources virtualization takes after the cutoff virtualization.

B. Advancement

There are different capacities at the rear of the improvement of a computerized machine, isolating memory and document structure. For instance, from the factor of perspective on a structure boss, the ability to get a whole virtual work area across gear improves the difficulty of expert upkeep. A working device can be traveled through the manager towards another person which enables to make the system enter inside a restricted mode when trying to restore the information which further computes the overall running time of the machine. In order to improve this sort of framework there are so many researches done which in turn makes progress in development of VM. The up gradation process even includes the memory and progress towards the overall formation shape. These headways can be generally affirmed up as follows.

1) Virtual Machine Migration:

In this approach, the design process includes the actualization process of VM. Advancements in these areas are again put up in areas like Xen virtual machines, hypervisor of gear and other OS environments. Zap [28] renders an approach which depicts very clearly the usages that comes under development of VM. It considers the dynamic nature of legacy and is able to form claims that produces a difference in minor way at the top layer of structure deployed. This is nothing but just present the reflection process of domain. Hence in this sort each of the unit represented as system will be able to focus on a cyclic nature that makes points of virtualization in identical way with a view in namespace said to be private. Further in [16] the researchers state that another substitute method can be used to replacing of VM. This in turn represents and stands opposite to the concept of host driven migration. Hence due to dynamic nature, the self-up-gradation and its features are not that much assisted and extra preferences are needed in this case. If an example is taken, where there is overhead in least amount and if need to achieve the related VM then there are possibility of extending its benefits related to security. Due to the movement of VM without the knowledge of the system role, it is very less dependent on the semantic structure of microkernels.

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2) Memory Migration:

As per PC structure that is present virtually, recollection progress seem to be the mainstream segments of advanced PC improvement. At the point when everything is said in done, the memory upgrade can be portrayed into three stages: to be unequivocal push stage, stop and-duplicate stage and pull stage. In the stop-and-duplicate stage, the source computerized processing gadget is done, pages are imitated all through to the objective advanced machine, and along these lines the new virtual work area is begun. In the draw stage, the new virtual registering gadget begins its execution, and on the off chance that it gets to a website which consists of different page that are not seemed to be enhanced or uplifted, then it is condemned, among the other since the relationship is stock VM. Utilitarian technique rules be a piece of plans blending by and large speak me a couple of the above stages. For instance, Internet suspend-continue with shape utilizes unadulterated stop-and-duplicate as its memory progress viewpoint. Furthermore, this structure applies certain first class heuristics to diminish the substance to be moved. Besides, unadulterated top rate improvement procedure utilizes stop-and-duplicate to cross major stage realities structures to the reasonable, which depends upon page defects at the site being moved to [16].

C. Resource planning

Inside the virtual framework shape, structure property are upheld and obliged with the guide of a computerized framework show. Each virtual framework designs the system property for a few endeavors with the valuable asset of utilizing a couple of resource saving figuring's, which can be given by means of limit of the advanced machine show. These resource organizing checks can be basically appeared as follows. The have been given computerized time booking figuring is depicted in [30]. The key of this appraisal is minimal effort complete scheduler depending on the danger of advanced time, dispatching the runnable computerized contraption with the most extreme irrelevant virtual time first. In like way, the figuring offers low-latency sponsorship to progressing and wanted applications by utilizing permitting torpidity faulty shoppers to "reshape" again in advanced event to get designing need. The easy most punctual cut-off date first (sedf) saving figuring is conveyed in [11]. On this figuring, each locale decisions its CPU prerequisites. The store booking correlation is portrayed in [31]. It is xen's most contemporary alluding to allow scheduler which incorporate changed weight changing of virtual CPUs all through genuine blue CPUs on a smp have. Sooner than a CPU goes slight, it will reflect on thought on stand-out CPUs to find any runnable advanced CPU. This structure guarantees that no CPU holds up while there may likewise be runnable work in the shape.

D. Security

On this way, the security wants are better inward the computerized gadget shape than that in like manner air. Also, there are possibly thought processes at the rear of spot, more prominent openings to rebuilding and more interconnection places in the advanced work area structure. To ensure the wellbeing of advanced framework canvases, a couple of security gadgets and frameworks are added. Broader experience with the machines that are advanced in nature enables to bring in security which is very much needed in VM and they are been able to take multi-dimensional aspect in fulfilling this feature [33]. Notwithstanding, if the computerized structure is subverted, the log messages might be obliged through the gatecrasher and on this way are

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presently no more solid. A VMI-ids is portrayed for looking through impedance demands in [34]. By implementing this process the enhanced process is getting executed right on the machine at top most layer and the impedance seeing accreditation structure executes in an advantaged virtual machine and yields records discarded from the inverse vms. The calm hypervisor experience [35] plans to help controlled sharing of possessions among vms on a degree.

E. Execution evaluation:

With the advancement of computerized contraption improvement, the execution of advanced machine begins developed to be the entire component seen as concerned. To take appear to be at the introduction of advanced machine, people blessing a marvelous pile of frameworks and gain a spectacular ground. These factor of view be a segment of a major pile of fields of computerized gadget shape. They may also be on a quintessential stage showed up as follows. Menasc'e bears the cost of a safe introduction rendition for the standard virtualized structures [36]. Bolker and ding [37] advances the idea of feature the virtualized to be empowered with covering models. They focused utilize at staying attempted their model to remember about the arrangement by means of a measuring stick. In [38], menon et al got an execution approach that empowers to overhead execution of PC in regards to the execution evaluation contrasting itself and Xen created approach. In this procedure, a contraption compartment is used to isolate execution overheads completed through developments association programs going for strolls in Xen VMs. In [21], the maker's assessment and separate the CPU schedulers inside the Xen advanced contraption show including cutting edge astounding weight managers. Further in [22] virtualization process is designed in such a way so as a framework is designed to check its shape. During the process involved Xenoprof are used so that the resources present in the cloud can be considered which enables the construction of profiling at different scenarios. Baba [23] states the evaluation system used to evaluate the virtual machine throughput by giving out an environment passage through the plate. Added to these function ye et al. [39] brought in and proposed a structure that enables to reduce the execution time of virtual machine by making it depending on the other model of mapping it together with resources.

3 CLOUD ENVIRONMENT SYSTEMS

In previous section detailed view of entire VM possibilities were discussed. In this section research is done specific on Health information exchange that are mainly related to cloud environment which help in patient records to be exchanged with the help of system that fall under these three categories:

3.1 Cloud-Based Sharing

Generally providers prefer cloud due to its storage capacity, flexibility and scalability that makes the health specialist to take drift and have their own storage for EHR [1]. Hybrid cloud based framework [5] was proposed in which the data access is enabled with attribute based encryption. Further in addition to this another research [12] put forth an approach that combines the attribute based along with identity based which impose access control. Practical solution in cloud for providing privacy without accessing other medical records was proposed [18], where privacy was implemented as different levels that are based on classification of records. In another study [4] it was stated that integrating and sharing the information helps in addressing the issues that are raised in accessing and managing these records. To be precise, it is noted that all the systems designed focuses on encrypting the data and pushing into cloud to preserve it

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secure and safe. But considering public cloud it is not 100% guarantee that the records will be secure without any frauds inspite of data being encrypted. Also added to this when huge data is been pushed inside synchronization cost hikes up and which cannot be just ignored. Hence we focus on indexing strategy that makes the common data to be stored and privacy original data will be still present in private cloud of hospital. Hence to access this isolated data then two-way authorization between the private and public is needed.

3.2 Legacy Electronic Health Record

These systems is not at the level of interoperability since it does not support the feature of exchanging medical records. But still, some noted articles [19] [10] puts out various aids which are accomplished by using this Legacy EHR systems that helps in attaining integration and improvement in this field. This type is suitable for small scale whereas when we consider to adopt in large scale it's not feasible since it has major problem in certain areas like security and privacy [3]. In case of very large hospitals they are reluctant to exchange their patient electronic records externally but will do it internally, this is due to the reason [2] that they don't want to lose their patients. Hence in this case interoperability adaptation is still not practiced and very far away. Due to this environment, it paves a way for the researchers to develop an interconnection between the hospitals. In one of the research it is very evitable that organizing exchange of data is most important challenge [14]. There are so many efforts taken into consideration for Health records sharing. The foremost thing to consider is information interoperability. In one study [17], the registry containing metadata and semantic info that helps for referencing query, processing common data element helps to attain interoperability. Inspite of using the latest ideology still in this field it's very difficult due to the terms and vocabulary used.

3.3 Privacy Preservation in EHR

Privacy is the next major and very critical challenge in sharing medical resources. The techniques like cross domain and fine grain are studied in detail [20]. It focuses on on-demand revocation which explains that if any one of the hospital not interested to share their data further. In another research [6] it describes the concept of messaging through mail like protocol that enables to transfer information related to health in online. But this also describes the possibilities of attack that might happen when this sort of technique is adopted [9]. Hence when considering all these things it is very clear that privacy need to be considered as the primary focus when developing this sort of system. Hence the process of interoperation can be handled by using various steps such as authenticating the access when it is been shared between the hospitals and identity of the particular patient. If all these features are to be implemented then more additional work need to be put in to maintain this large set of parameters so as to get associated with patient. Getting associated with the patient then it can be done by generation of hash code so that first the identity number can be mapped then the health records linked with the number will be retrieved. Hence to have data very secure more number of studies came to existence. These studies state that sharing of data and trying to breach the data has become a very major concern. In one of the study [7] it was proposed the usage of block chain in Electronic Health Records. The access of data are stored as transaction which are further used for tracking and controlling permission. So taking this into consideration the privacy issue we propose two way authorization so that security will guaranteed. Added to this using of hash map to

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locate the resources present in the cloud will be added advantage to the system.

4 METHODOLOGY

Health care system uses different devices such as smartphones, laptops and PC's through which records are send with the help of cloud and services are restored back related to prediction, diagnosis records. Now the agency holding the cloud said to be cloud broker will organize the entire process of transmission and receiving the request and response from cloud. This contains many servers integrated which provides service that can be allotted to carry out the task given to the cloud. When coming to the server each one has set of resources that can be used for the request raised. To monitor this entire process the person responsible will be the admin so that they will be able to coordinate among the servers present among the different clouds. Hence to provide this an optimized and intelligent algorithm must be applied so that it would suit the best that enables to choose the optimal VM to enhance the process of scheduling that helps to reduce the time of request and response and helps to utilize the resources to the maximum. The overall architecture depicting the process of proposed system is illustrated in Fig.1 and the flow of work is represented in Fig. 2. The overall concept includes the process to be divided into four phases: Device from where request is raised, intermediate cloud broker, content requested and administrator of network. When we consider the stakeholder, they can either be patient themselves or doctor or a health expert system who are trying to retrieve the record using any sort of devices. Through this device the request are send and processed to cloud for getting the information from them. The services provided by the cloud can be either prediction or diagnosis and analysis of any kind of diseases. The next process is that cloud broker turns as a midway amid the device and cloud that act as a point of request forward. Now inside cloud there are so many VM servers that are present which executes the request. As explained earlier the VM holds collection of resources and further mapped to the request. After this process, it's the work of the administrator who is main person taking care of coordinating the VM inside and outside the network probably supporting the selection process which must be optimal. The proposed system is been implemented using swarm intelligence approach, PSO, PPSO and APSO. The optimal VM is decided based on the parameters considering CPU utilization, implementation time of request and fitness function, waiting time. The turnaround time (TAT) is nothing but the time taken from submission of request to the execution and completion of request. Waiting time depicts the time taken after being ready for execution. Utilization time refers to the work amount done by CPU. Added to these parameters the burst time is also taken for consideration.

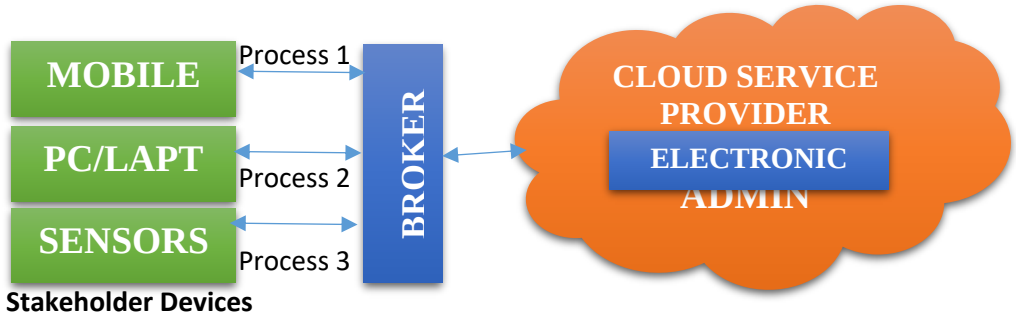

Fig.1 Architecture for selection of VM

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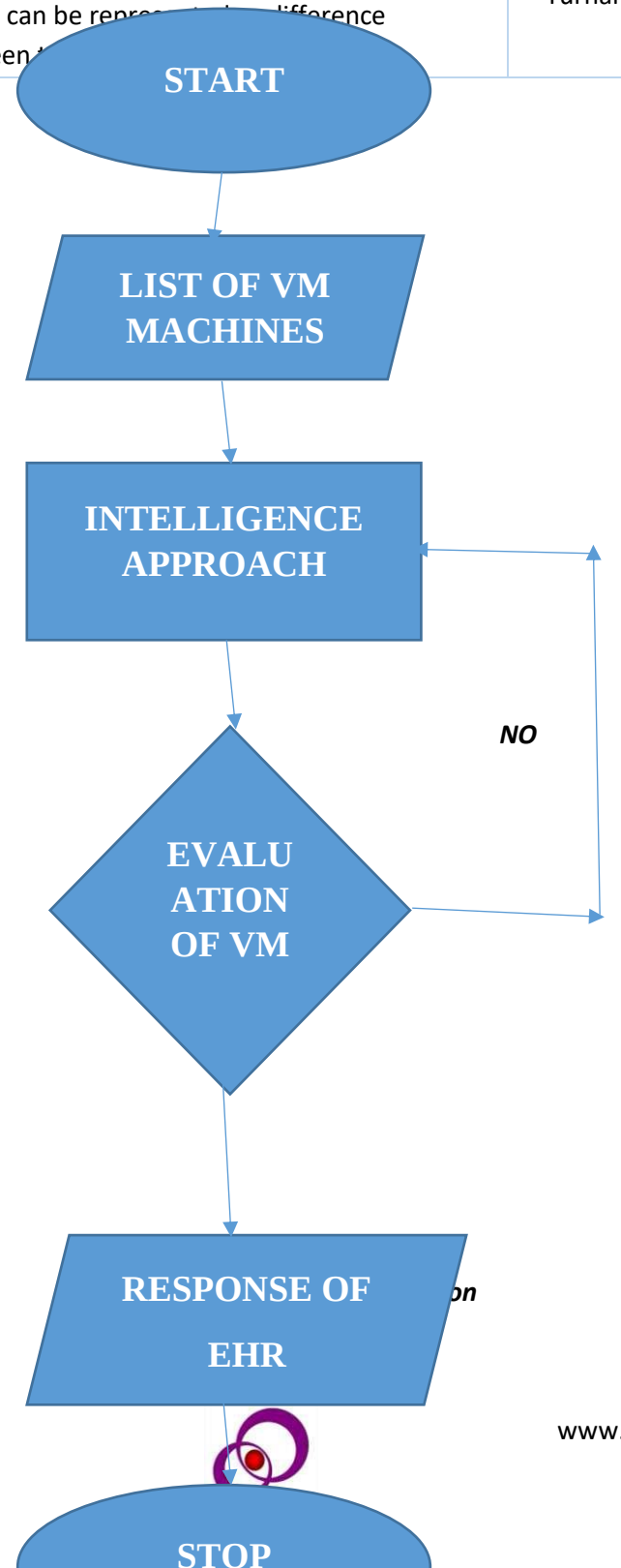
The parameter for selection of optimal VM is listed with calculation in below table:

Table 1 Parameters consideration for VM selection

Parameter	Description	Determined by
CPU Utilization	The amount of work carried out by CPU	100% - % of time executed
Turnaround Time	Amount of time between the request and completion of the task	Completion time – Arrival time
Waiting Time	Time taken for waiting to be executed. Other words can be repr difference between	Turnaround time – burst time



4.1 GENETIC ALGORITHM

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The Virtual machine present in the cloud are considered to be the chromosomes and denoted as M. The cloud is represented as s and the chromosomes are allotted as per the task requested so that it will be able to execute the task asked from backer's device. The process carried out with the help of this algorithm is denoted in the following flowchart represented in Fig. 3

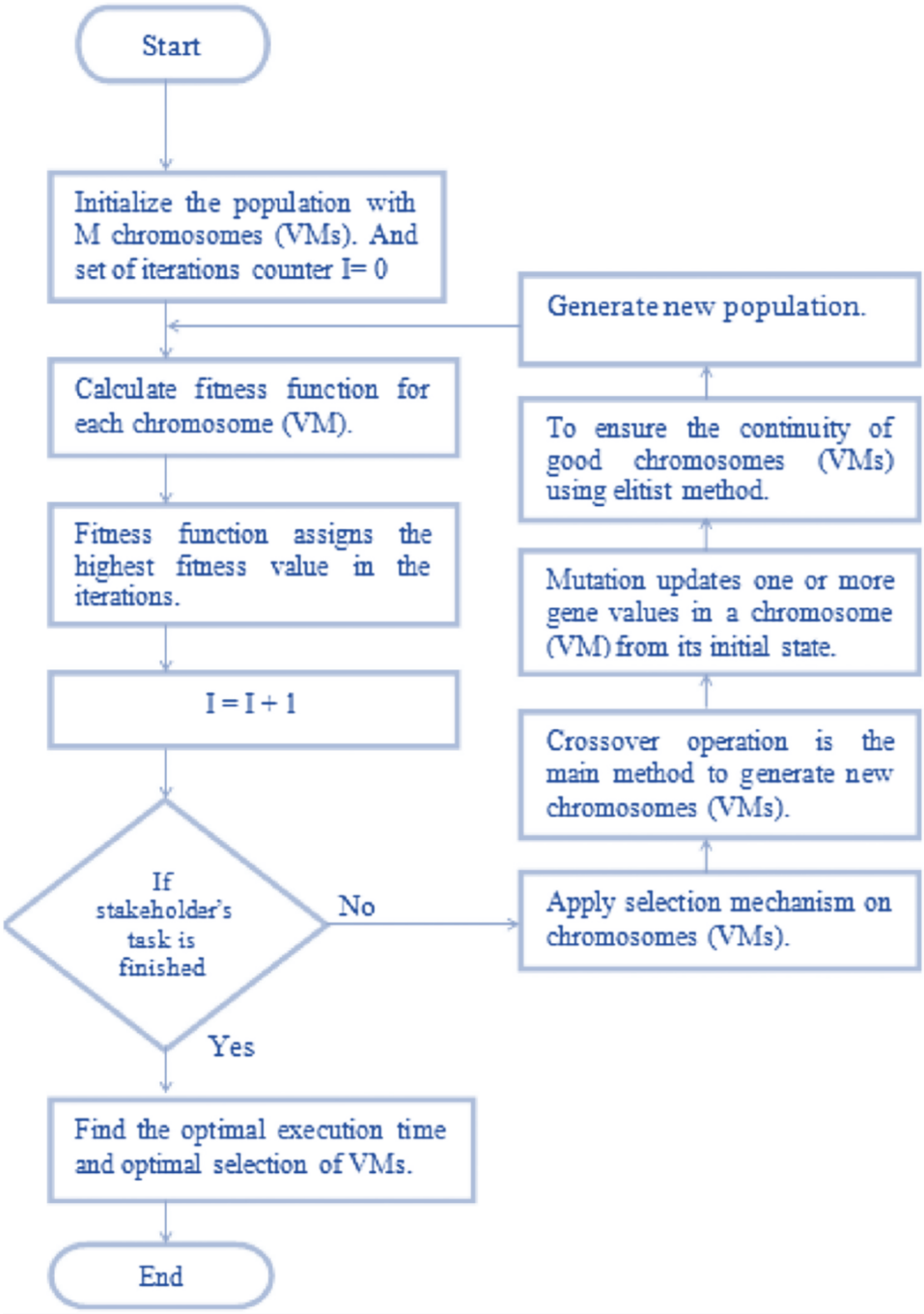

Fig. 3 Genetic algorithm calculation for optimal VM

4.2 SWARM INTELLIGENCE APPROACH

This approach denotes the usage of AI technique that is used globally to find out the optimal solution and functions in such a way that it works out in a self-organized manner and is decentralized. Initially it evolved from the concept of behavior of birds, animals or insects. It depicts that if a food is

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been identified by a bird it immediately sends information such that other birds near to that specific bird will be formed together. The particle near to the target is considered to be the local best and some cases represented as pbest. Further the value for each particle is calculate in two terms such as velocity and position. Based on the global value the particle is marked as global best or gbest. The various approach of this approach is PSO (Particle Swarm Optimization) and further techniques were evolved from this base. One of the intelligent technique is APSO which is a modified and enhanced from of PSO. The process is carried out with PSO and values are calculated initially and then enhanced approach and the implementation part is done. The final results shows that APSO performs and suits the best optimal solution when compared with PSO.

4.3 PARTICLE SWARM OPTIMIZATION (PSO)

This approach considers the VM as M particles. For each of the particle the velocity and position is calculated using the Eq.1. Each particle calculation is represented as an optimal potential solution so that the request can be allotted to that specific VM to give back the request. Each time the particle value is updated as per Eq. 1

$$V_i^{k+1} = w\, V_i^k + C1\, rand_2\, X\, (pbest_i - S_i^k) + (gbest_i - S_i^k) \quad \text{..... (1)}$$

Where, Vik+1 - Represents velocity for i^{th} particle at kth iteration

w - Weight function

Rand – Represents the random number either 0 or 1

Sik - Current position of particle at k iteration

Pbest – Considered to be the local best (particular agent)

Gbest – Considered to be the global best of the group

Along with the calculation of position and velocity of each of the particle that is agent providing the VM's present inside the cloud, weight of each particle is calculated using the following equation.

$$w = Wmax - \frac{W_{max} - W_{min}}{iter_{max}} \times iter \quad \text{..... (2)}$$

Where, Initial weight is represented as W_{max}. Final weight is represented as W_{min}. iter mentions the iteration number that is taking place currently and $iter_{max}$ represents the maximum amount of iteration taking place. The proposed approach handled by using this algorithm is depicted and illustrated with the following flowchart as shown in Fig.4

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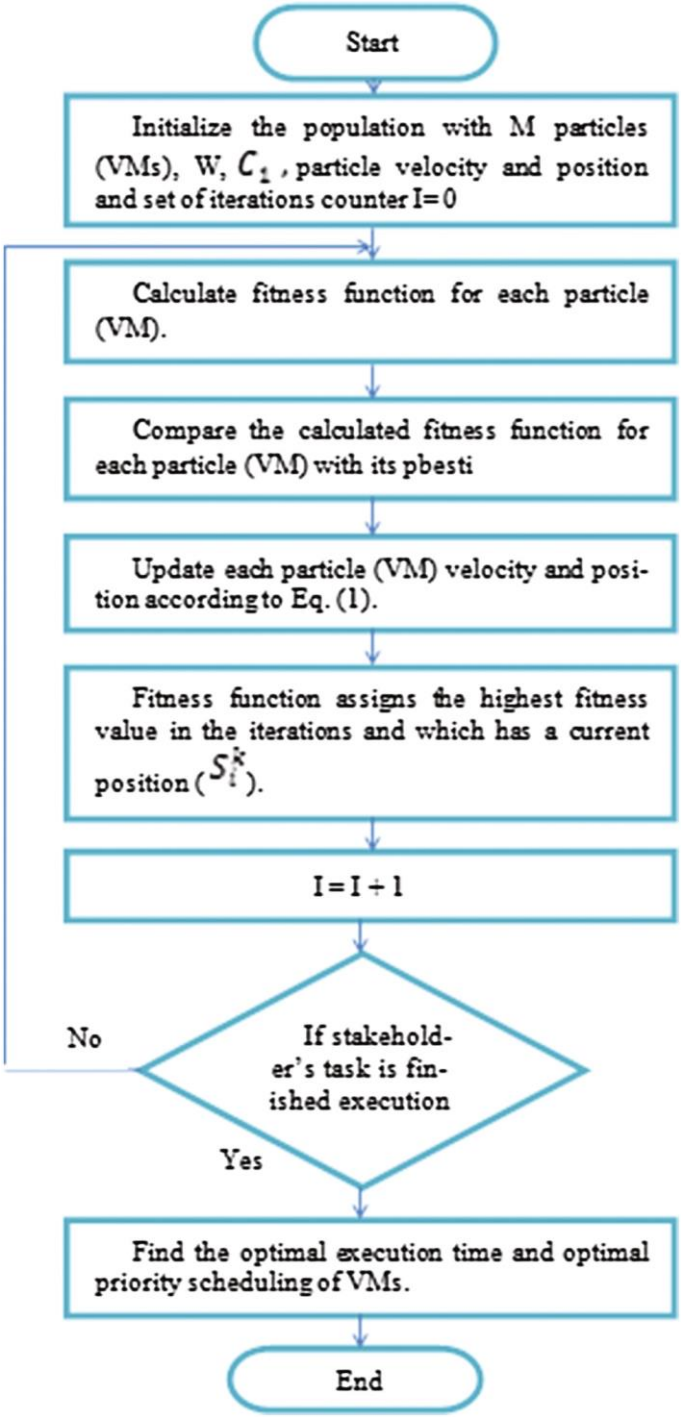

Fig. 4 PSO algorithm calculation for optimal VM

4.4 ENHANCED PSO (APSO)

This modified form of PSO is an iterative algorithm that keeps finding the best optimal solution through iterative procedure. At first in initial state takes many solutions then tries to update the position and velocity of each and results the best value to be the optimum solution. As said earlier two values for each particle is calculated, they are local best represented in this section as B_{pbest} and the next value is global best denoted as B_{gbest}. The local values is just calculated compared with its neighboring value and global is done with the entire particle present in the group. At each line the word particle represents the

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Virtual Machine and our task here is to find the best optimal selection of VM. The VM is said to be optimal only when the processing of the request raised is done with best options. The flowchart in Fig.5 depicts the process of proposed swarm approach (APSO).

The process carried out here is that VM which is considered to be optimal selected by APSO enables to reduce the execution time and increases the utilization of resources present in cloud. In all the calculation VM is represented as particle and the word analogous illustrates the ability of particles processing concurrently. The steps at starting is done by initializing the velocity and position for particle (VM) present in cloud. After the process of initialization, the fitness function is calculated. In case the achieved value or computed value is high when compared to the previous value then the value calculated is taken as current value. Else, the same value remains for the next iteration. The calculation of position and velocity for APSO is carried out by the following Equation 3 and 4 respectively.

$$V_a(x+1) = V_a(x) + R_1F_1 \times (B_{pbest} - P_a(x)) + R_2F_2 \times (B_{gbest} - P_a(x)) \ldots\ldots\ldots (3)$$

`

Where $V_a(x)$ represents the current velocity and (x+1) represents the calculated new velocity. The random numbers are denoted as R_1 and R_2 which takes the value in-between the range 0 and 1. Similarly F_1 and F_2 represents the learning factors. P represents the position of the particle and $P_a(x)$ represents the current position of the particle in search space. Further the equation of position calculated as given below:

$$P_a(x+1) = P_a(x) + V_a(x+1) \ldots\ldots\ldots\ldots\ldots (4)$$

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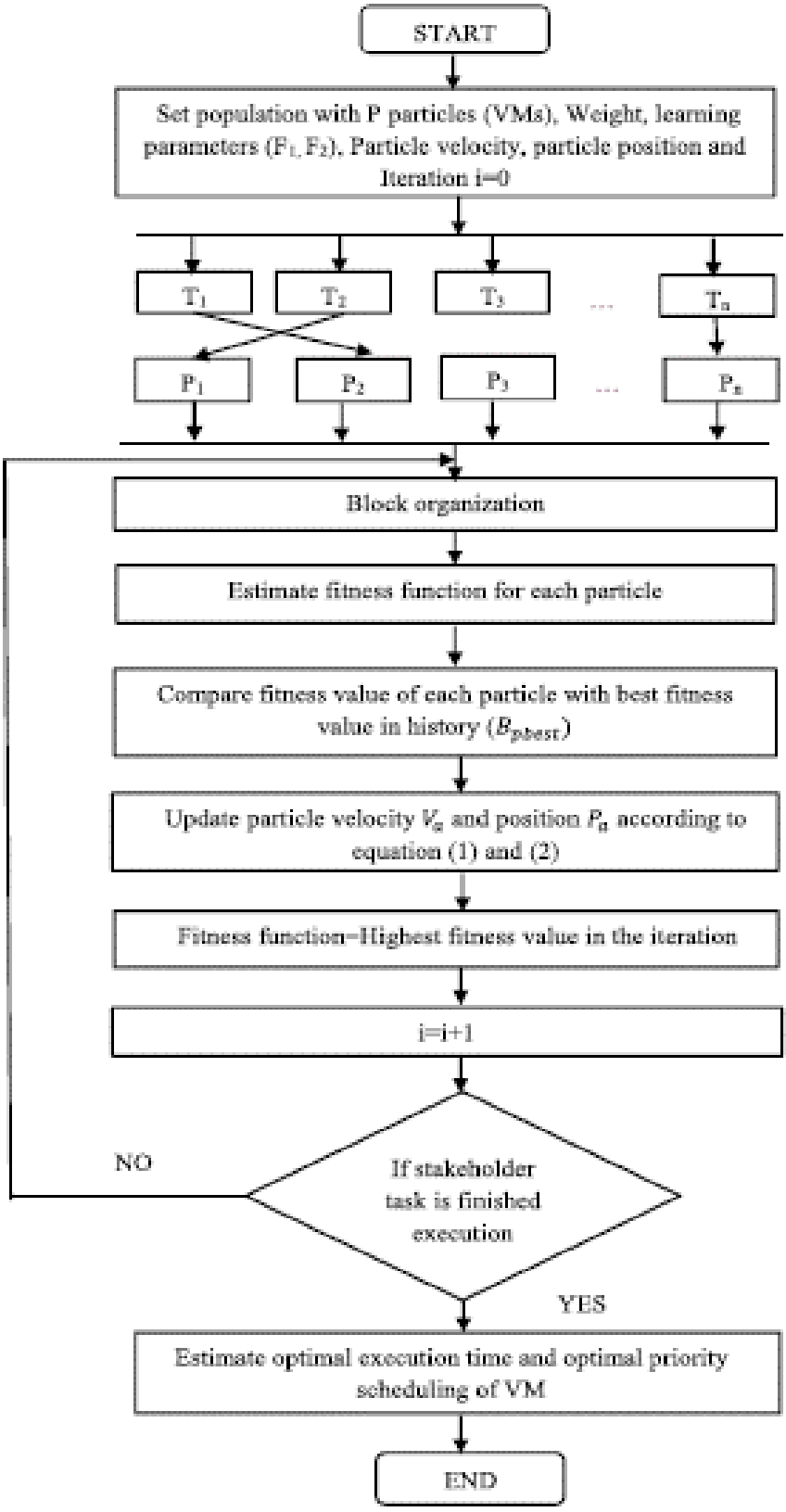

Fig. 5 Process flow of APSO

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The algorithm for the process of proposed approach is given below. The iteration is carried out until the final solution is received.

Input: Size of population indicated as P
Rate α of B_{gbest}
Rate γ of B_{pbest}
Number of iterations indicated as X
Output: ($Optimal_{Virtual\ machine}$, $Optimal_{Execution\ time}$ → B_{gbest})

Process:
Medical request given by stakeholders – Y
Count z = 0;
For z = 0 to P do
Current Velocity of particle() → $V_{Particle}$
Current position of particle (P) → $P_{Particle}$
$P_{Particle}$ → γ
If (cost (γ)← cost (α)) α←γ
End if
End for
1. While (Y ≠ 0)
2. For z= 0 to X do
a. Calculate fitness function
b. Update velocity ($V_{Particle}$, α, γ);
c. Update position ($P_{Particle}$, $V_{Particle}$)
i. $V_{Particle}$← Update velocity
ii. $P_{Particle}$← Update Position
d. If (cost ($P_{Particle}$) ≤ Cost(γ))
γ← $P_{Particle}$
e. If (cost (γ) ≤ Cost(γ))
α← γ
f. If (Y is finished == true)
Y = Y – 1
Save α
g. Else
Calculate fitness function for each particle (Virtual machine)
h. End If
i. End if
j. End if
3. z= z+1;
4. End for
5. End while
6. Return α

Algorithm of APSO to find the optimal VM in Cloud

5 IMPLEMENTATION RESULTS

In this section the implementation results of Genetic Algorithm, Particle Swarm Optimization and proposed APSO is done and compared. The implementation is carried out on CloudSim tool and execution results are computed in terms of parameters chosen to evaluate the best optimal VM in cloud. The Genetic algorithm exposes that there is positive liaison among the given population that is present VM in cloud and its implementation time. The results clearly states that incase when there is increase in population, amount of VM in cloud then it is directly proportional to the implementation time. Hence there is increase in time taken for implementation.

In the following the time taken from both PSO and APSO is measured and stated from where it is very clear that APSO seems the best.

5.1 IMPLEMENTATION OF PSO ALGORITHM

In this part the PSO to find whether the VM is optimal is calculated considering the minimal implementation time and maximum resource utilization. The initial execution is by default present in CloudSim in which the task 1 will take first, similarly the task 2 takes the second etc. In this case the time taken totally to form successful cloud is given in below image:

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----------OUTPUT----------

Cloudlet ID	STATUS	Data center ID	VM ID	Time	Start Time	Finish Time
0	SUCCESS	2	0	800	0.1	800.1
1	SUCCESS	2	1	1200	0.1	1200.1
3	SUCCESS	2	3	8000	0.1	8000.1
2	SUCCESS	2	2	16000	0.1	16000.1

BUILD SUCCESSFUL (total time: 3 seconds)

Fig. 6 Default CloudSim Values

The next iteration is done for PSO where the task 1 can be executed in second VM and task 2 may get executed in fourth VM. This is done by taking into consideration of the status of task, VM status and number of processors that are present. The time taken totally to build this positive cloudlets is 1s.

----------OUTPUT----------

Cloudlet ID	STATUS	Data center ID	VM ID	Time	Start Time	Finish Time
0	SUCCESS	2	0	1600	0.1	1600.1
1	SUCCESS	2	1	2000	0.1	2000.1
3	SUCCESS	2	3	8000	0.1	8000.1
2	SUCCESS	2	2	16000	0.1	16000.1

BUILD SUCCESSFUL (total time: 1 second)

Fig. 7 CloudSim Values for PSO

The graph in Fig. 8 shows that connection between the processors present and time taken is inversely proportional to each other. Hence when there is less amount of processors present then time taken for execution is high and vice versa when there is increase in processors count. The span in the graph clearly states the above said relationship.

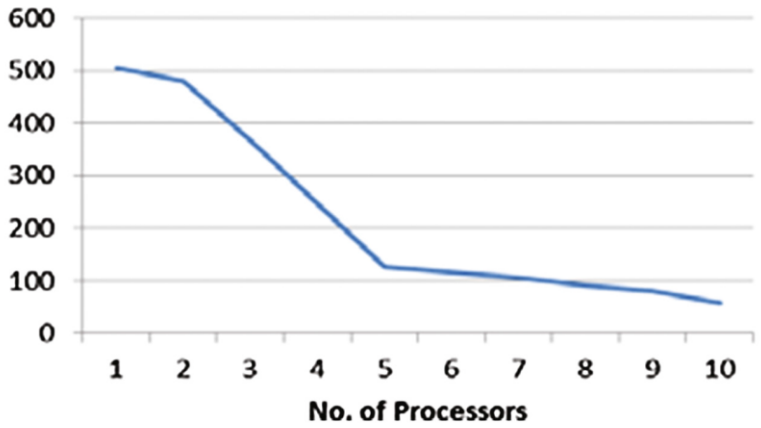

Fig. 8 Span of time using PSO

5.2 IMPLEMENTATION OF APSO ALGORITHM

The table below shows the implementation results of APSO algorithm. It shows the iteration count taken with number of particles and its execution time. The parameters taken for evaluation are generated after the results obtained. Parameters taken are the count of particles ranging from 0 to 100. The iterations count is fixed to be 10 and weight are assumed to be 0.8 and 0.2 as maximum and minimum weight respectively. The learning factors for F_1 and F_2 are taken as 2.

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Table 2 Results of APSO algorithm

Number of Iteration	Particles count	Execution time
		$\bar{x} \pm c\frac{D}{N}$
1	10	2.01
2	20	3.78
3	30	5.71
4	40	7.82
5	50	10.43
6	60	13.47
7	70	17.85
8	80	20.04
9	90	23.59
10	100	25.5

After getting the running time for each of the particles count at various iterations the confidence graph is engendered by values computed such as mean, median and standard deviation. The formula to carry out the confidence level is given using . Where c represents the confidence level, D denotes the standard deviation, x denoting mean value and N depicts the number of iterations or observations considered. The graph in Fig.8 illustrates that for each of the particle (VM) confidence interval is computed and positioned with the mean value of concern particle. The lines present horizontal represents interval of confidence and circle present shows their mean. In case if there is overlapping in interval then the vertical line is generated stating the mean value of the population, it's in black else present in red. The red line shows the sample size required. The table 3 shows the calculated value which helps to achieved the level graph.

Table 3 Values calculated for interval graph

Parameters	Values
95% Confidence interval	(5.4,18.3)
Mean	12.98
Geometric Mean	10.11
Median	12.11
Standard Deviation	8.21
Observations	10

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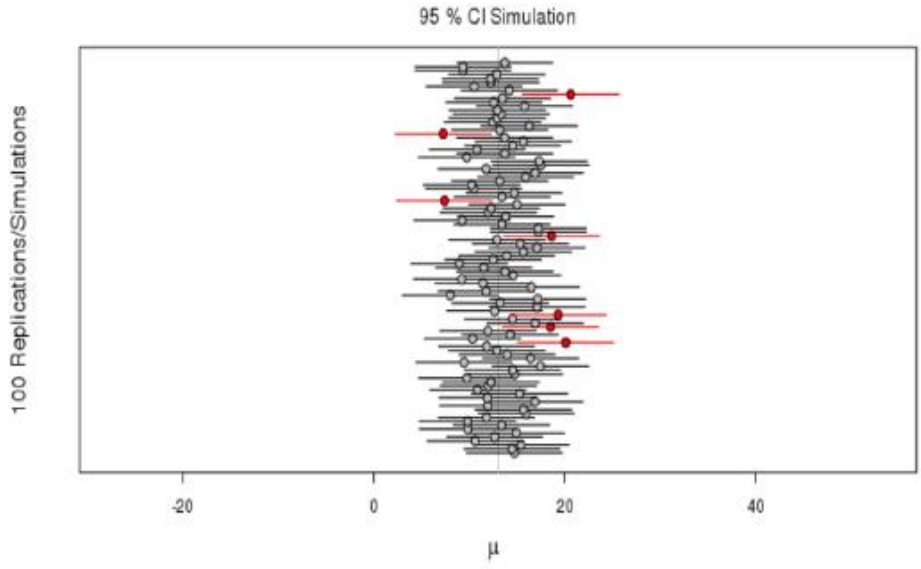

Fig. 8 Confidence interval graph

The proposed approach helps to given an optimal way for selecting the VM from cloud. The same is executed in CloudSim and results are displayed in Fig. 9. Total time taken to execute all the task received is found to be 1s with less amount of processors and with maximum utilization of 50% to 80%.

----------OUTPUT----------

Cloudlet ID	STATUS	Data center ID	VM ID	Start Time	Finish Time
0	SUCCESS	3	0	0.2	1500
1	SUCCESS	3	1	0.2	2000
2	SUCCESS	3	2	0.2	7000
3	SUCCESS	3	3	0.2	15000

BUILD SUCCESSFUL (total time: 1 second)

Fig. 9 Execution results of APSO

It is very clear from the above execution results that the execution time is less when compared to PSO. Further each of the parameter is compared separately and graphs are generated to illustrate the difference between these two approaches. When considered to other selection approaches stated earlier it is evitable that the efficiency of the approach that is proposed is increased with 5.6% of utilization, that is there is reduce in running time and increase in resource utilization which concludes that APSO is best optimal solution for VM selection. Execution time is calculated using Turnaround time, Waiting time and utilization of CPU.

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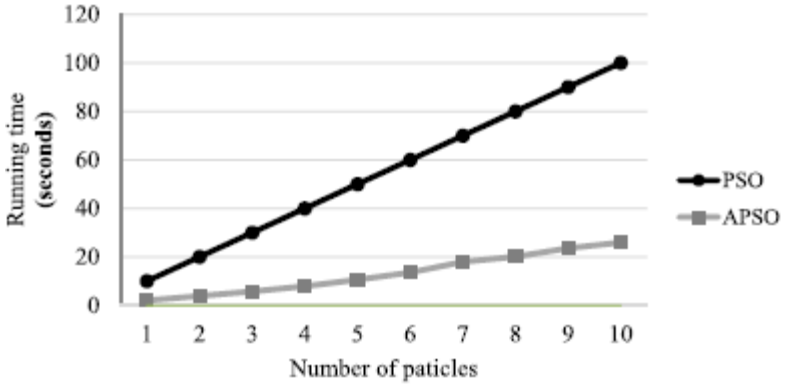

Fig. 10 Comparison between Running time and Particles count

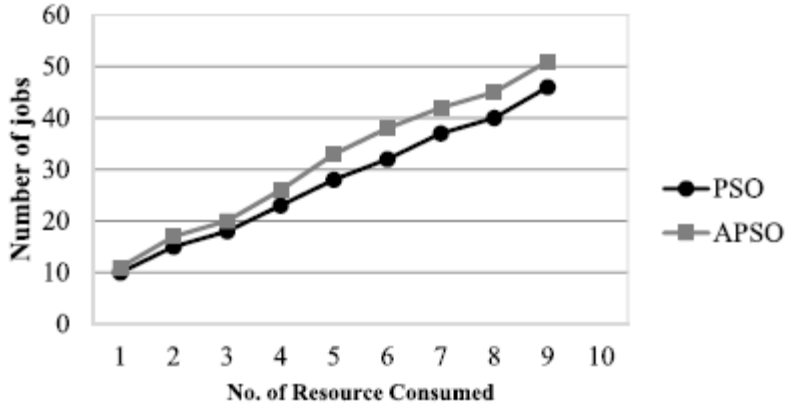

Fig. 10 Comparison between resources used and tasks requested

6 CONCLUSION

In this paper, we propose and recommend an enhanced novel approach that suits the best for selection of VM using Swarm Intelligence approach. The results clearly shows the execution time is decreased for the request received from various stakeholders and maximum amount of utilization of resources provided by cloud. The algorithms are implemented using CloudSim and execution time is calculated by considering the waiting time, CPU utilization and turnaround time. The proposed technique performed well when compared to other models and overall execution time was done with 1s and efficiency was increased by 5.6%.

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