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An Improved model for OKP product planning stage in a cloud-based design environment

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ABSTRACT

Nowadays, in the software world, cloud computing has great importance. This massive network has reduced the cost of software for users, but has risen in revenue from manufacturers, the products of the one-of-a-kind (OKP) companies are cloud-based, and customers access the software through the cloud, In this architecture, the company places part of the software that is expensive and does not have the ability to buy for the cloud on cloud servers, and users can connect with the cloud to the cloud using this software, But since the number of users is greater than the number of servers, they must run a scheduling mechanism to execute requests, We present a timing system for OKP products in this paper, compared with two other methods, the simulation results show the superiority of the proposed method.

Keywords: software production, one-of-a-kind products, customization, cloud environment, scheduling

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1. INTRODUCTION:

Cloud computing has become a significant process of technology today, with unique benefits such as paid-for-use and customer-centric user interface; they have been able to drive e-commerce companies to this technology. Types of cloud implementation models, such as the public cloud, private cloud, and hybrid cloud, each with its own characteristics that empowers users. But a company in a variety of business situations may require different cloud environments, few cloud systems offered for business purposes can adapt to changes in the business environment. Therefore, a hybrid production cloud that allows companies to deploy multiple cloud environments for periodic business purposes is not necessary. Desirable offerings are offered through the proposed system, the lack of specialized designers in the organization, low costs, three cloud support, easy use, optimized services, and practical advice on how to migrate to the cloud by hybrid cloud production.

In this research, we want to provide a model for supporting the Unique Product Planning Process in a cloud-based design (CBD) environment, which will provide sufficient resources, reducing the timeframe for the production of products for OKP companies in an affordable way. , Let's take a look.

OKP companies can offer cloud services as cloud service providers by sharing design resources with customers, and provide service platform as well as accessing abundant resources from other cloud service on the cloud service platform [P. Zheng, et al., (2016).].

The "pay-per-charge" model in the cloud prevents high costs. Accurate and immediate customer requirements (CRs) Analysis is essential in the early stages of design for the success of OKP companies, But they are small or medium-sized enterprises (SMEs), which, due to limited resources and little budget planning for the product, often cannot achieve a lot of CR information or go beyond the expense of the complex planning process [Hu, S-J. (2013).].

In the proposed model, by using customer requirements, co-design between the company and the client is designed to tailor the products to the needs of the customers, thereby achieving their satisfaction and profitability for the company. The

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manufacturing industry has evolved in different phases since two centuries ago. This change began with "Craft and Industry", which included "design for the customer" with high price and low efficiency, then it turned to "mass production", namely, "customer design" by offering limited but high performance products. We recently have "mass customization", which means "customer design" and "mass privatization", meaning "customer design" All of these methods were designed to meet customer satisfaction at an affordable and cost effective cost. This field helps to make the dream of a unique market a reality. Obviously, the emphasis of manufacturing from maximum production to maximum individualization has changed from the standard production process to the flexible process from the axis of commodity to the core service. Unique Production is an acute and special case in the field of mass customization, focused on the "unique market" and generally uses an "order-based engineering" business model. This kind of production attempts to offer proprietary products while maintaining the efficiency and quality of "mass production" based on the individual needs of each customer[Zheng, P. Xu, X. Xie, S-Q. (2015).].

Cloud-based design (CBD), which lies in the domain of the new and emerging cloud paradigm, was first described by Wu et al. The CBD can lead to the growth and growth of OKP companies in two dimensions:

- A paid-for-sale payment model based on which customers must only pay subscription or periodic usage fees. This model dramatically reduces the cost of manufacturing and information technology (IT) infrastructure.
- In a cloud-based environment, OKP can access many design resources through various channels such as the online community, software as a service (SaaS), etc. [Lee, J. Lee, Y. Lee, Y-J. (2012).].

In this article we are going to answer the following questions:

- Can OKP companies use the cloud computing environment to customize products for the product design phase?
- Are OKP companies well-funded to meet customers' needs at the product planning stage? If not, what solution would they use?

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The main goal of this research is to achieve customer satisfaction in order to customize unique products in OKP companies, and ultimately the profitability, growth and development of these companies using a cloud-based design environment that it is affordable.

Although there are many research and surveys to match the needs of customers to customize products and obtain customer satisfaction for different stages of product lifecycle, research for the first phase of product design is rare. Mass customization is called the unique product creation [D. Wu, D.W.Rosen, D.Schaefer, (2014).]. Research has shown that targeting customization programs provided by online businesses (such as small and medium-sized organizations) is useful for building better customer relationships [L.Ren. (2012).]. The quality of a strong and positive relationship encourages the consumer to loyalty to the firm. Custom production for consumers who are looking for proprietary products allows for participation in the production process. Providing user-friendly sites and easy-to-use gadgets may be worthwhile to make this process more engaging for people who have low visualization capabilities. Such strategies are essential to attract more audience in the early stages of the product design process [X.V.Wang, X.W.Xu, (2013).].

OKP companies have limited resources. They may not be able to meet the costs of the quality function deployment (QFD) product planning process, or that they may not be able to efficiently provide much information about CRs in a traditional Internet-based environment. Providing a QFD-based method in the cloud manufacturing (CMfg) paradigm can be used to strengthen the product planning process of OKP companies [B.Q. Huang, C.H.Li, C.Yin, X.P.Zhao, (2013).].

2. METHOD OF CONDUCTING RESEARCH:

A. Type of Research Method: Studies

B. Information gathering method (field, library, etc.): library, internet, scientific journals

C. Data collection tools (questionnaire, interview, observation, test, tab, sampling, laboratory equipment and data banks, computer and satellite networks, etc.): Database and computer networks

D: Data analysis method:

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In this project, it's difficult to create a real model for some reason, such as the high cost of the tests and the many risks involved. Cloud computing is an Internet-based technology that makes Internet-based simulations widespread and complex issue where the definition of the problem and the research objectives should be properly determined, so the difficulty and accuracy of simulating it is less than its actual model; So, cloud computing software that is generally Java-based, and it can be used to simulate all aspects of cloud computing using these tools. CloudSim is one of the most famous of these applications.

3. THE PROPOSED FRAMEWORK:

With the advancement of IT, we need to do computational work everywhere and all the time. It also requires people to do their heavy computing work without having to pay for expensive hardware and software through the service.

Cloud computing has been the latest technology response to these needs. The load balancing uses different algorithms for dividing work between virtual machines, the load balancing actually divides user requests into the response time between virtual machines [S.Jyothsna, (November – December, 2016).].

4. MAIN IDEA:

In this article, we have developed a new approach for organizations that offer OKP products. In this way, the organization produces its own cloud-based product, so that the main components of the product are provided by a private cloud to its customers and users, so that they all share resources in order to save money economically and resources. This savings will be very profitable for the organization itself and its customers. In the Fig. 1, the general schema of this division of workflow and timing is shown:

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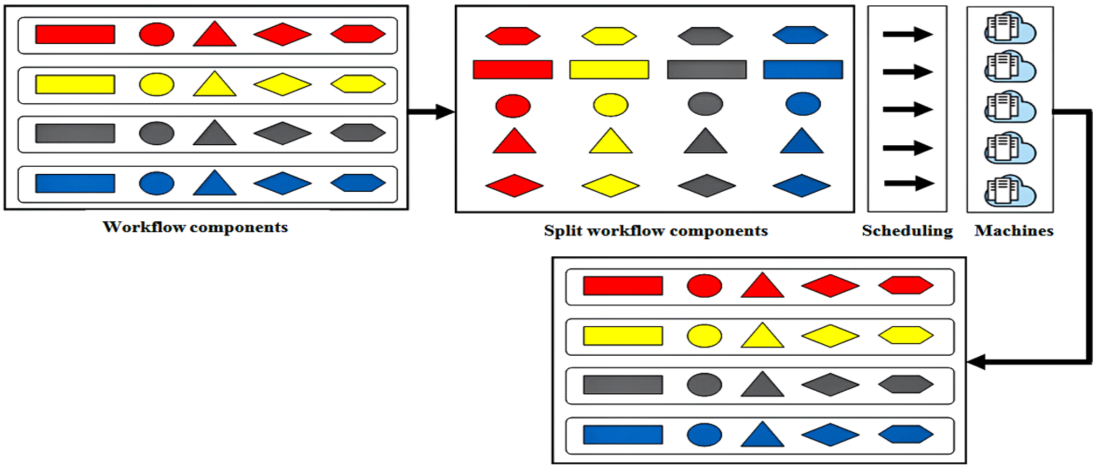

Fig. 1. Proposed work syllabus

With the advent of information technology, computing needs to be done everywhere and all the time. It also needs people to be able to do their heavy computing work without having expensive hardware and software through the service.

Considering that cloud computing has provided a lot of services, including computing services and the provision of high storage space, many users from all over the world want to use cloud computing technology. Due to the very high demands of users, they have to plan so that all users can access cloud computing. Accordingly, to obtain better and fair results in order to allow all users to access the cloud at a given time, use the load balancing algorithm to divide the work between the data centers with a specified time period in order to provide services tailored to the needs of users at the optimum time.

5. COMPARISON METHODS:

The first method of the bee method:

The honeybee exploration solution has been explored as a direct implementation of a natural phenomenon. Then, a randomized biased and distributed sampling method has been investigated that maintains the loading of individual nodes near the global average. Finally, an algorithm (ant colony algorithm) is evaluated for connecting similar services to local wiring as a load balancing tool with the active rebuilding of the system structure. At load balances, such as Web servers, demand increases or decreases,

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services are dynamically assigned to adjust user-changing requests. Servers are grouped into virtual servers; each virtual server has its own virtual queue. Each server processes the request from its queue and calculates the amount of profit and reward that is similar to that of the bees in their dance rotation [9].

Second method Ant colony method:

In this study, an ant colony algorithm is used to balance the load in the data center, as you know, in the data center of the virtual machine clouds with different powers and capacities. These differences are determined when we give the same tasks to the machines, on the other hand, despite these differences; the tasks tend to move towards high-performance systems. This makes many systems that have a good performance to be highly welcomed, resulting in overload, and systems with lower performance are not considered and remain idle. The result is a waste of resources and, as a result of load imbalance, reduces the efficiency of the cloud data center [10].

6. SIMULATION SCENARIO:

In this section, experiments were carried out with 10 data centers with 50 virtual machines and 100-1000 tasks under the bedding simulator. Duration of tasks varies from 1000 to 20000 million instructions. The setting of cloud simulator parameters is shown in the Table. 1. Several values for each parameter, with other parameters being kept constant, have been investigated for optimizing the scheduling of tasks to a virtual machine.

Table. 1. Configuration details

Duration of tasks	1000-20000
Total number of tasks	100-1000
The number of processors required to run	1
The total number of virtual machines	50
Millions of instructions per second	500-2000
The size of the virtual machine image	10000
RAM memory	256-2048
Bandwidth	500-1000

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Number of processors	1-4
Timing policy	Time spacing
Number of data centers	10
Number of host machines	2-6
Timing policy	Time spacing and time sharing

Machines are also stored in a matrix that is visible in the Table. 2.

Table. 2. Machine specifications before running

Total amount of consumed energy	Number of running work	Total free resources	Total resources
0	0	70	70
0	0	85	85
0	0	55	55
0	0	60	60
0	0	70	70
0	0	70	70
0	0	75	75
0	0	75	75

Table. 3.View details of tasks before running

Work number	Total work resources	Required resources	Deadline	Delay
1	25	25	110	0
2	30	30	90	0
3	22	22	120	0
4	31	31	89	0
5	20	20	122	0

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6	40	40	70	0

In simulation, the machine and then the task (as shown in the Table. 3) are done randomly according to the above. In the sequel, the tasks are arranged according to the time of death, and the first job is to be mapped to the best car. Each mapping operation is considered to be one second, and each one runs the required resource amount in one second. . The simulation has a manual timer. Each time the timer is added, a single unit is cut off from all the task in the machines, in fact each machine carries out a unit of task per second. Everything that is dedicated to the car is recorded, and it records when it arrives at all its resources and leaves the car, which can be calculated according to the time of creation, the mapping time to the machine and the execution time.

The specification of the system in which the simulation is implemented is described in the Table. 4:

Table. 4. System specification required to run

CPU	INTEL CORE I5
RAM	2GB
VGA	1GB
OS	win 1064 bit
HDD	500GB

7. CHECKING FOR COMPLETION TIME:

Completion time is one of the important parameters of service quality for scheduling tasks in cloud computing. The less time is left; the users will wait a short time to get the results of the request in the cloud. The simulation result and the comparison of the proposed method are visible in the form. Fig. 2 shows the size of the task is fixed and the number of machines in each stage is increased.

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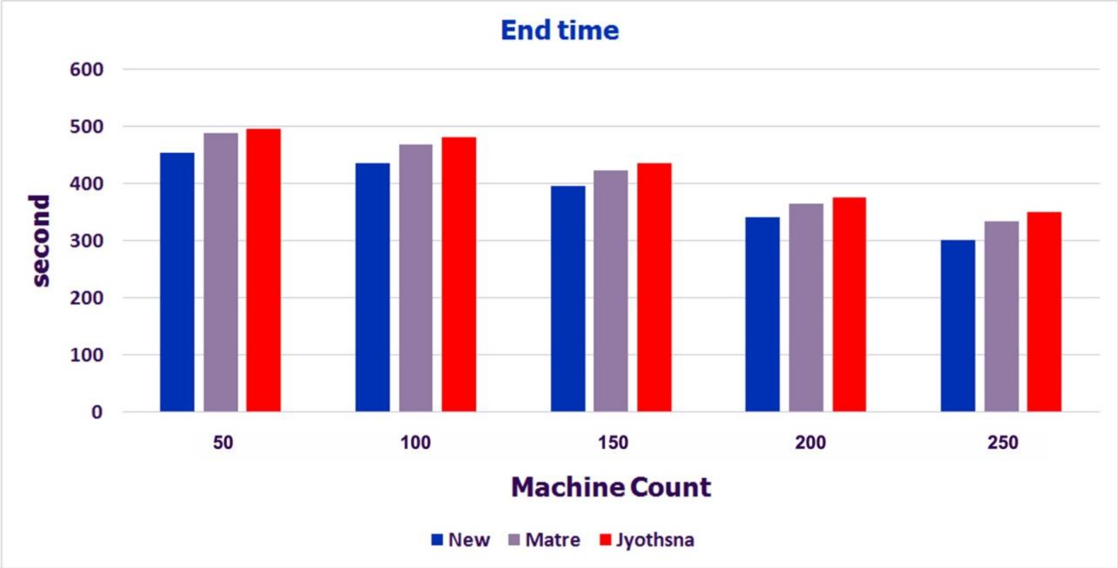

Fig. 2. Completion time with variable machine number

In the second case, the number of machines is constant and the number of tasks in each step is increased. The result is shown in the Fig. 3.

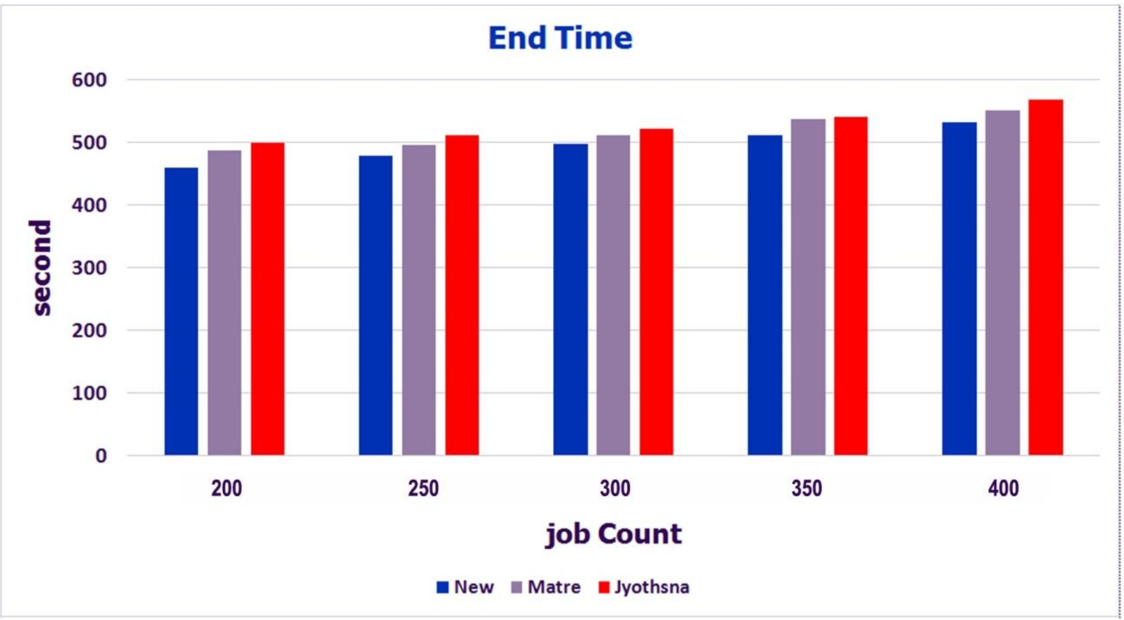

Fig. 3. The completion time of the task with the variable number of jobs

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The simulation result in two scenarios shows that the proposed method has a good performance. The reason for proposing a bid on this benchmark is better use of the priority queue. The priority queue is chosen in such a way that the completion time of the job is minimal.

8. RESPONSE TIME:

In the timing algorithms, the faster the response time is, the lower the method is. The response time is the length of time that the task waits for the resource after reaching the system. In the first case, the number of machines varies; the result is shown in Fig. 4.

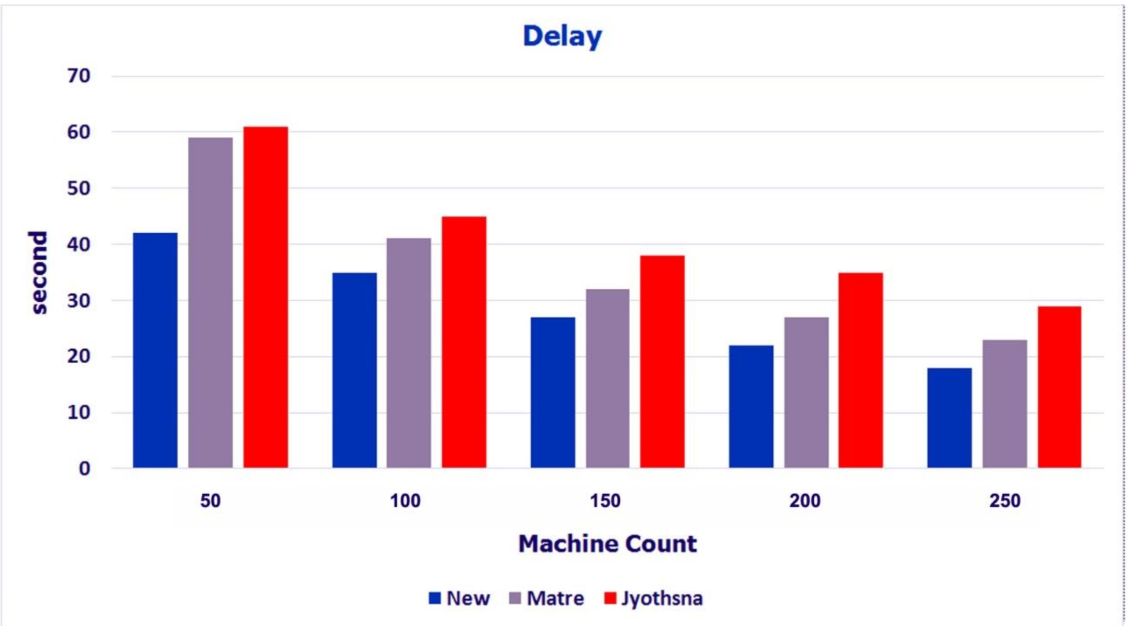

Fig. 4. Response time with variable machine number

In the second case, the number of fixed machines and the number of jobs varies; the result is shown in Fig. 5.

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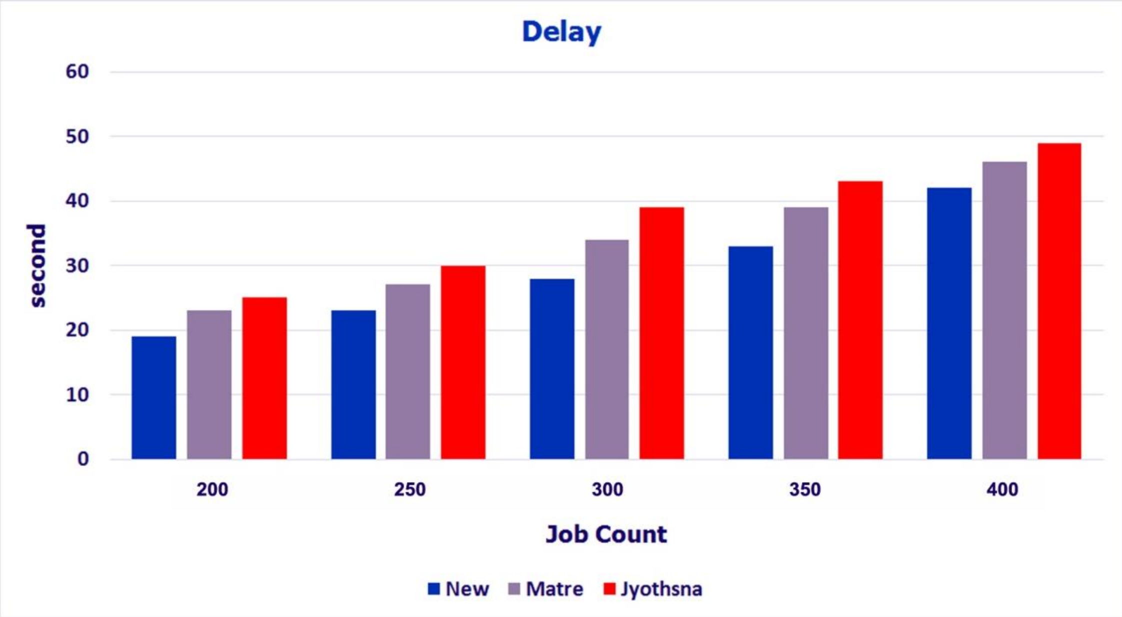

Fig. 5. Response time with variable job number

The result for the above criterion shows that the proposed method is less due to the use of the delay distribution algorithm.

9. LOAD BALANCING IN VIRTUAL MACHINES:

The more workloads are distributed equally between virtual machines, virtual machines will perform better, and as a result, the response time will be reduced. In order to measure the load balancing among virtual machines, we use the unbalanced degree of load that is calculated using the following equation.

$$DegreeofImbalance = \frac{ExecutionTime_{Max} - ExecutionTime_{Min}}{ExecutionTime_{Avg}}$$

The simulation result for the above criteria is shown in Fig. 6.

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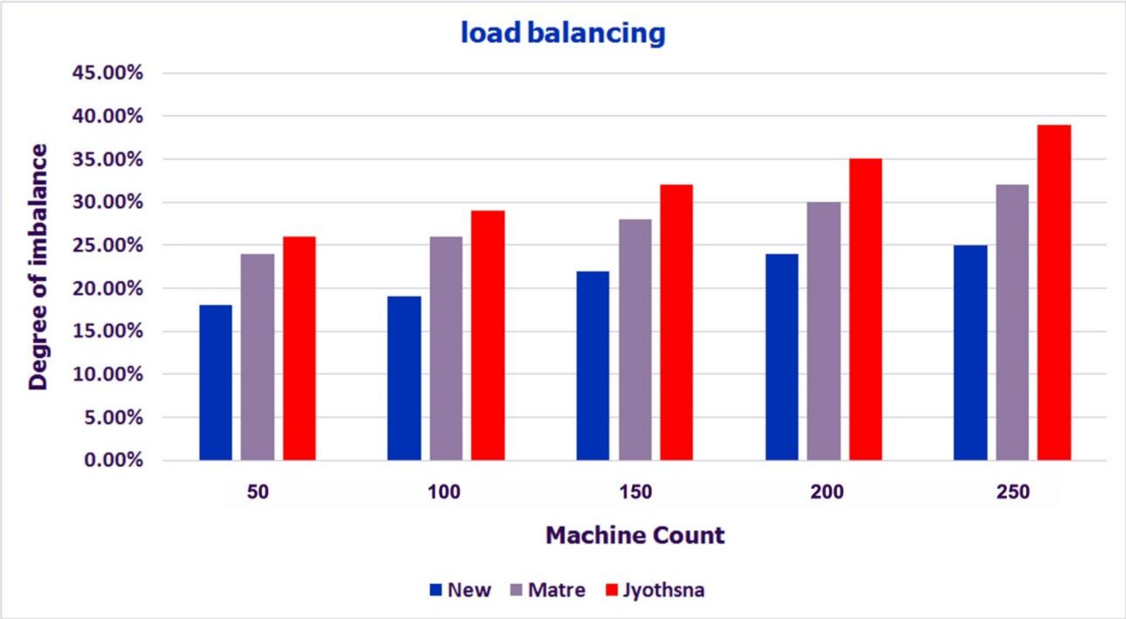

Fig. 6. Distribution of loads in machines

As the figure shows, in the proposed method, load distribution is better.

10. NUMBER OF IMMIGRATION:

The number of immigrations is actually the number of displacement after the assignment to a machine. The lower the number of migrations, the better the algorithm works. The simulation result is shown in the Fig. 7. In this scenario, the number of machines has been fixed and the number of jobs has increased.

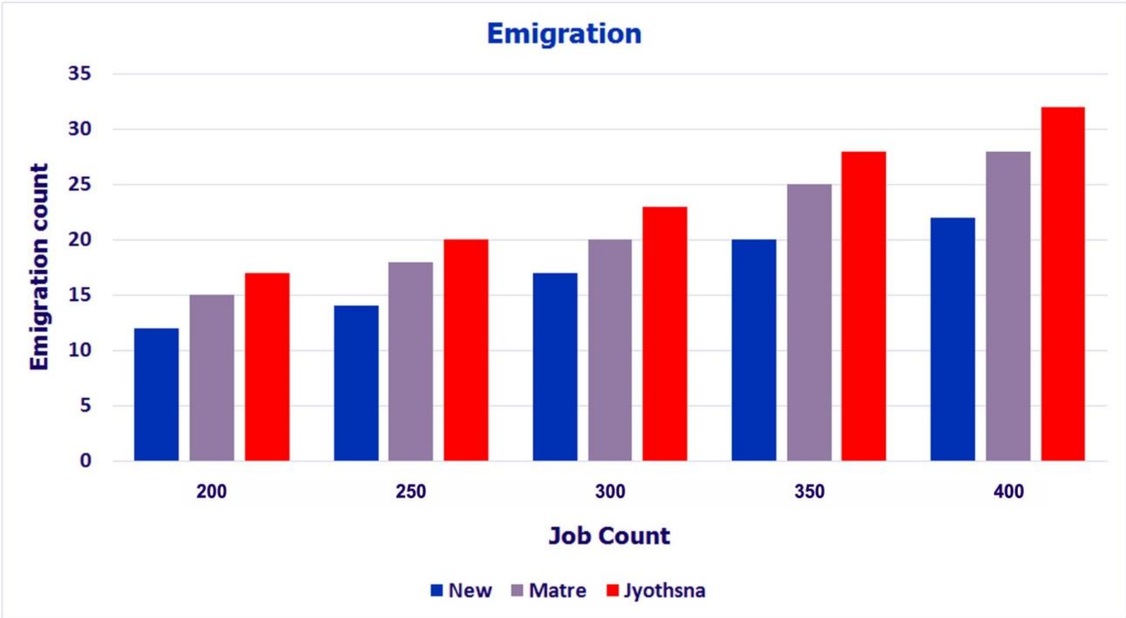

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Fig. 7. Immigration number after scheduling

The reason for the improvement of the migration is the load balancing algorithm, which first attempts to distribute the job in a car to the end.

11. ENERGY CONSUMPTION PARAMETER:

Reducing energy consumption is one of the most important issues of the day, especially in the industrial sector. In recent years, the increasing human needs of computer systems have led to the creation and expansion of more data centers with a large number of computers, which have significant overall power consumption. Obviously, in this context, efforts have been made by experts to reduce power consumption in these centers, and now efforts in this area are of particular importance. One of the ways to reduce power consumption in data centers is virtual machine migration. Energy consumption refers to the energy consumed by the physical machine, which is used after receiving the tasks and executing them, as shown in the Fig. 8. In this figure, the number of machines varies.

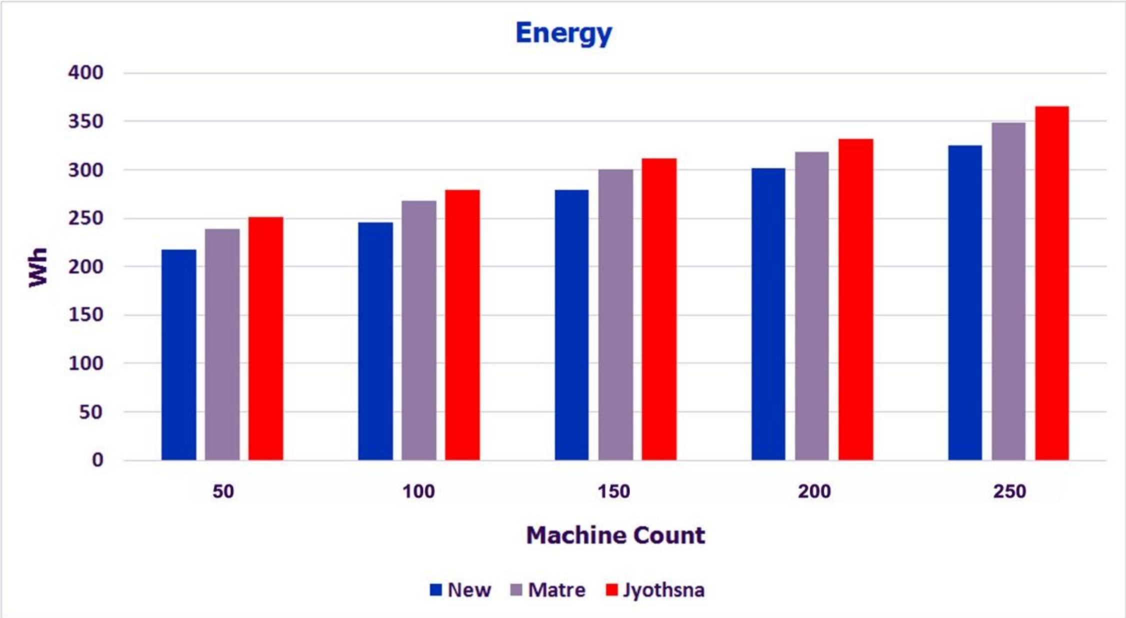

Fig. 8. Comparison of energy consumption

The simulation and comparison result shows that the proposed method has an acceptable performance.

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12. MAKESPAN MAKES:

Generally, Makespan can be defined as the time it takes to work. We show the completion time of the task Ti in the virtual machine j in CTij, so Makespan is defined as the following function:

$$Makespan = \max\{CT_{ij} | i \in T, i = 1, 2, \ldots, n \ and \ j \in VM, j = 1, 2, \ldots, m\}$$

The response time is the amount of time deleted between sending a request and response that is generated. This reduction in waiting time is helpful in improving the responsiveness of virtual machines. These virtual machines {VMm, ..., VM5, VM1} = VM represent the set of virtual machines M, which must work N (TN, ..., T5, T1) = T. All machines work independently and parallel, and are identified as R in the model. We assign schedules of tasks to independent machines and virtual machines independently. Non-exclusive tasks are shown as NPMTNs. Non-exclusive work means that the processing of those tasks on a virtual machine cannot be interrupted by R. The result of comparing the proposed method with two other methods is visible on the Fig. 9. In this scenario, the number of resources is constant and the number of tasks in each step is increased.

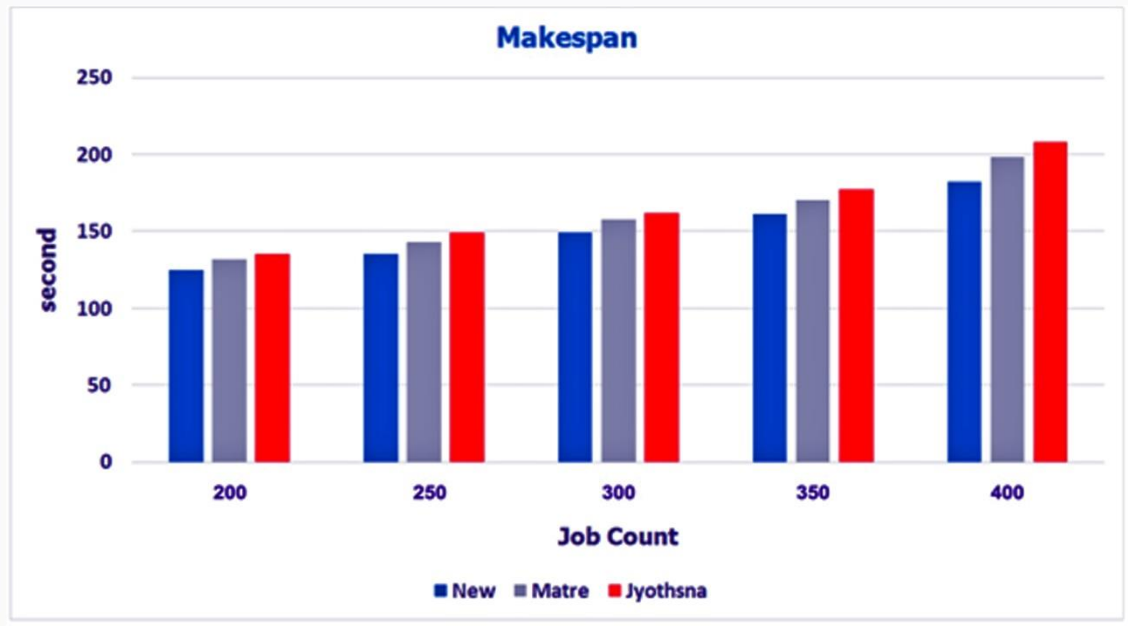

Fig. 9. Compares makespan

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The simulation result shows that the proposed method is better than the other two methods on average 9%.

13. AVERAGE RESOURCE UTILIZATION RATIO (ARUR):

This criterion shows how much resources have been used on average. The average resource productivity rate is obtained from the following equation.

$$ARUR = \frac{\sum_{i=1}^{n} t_i N_i}{T_s \sum_{i=1}^{Sum} O_i}$$

The result of simulation and comparison is visible in the form. In this scenario, the number of machines is fixed and the number of jobs varies that shown in Fig. 10.

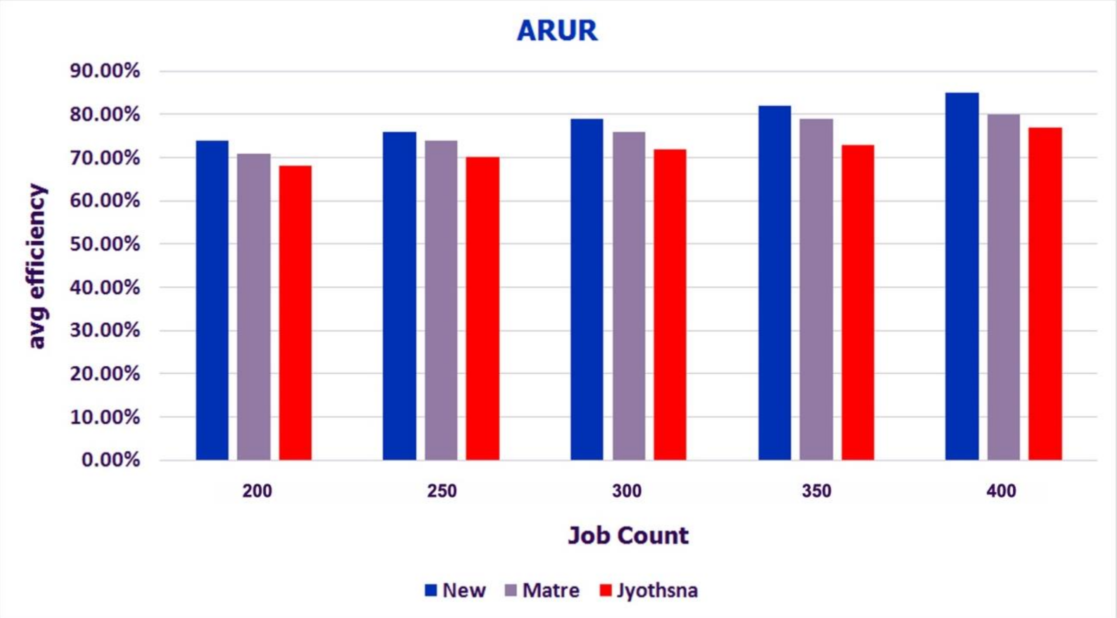

Fig. 10. Comparing the productivity rate with the number of variable jobs

In the second scenario, the number of jobs is constant, and in each step, the number of resources is increased, the result of the comparison is shown in the Fig. 11:

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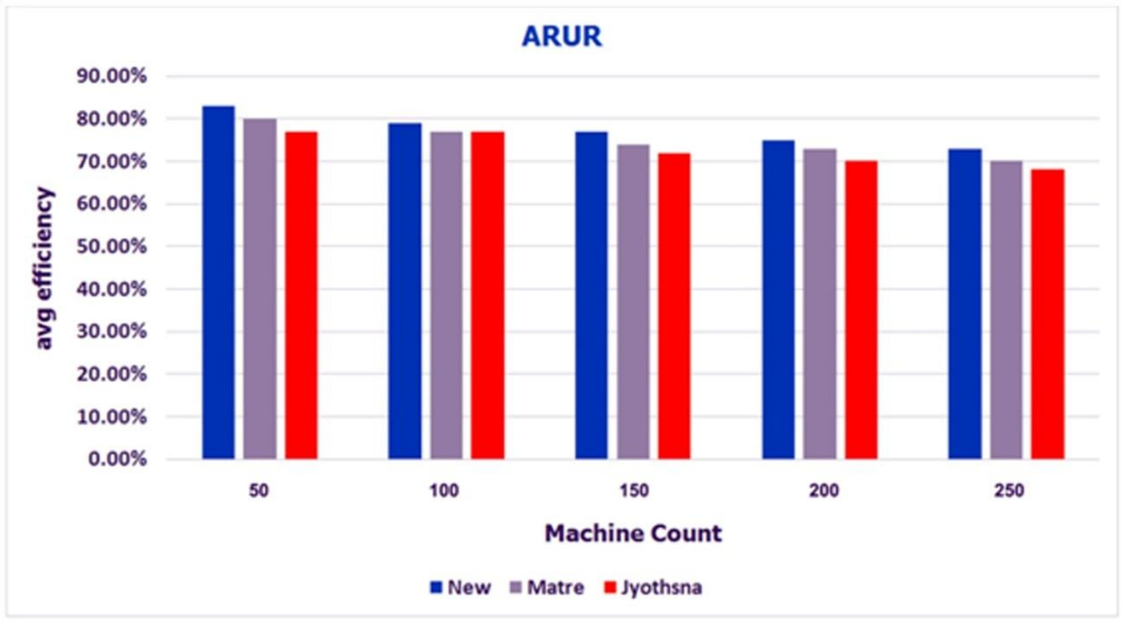

Fig. 11. Comparing the productivity rate with the number of variable machines

In this simulation, productivity increases as the number of machines grows.

14. **DISCUSSION AND CONCLUSION:**

Cloud computing has transformed a large part of the information technology industry with features that provide users with a different form of service. With the introduction of such technology, organizations do not need to invest heavily in the provision of hardware to provide services, as well as the cost of hiring and training professionals to support this hardware. In traditional data centers, many of the costs and resources are lost due to the special service provider being considered for service provision. Cloud computing is a technology used in data centers. These ideas are outdating traditional data centers and integrating servers. The current computing platform intends to integrate existing facilities and implement services to the extent possible through fewer servers. This is done through virtualization technology.

Virtualization technology saves in many areas such as physical location, electricity, cost, cooling systems, cable and space. In addition to the above, the availability, management, and exploitation of resources are also the benefits of virtualization. Many of the cloud computing services provided by the public computer model enable the use of these services to be similar to those of the general public. This is while other types of suppliers offer their subscription services. The sharing of computer-aided power among

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several tenants can improve the productivity rate, because in this way other servers do not go unheeded without reason.

One reason is that computers are used more often because cloud computing customers need to calculate and determine their maximum load. In general, the benefits of cloud computing can be exploited in the application of both industry and organization.

In the business, Cloud Computing displays access and use of business services in a new way; in addition, it has revolutionized the economic debate because, despite the large scale of infrastructure shared, for each application Or the business unit is used only as a private part of this shared space, and upon request and at the moment, the scale and quality of the service is provided. Most importantly, cloud computing provides organizations with a new pricing model that does not require much investment to achieve organizational goals, but a new economic model based on pay per user, every month, and a variety of ways to use Has been raised.

Cloud computing has led to the elimination of many of the cost of implementing OKP products, not only for this platform, but also for hardware servers, databases and storage computers, test and development resources, and so on. Cloud computing provides the development of processes with the use of external service providers or a combination of internal services. Regardless of the scale, cloud computing allows businesses to focus on continuous innovation rather than on the details of service development, hosting, and maintenance, and thus significantly reduce the barriers that OKP faces. By using cloud computing, the business will be able to speed up process improvements and graduate from dependency on IT resources; besides, the business can look for new solutions to process development that fully integrates IT Independent or only slightly dependent on it.

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