Research on the Construction of Home Service Enterprise Standardization System

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ABSTRACT

The healthy development of domestic service enterprises is inseparable from standardization. Based on the cloud manufacturing service scheduling optimization method, a sound standardization system for home service enterprises is established. Task scheduling is a complex problem in collaborative virtual manufacturing chain operation management. Considering that the current home service enterprises rely on the long-term commitment to the scheduling and organizational model, a scheduling framework for the cloud manufacturing model is urgently needed. For this reason, a cloud manufacturing service scheduling orchestration model based on availability and time slots analysis is put forward.

KEYWORDS
Home service enterprises; cloud manufacturing; cloud services; scheduling framework; enterprise standardization.

INTRODUCTION

The continuous improvement of urban residents' living standards has promoted the rapid development of home service industry [1]. However, due to the low level of management of enterprises, the quality of service is not high, resulting in poor reputation in the enterprise market. It leads to the development of home service enterprises lack of motivation. Therefore, based on the cloud manufacturing service scheduling optimization method, a sound home service standardization system is established [2]. The research on Cloud manufacturing is mainly articulated around the promotion of collaboration among service providers to increase the global manufacturing capabilities and create virtual enterprises that satisfy complex service requirements and designs. For manufacturers, here denoted as service providers, Cloud manufacturing also presents a valuable enhancement of their resources’ occupancy and a way to rapidly expend their business [3]. However, the interplay among service providers is an important parameter to issue when it comes to cloud service scheduling. The collaboration orientation and the resource occupancy must be addressed as the main driver for the scheduling framework establishment [4]. Therefore, a strategy concerning the scheduling approach in Cloud manufacturing based on resource service availability and globally optimized through artificial bee colony (ABC) algorithm is proposed.

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CLOUD MANUFACTURING RESOURCES DYNAMIC SCHEDULING
SYSTEM COMPONENTS

In order to improve resource utilization under the premise of ensuring resource performance, we propose a dynamic scheduling strategy based on resource load balancing, and establish a dynamic management and scheduling system for cloud manufacturing resources, as shown in Figure 1. Dynamic scheduling system consists of five major components: Task Manager, load balancer, task selector, dynamic scheduler, fault-tolerant processing.

The role of task manager is to manage the various tasks, set up a ready task set, and dynamically describe tasks that can be scheduled at a time. In the process of submitting a task, the client submits a file that contains all the processing information of the task and some other task description information. They constitute a global description of the task, including the task space, form, content, quality of service requirements, monitoring parameters and task execution strategy.

Load balancer monitoring the system and the load of each resource in the system, and determines whether the task should be assigned to the resource node according to the load of the current system and the load of the current resource node. At the same time, complete the dynamic information collection. According to the dynamic information to complete the evaluation of some indicators and the corresponding process control, and the dynamic information of the database is written to the database.

Task selector is responsible for selecting the corresponding task to the resource node, and the task is distributed according to the Qos of the task submitted by the user. At the same time, the task of fault tolerance is selected and added to the task manager to its re-scheduling.

The dynamic scheduler according to the set of ready task resource requirements and resource node service capacity, negotiation scheduling request for each task in the task set. Most jobs are scheduled to those processes in which the jobs have both minimum execution time (MET) and earliest finish time. According to the change of the system state, the type and quantity of the resources are allocated reasonably [5]. This part is mainly based on the needs of the customers, matching the task to the best resources, forming the scheduling result set and feedback the system information to the customers and the resource providers.

Figure 1. Dynamic management and dispatching system of cloud manufacturing resource.
Fault tolerant processing is re-scheduling. Re-scheduling situation occurs in the production or after the scheduling. The customer or the resource provider is not satisfied with the scheduling result and rejects the scheduling result. During the production process, the resource provider has to abandon the task because of a short-term irreparable fault. In both cases, the platform management system should re-scheduling according to the actual situation and data.

EXPERIMENTS

Probability selection based on population

In the original Artificial Bee Colony (ABC) algorithm, the probability selection is based on the fitness value only, so that the super-individual with the useful information but poor fitness value is easy to be eliminated [6]. The missed information will directly affect the global convergence of the algorithm. The population-based method was chosen to update the nectar source, and the population diversity was maintained regardless of the objective function value. The following experiments are around the ABC control parameters, the time unit variable considered and the vector of the time allocation precision. In fact, when scheduling is measured by the hours instead of days, the precision is more accurate although the computational time will be increased. In the following experiment, we suppose a period of 30 days, with the unit of time expressed in hours, that is to say, 12 working hours per day, so that a period is 360 hours. We fixed the weights \( \omega_k \) and \( \omega_{rel} \) as \( \omega_k = \omega_{rel} = 0.5 \). These ABC tuning parameters are linearized according to the problem size. As shown in equation (1).

\[
P_{\text{Pop}} = \prod_{i=1}^{N} \frac{\sum_{i=1}^{N} \sum_{j=1}^{M} (t_{\text{end}_{ij}} - t_{\text{start}_{ij}})}{\sum_{i=1}^{N} \sum_{j=1}^{M} (t_{\text{end}_{ij}} - t_{\text{start}_{ij}})}
\]

(1)

Finally, the three control parameters expressed as follow (i.e. NP, limit and MCN), where MCN is main driver for the balance between time consumption and optimal fitness precision.

\[
NP = \frac{N(t_{\text{end}} - t_{\text{start}})}{100}
\]

\[
\text{limit} = 5NP
\]

\[
MCN = P_{\text{Pop}}^{0.5}
\]

(2)

Performance evaluation

In the following experiment, we suppose a sequence model composed of 10 resource services (i.e. \( N = 10 \)) with 200-time units divided in 4-time slots for each resource service. Therefore, the number of \( P_{\text{Pop}} \) is equal to \( 10^2 \times 10^{20} \). Then, focus on the fitness evaluation over computational time. ABC_Cloud manufacturing SCH fitness evolution toward GA_Cloud manufacturing SCH and PSO_Cloud manufacturing SCH as shown in Figure 2.
Figure 2. ABC_Cloud manufacturing SCH fitness evolution toward GA_Cloud manufacturing SCH and PSO_Cloud manufacturing SCH.

Figure 3. MCN cycle number vs. Percentage Covered.

Due to ABC_Cloud manufacturing SCH not only rely on the manufacturing time, but also rely on the reliability of the solution issued. Through analyze the exploration of possible solutions, we can observe the performance of ABC_Cloud manufacturing SCH. The following analysis includes 10,000 possible solutions (i.e. Figure 3) result of the worst evaluation runs around 100 results. This proves the efficiency of the optimization as it only browses 35% than the existing population.

**Manufacturing time evaluation impact**

The purpose of ABC_Cloud manufacturing SCH is to include it to the ABC_CSCloud manufacturing the composer agent. Finally, the best solution is calculated with the simple consideration of the linear expression of manufacturing time i.e. the sum of all the cloud service manufacturing time for a total availability (100%) (i.e. Best no Av solution), and oppose it to my approach based on availability focus (i.e. Best no Av solution with Av). Thus, we can observe the difference from the optimal fitness. The results are shown in Figure 4.
CONCLUSION

Standardization is of great significance to promote the healthy development of domestic service enterprises. In order to improve the standardization level of home service enterprises, based on the cloud manufacturing service scheduling optimization method, a sound standardization system for home service enterprises is established. The present scheduling framework provides significant benefits in term of service manufacturing. From an availability concern and providers time slots, ABC_Cloud manufacturing SCH is able to achieve optimal balance between the manufacturing duration and the reliability associated to the service manufacturing process. Once the cloud manufacturing service composition issued, the scheduling process takes over. ABC_Cloud manufacturing SCH is the warrant of the Cloud manufacturing paradigm. From the perspective of future work, there are still other challenges await as many discussions on its resource organization and manufacturing service processing model.

REFERENCES