A Balance Optimization Method for the Quantity of Business in Finance Shared Service Center

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Abstract. This paper proposes using Zipf-like distribution to balance and predict the quantity of business in finance shared service center. It can estimate prediction parameters according to the present statistics of the business quantity occurrence. We classify the quantity of business from finance shared service center, and analyze the prediction rate through the quantity of business’s characteristic. We synthesize the analysis results in different prediction time granularity and prediction business quantity queue. Finally, we use the actual data from finance shared service center to discuss the effectiveness of prediction method. The discussion and analysis results indicate that this prediction method can balance the quantity of business efficiently.

Introduction

The access patterns of many applications reveals certain characteristics: high workloads, large number of users, massive data and many storage nodes. But the most notable characteristic of this access pattern is: 80% IO requests only access 20% data, which is known as “Pareto principle” [1]. These characteristics lead to the emergence of business quantity in finance shared service center. As a result, how to balance these quantities of business is a critical research focus in optimization of finance shared service center. We develop a new Prediction Business Quantity Model (PBQM) based on Zipf-like distribution. We first estimate parameters according to the present statistics of the business quantity occurrence: α parameter, time granularity, and auxiliary parameters such as business quantity occurrence frequency’s growth rate, quantity of business queue and the least accuracy rate etc. Then we use the actual data from finance shared service center to discuss the effectiveness of PBQM. We classify the type of business quantity, and analyze the prediction rate through the classified business quantity’s characteristic. Finally, we synthesize the analysis results in different time granularity and prediction quantity of business queue. The discussion and analysis result above indicate that PBQM can predict and balance the quantity of business efficiently.

As the enterprises’ business spreads over the world and become stronger, the characteristics of business which are crossing areas and industries get more obvious. Multinational companies and their regional headquarters in every country have been increasing year by year. Enterprises’ international competence becomes vital. Accordingly, it is now one of the most essential problems faced by accounting and financial business from different countries, locations or industries in one or several places to ensure the records and reports of accounting to be on time, with standard integrated structures, therefore, the appearance of the new type of management mode is inevitable in the history.

Finance shared service center is the new application of the companies’ fresh assembling sharing management mode upon financial management whose aim is to realize the integration of financial sharing service, financial management and monetary management, establish centralized finance shared service center in the company, support multiple terminals and finally realize the co-operational application of check-ups, reimbursement, fund and decision-making [2]. After transforming the financial management into finance shared service center, it soon becomes the engine for managing
updating which makes the financial management and accountancy’s checking functions of group’s headquarter and all level of management clearer and more detailed in order to make it rise form sharing level to real and timely management and decision-making, let financial managers participate more in business and operations, deepen management accounting and facilitate the financial control transferring to business control by breaking the boundary and restriction in regions, time and traditional checking equity. Whereas finance shared service center is an integrated sharing backstage mode which allocates each employee huge workload as all member units brought in are addressed together under finance shared service center and its time and quantity of work are out of balance, it is hard to attribute working time of employees who work under the finance shared service center properly and as a result, over work is inevitable. Long term overload won’t only reduce enthusiasm of employees but the accuracy of financial management and accounting check-ups will also be cut down enormously which departs from the initial reason why to build financial shared service center [3]. Consequently, the analysis of business quantity and balance optimization under the finance shared service center arouses wild attention. Suppliers and people work on finance cannot merely enhance the emphasis on business quantity mentally, but also need to adopt systematic key technique to improve the balance of business quantity under the finance shared service center effectively beginning with the aspect of business quantity regarding tackling of the financial shared service center’s business and achieve key technique of balance optimization and business quantity analyzing model by taking multiple theories and technique into account. Aiming at the high efficiency of the need to tackle business, this passage will begin at the quantity that affects the business balance under the financial shared service center [4].

Aiming at the high-efficient business processing requirement which is concerned about financial shared service center, this text will start from the quantity of business which influences business balance under the environment of financial shared service center, analyzing all kinds of business works’ different characteristics under the financial shared service center, establishing the business quantity analytic models which is based on the Zipf Law. Also, the statistics such as the current workload done by all of business end of processing in the finance shared service center will be acquired and counted. Thus, parameters required by the models can be estimated. Through the results which are tested out whether these models have accurate rate of prediction using Zipf Law models, estimated parameters and multiple application environments’ data sets, thereby, the new workload and the situation of ranking which are concerned about these business end of processing can be predicted in the future time of financial shared service center. What's more, redistribution concerning business improvement which is aimed at the different predicted business end of processing classified by high business quantity and low business quantity can be carried out in the future time. The objective of improving business quantities evenly under the finance shared service center will be achieved. This text lucubrates the business quantity analyzing models and balanced improvements under the environment of finance shared service center at the theoretical foundations. The objectives are not only putting forward more flexible and efficient business quantity analyzing models and the vital technology of balanced improvement, but also being able to arrange enterprise staffs’ workload and working time scientifically and reasonably, which leads to the results of improving employees’ motivation and working efficiency, improving the accuracy of business processing, improving financial working efficiency. Consequently, it can give full play to financial shared service center’s advantage functions. This text is not merely having a great practical significance, scientific significance and considerable economic benefits. It is also beneficial for industries relating with finance shared service center of our nation about their health, steady and rapid development.

This paper is based on the foundation of investigating business quantity analyzing models’ establishment and balanced improvement under the environment of financial shared service center, directing at the following aspects: finance shared service center is the newest application in the financial management with respect to a kind of enterprise centralized and shared management mode which deals with both enterprise globalization’s development and the problem regarding to how to strengthen management of subsidiaries distributed in all global and all kinds of industries, reducing
enterprise management costs and improving business operating efficiency [5]. Additionally, the imbalance of business quantity made from different end of processing is on the rise, resulting in the practical background which shows the low working efficiency of financial shared service center. According to the most cutting-edge finance shared service center with business quantity and the vital technology about balanced improvement from home and abroad, it will start from counting and acquiring the handling capacity of every business end of processing under the financial shared service center, combining with Zipf Law’s mathematical method. In order to make the finance shared service center takes advantage of higher efficiency, the researches regarding to business quantity analyzing models and the vital technology of balanced improvement will be carried forward. At last, it will be able to adapted to the enormous needs of finance shared service center in the future and achieves the objectives with respect to industrialization of business quantity analyzing forecast and improving platform workings evenly.

**Prediction Business Quantity Model**

Zipf observed long time ago that the distribution of word frequencies in English, the rank-r word has the probability \( P_r \) [6]. So, in finance shared service center, we also observe that the distribution of business quantity in work flows. M denotes all business quantity and B denotes one business quantity in the finance shared service center, so the probability distribution about the business quantity is

\[
P_r = \frac{C}{r^\alpha}, \sum_{r=1}^{M} P_r = 1 \Rightarrow C = \left[ \sum_{r=1}^{M} \frac{1}{r^\alpha} \right]^{-1}
\]

The parameter \( \alpha \) is a variable, In a fixed period of time, the value of \( \alpha \) in Zipf’s Law is a constant, and from the Eq. 1, we have \( C(kT) = C(T) \). At the work time \( T \) or \( kT \) in finance shared service center, if a business quantity in the high frequency business quantity queue, \( f_r \) denotes the business quantity work frequencies, the business quantity work probability of the \( B_r \) and \( B'_r \):

\[
P_r(T) = \frac{C}{r^\alpha}, P_{r'}(kT) = \frac{f_r(T)}{F(T)} \Rightarrow f_r(T) = \frac{f_r(kT)}{F(kT)} = \frac{F(kT)}{F(T)} r^\alpha
\]

In order to simplify the computation, if \( M \) remain unchanged from time 0 to \( kT \) and assume that \( F \) (the total number of business quantity work frequencies) is a linear function which only decided by time (this condition conforms to the most of business quantity work pattern of the practical finance shared service center environment). So we have:

\[
\frac{F(kT)}{F(T)} = k
\]

Combining the Eq. 2 with Eq. 3, we have:

\[
\frac{r'^\alpha}{r^\alpha} = \frac{f_r(T)}{F(T)} \cdot \frac{F(kT)}{f_r'(kT)} = k \cdot \frac{f_r(T)}{f_r'(kT)}
\]

At the time \( t = kT \) in finance shared service center, we just compute the ratio of \( f_r(T) / f_r'(kT) \). So, considering the extreme scenario, the business quantity work frequency of \( B_r \) doesn’t increase from the time \( T \) to \( kT \) (\( f_r(T) = f_r'(kT) \)). So we revise the Eq. 4 to Eq. 5, and \( Q_h \) denotes high frequency business quantity queue, we have:

\[
\frac{r'^\alpha}{r^\alpha} = k \Rightarrow r' = k^{\frac{1}{\alpha}} \cdot r \Rightarrow r' \leq Q_h \Rightarrow r \leq Q_h \cdot k^{\frac{1}{\alpha}}
\]
Estimating Parameters of the PBQM

**Estimating \( \alpha \) parameter.** In Zipf-like distribution, according to the Eq. 1, we first have: C is equal to the most frequently working business quantity that appears in the finance shared service center with the probability \( P_1 \), if \( r = 1 \), then \( P_1 = C \).

In order to acquire many methods to estimate the value of \( \alpha \), we re-compute the Eq. 2 and have (\( r < j \)):

\[
\frac{P_r}{P_j} = \frac{C / r^\alpha}{C / j^\alpha} = \left(\frac{j}{r}\right)^\alpha \Rightarrow \alpha = \frac{\log(P_r / P_j)}{\log(j / r)}
\]  

(6)

From the Eq. 6, we compute many values of \( \alpha \) and acquire arithmetic mean value and geometric mean value. At the time \( t = T \), we choose the business quantity work frequency \( N \) is 100 thousand. If we choose two different \( r \) and \( j \) from (1, 2 \( \ldots \) 10), which can compute 45 different \( \alpha \) values. The simplest method to judge whether the value of \( \alpha \) is reasonable or not: if \( q_r = P_r \) and \( C = P_1 \), transferring the Eq. 1, we have:

\[
q_r = \frac{C}{r^\alpha} = \frac{P_1}{r^\alpha}
\]  

(7)

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<th>( \alpha )</th>
<th>( p_1/q_1 )</th>
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On the whole if \( q_r \) is close to \( p_r \), \( \alpha \) is reasonable, otherwise \( \alpha \) is unreasonable. We utilize (Fit ratio) \( P_r / q_r \) to judge whether \( q_r \), (Fit frequency) is close to \( p_r \). The more \( P_r / q_r \) is close to 1, the more \( q_r \) is close to \( p_r \). For example in the actual finance shared service center (FSSC1). When \( r = 9 \) and \( j = 10 \), we compute the value of \( \alpha \) is 0.329392, the fit ratios of this \( \alpha \) are shown as Table 1. Most of the fit ratio is close to 0 (much less than 1), so this \( \alpha \) value is unreasonable. According to our calculation, the most reasonable value of \( \alpha \) is 0.94. The fit ratio of the most reasonable \( \alpha \) in FSSC2, FSSC3 and FSSC4 are 0.62, 1.34 and 0.68.

**Estimating \( k \) parameter.** The most important evaluation criterion is High frequency business quantity Prediction Accuracy (HPA): the ratio of true positive predicted high frequency business quantity to the high frequency business quantity queue:

\[
HPA(t) = \frac{P(t)}{Q_h}
\]  

(8)

In Eq. 5, we have \( Q_h \cdot k^{-\frac{1}{a}} \), this is the boundary value which is still in the new popularity data queue, if only the data rank smaller than or equal to this value, it is still popularity data. So we have:

\[
HPA(kT) \geq \frac{Q_h \cdot k^{-\frac{1}{a}}}{Q_h} = k^{-\frac{1}{a}}
\]  

(9)

In Eq. 9, if \( HPA(kT) = k^{-\frac{1}{a}} \), defined as Minimum High frequency business quantity Prediction Accuracy (\( HPA_m \)). We can make sure that if \( HPA_m \) value is high, then the prediction time is short, and
PBQM can not reflect the efficiency; if HPA value is low, then the prediction time is long, and the results of the prediction model might be not accurate. So, we first choose 5 values about HPA: 10%, 20%, 30%, 40% and 50%, and then we compute 5 values of k. We define $k_1 T = T_1$, $k_2 T = T_2$, $k_3 T = T_3$, $k_4 T = T_4$ and $k_5 T = T_5$, meanwhile, $T_1 > T_2 > T_3 > T_4 > T_5 > T$. In four finance shared service centers, some of them are small data sets, some are big data sets. Based on PBQM, the popularity data queue is 30, 40, 50, 60, 70, 80, 90, 100 and 200.

Experiments and Analysis

**Actual finance shared service centers.** The actual finance shared service centers that drive our experiments consist of four types. Four different finance shared service centers are used, FSSC3 and FSSC4 are typical of small and short-period data centers. FSSC1 and FSSC2 are typical of big and long-period data centers.

**Prediction rate results.** The results of prediction rate are shown in Fig. 1-2. In these figures, the prediction rate at the time $T_3$ is higher than the results at other prediction time, the reason is we use unchanged parameters at the time $T$ in finance shared service centers to predict high frequency business quantity rank from $k_1 T$ to $k_5 T$, but in real finance shared service center, when current time is $k_3 T$, our PBQM prediction is dynamical, and the parameters used in model would adjust according business quantity work condition, we would use related parameters at the time $k_3 T$ to predict $k_2 T$ or $k_1 T$, thus the accuracy of high frequency business quantity prediction model would be higher.

**Results analysis.** Periodical high frequency business quantity refers to one work accessed frequently in a time period. FSSC3 has periodical high frequency business quantity characteristics. The FSSC1 business quantity ranked top in the growth rate of business quantity work frequency during $\Delta T$, but fall behind during time $T$. Therefore, the time from 0.8T to T will be predicted as a new high frequency business quantity in the next period. But, the actual business quantity work is on the contrary, as the growth rate in T to KT decreased, which lead to a drop in the rank, so some of prediction in KT period is relatively low.

![Figure 1. Prediction rate of FSSC1 and FSSC2 (left figure is FSSC1 and right figure is FSSC2).](image1)

![Figure 2. Prediction rate of FSSC3 and FSSC4 (left figure is FSSC3 and right figure is FSSC4).](image2)
Temporary high frequency business quantity refers to the business quantity that transfer from seldom worked to the focus of business quantity work, and when they become high frequency business quantity, other business quantity fall behind in the rank. FSSC4 has temporary high frequency business quantity characteristics. The work frequency of these business quantities stay unchanged from 0.9T (or 0.8T), and become leading in the work frequency rank. Therefore, these business quantities will be predicted as the new high frequency business quantity in the next moment. However, the actual work situation is on the contrary: the high frequency business quantity stays unchanged in KT, while other business quantity’s work frequency increase, which leads to the actual rank fall behind compared to moment T, so part of the prediction in KT is not so accurate.

The prediction of high frequency business quantity rate FSSC1 and FSSC2 are very stable now, and the rate is fairly high.

Summary

In this paper, we propose a Prediction Business Quantity Model (PBQM) based on Zipf distribution. We combine the different characters of finance shared service centers, use different high frequency business quantity queue and prediction time to demonstrate the efficiency. The summaries of this paper are as follows:

(1) Due to different working characteristics, different work load and different level of importance by business quantity concerning every business end of processing, thus, different working methods need to be used for each business end of processing to improve business quantity balance. The way of PBQM which are based on Zipf distribution can handle the business balance problem under the finance shared service center.

(2) The degree of any models’ accuracy rate is related to realize efficiency directly. Through analyzing business end of business quantity prediction model, and testing this model’s accuracy of prediction, guarantee of business quantity balance research under the finance shared service center will be provided.

(3) As for the business end of processing which rankings are in the top under the finance shared service center in the future time, the proportion occupying finance shared service center is small. Redistribution concerning business improvement which is aimed at the different predicted business end of processing classified by high business quantity and low business quantity can be carried out in the future time. Sequentially, business quantity balanced improvement scheme can be realized by the use of predicted results which is based on PBQM.

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