



# Research on Dynamic Network Load Evaluation Algorithm Based on Throughput Monitoring

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**Abstract.** In order to solve the problem of too low total load of individual nodes, a dynamic network load evaluation algorithm based on throughput monitoring was proposed. The node monitoring quantity analysis and evaluation parameter determination were used to complete the monitoring description of the dynamic network throughput rate. On this basis, through the improvement of load effect, evaluation mechanism establishment and correction factor calculation, the new evaluation algorithm was completed. The experimental results showed that after applying the dynamic network load evaluation algorithm based on throughput monitoring, the problem of too low total load of individual nodes was effectively solved.

**Keywords:** Throughput monitoring · Load evaluation · Network algorithm · Node monitoring · Equilibrium mechanism · Correction factor

## 1 Introduction

The throughput rate originally refers to the total amount of service data that the business system can provide in a unit of time. However, with the advancement of scientific and technological means, this concept has gradually been applied to many fields such as computer and data application communication. It refers to the average rate of network data passing through the communication channel in a unit time, and can also be described as the average rate at which the node successfully completes the data delivery processing per unit time. Usually, bit/s is used as the description unit [1]. Under the premise of accurately measuring the network throughput rate, by testing the performance of dynamic data under the condition of overloaded resources, the processing method of obtaining the overall workload level is the load evaluation method of the dynamic network. In the past, for a long time, relevant research departments in China used virtual machine delivery means to divide the load of dynamic networks. Then, through the method of fixed-point throughput calculation, the trend of network load in each operating area is counted, and a detailed load evaluation algorithm is developed according to the development of monitoring nodes in the functional area. Although this algorithm construction method can fully reflect the importance of network throughput monitoring parameters, with the gradual increase of application time, the total load of individual nodes can not be effectively averaged, resulting in large

deviations in the evaluation results. In order to avoid the above situation, a new dynamic network load evaluation algorithm based on throughput monitoring is proposed by means of equalization evaluation mechanism and correction factor. And through the way of comparing experiments, the practical application value of the new algorithm is proved.

## 2 Dynamic Network Throughput Monitoring Description

### 2.1 Dynamic Monitoring of Web Nodes

Web network dynamic node monitoring is a non-functional description attribute. It can realize real-time analysis of node monitoring by determining load condition response time, service throughput, information access frequency, and node available service rate. Applying this analysis result can fully represent the basic access status of dynamic throughput in the Web dynamic network environment. The quality of service in the Web monitoring environment can further influence the distribution of dynamic nodes on the network. It evaluates the monitoring of dynamic nodes of the Web network from the perspectives of node accuracy, distribution security, and average response time, and can obtain multiple conditional indicators with description functions [2]. Assume that the average response delay in the web network environment is  $q$ , and the access frequency of each node monitoring is  $p$ . Under the condition that the basic evaluation index remains unchanged, the dynamic monitoring amount of the Web network can be expressed as:

$$R = \frac{qe + pw + u(i - 1)}{yt^2} \quad (1)$$

Where  $R$  represents the dynamic network monitoring amount of the web network,  $e$  represents the load condition response time, and  $w$  represents the service throughput parameter,  $i$  represents the information access frequency limit,  $u$  represents the node available service rate,  $y$  represents the analysis condition index coefficient, and  $t$  represents the basic access adjustment frequency. The flow chart of the web network is as follows (Fig. 1):

### 2.2 Throughput Load Evaluation Parameter Determination

When the user issues an access service to the Web dynamic network node, the evaluation parameter value of the throughput load situation and the Web service load parameter may cause a certain discrepancy. When the access value is small, the user's access request will not be affected, and the expected value of the load evaluation algorithm will not cause a large deviation. However, when the access value is large, the execution time of the user access request will gradually increase as the frequency of access increases, until the average response delay reaches the full operating cycle of the server [3, 4]. The positive attribute has a decisive influence on the throughput load evaluation parameter. The non-affirmative attribute needs to be combined with the Web

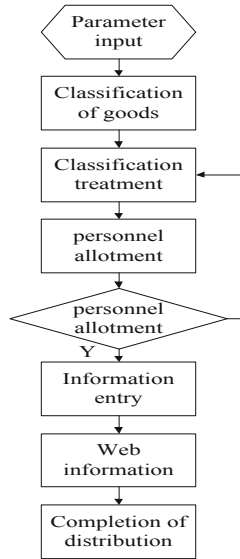


Fig. 1. Flow chart of the web network

service evaluation to reflect the impact on the throughput load evaluation parameters. The specific parameter determination criteria are as shown in formula (2).

$$D = 1 + \frac{1}{n} \left( \sum_{a=1}^s \frac{fG - H_1}{R} + \frac{H_2 - lG'}{R'} \right) \tag{2}$$

Where  $D$  represents the throughput load evaluation parameter,  $n$  represents the Web service load parameter, and  $a$  represents the execution lower limit value of the complete operation cycle.  $s$  represents the execution upper limit value of the complete running cycle,  $f$  represents the discriminating threshold of the function execution condition, and  $G$  represents the affirmative attribute operator.  $H_1$  represents the original variable of orientation,  $R'$  represents the opposite of the monitoring amount of the dynamic node of the network, and  $H_2$  represents the quantitative operator related to the non-positive attribute.  $l$  represents the average deviation degree parameter, and  $G'$  represents the opposite of the affirmative attribute operator.

### 3 Load Assessment Algorithm Based on Monitoring Description Results

#### 3.1 Dynamic Network Service Load Effect Is Perfect

The dynamic network service load improvement is the key to the establishment of new evaluation algorithms. With the support of the Xen paravirtualized operating platform, all virtual machines are created and debugged by the simultaneous operation of

multiple physical servers. It then uses the Web Services service of the dynamic network configuration to deploy the location of all virtual machines [5]. When all the dynamic network load factors that meet the throughput monitoring requirements exist in the Tomcat container in the state of the War package, the migration scheduling operation of the network virtual machine is effectively mediated. In order to achieve a high level of dynamic network service load, the dynamic network load resources are balanced and monitored with the support of the virtual monitoring module and the cluster selection module. Under the premise that the server Apache hot start function is not affected, the throughput of all network dynamic loads can be modified and configured to ensure that the algorithm automatically generates continuous access path backups during the evaluation process. And by collecting the monitoring result scheduling scope, the load information of all running virtual machines is effectively summarized, and the dynamic network service load effect is effectively guaranteed when the total amount of data remains unchanged [6, 7]. The detailed effect improvement process is shown in Fig. 2.

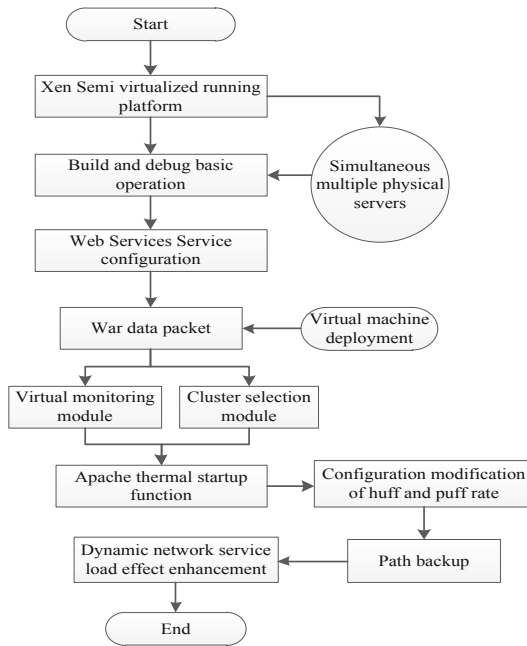


Fig. 2. Dynamic network service load effect improvement flow chart

### 3.2 Equilibrium Evaluation Mechanism

The equilibrium evaluation mechanism is the key to ensuring the efficiency of the new algorithm. When the dynamic network service accesses the starting load request to the virtual machine, the load on the server side will be transiently over-excited, resulting in a large deviation between the load service instance selection and the standard result. In order to avoid the above situation, the server selects the algorithm service type, selects

the overload limit value of the current network running state on the core virtual machine, and maintains the overall service load value at a stable level through subsequent equalization adjustment. Using the above adjustment results, the load service information of the dynamic network is organized and improved. After all the destination migration nodes meet the service maintenance requirements, select the most suitable virtual machine running position as the transition node of the load information, and then create a new connection path, so that the true value of the equilibrium evaluation result gradually approaches the target value. After all dynamic network load service items are migrated to the virtual machine node, the establishment of a new algorithm equalization evaluation mechanism is completed. Detailed mechanism analysis is shown in Fig. 3.

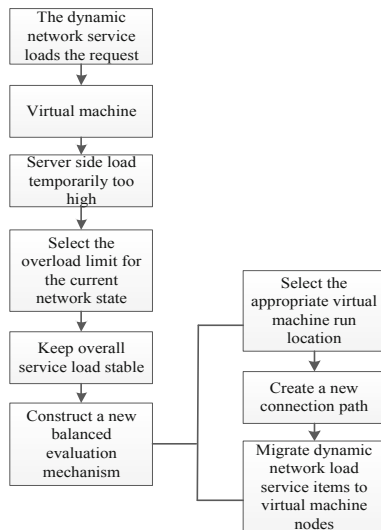


Fig. 3. Analytical diagram of establishing principle of equilibrium evaluation mechanism

### 3.3 Load Evaluation Correction Factor Calculation

The load evaluation correction factor can guarantee the authenticity of the dynamic network throughput monitoring results and make the evaluation results of the algorithm more convincing. The web network server has two kinds of load transmission modes: CPU occupation and background occupation. The CPU usage can cause the throughput of the to-be-detected to be gathered by triggering the network load, and the total amount of the core CPU can be effectively controlled by executing the load connection request. When the throughput of the network dynamic load reaches a certain level, all background processing rights are released, and the CPU usage no longer fluctuates with the change of the load evaluation correction factor. The background occupancy mode can directly obtain the throughput rate monitoring result of the dynamic network load situation, and trigger a series of evaluations to take up the occupation. At this time, the evaluation accuracy reaches the boundary state, and as the application time of the

algorithm increases, the accuracy of the load evaluation correction factor will gradually increase. The specific factor is calculated as follows:

$$\phi = \frac{\int (\frac{\eta^k}{D} + |c \cdot \lambda|)}{M + xv} \quad (3)$$

Where  $\phi$  represents the load evaluation correction factor,  $\eta$  represents the total amount of CPU carried, and  $k$  represents the occupied load stator.  $c$  represents the throughput aggregation period,  $\lambda$  represents the dynamic network load monitoring coefficient,  $M$  represents the call extreme value of the load evaluation process,  $x$  represents the authority liberation parameter, and  $v$  represents the absolute value of the background occupancy operator. Integrating the above operating principles, the construction of a dynamic network load evaluation algorithm based on throughput monitoring is completed.

## 4 Experimental Results and Analysis

### 4.1 Experimental Parameter Setting

In order to ensure the authenticity of the experimental results, the experimental running environment and parameter setting scheme are shown in the following Table 1.

**Table 1.** Experimental environment

Experimental environment index	Parameter
Computer CPU	Intel(R) Core(TM) i7-6700 CPU@3.40 GHZ
RAM	8 GB
Operating system	Windows 10
The development tools	Eclipse
Computer built-in hard disk capacity	1 TB
External hard disk capacity	5 TB

The relevant experimental parameters can be set according to the following table.

**Table 2.** Experimental parameter setting table.

Parameter name	Experience group	Control group
EPT/(min)	50	50
NLP	0.66 (high speed) 0.82 (low speed)	0.66 (high speed) 0.82 (low speed)
TNL/(T)	$9.82 \times 1011$ (high speed) $9.94 \times 1011$ (low speed)	$9.82 \times 1011$ (high speed) $9.94 \times 1011$ (low speed)
DNS/(%)	92.75	92.75
AEP	0.43	0.43

In the above table, the EPT parameter represents the experimental time, the NLP parameter represents the node load parameter, the TNL parameter represents the total node load, the DNS parameter represents the dynamic network stability, and the AEP parameter represents the algorithm evaluation parameter. In order to ensure the authenticity of the experimental results, the experimental parameters of the experimental group and the control group were always consistent.

### 4.2 Individual Node Load Total Comparison

In order to avoid the impact of sudden events on the authenticity of the experimental results, this experiment is divided into two parts. As an experimental execution condition, the values of dynamic network stability, algorithm evaluation parameters, etc. remain unchanged. Under the condition that the running experiment computer keeps running at high speed and the node load parameter is 0.66, 50 min is used as the experiment time, and the changes of the total load of individual nodes after the application of the experimental group and the control group algorithm are respectively recorded; Under the condition of running the experimental computer to keep the low speed operation and the node load parameter of 0.82, the experiment time was recorded with 50 min as the experiment time, and the change of the total load of the individual nodes after the application experiment group and the control group algorithm were respectively recorded. The specific experimental comparisons are shown in Tables 3 and 4.

**Table 3.** Comparison of individual node load totals (high speed).

The change of the total load of the individual node in the experimental group/( $\times 1011$ T)	Experimental time/(min)	The change of the total load of the individual node in the control group/( $\times 1011$ T)
6.78	5	6.57
6.78	10	6.34
6.78	15	6.20
7.89	20	6.12
7.89	25	5.99
7.89	30	5.83
9.31	35	5.71
9.31	40	6.02
9.31	45	6.15
10.42	50	6.73

Comparing Tables 2 and 3, it can be seen that under the condition that the running experiment computer maintains high speed operation and the node load parameter is 0.66, with the increase of experimental time, after applying the experimental group load evaluation algorithm, the total load of individual nodes shows a step-wise increasing trend. When the experiment time is 50 min, the total load of each node reaches the maximum value of  $10.42 \times 1011$  T, which exceeds the target upper limit value of  $9.82 \times 1011$  T.

**Table 4.** Comparison of individual node load totals (low speed).

The change of the total load of the individual node in the experimental group/( $\times 1011$ T)	Experimental time/(min)	The change of the total load of the individual node in the control group/( $\times 1011$ T)
7.21	5	8.35
7.35	10	8.35
7.66	15	8.35
7.84	20	8.35
7.91	25	8.35
8.26	30	8.35
7.93	35	8.35
9.98	40	8.35
10.23	45	8.35
9.79	50	8.35

Comparing Tables 2 and 4, it can be seen that under the condition that the running experiment computer keeps running at a low speed and the node load parameter is 0.82, with the increase of experimental time, after applying the experimental group load evaluation algorithm, the total load of individual nodes shows a trend of rising and falling alternately. When the experimental time is 45 min, the total load of individual nodes reaches the maximum value of  $10.23 \times 1011$  T, exceeding the target upper limit value of  $9.94 \times 1011$  T; After applying the load evaluation algorithm of the control group, the total load of individual nodes is always stable, which is  $8.35 \times 1011$  T from the beginning to the end, which is much lower than the experimental group. In summary, under the condition that the experimental computer keeps running at low speed and the node load parameter is 0.82, the dynamic network load evaluation algorithm based on throughput monitoring can increase the total load of individual nodes by  $1.88 \times 1011$  T.

## 5 Conclusions

The dynamic network load evaluation algorithm based on throughput monitoring uses the Web platform as the background. By continuously improving the node monitoring and basic load conditions, the evaluation accuracy of the algorithm reaches the expected level. Compared with the prior art, the influence of a large number of operation processes on the execution efficiency of the algorithm is avoided, and a complicated carrying manner is not required to ensure the execution of the algorithm. From the perspective of practicality, this new algorithm does have certain application feasibility.

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