Journal of Applied Science and Engineering Innovation, Vol.8, No.1, 2021, pp.32-35
ISSN (Print): 2331-9062
ISSN (Online): 2331-9070

ACSS Computation for Life ®

Research on the Computing Method of Network Hosting Service

Ran Li [1,*], Xiao Zhang[1], Yin Tian [1], Haodan Ran

[1] *College of Information and Communications, National University of Defense Technology, Xi'an, Shaanxi, 710106, China*

**Corresponding author. Email: 51375908@qq.com*

Abstract: Calculation method, this paper USES the data envelopment analysis in A zone and B zone, for example, an analysis of the test system managed services, to determine whether the system hosting the effective use of such as computing, storage, network resources and so on all kinds of hardware resources, providing services of ability, with regard to quality resources whether reach the optimal investment portfolio.

Keywords: Envelopment analysis; Hosting service; Information network system

INTRODUCTION

The performance evaluation of the system hosting service is mainly aimed at the efficiency of the system hosting service. The efficiency refers to whether the system hosting service makes effective use of various hardware resources, such as computing, storage and network resources. Whether the ability and quality of service delivery and the input of resources are optimal. Among the existing evaluation methods, data envelopment analysis (DEA) is applicable to the evaluation of system efficiency and effectiveness. DEA is a method to use mathematical programming model to evaluate the relative effectiveness of decision making units (i.e., evaluation objects) with multiple inputs and multiple outputs. According to the evaluation purpose, the system hosting service is evaluated by data envelopment analysis (dea).

THE EVALUATION EVALUATION AND CACULATION PROCESS OF DATE ENVELOPMENT ANALYSIS

Determine the input /output indicator

DEA is a multi-input and multi-output evaluation method. Firstly, a reasonable input \ output index should be determined according to the purpose of evaluation. Generally, the utility index of the evaluation object can be used as the output index. For example, for the system hosting service, the number of managed systems, the faultfree running time of the system, the system failure recovery rate, the system hosting service guarantee rate, the user recommendation rate, the user satisfaction, these indicators are utility indicators, which reflect the ability and quality of the managed service, and take these indicators as the output indicators. Other indicators, such as CPU, memory capacity, storage volume, network bandwidth, etc., are cost indicators that reflect the resources to be invested, and take these indicators as input indicators.

After determining the input \ output index, the evaluation object can be expressed as:

There is a decision-making unit (i.e., the evaluation object) with input indicators and output indicators. The evaluation data of their input indicators and output indicators can be expressed as follows in the form of vectors:

$$X_j = (x_{1j}, x_{2j}, \ldots, x_{mj})^T > 0$$

$$Y_j = (y_{1j}, y_{2j}, \ldots, y_{sj})^T > 0, \quad j = 1, \ldots, n$$

Assuming that the weight vectors of input and output are $v = (v_1, v_2, \ldots, v_m)^T$ and $u = (u_1, u_2, \ldots, u_s)^T$, the following definitions can be obtained:

$$\theta_j = \frac{u^T Y_j}{v^T X_j} = \frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}}, (j = 1, 2, \ldots n) \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Is the efficiency evaluation index of the j decision making unit.

Fractional programming

Considering the evaluation efficiency of the unit of the j_0 decision making unit $DMU_{j_0} (1 \le j_0 \le n)$, the fractional programming model is constituted by taking the efficiency evaluation index of the unit $\theta_{j_0} = \frac{u^T Y_{j_0}}{v^T X_{j_0}}$ as the target and the efficiency evaluation index of all the decision making units $\theta_j = \frac{u^T Y_j}{v^T X_j} (j = 1, 2, \ldots n)$ as the constraint:

Corresponding Author: Ran Li, College of Information and Communications, National University of Defense Technology, Xi'an, Shaanxi, 710106, China

$$Maximize \quad \frac{\sum_{r=1}^{s} u_r y_{ro}}{\sum_{i=1}^{m} v_i x_{io}} = \theta_o$$

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \le 1,\ j = 1,2,\ldots,n, \quad \ldots\ldots\ldots\ldots \ (2)$$

$$u_r \ge 0, v_i \ge 0, \forall r, i.$$

Linear programming form

Charnes-cooper transformation using the fractional programming proposed by Charnes and Cooper:

$$t = 1/\sum_{i=1}^{m} v_i x_{io}\ ,\ \mu_r = tu_r, (r = 1,\ldots,s)\ ,$$

$$\omega_i = tv_i, (i = 1,\ldots,m) \ \ldots\ldots\ldots\ldots \ (3)$$

The linear programming model is obtained by (2) transformation as follows:

$$Maximize \quad \sum_{r=1}^{s} \mu_r y_{ro} = \theta_o$$

$$\sum_{i=1}^{m} \omega_i x_{io} = 1, \quad \ldots \ (4)$$

$$\sum_{r=1}^{s} \mu_r y_{rj} - \sum_{i=1}^{m} \omega_i x_{ij} \le 0,\ \ j = 1,\ldots,n,$$

$$\mu_r, \omega_i \ge 0, \qquad r = 1,\ldots,s; \quad i = 1,\ldots,m.$$

Dual programming model

According to the relevant basic theory of linear programming, the dual problem expression of model (4) can be obtained as follows:

$$Minimize \quad \theta_o$$

$$\sum_{j=1}^{n} x_{ij}\lambda_j \le \theta_o\, x_{io},\ i = 1,2,\ldots,m,$$

$$\sum_{j=1}^{n} y_{rj}\lambda_j \ge y_{ro},\ r = 1,2,\ldots,s, \quad \ldots\ldots\ldots\ldots \ (5)$$

$$\lambda_j \ge 0,\ j = 1,2,\ldots,n.$$

Relaxation variables $s_i^-(i = 1,\ldots m)$ and residual variables $s_r^+(r = 1,\ldots,s)$ are introduced, and the dual programming with non-archimedes infinitude is:

$$Minimize \quad \theta_0 - \varepsilon(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+)$$

$$\sum_{j=1}^{n} x_{ij}\lambda_j + s_i^- = \theta_o x_{io},\ \ i = 1,\ldots,m$$

$$\sum_{j=1}^{n} y_{rj}\lambda_j - s_r^+ = y_{ro},\ \ r = 1,\ldots,s \quad \ldots\ldots\ldots \ (6)$$

$$\lambda_j, s_i^-, s_r^+ \ge 0,\ \ \forall i, j, r.$$

Where is the non-archimedes infinitesimal quantity, usually 10-6; Is the RMS of the dmu (the effective utilization of the input relative to the output).

According to the above model, the definition of effectiveness of the evaluated decision making unit is given:

if the optimal solution of model (6) $\theta_o^* = 1$ is satisfied, and $s_i^- = 0$, $s_r^+ = 0$ is valid, it is called DEA valid.

if the optimal solution of model (6) $\theta_o^* < 1$ is satisfied,it is called DEA valid.

SYSTEM HOSTING SERVICE TEST ANALYSIS

The purpose of this evaluation is to evaluate and compare the efficiency of the system hosting services provided by different units.

Calculate performance indicators

The calculation performance indexes of zone A and zone B are shown in table 1. The specific indicators of devices providing system hosting service in zone A are shown in table 2, and those providing system hosting service in zone B are shown in table 3.

Table 1 Calculates performance indicators

Index	A section	B section
CPU Index mean (GHz)	2.504	2.704
Average memory capacity (GB)	115.2	102.4
CPU Kernel Average(number)	2.8	3.2

Table 2 performance indicators calculated in section A

Index		CPU Index mean (GHz)	Average memory capacity (GB)	CPU Kernel Average (number)
A	1	2.66	256	4
	2	2.4	128	2
	3	2.33	128	4
	4	2.5	128	4
	5	2.5	64	2
	6	3.2	128	2
	7	2.33	64	4
	8	2.33	64	2
	9	2.13	64	2
	10	2.66	128	2
	average value	2.504	115.2	2.8

Table 3 performance indicators calculated in section B

index	B section					
	1	2	3	4	5	Average value
CPU Index mean (GHz)	3.2	2.5	2.66	2.5	2.66	2.704
Average memory capacity (GB)	128	64	128	64	128	102.4
CPU Kernel Average(number)	2	4	4	4	2	3.2

Storage performance indicators

The storage performance indicators of regions A and B are shown in table 4.

Table 4 storage performance indicators

index	A section	B section
The total storage (TB)	255	230
Average storage granularity (MB)	24	44.8
Number of storage nodes(number)	2	2

Network performance indicators

The performance indicators of network storage in zones A and B are shown in table5.

Table 5 network storage performance indicators

index	A section	B section
network bandwidth (Mbps)	5000	4000
Node passability	95%	90%
User availability	90%	85%

Hosting performance index

The hosting performance indicators for zone A and zone B are shown in table 6.

Table 6 hosting performance indicators

index	A section	B section
Managed system number	34	10
System trouble-free running time (hours)	696	472
System failure recovery rate	95%	65%
System hosting service guarantee rate	95%	70%

User evaluation indicators

The user evaluation indexes of zone A and zone B are shown in table 7. A questionnaire survey was conducted on 10 users with scores ranging from 1 to 10. The survey results obtained are shown in table8.

According to the above test process, the evaluation data of indicators in zone A and zone B are obtained. The evaluation and analysis function of the system is verified through the performance evaluation of the system hosting service. DEA data envelope analysis method is adopted to evaluate the two evaluation objects by using the evaluation data entered into the system. Detailed evaluation results can be obtained as shown in table 8.

Table 7 user evaluation indicators

index	A section	B section
User recommendation rate	60%	40%
Average user satisfaction	8.55	6.6

Table 8 indicators of user satisfaction

object	A section	B section
Index / user	users' satisfaction	users' satisfaction
1	9	7
2	9	6
3	9	7
4	8	7
5	8	7
6	9	6
7	9	7
8	8	7
9	9	6
10	8	7
average value	8.6	6.7

CONCLUSION

By the evaluation results can be seen that area A system hosting service evaluation result has A value of 1, and all the slack variables, and the rest of the variables is zero, suggests A zone system hosting service for DEA efficient, system in section A hosting service for effective technology effectively and scale at the same time, the system hosting service fully use of computing, storage, network resources, providing services of ability and quality in combination with resources to achieve the optimal.

REFERENCES

Adel H M,Ali E，MadjidT.A Taxonomy and Review of the Fuzzy Data Envelopment Analysis Literature:Two Decades in the Making[J].European Journal of Operational Research，2011 ,214(3):457-472.

Charnes A， Cooper W W , Rhoes E Measuring the efficiency of decision making units[J].European Journal of Operational Research, 1978,2(6):429-444

Hu S Y , Xiao C L , Liang X J , et al. Influence of water-rock interaction on the pH and heavy metals content of groundwater during in-situ oil shale exploitation. Oil Shale, 2020, 37(2):104.

Hu S Y, Wu H, Liang X J, et al. A preliminary study on the eco-environmental geological issue of in-situ oil shale mining by a physical model. Chemosphere, 2022, 287: 131987. doi: 10.1016/j.chemosphere.2021.131987

Kao C， Liu S T. Fuzzy efficiency measures in data envelopment analysis[J]. Fuzzy sets and Systems，2000，113(3):427-437.

Mead N R,Ellison R J,Linger R C.Survivable network analysis method[R].Technical Report, CMU/SEI-2000-TR-013,2000,9-10.