

APPLICATION SERVER SELECTION FOR DEFINITE SYSTEMS' CLASS

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Abstract. The paper studies some aspects of an application server selection for definite systems' class. An application server selection method based on multiattribute comparing approach is offered. Application server evaluation criteria are classified in 11 categories and outlined. The example of application server evaluation on the base of the enterprise high performance and fault tolerant systems' class is considered. Each of seven J2EE application servers overall estimation is shown too.

Keywords: application server, multiattribute comparing method, Java2 Enterprise Edition

1. INTRODUCTION

Nowadays information technology industry evolves rapidly and the customer requirements for software functionality, too. To satisfy these needs a client-server application model with multi-layer architecture was developed. This model contains three layers:

- client layer that usually includes simple, WEB or WEB services applications;
- server layer, which provides business logic and is realised as an application server;
- database layer, where necessary data are stored.

An application server is a kind of software which is placed on the server (middle) layer and connects client layer with data storage, realizing such services as server component management, fault tolerance, load balancing, transaction management, security management, server administrating tool and some other services [6].

The advantage of this model is application functionality replacing from the client to the server layer. This gives an independence from the client resources and allows increasing the application performance and functionality.

One of the first technologies that implemented this model was Java2 Enterprise Edition (J2EE) platform based on programming language Java. Seven J2EE application servers: Borland Enterprise Server 5.2. [2], IronFlare Orion 2.0.2. [11], Oracle9i Application Server 9.0.2. [10], BEA WebLogic Server 8.1 SP2 [1], IBM Websphere Application Server 5.1. [13], JBoss 2.4.4. [7], Macromedia JRun 4 Service Pack 1a [9] are most popular now. They take more than 80% of J2EE application servers' market [4] and are used for different software systems development.

2. SOFTWARE SYSTEMS CLASSIFICATION

Application servers can be used in developing and maintenance process of different systems classes, so each system has its own requirements to the application server. It is possible to classify systems with similar requirements in five groups:

- Large enterprise application development. In this group the requirements are distributed homogeneously, because this group requires server to support well primary functionality, additional functionality, performance, scalability opportunities, development and deployment opportunities. Server is used as single service.

- Large enterprise application development with requirements for additional functionality is similar to previous group, but more important is server additional functionality. Server is used only as a part of large platform. For example, portal with complex functionality services.
- Large enterprise application development with requirements for high performance and fault tolerance group. In this group banking or military system can be meant.
- Small and medium enterprise application development group. The most important requirements are low cost and good integration opportunities (for example, with freeware products to reduce costs).
- Specific cases. Group is used when server is used in cooperation with some defined system and this cooperation highly influences server performance and functionality (for example, Oracle server with Oracle DB).

One of the groups with requirements to high performance and fault tolerant system was chosen and authors tried to select most applicable server to satisfy these requirements.

To evaluate and select server for definite software system the multiattribute comparing method based on server's estimation according a set of criteria can be used.

2. SERVER SELECTION COMPARING METHOD

The main idea of multiattribute comparing method [8] is to evaluate each server estimating all criteria that characterize the server.

First of all server estimating criteria are selected and then classified into categories. On the base of the system requirements (requirements groups) categories of criteria are estimated, giving weights w_i for each of them. So, $W = \{ w_1, w_2, \dots, w_n \}$, where n – number of categories, w_i - i -category's weight coefficient (value from 0 till 1). The sum of w_i ($i=1, 2, \dots, n$) is equal to 1. Value w_i depends on overall category criteria importance for the system. Analogically criteria of each category are estimated: $Z_i = \{ z_{i1}, z_{i2}, \dots, z_{im} \}$, where z_{ij} - i -category's j -criterion weight coefficient (value from 0 till 1), m – number of criteria in category i . The sum of z_{ij} ($i=1, 2, \dots, m$) is equal to 1. Value z_{ij} depends on criterion importance in category. As the result the template with weights for future servers' estimation is ready for use.

Secondly each of application servers x is estimated, assigning such value $t_{ij}(x_k)$ to every criterion j of separate category i that corresponds the possibility to realise the system requirements. Each server is evaluated by each criterion with value in range of 0..1 and usually it is done by experts (0 – feature not supported, 1 – fully supported by server) When all criteria of a server x_k is estimated can calculate a server's evaluation $V_i(x_k)$ appropriate to category i using formulae:

$$V_i(x_k) = \sum_{j=1}^m z_{ij} t_{ij}(x_k), \quad (1)$$

where $t_{ij}(x_k)$ – server x_k i -category's j -criterion estimation;

z_{ij} – i -category's j -criterion weight coefficient;

m – number of criteria in category i ;

K – number of examined servers.

The overall evaluation of each server x_k is calculated using formulae:

$$V(x_k) = \sum_{i=1}^n w_i V_i(x_k), \quad (2)$$

where $V_i(x_k)$ – server x_k i -category's evaluation;

w_i – i -category's weight coefficient;

n – number of categories ($n=11$),

Each server has evaluation value $V(x_k)$ for each of the requirement groups, so the best server is one which has best score for selected requirements group.

3. APPLICATION SERVER ESTIMATION CRITERIA AND THEIR EVALUATION

Many criteria are used for comparing application servers. To simplify the process of comparing criteria are classified into 11 categories (some of them are used in [3] [5]):

- J2EE support, which checks server compliance to J2EE specification requirements.
- EJB container and bean support. Category allows estimating server components functionality.
- WEB component support. This category summarizes WEB support possibilities.
- Services, that is predestined for estimation of implemented services.
- Additional functionality. Category consists of criteria which allow estimating product additional functionality, supported extra services and technology, integration opportunities with extra tools.
- Scalability opportunities. Category consists of scalability criteria.
- Development and Deployment. This category allows estimating a presence of tools for component development and deployment.
- System management, which contains criteria of system administration and control.
- Product adaptation. Category includes such criteria as putting into operation and support opportunities;
- Server performance.
- Specific properties. Category consists of important criteria used in server comparing analysis, but not included in previously described categories.

So, for the group with requirements to high performance and fault tolerant system a template with criteria and categories importance weights is prepared. The list of criteria and their estimation for this class of software system is shown in Table 1.

Table 1. Categories and criterion estimation

Categories and criterion name	Weight	Categories and criterion name	Weight
J2EE support	0.10	Other technology support	0.32
Component support	0.19	Scalability opportunities	0.21
Protocol support	0.22	Clustering	0.10
Unit support	0.19	Fault tolerance	0.70
Services support	0.17	Load balancing	0.20
Technology version support	0.23	Development and Deployment	0.06
EJB container and bean support	0.08	Tool common functionality	0.13
Container functionality	0.24	Server component development	0.13
Session bean support	0.18	Server component deployment	0.18
CMP additional opportunities	0.17	System robustness in development time	0.22
CMP entity finder methods	0.24	Unit independence	0.17
Message-driven bean support	0.17	Compatibility opportunities	0.17
WEB component support	0.04	System Management	0.09
WEB server support	0.40	Server installation opportunities	0.10
WEB container support	0.40	Server and services administration	0.35
WEB services support	0.20	Server components administration and control	0.30
Services	0.08	Debugging and logging	0.25
Transaction support	0.20	Product adaptation	0.09
Database support	0.22	Putting into operation opportunities	0.20
Security	0.25	System required resources and platforms	0.25
Naming service	0.15	Documentation, samples and examples	0.20
Services flexibility	0.18		
Additional functionality	0.02		
Additional functionality	0.40		
Integration opportunities	0.28		

Categories and criterion name	Weight	Categories and criterion name	Weight
Product distribution level	0.10	Performance costs	0.10
Prices	0.10	Specific properties	0.06
Version issues	0.15	Intuitive understanding	0.15
Server performance	0.17	Certificates, awards	0.60
Server performance	0.90	Specific points	0.25

Requirements group selected for analysis claims highest weights to such criteria and categories: criterion “Server performance”, category “Scalability opportunities” (especially, criterion “Fault tolerance”), because every system crash becomes a reason of losing large amounts of money. For this class of requirements server reputation is also important, that is why attention is paid to criterion “Certificates, awards”.

4. RESULTS OF SERVER SELECTION USING MULTIATTRIBUTE COMPARING METHOD

Each server was estimated by each criterion and tables like Table 1 have been prepared. Then overall server estimation $V_i(x_k)$ by each category was estimated. For example, BEA Weblogic Server has got such weights of criteria in sixth category “Scalability opportunities”: “Clustering” – 0.9, “Fault tolerance” – 0.9, “Load balancing” – 1. After that server overall estimation by category was made using formulae (1) and importance weights from Table1 (“Clustering” – 0.1, “Fault tolerance” – 0.7, “Load balancing” – 0.2):

$$V_6(x_4) = 0.1 \times 0.9 + 0.7 \times 0.9 + 0.2 \times 1 = \mathbf{0.92}$$

Then using formulae (2) overall results were calculated.

Overall results of seven servers evaluation are given in Table 2 as well as some technical data including application servers’ system requirements and prices.

Table 2. Server estimation overall results

Server	System Requirements	Price, \$ [12]	Overall score
Borland Enterprise Server 5.2.	PIII, 600 MHz, 256 Mb RAM, 600 Mb HDD	12000	0.7660
Orion 2.0.2.	10 MB HDD	1500	0.6520
Oracle 9i Application Server 9.0.2.	No 435 MB HDD un 128 RAM līdz 2.1-3.58 GB HDD un 512 MB RAM	5000 – 20000	0.8773
WebLogic Server 8.1. SP2	600 Mb HDD, 256 MB RAM	3000 – 17000	0.8918
WebSphere Application Server 5.1.	PIII 500, 512 RAM, 1.2 Gb HDD	10000 – 30000	0.8485
JBoss 2.4.4.	40 Mb HDD	free	0.3896
JRun4 Service Pack 1a	64 Mb RAM, 100Mb HDD	899	0.7298

BEA WebLogic server got best overall score during application servers’ estimation process. So, WebLogic server is the most applicable for using in systems with requirements to high performance and fault tolerance.

5. CONCLUSION

The comparing analysis of application servers and most applicable server selection for definite systems' class has led to the following conclusions:

- offered criteria and categories and comparing method can be useful for IT companies, when is necessary to select a server for some system implementation (requires only criteria weights changes accordingly to system needs);
- developed estimation methods are flexible, so criteria list can be extended accordingly application servers evolution;

Future work: recommendations of criteria weights for different requirement groups should be offered. It gives customer an opportunity to change base weights of criteria accordingly to his specific requirements. Other technology application servers should be investigated and compared (.Net and others).

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