A Web Performance Testing Model based on Accessing Characteristics

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Abstract. After researching the user behavior of Web Performance Testing, this paper summarizes the performance indicators and the accessing characteristic of users, and Proposes a Web performance testing model which based on accessing characteristics, improving the lack of independent in the original model, it increases the actual delay time and request failure rate to reflect the characteristics of user behavior, strengthening the simulation of original model' user behavior. And form a new performance testing process to make the performance test better simulate the real users' actions.

Keywords: Testing Model , Accessing characteristic , Testing indicator ,Test process

1. Introduction

With the rapid development of the Internet have made the Web application system to a large presence, web performance testing is more and more attention by people. Web performance test is through the simulation of a certain number of users and implement corresponding operation to get all kinds of performance indicators of the system to judge bottlenecks of the system under the expected load, facilitate system in the development and deployment for the corresponding adjustment and optimization[1]. Based on the existing Web performance test model, and puts forward the research based on accessing characteristics of the performance test model, perfect and comprehensively analysis performance index, add test tools into module, established a new performance test process, and through the concrete example to demonstrate the validity of the test.

2. Analysis of the Web Performance Test Model

Web performance test is mainly for the goal to maintain the performance of the system and find effective strategies of the improvement. In the Web application performance test,big differences between test

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environment and real environment, uncertain load of the test, difficulties of simulation environment and simulation real user behavior become the bottleneck of the performance test[2].

The performance test model mainly consist of the performance index, performance parameters and performance indicators. At present the performance of existing models use measures mainly include response time, throughput, system resources utilization, concurrent users, network statistics, resource requests queue length, number of HTTP affairs /SEC and session number/SEC etc[3].

（1）Response Time:Response time also called waiting time, from the user perspective, it is the experience of delay that server received a response from a request to the clients. Response time usually used seconds or milliseconds to measure the unit. Waiting time is general inversely proportional to the system capacity which the system has not used. In order to better position performance bottlenecks, response time can be further broken down,waiting time can be divided into many small fragments of the time.

（2）Throughput:System throughput is to point that system handled user requests number in a certain time of the units. It directly reflects the carrying capacity of the performance of the system. Commonly used unit is requests per second or the page number/SEC.

（3）Resource Utilization:Resource utilization is refers to the system to the level of use different resources, Such as server's CPU, memory and disk utilization ratio etc. It often takes the percentage of the resource and maximum with the resources available to measure.

During test most important is to choose and set up the performance index. Performance index is an important measure of the system performance, but not all indicators have relations with each or all applications, in the specific working environment, selecting the reasonable performance evaluation index is the base of correcting web server performance.By adding the actual delaying time and request failure rate, the performance test model mainly includes a few indexs of average response time, throughput, CPU utilization, actual delaying time and HTTP request failure rate.

3. Designing of the Web Performance Test Model

Accessing characteristics is to point to various behavioral characteristics of the real users when interacting with the Web system. The user when interacting with the Web system mainly includes characteristics of dynamic pages, thinking time, overtime give up browsing etc. During test, through simulate users to represent real users. Only real simulation the users' behavior of accessing the web system, to produce actual request of web load characteristics, to reach the purpose of improving the accuracy and reliability of the test, so web performance test model need improve according to the accessing characteristics.

In Web performance test, there are closely contact each index, each parameter index can't explain the system performance alone. Real user conduct on the server it affects the actual performance[4]. Through adding users' request failure rate to reflect the pattern of users' overtime give up browsing. Request failure rate reflects multiple performance index common effect. For dynamic pages, taking and adjusting some of the realization mechanism steps' order to get response data before the users' requests. When the user sends request, the server is generated by static page back to the user, improve the response speed[5].

Through the comprehensive analysis parameter index of the test model, form a whole Web performance test framework. In order to become more real simulation delay of user operations, during the test there is period of time between the two operation. On the basis of the existing test framework , add into test tools, this paper puts forward a new Web performance process test framework. The process of basic follow include: Web performance test requirement analysis, generating test cases, implementation and supervision testing, testing results and the measure index and adjustment, and generating the test report. Specific performance test model shows as Fig.1:
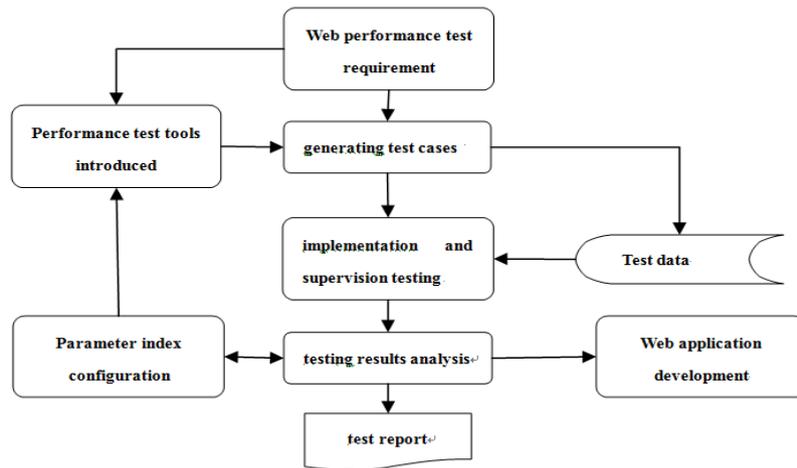
Fig.1 Web performance test model

Through to the Web system performance test requirement analysis, including ensure the test strategy and test range, laid the foundations for the whole performance test. And then analysis system and application, according to use mode and the system characteristics of distribution of information of client to determine the test loads, design test cases, and develop the relevant test scripts simulation of different types of typical users' behavior. Through the configuration parameters to create test environment, configuration testing machine, to define parameters of computer operation performance and testing time for plan etc. According to relevant test configurations and test tools to create test cases. The real test tools or by users to do implementation and supervision of the generation of test cases. To test cases of the implementation and supervision can also provide the basis for Web applications development. Finally, it is analysis the test data generated by executing test cases to get test results that determine the performance index of concern whether meeting performance requirements, and create the test report, and realize the performance test of the system.

In order to get the actual delay time must first calculation thinking time, real users operation can be more real simulation by thinking time. In the specific test according to the following steps can get:

(1) According to the formula: $C = \frac{n\,L}{T}$ (C is an average of concurrent users, n is the number of login session, L is the average length of login session, T says the amount of time of performance test) calculated the average of system concurrent users;

(2) Statistics the average of system throughput, throughput use the equation $F = \frac{N_{vu} * R}{T}$ (F is throughput, N_{vu} is the number of virtual users, R is the number of request from each virtual users) to compute;

(3) Statistics request quantity from an average of each user;

(4) According to the formula $R = \frac{T}{T_s}$ to calculate the thinking time (Ts is thinking time).

In some of the interactive system, sometimes ignore thinking time in order to simulate the pressure of as big as possible to observe the performance of the system. But for interactive system, from the point of view of business, generally don't ignore thinking time, because such words will not have practical significance.

4. Case Analysis

With the new test model as the foundation, according to the following test process as shown in Fig.2, choose LoadRunner[6] performance test tools for a shopping website for case analysis, to realize the validation of the effectiveness of the model.
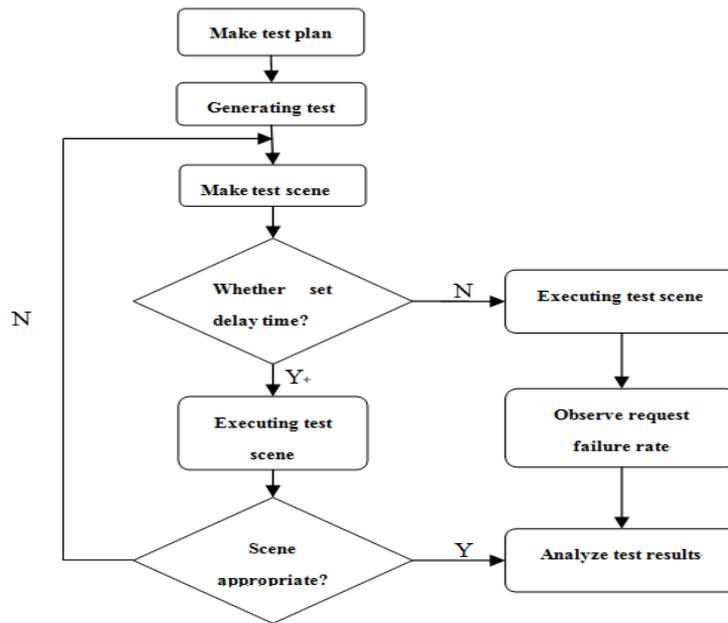
Fig.2 Test flow chart

(1) Through the analysis function of the shopping site, select the affairs that user inquires the commodity information as an example for testing. Based on the investigation of the information from the user of the measured system, using the formula which is used to calculate thinking time steps to get: the system average throughput is 10 (requests number per second), each user sends the number of request per second is 9.480, benchmark time of test time is 12.496 seconds. In a scene set operation due to set thinking time have certain effect on performance test data, so when the test choose to ignore thinking time and set up thinking time as20% of the benchmark about the time (2.5 s) to test. Use the LoadRunner's VuGen to create virtual users, by the way that virtual users simulate real users' business operations.

(2) In the generation of the test script because virtual users is category of electronic business, so when recording script choose "Web (HTTP/HTML) "agreement. In creating scripts, ignore thinking time and set respectively corresponding thinking time to produce different execution scripts. In addition, sometimes in order to be able to replay the script, also need "parametric" to some script. And by "parametric" (such as login module, the use of the test user name and password parametric) can make script adapt to a changing environment.

(3) Use Controller function to design test scene. According to the system's requirements and designing documents to determine the test target of system, reasonable configuration testing scene, and set respectively different quantity of virtual users. Through the technology of virtual IP to imitate many different users to solve the problem that the default state of virtual users have used the same IP to run a Web system. After the setting of the scene, Complete running test scene tests, and use "Analysis" to analysis test results. Record the indicators as shown in Tab1.

Tab.1. Test results of the affairs about inquiring the commodity information

The number of users	100		240		320	
Measurement index	Without thinking time	Thinking time （2.5seconds）	Without thinking time	Thinking time （2.5seconds）	Without thinking time	Thinking time （2.5seconds）
Average response time of affairs（s）	5.66	4.05	8.26	5.19	12.26	8.48

CPU utilization	76%	65%	82%	73%	93%	82%
Request failure rate	0%	0%	0%	0%	4%	0%

Observation data in Tab.1 can see, after joining thinking time (considering the actual delay time), and in the larger extent can reduce CPU utilization and affairs of the request of the failure rate.

In the test results can be found, the average response time of affairs are not that great, in the range of users can bear. If the model hardly considers request failure rate, then the testers might think the performance of the system to be in good condition. But at the moment, in fact in high load users may have occurred the condition of the user attempt failed, then may exist the potential risk. But according to the improved test model, comprehensive analysis each test index, then testers will come to different conclusions: the performance of the system under the condition that does not occur in the request failed, the number of limit load will decrease, performance condition fell. In order to pay more attention to the actual operation of the user behavior, join the actual delay time to the index of the test to ensure the performance test.

5. Summaries

Through to research the Web performance test of the concept, content, index, model, tools and so on, put forward a performance test model based on accessing characteristics of the users. But in reality, the more accurate for Web performance testing, completely simulation of the specific conditions of the real users, must also consider other factors, such as both hardware and software.

6. References

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