Performance testing is an extremely important element before any software product is launched in the market. A well-tested software product ensures customers satisfaction, retention and loyalty, and eventually helps create strong brand equity.

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INTRODUCTION

Long wait times, delays, errors and service interruptions taxes the patience of website users. A quick and responsive website that can keep visitors happy and engaged is the dire need of today’s online entrepreneurs who face stiff competition from their counterparts.

Since, every fraction of a second matters when it comes to web performance, it becomes inevitable for businesses to address the performance challenges of their website in the quickest possible time.

An adept performance testing strategy that identifies the bottlenecks and different areas of performance testing including calculation of application performance, investigating best methods for performance upholds the performance and scalability of a site and should thus be adopted.

This whitepaper delves into volume and load testing, inspecting different sections of a successful load and performance testing process, finding the attributes of a load and performance testing tool that is trustable.

Apart from this, this paper addresses the challenges created as a result of technological up-gradation and advent of new technologies that are abstract and complex.
PURPOSE OF PERFORMANCE TESTING

Certain performance bottlenecks are identified in the testing of web applications for most of the software development projects. Performance is a crucial success factor. Project managers should plan in advance for performance in the initial stages of design and development, as performance will be on the agenda during the first production run. Most web applications have better performance as long as they cater to few users. But what would happen if large number of users work with the application simultaneously? At this point Load and Performance Testing (L&P) becomes a major factor. By simulating a large number of web users, load and network traffic can be generated on the system and can be driven to their performance limit.

There are several reasons to perform L&P tests. Since, there is no 100% certainty whether or not multi-user software makes all its functions and methods available to all its users, (and is therefore multi-user capable), it is possible to find high percentage of faults with performance testing. These faults could not have been identified by individual manual testing, independent of whether unit tests or system tests were performed. Performance testing allows a realistic check of the configuration of interfaces to other systems or subsystems and computers. In addition, performance tests can also detect bottlenecks in the host systems.

Performance tests essentially concern the following topics:

- Consumption of resources
- Response time
- Large load / number of users

People especially from operations are mainly interested in the system resource consumption and are interested in knowing what to expect with the introduction of an application to the production system.
CURRENT CHALLENGES

Prior to the era when development frameworks were not introduced, application development used to be done using machine-oriented programming languages. This way programmers developed a more precise view of the target platform, on which the application code was deployed. For this reason, they could identify certain performance-related risks more clearly than in the current time. New methodologies and technologies promote the use of distributed applications, which offers high flexibility for interaction between components and composition of services to construct application systems.

The advanced world of Web and Mobile applications has changed the way companies promote, market, and sell their products besides automating key business processes, making it faster and easier to enter orders, processing payments, or even tracking data.

The large volumes of information gathered by Web applications can help companies define more precise marketing strategies, target specific customers, while offer better and more personalized services to their clients. But more the companies rely on Web applications for running their businesses and generating revenues, greater is the risk of failure due to the complexity behind the Internet.
At the early age of online commerce, most companies didn’t invest any time in pre-production performance testing. At the very best they performed manual testing, expecting their infrastructure to support the user load once the application went live.

It wasn’t indeed uncommon to see a website going down right/crashed immediately after sites were launched or after the execution of a major upgrade etc. However, businesses can’t afford to endure even short term interruptions, as the new generation of online-savvy consumers expect reliable services and timely response at all times. If a site cannot accept an order or is taking too long to display a cart for selecting a product, customers won’t hesitate going elsewhere.

Today’s web applications are also more complex than ever before. Scaling a multifaceted, integrated infrastructure from end-to-end means managing the performance and capacities of individual components within each tier while measuring the overall transaction response time of the entire system.

**PROPOSED SOLUTION**

- **Upgrading our framework as per new technologies, as well as, on previous environment (Hardware/software).**
- **Organizations involved in providing performance testing services should upgrade their baseline scripts/code/infrastructure accordingly with the advent of new technologies.**
- **Performance testing should be performed on a regular basis (like functional testing) on new upgradation so as to identify performance issues during the initial stages or before going live.**

A typical response to growing traffic on your website is to add more hardware to each component of the system. However, such attempts to improve performance often lead to overbuying hardware and not necessarily to better performance and scalability since many times the application was not designed to be elastic. Thus, the only way to precisely predict system behavior is to execute end to end performance testing in your applications, measure response time from end-user perspective, while diagnosing and remedying any performance issues prior to going live.

Applications performance testing is the way to measure your web application’s ability to conduct multiple transactions simultaneously while maintaining adequate response time. It also helps you isolate bottlenecks in any component of the network infrastructure to accurately pinpoint potential problems.
Two common approaches to performance testing methods are manual and automated testing.

Automated testing tools typically use three major components to execute a test:

- A control console: One that organizes, drives, and manages the load and use behavior
- Virtual users (Vusers): Processes used to imitate a real user performing a business process on a client application
- Load servers (used to run the Vusers): By using these components, automated load testing tools can:
  - Substitute manual testers with automated Vusers
  - Concurrently run many Vusers on a single load generating machine from a unique location or from multiple locations around the globe
  - Automatically measure transaction response time and monitor the infrastructure components
  - Effortlessly repeat load scenarios to authenticate any changes you make to optimize performance

**CASE STUDY**

The scope of the project was to carry out performance and load testing for web application and window application. Client wanted to check the bottleneck of servers and data base as per requirement.

For this we had started with load of 500 VUs with interval of 10 seconds and had tested the load test for 7500 virtual user and script run for 30 mins.

The objective of this testing activity was to get the memory usage, page response time, transaction Response time and performance test total time to login in the client portal.

**TEST RESULTS:**

<table>
<thead>
<tr>
<th>Scenarios/Test Name</th>
<th>Virtual User</th>
<th>Load Test-Time of Execution(mins)</th>
<th>Memory Usage</th>
<th>Page/Sec Response Time</th>
<th>Transaction Response time</th>
<th>Avg. Transaction Response Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Min. (MBs)</td>
<td>Max. (MBs)</td>
<td>Avg (MBs)</td>
</tr>
<tr>
<td>CR_ST_Smoke Test</td>
<td>500</td>
<td>30</td>
<td>1238</td>
<td>2108</td>
<td>1558</td>
<td>0.2</td>
</tr>
</tbody>
</table>
PERFORMANCE TESTING TOOLS AND THEIR CHARACTERISTICS

The primary goal of load testing tools is to accurately predict system performance while isolate performance issues. To identify performance problems, performance testing tools monitor key system-level components and identify bottlenecks during the test run. Accuracy is defined by how closely an automated tool can emulate real-user behavior. A dependable tool is capable of simulating greater load by using fewer resources. There are a wide variety of performance testing tools available in the market. The tool you choose for testing will depend on many factors such as application controls, hardware requirements, license cost, and protocol supported.

Here is the list of web performance automation tools:

<table>
<thead>
<tr>
<th>Performance Testing Tools</th>
<th>Free - Y/N</th>
<th>System Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Studio</td>
<td>N</td>
<td>Windows/ Vista/ XP</td>
</tr>
<tr>
<td>Apache JMeter</td>
<td>Y</td>
<td>It works under Unix and Windows OS</td>
</tr>
<tr>
<td>LoadRunner</td>
<td>N</td>
<td>Microsoft Windows and Linux are the favourable OS for this measuring tool.</td>
</tr>
<tr>
<td>WebLOAD</td>
<td>N</td>
<td>Windows, Linux</td>
</tr>
<tr>
<td>Appvance</td>
<td>Y</td>
<td>Runs in private or public cloud</td>
</tr>
<tr>
<td>NeoLoad</td>
<td>N</td>
<td>This tool is compatible on operating systems like Microsoft windows, Linux and Solaris.</td>
</tr>
<tr>
<td>LoadUI</td>
<td>Y</td>
<td>Cross platform</td>
</tr>
<tr>
<td>WAPT</td>
<td>N</td>
<td>Windows OS is required for this testing tool.</td>
</tr>
<tr>
<td>Loadster</td>
<td>N</td>
<td>Windows 7/Vista/XP</td>
</tr>
<tr>
<td>LoadImpact</td>
<td>Y(Premium paid)</td>
<td>This works well on Windows OS and Linux.</td>
</tr>
<tr>
<td>Rational Performance Tester</td>
<td>N</td>
<td>Microsoft Windows and Linux AIX good enough for this performance testing tool.</td>
</tr>
<tr>
<td>Testing Anywhere</td>
<td>N</td>
<td>This tool is compatible with all versions of Windows OS.</td>
</tr>
<tr>
<td>OpenSTA</td>
<td>Y</td>
<td>OpenSTA runs only on Windows operating system.</td>
</tr>
<tr>
<td>QEngine (ManageEngine)</td>
<td>N</td>
<td>This tool works with the Microsoft Windows and Linux.</td>
</tr>
<tr>
<td>Loadstorm</td>
<td>Y</td>
<td>Cloud load testing for web applications.</td>
</tr>
<tr>
<td>CloudTest</td>
<td>N</td>
<td>It runs on Windows, Linux and Mac OS.</td>
</tr>
<tr>
<td>Httpperf</td>
<td>N</td>
<td>Windows and Linux</td>
</tr>
</tbody>
</table>
CONCLUSION

Performance Testing has become a success quotient for online business. Though, it is not the only solution that works, it definitely assures positive results. Automation testing not just adds value but is a stepping stone for successful deployment of applications. Performance testing plays a significant role before software products are marketed to online customers while ensuring customer satisfaction and retention.
ABOUT THE AUTHOR:

Ravi Kumar is a Senior Software Engineer at R Systems. He is an M.Sc in Mathematics and has 9 years of experience in Software Testing Specialization in managing different areas of Automation and Manual Testing across Web-based applications, Client/Server based applications, and Stand-alone applications.

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