

Understanding
Performance Testing

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I. Executive Summary

IT managers face a paradox trying to match maximum efficiency and productivity with optimum application performance. Will the improvements optimize the investment in hardware and software? Or will bugs and bottlenecks endanger the effectiveness of the 'improved' system? Failure is not an option. Haphazard assessment of applications and potential users is a recipe for disaster.

Performance testing is the set of tests that ensure an application is in a healthy state under the desired load and the end user is experiencing a good response under such a load.

Success depends on rigorous performance testing from the beginning of the Software Development Life Cycle (SDLC). Yet, too often, insufficient resources are allocated. Ignoring performance testing risks jeopardizing a business's reputation,, and profits, in addition to loss of customers. Many challenges remain for those adopting sound performance testing practices.

There are many reasons why systems are not properly tested: The absence of a universal definition for performance testing and agreed standards, the high cost of performance testing and the complexities of simulating real life scenarios. Nevertheless, many development companies have invested heavily in their testing capabilities while others outsource performance testing to specialized companies. Despite these welcome advancements effective performance testing is often overlooked and under-resourced.

ITWorx has invested heavily in performance testing to ensure that all its applications meet required performance levels. This White Paper discusses the issues and proposes solutions, including performance testing in dedicated laboratory conditions.

II. What Should Be Tested?

A healthy system is designed and constructed to cope with high demand. Loads, stress, volume and the components need to be thoroughly tested as a system is developed or modified. To prepare for an anticipated increase in users, the number of system resources each user consumes should be measured.

Organizations employ different types of performance tests. However, their choice of test should depend on their performance requirements. Separate tests measure different indicators of the system performance. These include the throughput, the response time, and system endurance.

Loads: The most common type of test is load testing, which determines the response time and throughput of an application when subjected to the maximum load requirements. Load testing helps the team to determine the application's capability to manage peak user loads.

Load is calculated by the number of hits/second (HTTP requests /second). It is not the number of concurrent users since the user may be busy reading the content of a page and not submitting requests to the server. Neither is hits/second equivalent to pages/second since requesting a single page may result in a number of server hits. Depending on the page design the page may contain several images.

Stress: Stress testing establishes the point at which a system fails, from failing to respond to users in an acceptable time to failing to respond to new requests.

Volume: Volume testing identifies problems during long-term user activity, such as memory leaks in an application server.

Components: For a closer look into the specific components of a system, component testing measures the performance and behavior of a specific component of the application. The three components of a system comprise bandwidth, hardware (CPU and memory) and applications. Global systems, in particular, require adequate bandwidth to perform well.

System resources: To help plan resource requirements, transaction cost analysis measures the system resources a single user consumes (Performance Testing in the Enterprise, 2004).

III. Justifying the Costs

Some development companies have invested heavily in their testing capabilities, while others have outsourced their performance testing to specialized companies. Nevertheless, the area of performance testing remains underdeveloped.

Companies expect their employees to work together seamlessly, regardless of distance. Customers expect to be able to research, place orders and communicate via a website.

The cost of poor performance is high. SCIVisum, a performance and functionality testing company in the UK, points out the significant financial loss companies risk if they fail to guarantee a positive experience for their online clients. In a survey 16 percent of users said they would not revisit a website after experiencing a poor performance and 25 percent said they would turn to a competitor's website or make an offline purchase if they experienced problems on more than one occasion ("Web performance – Are you a smooth operator?" 2006).

The growing dependence on the online world emphasizes the importance of a site that performs well. Poorly performing websites reflect badly on their owners and are potentially disastrous. Thirty-three percent of shoppers abandon a site if they have a poor experience. Seventy-five percent are unlikely to shop on that site again (What You Should Expect From Load Testing Your Web Applications).

The result of poor performing websites is not only reflected in the dissatisfaction of customers but also in lost or abandoned sales. The consequences are even more disastrous for the likes of hospitals, banks or universities when mission-critical systems perform poorly.

Inadequate application testing costs the USA as much as \$59 billion¹ annually, according to the National Institute of Standards and Technology (NIST). In a recent UK survey of 100 IT directors, 72 said poorly performing applications cost their organizations between £100,000 and £500,000 per year (Performance Matters).

A system that performs well has a significant impact on a company's use of resources and the bottom line if the system is working well. Employees work efficiently, avoiding 'lost time' waiting for the system to respond.

¹ <http://www.itl.nist.gov/div897/docs/ConformanceAdvisory.html>

A well performing system is one of the pillars of a business's success, regardless of the nature of the business. It affects its image, competitiveness, and efficiency, combining to impact profitability. It is imperative for companies to invest wisely in perfecting their IT system's performance.

IV. Adding Value

Quality, reliability, service to users and cost effectiveness are the essence of value. Each can be measured in a professional performance testing environment.

The value of performance testing stretches far beyond those responsible for an application's development. A comprehensive test generates reports that can empower management with the knowledge of how to scale an application for future growth. The IT department may use the data to deduce when a new version of an application will be required.

The developers can be led to the source of bugs and other impediments in the system. The reports will provide a clear picture of every aspect of the application, enumerated in a myriad of statistics.

The immediate benefit is that a new or upgraded system will perform optimally as soon as it goes 'live'.

Without thorough performance testing from the outset, an application's flaws may only show up when deployed on production servers. Defects may include slow response time, inability to handle peak loads and sudden surges in demand. Under a live heavy load the system's frailty may be exposed – crashing or hanging and failing to recover from errors.

Resistance to application testing can come from an organization's testing staff. They may consider functionality testing performed on the application as adequate. They may be under pressure to keep the cost of performance testing down. The cost of performance testing is much higher than normal testing. Additional servers and tools are required. However, cost benefit analysis points up the significant losses that occur when insufficient resources are allotted to performance testing.

The value is enhanced when performance tests are built into the development process from the beginning. Including performance testing at the beginning of the SDLC ensures that problems are discovered sooner and are resolved much faster and easier, saving time, money and resources. Statistics show that the later performance problems are discovered in an application the more they cost to fix.

Performance optimization should not be limited to testing the application, but, from the beginning, to gathering the customer requirements for the target performance and the network characteristics. Setting the performance objectives of the system is vital: It guides the development team throughout the SDLC to

build the required level of resilience into the application. The target performance could be derived directly from the customer. However, if the customer is not familiar with the exact specifications, the development team should conduct a brief study of the forecasted load by assessing the number of users of the system and the market standard for similar applications.

V. Simulating Production

One of the important pillars of a successful performance test is the accurate simulation of the production environment. The problem facing performance testers is that the tests cannot take place on the normal company network or computers. Yet this is where problems will surface.

The solution is to replicate the customer's system in a precise simulated environment so that the application acts as if it is live on the customer's servers. This is often the cause of many performance tests' failures. The servers being used for the test need to be isolated from the company network and the production network conditions simulated absolutely.

The tools used for testing systems and applications need to be chosen with care. Selecting the wrong tool can cost companies dearly. Different tools varying in capability and price can be found to help companies manage the performance testing process or reproduce the environment and the different user requests. Some expensive tools can be justified for their superior testing capabilities, whereas, sometimes, inexpensive tools might satisfy a company's needs.

VI. Performance Testing at ITWorx

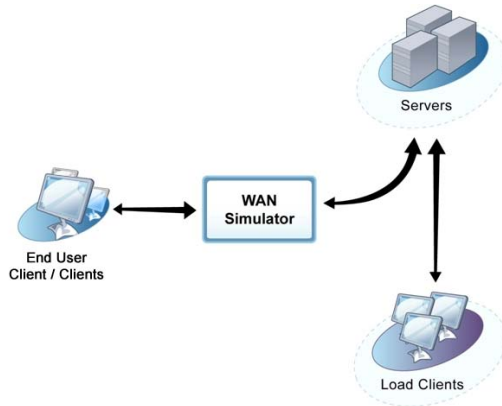
ITWorx has adopted a comprehensive plan to eradicate the problems of poorly performing applications. Performance testing is a mandatory quality test. Performance standards are adopted during application design and coding.

ITWorx conducts different types of performance tests on their applications. The main tests include load testing to measure the maximum load an application can withstand and its corresponding response time. Endurance testing is also carried out to measure the stability of an application under a high load for a long period of time. Depending on the results of the tests and the initial performance objectives both the hardware and software components of the system are tuned in order to optimize the performance of the application and to handle the required capacity.

To perfect ITWorx performance testing, an independent performance testing lab was set up completely isolated from the ITWorx network to ensure no network traffic from the company's network interferes with the testing process. The lab replicates the exact configurations and settings to be found in the production environment. In addition, powerful servers are used to simulate the capabilities of the production servers.

ITWorx performance testing lab is equipped with advanced tools that help simulate the WAN environment and assist load testing. The WAN simulator replicates the customer's LAN/WAN conditions, bandwidth, latency, and packet loss ratio. Testing tools are used to simulate the different usage scenarios and virtual users.

The testing lab infrastructure is designed to resemble the customer's system settings. The servers are connected to the load machines, which simulate the virtual users. Then, based on the requirements of the test, single or multiple users are simulated using another set of load machines connected to the servers via the WAN simulator, as shown in the figure below.



In a test using the lab to simulate a public website, the servers would represent the website hosting servers, the load clients would simulate the load on the website from users worldwide, and the end user client would be used to simulate a user trying to access the website from home. This would help ITWorx to measure the response time of the website under different loads. The performance lab could also be used to test the performance of a company intranet. The servers would represent the main company servers hosting the intranet, the load clients would be used to simulate the load at the main office in one country, while the end user clients could be used to simulate users trying to log on to the intranet from another company branch in another country, or continent.

All ITWorx applications pass through the performance lab tests to ensure that they meet the required performance specifications. Applications are tuned until they reach the desired level of resiliency. Continuous development in the ITWorx performance testing lab ensures that the latest techniques and technologies are adopted in the lab. This guarantees top quality applications with high performance capabilities.

VII. Conclusion

A different approach is needed for performance testing than to other testing processes. A successful performance is isolated from the company network either outsourced or conducted in-house. The production settings need to be absolutely replicated in the simulated environment.

Companies should appreciate the importance of performance testing, and integrate it smoothly into their SDLC.

Performance testing can be the key to the success of an organization. Optimal application performance is a crucial requirement whether the application is a website for customers or an internal application for employees.

Performance testing still has a long way to go. The increasing demand for improved performance has fueled an initiative for immense research efforts dedicated to improving its quality and effectiveness. It is thus vital for development companies wanting to stay competitive to adopt a positive performance testing approach.

VIII. About ITWorx

ITWorx is the largest software professional services firm in Egypt. The company offers Portals, Business Intelligence, SOA and Product Development services to Global 2000 companies with a focus on Financial, Telecommunication, Government, and Educational institutions, in addition to a number of Independent Software Vendors (ISVs) across North America, Europe and the Middle East.

By partnering with Magic Quadrant technology vendors Microsoft, BEA Systems, Vignette, Business Objects, Sun, IBM, and Oracle, ITWorx leverages its global delivery capability, CMMi Level 3 certified processes, and model driven development tools to seamlessly extend its customers' IT organization augmenting it with agile, high quality productive capabilities, technology competences and vertical industry know-how

ITWorx integrates international security development principles in its SDLC. All software developed by ITWorx abides by strict security guidelines. ITWorx has developed several solutions for secure online payment and secure banking portals.

ITWorx offers includes: secure solutions development, security consultancy, and training services in various security topics. For more information please contact sales@itworx.com.

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