

# OPNET: Ensuring Application Quality Through Pre-Deployment Testing and Predictive Analytics

## Abstract

As customer-facing and revenue-generating business services are deployed as multi-tiered applications, predicting application performance before deployment to production is becoming increasingly critical. Three products in the OPNET product line—Application Characterization Environment (ACE), Panorama, and LoadScaler—provide significant value in measuring performance throughout the application lifecycle. This brief focuses specifically on their applicability during the pre-deployment phase, and the ways in which they support the Quality Assurance (QA) function.

OPNET's multi-tier visibility and predictive analytics are key differentiators that provide a basis for evaluating application performance pre-deployment. Unlike competing solutions, OPNET goes beyond simple load testing and directs QA engineers to the root cause of specific performance problems. This provides a basis for both software optimization and capacity planning, two key factors in producing and deploying high performing applications.

## Poor Performance Impacts Internal and External Customers

Application performance is becoming a major focus as companies increasingly rely on software applications to service customers and support the business. One reason is that application performance can impact revenues, brand equity and growth.

EMA research studies have found that the cost of a poorly performing customer-facing application can potentially exceed four million dollars an hour. Performance problems can also influence a customer's perception of brand quality, a key driver of brand equity. A 2006 study from Stanford's Graduate School of Business entitled "Calculating the Dollar Value of Brand Equity"<sup>1</sup> indicates that brand equity, which can drive millions of dollars in revenue, is an incremental asset that is based on customer experiences and perception. Poor performance implies low quality, and, in terms of brand equity, perception is reality.

The effect of transaction performance on internal customers carries a major impact as well. Performance drives productivity, and in a call center environment where a company is getting paid by the call, a twenty second response time can translate to thousands of lost dollars. On a catalog order desk,

<sup>1</sup> Found at: [http://www.gsb.stanford.edu/news/research/mktg\\_srinivasan\\_brand-equity.shtml](http://www.gsb.stanford.edu/news/research/mktg_srinivasan_brand-equity.shtml), May 23, 2007.

order throughput, customer satisfaction and staffing costs are all impacted by poor performance. The bottom line is that transaction-based applications are increasingly critical to all aspects of the business, but they have to perform well to be assets instead of detriments.

Pre-deployment testing can ensure high performing applications, but testing tiered applications is a complex activity that has historically been shortchanged. As a result, many applications are deployed to production without adequate testing. Testing application performance, then pinpointing root cause when performance turns out to be sub-par, requires in-depth visibility to the execution ecosystem and expert knowledge about diverse products, platforms and technologies. This is a formidable process and one that requires a high level of expertise and a great deal of time. Even if a QA group has such expertise, most performance management products do not.

OPNET's multi-dimensional perspective on the multiple components of the execution ecosystem can help to mitigate this problem. The OPNET product line facilitates thorough pre-deployment testing that includes identification of performance bottlenecks, as well as root cause diagnostics when bottlenecks occur. OPNET's broad, deep visibility to execution environments is the foundation for a robust QA product that detects performance and scaling issues before the application is deployed to internal or external customers.

## OPNET's Integrated Solutions

OPNET's Application Characterization Environment, or ACE, performs network analysis that generates a true 'end-to-end' view of the entire transaction. ACE then applies advanced heuristics to each transaction as it executes across multiple tiers. ACE's deep transaction visibility and robust modeling capabilities are major competitive strengths.

Another strength is predictive modeling. ACE builds on captured transactions to generate predictive models grounded in the actual state of the execution environment. This modeling projects the impact of the infrastructure on the application's response times via a virtual infrastructure consisting of network, servers and other elements. This is useful for capacity planning as well as for pre-deployment performance analysis.

OPNET Panorama offers real-time performance analysis of complex applications by monitoring system and application metrics within each server and across all tiers. Panorama's transaction tracing capabilities provide deep analysis of Java

transactions as they execute inside the Java Virtual Machine (JVM). It yields depth of visibility to SQL calls, Java 2 Enterprise Edition (J2EE) execution code and operating systems. Panorama automatically sifts through thousands of measurements to correlate metrics that are out-of-bounds with other metrics that exhibit similar patterns. This automated cross-tier analysis detects both usual and unusual suspects, allowing Panorama to troubleshoot “unsolvable” problems.

OPNET LoadScaler integrates with Panorama to measure the impact of increasing user load. Web deployment experts know that as user load increases, there is a growing danger that bandwidth limitations, user utilization patterns, application design flaws, or hardware limitations can degrade performance. An application with sub-second response time under a 50-user load can deteriorate to 20 second response time under a 75 user load; finding out why typically involves sifting through multiple tiers and thousands of metrics. OPNET’s analytics reduce the manual effort usually associated with such efforts, minimizing the expensive cross-functional team meetings typically required to solve such problems.

The three solutions together provide distinctive predictive and actual perspectives on transaction performance. Such analysis helps QA teams determine whether the application performs as expected, and if not, what has to be changed for it to scale. It also provides a basis for “what if” scenarios based on changes to application code, SQL calls or infrastructure capacity.

## Key Features

- *Answers key application performance questions during the QA cycle:* OPNET answers the classic questions that testers typically struggle to answer. Does this application perform to specification? What will happen if I move the application across the MAN or the WAN? Do coding changes improve performance or not? If this application does not perform, where is the problem?
- *Web Services support:* OPNET supports SOA and Web Services transactions with testing, modeling and management capabilities. Early adopters of such applications report performance challenges, but the root cause is often difficult to quantify because many QA testing products lack visibility to Web Services standards.
- *Planning whiteboard:* A whiteboard feature provides pre-deployment modeling and capacity planning. This gives architects a way to model a hypothetical application, then simulate its execution impact.
- *Cross-tier correlation of “cause and effect:”* This capability looks across tiers to determine which metrics are abnormal in tandem with others. For example, if OPNET sees a

CPU spike on a database server, it examines other tiers to determine whether it correlates with SQL queries, disk or CPU utilization, or a particular piece of Java code. These cross-tier correlations are done automatically, eliminating the need for manual tasks required by many competing solutions.

- *Advanced analytics provide a basis for cross comparison of performance across multiple execution tiers:*
  - *Time-aligned view of network and server traces:* Time-aligned traces give OPNET the capability to relate traces from multiple sources based on time of day. This is an often requested capability that is beyond the reach of many competing solutions.
  - *Integration between Panorama and LoadScaler:* While LoadScaler demonstrates that a 50 user reference load performs well, while the application breaks under a 75 person load, Panorama pinpoints the failing tier. This functionality identifies the source of the problem at the method level with visibility down to the specific statement or function call.
- *Rich query and reporting capabilities:* QA engineers can ask open-ended questions such as, “Where do I look?” Of tens of thousands of possibilities, the system filters metrics into a limited list of focus areas. This can dramatically reduce the effort required to identify misconfigurations, capacity limits, and problem Java classes and statements.
- *Automatic trace capture based on user-specified policies:* Trace capture can be set to automatically start based on specific metrics hitting dynamically adjusted thresholds. Trace captures can be triggered by threshold violations to gather a detailed trace of the execution specifics within the JVM class/statement for forensic analysis and troubleshooting.

## EMA’s Perspective

QA is an often neglected aspect of application deployment, and testing is typically the last step in the application development lifecycle. The process can be unwieldy because it attempts to duplicate the effect of the application on production systems while actually executing in a non-production environment. This is an unwieldy process and products that make this process simpler, more thorough, and more predictive are valuable assets. However, few vendors have covered all the testing bases as well as OPNET.

Of particular interest is OPNET’s proactive, predictive modeling capability. In lieu of actually testing applications in production, being able to model production execution based on real metrics is a breakthrough. Development and QA organi-

zations can proactively predict the impact of applications and, where those applications fall short, can fix problems before they impact users. This single capability, in and of itself, can result in significant Return on Investment.

Testing may also demonstrate that the software can't be optimized any further and that production deployment requires additional infrastructure capacity. Knowing this ahead of time helps IT organizations move from a reactive to a proactive release management model by anticipating the impact of applications on production systems.

For companies that look at their applications as organizational assets, and particularly those in which software is routinely reused, such as Service Oriented Architecture (SOA) deployments, software is the "gift that keeps on giving." Unfortunately, that gift can either be positive or negative. High performing software is a true asset that gains incremental value with reuse. Marginal software continues to sow intermittent problems and user dissatisfaction over time.

OPNET's distinctive predictive capabilities and reasonable price-points relative to competing solutions deserve notice. Companies seeking to improve their QA testing capabilities and the quality of delivered applications should look closely at OPNET products, as they are well positioned to do both.