Mastering Peak Traffic with Performance Testing

Best Practices with Micro Focus® Performance Testing Suite
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Are Your Online Services Ready for Peak Traffic?

Most people would say that Mother’s Day, the Super Bowl, and the election of a Pope have absolutely nothing in common. But on closer inspection, all three events produce a similar result: They generate significant online traffic.

Contrary to popular perception, occasional spikes in demand for online services aren’t just a concern for retailers. The same story plays out across virtually all industries. From insurance to entertainment, from government to higher education, organizations have to prepare their websites and apps for massive volumes of concurrent users. Sometimes they can see the deluge coming in the form of predictable seasonal spikes in demand, but often they can’t.

Let’s take a look at a real-life example. In November 2016, Canada’s main immigration website suffered repeated outages on the same night that Donald Trump took the lead in several major states, and his chances of winning the US presidency turned markedly higher.

![Server Error](image)

**Figure 1.** Canada’s main immigration website outage
This is where the performance testing conversation comes into play. Most people would look at a massive crash like that and say that it could have been prevented if they had only tested and planned properly. That sentiment is true—as long as they knew what they were testing. But how do you predict the maximum peak for a load test on an immigration site for Canada?

The right preparation and tools can help to make sure that organizations don’t suffer catastrophic scalability or stability issues under high-traffic situations. Consider these recent statistics about peak traffic:

- Super Bowl 2017: 1.72 million people watched this year’s Super Bowl online
- Total number of digital buyers in 2016: 1.6 Billion
- According to Gartner, the downtime of a computer networks costs an organization $42,000 an hour

8 Best Practices for Handling Peak Traffic: a Complete Approach

When peak traffic hits, both external applications and internal applications are impacted, causing losses in revenue, brand reputation, and employee productivity. To make sure you are ready for a peak season—whenever it hits—here are eight best practices to implement an effective performance test for both consumer-facing and internal applications.
1. Identify Performance Targets (or Goals)
This step is critical to interpreting your testing needs and is used to determine whether the system can scale and perform to your specifications. At this stage, you need to translate your user requirements into performance testing objectives (such as response time for each transaction). A thorough evaluation of the requirements before beginning load testing can help provide realistic test goals and conditions. A crucial Key Performance Indicator (KPI) for the peak season is how much traffic goes to the company’s website and/or internal application. For website traffic, you can use a free service available on the Internet that estimates daily page views/daily visitors of a website (for example, siteworthtraffic.com). For internal traffic, you can use information provided by the production environment (such as logs).

**PERFORMANCE APPLICATION LIFECYCLE (PAL) WITH MICRO FOCUS PERFORMANCE CENTER**
Performance Application Lifecycle (PAL) enables complete end-to-end testing and DevOps feedback. Users can accurately compare performance test results with real production data benchmarks. PAL allows you to use traffic and system monitoring data in production to design a performance test that closely resembles production behaviour. You can import production data from Microsoft IIS W3C Extended Log Format (IIS W3C), Apache, and Micro Focus Real User Monitor (RUM).

The PAL flow includes the following main steps:
- **Import**: Import a data set from a production system. Different production monitoring systems provide different data, which may influence which information is available to the user.
- **Create**: After uploading your data set to Performance Center, it analyses the data and creates a PAL scenario with business flows. You can translate each business flow into a script.
- **Run**: Run your performance test.
- **Compare**: Compare performance test results with your production data. If necessary, readjust and rerun your test.

![Figure 3. Performance Application Lifecycle steps](image)

2. Script and Emulate Business Processes
A virtual user (Vuser) emulates the real user by interacting with the application as a client. You must identify and record all the various business processes from start to finish.

**TIP:** Peak traffic rates are usually 2-3 times the usual volume.
CREATING A VIRTUAL USER SCRIPT WITH MICRO FOCUS VIRTUAL USER GENERATOR (VUGEN)

When testing an environment, you need to emulate the true behavior of users on your system. Micro Focus testing tools emulate an environment in which users concurrently work on, or access, your system. To perform this emulation, the human is replaced with a Vuser. The actions that a Vuser performs are typically recorded in a Vuser script. The primary tool for creating these scripts is Micro Focus Virtual User Generator, also known as VuGen. You can use VuGen scripts across all the Micro Focus Performance Testing Suite (LoadRunner, Performance Center, StormRunner Load*).

The following table lists the supported Vuser protocols.

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Java Vuser</th>
<th>LDAP (Listing Directory Service)</th>
<th>RDP (Remote Desktop Protocol)</th>
<th>Teradici PCoIP Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ajax (Click &amp; Script)</td>
<td>Vuser</td>
<td>MAPI (Microsoft Exchange)</td>
<td>RTE (Remote Terminal Emulator)</td>
<td>TruClient—Mobile Web</td>
</tr>
<tr>
<td>COM/DCOM</td>
<td>MMS (Media Player)</td>
<td>SAPI (Click &amp; Script)</td>
<td>TruClient—Native Mobile</td>
<td></td>
</tr>
<tr>
<td>DNS Domain Name Resolution</td>
<td>MMS (Multimedia Messaging Service)</td>
<td>SAP GUI</td>
<td>TruClient—Web</td>
<td></td>
</tr>
<tr>
<td>Flex</td>
<td>Mobile Application—HTTP/HTML</td>
<td>SAP—Web</td>
<td>Web—HTTP/HTML</td>
<td></td>
</tr>
<tr>
<td>FTP (File Transfer Protocol)</td>
<td>ODBC</td>
<td>Siebel—Web</td>
<td>Web Services</td>
<td></td>
</tr>
<tr>
<td>IMAP (Internet Messaging)</td>
<td>Oracle—2 Tier</td>
<td>Silverlight</td>
<td>Windows Sockets</td>
<td></td>
</tr>
<tr>
<td>Java over HTTP</td>
<td>Oracle—Web</td>
<td>MQTT</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TRUClienT SCRiPTiNG

The complexity of new technologies, lack of commonly recognized and accepted standards, and sheer multitude of emerging frameworks and toolkits make it difficult for companies to build Web 2.0 testing strategies and select appropriate automation solutions. Micro Focus TruClient is an innovative, browser-based virtual user generator that supports simple Web as well as modern JavaScript-based applications. The scripting engine is embedded within the browser and behaves like a true browser client.

Micro Focus TruClient is an innovative, browser-based virtual user generator that supports simple Web as well as modern JavaScript-based applications.

* with some limitations
SCRIPT REUSE
Micro Focus StormRunner Load supports popular open source testing tools such as JMeter and Gatling, so DevOps teams can easily upload existing scripts created with these tools into StormRunner Load and run them. Starting with version LR and PC 12.55, you can run your JMeter scripts and integrate JMeter with additional script types in any performance test.

StormRunner Load supports also integration with widely adopted open-source tool, Selenium. Selenium scripts are very similar to load testing scripts, that is they simulate user steps, keyboard inputs, behavior in different browsers, and so on. By reusing the code written for the functional test and modifying it in the context of performance testing, while being careful that it applies to the same use case, DevOps teams obviously save time. In addition to the timesaving, they also experience better test coverage and can rest assured that the user experience has not been compromised.

3. Plan and Design Tests
You should identify key scenarios, determine variability among representative users and how to simulate that variability, define test data, and establish metrics to be collected. Consolidate this information into one or more models of system usage to be implemented, executed, and analyzed.

Performance tests are usually described as belonging to one of the following four categories:

- **Performance Test**: To determine or validate speed, scalability, and/or stability
- **Load Test**: To verify application behaviour under normal and peak load conditions
- **Stress Test**: To determine or validate an application’s behaviour when it is pushed beyond normal or peak load conditions
- **Capacity Test**: To determine how many users and/or transactions a given system will support and still meet performance goals

Each type of test can help identify and address the risks related to peak traffic:

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Risk(s) Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>Is system capacity meeting business volume under both normal and peak load conditions?</td>
</tr>
<tr>
<td></td>
<td>Will performance be consistent over time?</td>
</tr>
<tr>
<td></td>
<td>Are these slowly growing problems that have not yet been detected?</td>
</tr>
<tr>
<td></td>
<td>Is there external interference that was not accounted for?</td>
</tr>
<tr>
<td>Volume</td>
<td>How many users can the application handle before undesirable behavior occurs when the application is subjected to a particular workload?</td>
</tr>
<tr>
<td></td>
<td>How much data can my database/file server handle?</td>
</tr>
<tr>
<td></td>
<td>Are the network components adequate?</td>
</tr>
<tr>
<td>Load</td>
<td>What happens if the production load exceeds to the anticipated peak load?</td>
</tr>
<tr>
<td></td>
<td>What kinds of failures should we plan for?</td>
</tr>
<tr>
<td></td>
<td>What indicators should we look for?</td>
</tr>
<tr>
<td>Spike</td>
<td>What happens if the production load exceeds to the anticipated load?</td>
</tr>
<tr>
<td></td>
<td>What kinds of failures should we plan for?</td>
</tr>
<tr>
<td></td>
<td>What indicators should we look for in order to intervene prior to failure?</td>
</tr>
<tr>
<td>Stress</td>
<td>What happens if the production load exceeds to the anticipated load?</td>
</tr>
<tr>
<td></td>
<td>What kinds of failures should we plan for?</td>
</tr>
<tr>
<td></td>
<td>What indicators should we look for in order to intervene prior to failure?</td>
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PLAN FOR DIVERSE NETWORK CONDITIONS

App performance and the user experience are affected by network latency. Excessive network latency or packet loss doesn’t just make your app respond slower; it can cause the app to behave erratically or even fail outright. One of the keys to addressing this challenge is to use Micro Focus Network Virtualization (NV) to simulate realistic network conditions in your load tests. Network Virtualization (NV) helps you accurately test the impact of the network on apps long before they are put into production. Once you understand the impact of the network, take the next step: optimize and fine-tune your app to make sure that it will perform well in the expected network conditions. Micro Focus Network Virtualization is embedded into StormRunner Load and fully integrated with LoadRunner and Performance Center.

4. Execute the Test

Among those new to performance testing, there is often a misconception that execution is a single event. In fact, it is a multi-step process consisting of several types of performance tests.

Creating a baseline is the process of running a set of tests to capture performance metrics for the purpose of evaluating the effectiveness of subsequent performance-improving changes to the system or application. After executing the baseline test, you should execute the following ones:
**Debug Run**
- Run 5-10 virtual users
- Eliminate data concurrency errors and fundamental issues
- Use appropriate think time and full extended logging

**Isolate Top Time Run**
- Run 20% of full load
- Isolate transactions that are taking an unusually long time
- Use appropriate think time and standard logging

**Smoke Test**
- Run 100% of full load for short time
- Do not report the results as official or formal parts of your testing
- Use appropriate think time and standard logging

**Full Load**
- Run 100% of full load
- Perform actual test run comparing results with test goals
- Use appropriate think time and just-in-time logging

**SCALE**

We have to be honest: creating a load in terms of calling an API with a set number of requests/sec for a few virtual users is possible, but it can give you the wrong results. Aspects of user behavior, such as think time, need to be taken into account. So we need to execute the expected load with the actual number of potential users. How many users? 1,000? 100,000? 1 million?

With Micro Focus StormRunner Load you can scale easily for more than 3 (three) million Vusers without requiring hardware; it does everything automatically and quickly via the cloud. There is no need to spend time and money setting up hundreds of load generators.

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**Figure 6.** Micro Focus StormRunner Load scales for millions of Vusers
CONSIDER PERFORMANCE TESTING FROM THE CLOUD

Your customers are coming from all over the world, so to gain a realistic view of performance you need to test from all over. Because of this, cloud-based load testing is essential for testing performance against spikes in demand. Using cloud load-testing generators is the only way to scale quickly and add users from different worldwide e-locations.

Micro Focus StormRunner Load is a cloud-based performance testing solution: you can spin up load generators via multiple cloud vendors such as Amazon Web Services (AWS) and Azure, and you can see the results of your tests and gain real-time insights into performance issues instantly. If you are using Micro Focus LoadRunner or Performance Center and you need additional firepower, you can easily add cloud-based load generators to a scenario.

Figure 7. Cloud-based load generators

5. Monitor Performance and Availability

Monitoring the performance and availability of your software applications is an important best practice, and Application Performance Management (APM) tools are essential.

APM TOOL INTEGRATION

APM tools are used to monitoring and manage of performance and availability of software applications by reporting mainly the following metrics:

- End user experience (for example, response time)
- Server performance (for example, CPU, memory, server response time, code hotspots, exceptions)

So your tool will generate load, while the APM tools will mostly monitor server behavior. Using them in conjunction, teams can better identify performance drawbacks before real users find them.
LoadRunner 12.55 supports Dynatrace and both StormRunner Load and Performance Center version 12.55 supports Dynatrace and New Relic. So you can:

- Integrate Dynatrace/New Relic graphs during online execution
- Measure hundreds of metrics in each test run
- View combined results in analysis report

ONLINE ANOMALY DETECTION WITH PERFORMANCE CENTER
The anomaly detection capability of Performance Center 12.55 enables teams to use powerful analytics to visualize and spot anomalies and performance problems and find root causes using real-time metrics. Engineers can use these insights to speed their diagnosis and investigation into system performance, and even see the precise triggers that caused the anomalies.

6. Analyze Results
Performing root cause analysis means drilling down from the most general reports to localized metrics. The combination of complex applications and dynamic characteristics of network traffic can significantly degrade application performance. Performance problems can occur at many points along the route between the application and users.

There are typically three phases to pinpointing bottlenecks during results analysis:

- **Compare results against goals**: confirm when performance has not met expectations.
- **Identify potential bottlenecks**: list all the pieces of the system that might have caused the slowdown.
- **Correlate results**: determine the most likely cause by correlating transaction times and backend monitor metrics.
FOCUS ON THE END-USER EXPERIENCE

In your performance testing, focus on load times and intuitive flows. And keep the user’s perspective in mind. There are many ways to improve perceived load times compared to actual load times, such as optimizing image sizes and rendering certain content to appear first, such as the top of a page.

The NV Insights Report is a comprehensive network analysis report that provides information about how your application performs over various networks, during a scenario run. The resulting NV Insights Report can help to pinpoint root causes for performance issues, and provide optimization recommendations to resolve the issues, thereby improving the performance of your application.

With the Client-side Breakdown Report, your teams can view statistics that help you measure the quality of the user experience on your application.

Things to look out for during execution:

- The sudden appearance of errors
- A sudden drop in transaction throughput
- An ongoing reduction in available server memory

Network Virtualization receives the time of the events (Start render, DOM loaded, Page loaded), allowing the user to inspect events in the client as they correlate to network calls.

ANALYSIS WITH LOADRUNNER AND PERFORMANCE CENTER

Our testing and operational environments are becoming increasingly complicated. Tools can help us to step past the complexity and perform root cause analysis quicker. The Analysis tool—a unique tool in the performance testing space—provides graphs and reports enabling you to view and understand the data, and analyze system performance after a test run, helping you to find bottlenecks and thus improve the performance of your application.
The correct interpretation of results is obviously vitally important. Assuming that you’ve (hopefully) set proper performance targets as part of your testing requirements, you should be able to spot problems quickly during the test or as part of the analysis process at test completion. What’s important is having all the necessary information at hand to diagnose when things go wrong and what happened when they do.

**TREND REPORT IN PERFORMANCE CENTER**

The Performance Center trend reports allow you to compare performance test run data over time, giving you better visibility and control of your application’s performance. By comparing the same measurement in more than one instance of a test run, you can identify whether its performance trend is improving or regressing. Trending information can now be viewed directly within Jenkins, giving you the metrics you need sooner without logging onto Performance Center.
8. Establish Continuous Performance Testing

Without question, continuous performance testing is critical to the success of your apps. If you don’t test until the end of the cycle, you risk production issues, user complaints, poor reviews, and damage to your brand. So in Agile development/DevOps environments, performance testing must be integrated with the whole development process.

StormRunner Load integrates with your open-source CI/CD frameworks such as Jenkins and Bamboo. This integration lets you fire up performance tests to check that new code you’ve pushed out hasn’t caused any regressions or broken your compliance with performance SLAs.

StormRunner Load also integrates with AWS CodePipeline. This powerful utility helps you automatically build, test, and deploy your applications in the Amazon Web Services (AWS) cloud. StormRunner Load relies on a public REST API that can be used to trigger tests and collect results from CI/CD tools, and the command line interface (CLI) tool provides a less technical way to interact with StormRunner Load. If you’re running Linux, for example, you can simply use the CLI tool to run a specific test without the need to open a browser and perform multiple steps. StormRunner Load integrates with the open-source Git version control system, enabling you to upload scripts from your Git repository.

LoadRunner and Performance Center continue to introduce new features and integrations to incorporate load and performance testing into continuous integration and continuous testing practices. Performance Center features strengthened integration with Jenkins, and now includes Trending (see above), while LoadRunner supports testing in Agile and DevOps environments as well (JUnit, nUnit, Eclipse, MS Studio, Selenium, Jenkins, Git).
Innovations We Are Delivering

The Micro Focus Performance Testing suite empowers teams to manage testing and performance complexity. Micro Focus StormRunner Load, LoadRunner, Performance Center, and Network Virtualization work together to enable teams to thrive in today's chaos and deliver predictable quality across all development environments.

Learn More At
www.microfocus.com/performancetest