

Performance Testing

Why testing your **system stability** matters



Prolifics**Testing**

What is performance testing?

Having confidence in the functional behavior of an application or website is vital – yet proving your systems work is only half the battle. In today's competitive digital space, websites and mobile apps are your shop window, and user experience is everything. Keeping response times low is a vital part of this user experience.

How do you know your systems will support a large number of users, especially at go-live, or after marketing activity?

Performance testing is an important non-functional test phase that accurately gauges system stability and response time under different workloads. In some cases, performance testing can identify problems that would otherwise cause a website to crash.

Performance testing also involves making sure that websites respond quickly to user input. Nowadays, users demand a high rate of responsiveness, and waiting on webpages often leads to them navigating away to locate a different resource.

Despite its importance, performance testing is often seen as an afterthought – something to be carried out after all functional tests have been concluded. In his 2015 book, *The Art of Application Performance Testing: From Strategy to Tools*, the performance testing expert Ian Molyneaux writes:

“

It is strange that companies continue to overlook the importance of performance testing, frequently deploying applications with little or no understanding of their problems, only to be beset with performance and scalability problems soon after the release.

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Performance testing is therefore crucial if application quality is to be ensured after go-live and beyond. At Prolifics Testing, we are experts in performance testing, augmented by our advanced Performance Engineering services.



Types of performance testing

The two most common types of performance testing are **stress testing** and **load testing**.

Stress testing involves examining the stability and reliability of IT infrastructure and accurately gauging its ability to support exceptional transaction volumes. In other words, stress testing aims to identify the failure threshold of the application in question, often through network visualisation of high user concurrency.

Automating user journeys in this way means usage spikes and floods can be simulated, yielding greater reliability at reduced cost and time.

Load testing gauges the ability of infrastructure to support the expected usage of a system, as opposed to the extreme transaction volumes involved in stress testing. It too uses network visualisation to simulate realistic conditions, especially when all elements of an application are not available for a performance test.

Load tests are designed to identify bottlenecks within the layers of software, infrastructure and integrations that make up modern applications, so that fixes can be quickly deployed and tests re-run.

We help our clients with performance testing for numerous system types, including websites, mobile apps, ERP and CRM systems, ecommerce sites, Student Record Systems, and more.

Why performance testing matters

The nightmare scenario for many companies is when high levels of traffic bring systems grinding to a halt, enraging existing and prospective customers alike.

According to [Atlassian](#), website downtime incidents 'are not only potentially toxic to customer trust and loyalty [...] – they're also the financial grim reaper.' Downtime is so costly to companies big and small, not just because of the opportunity cost of an outage, but because of business disruption and reputational damage.

In 2014, [Gartner](#) cited \$5600 per minute as the average cost of network downtime, equating to just over \$300,000 an hour. This figure has only increased further in recent years, to a point where many small businesses are dealt a killing blow by extensive periods of downtime. The more popular your website, the more you can expect to lose from a disruption.



Who needs performance testing?

Performance testing is [especially vital for](#) 'life critical applications in healthcare, medical, biotech and drug discovery systems, and mission critical situations such as automotives, flight, [and] defense'. It is also highly important for retail, financial services, higher education, and public sector organisations.

We are proud to have carried out performance testing for the likes of Cancer Research UK, the University of Leicester, Bristol City Council, and the NHS.

Case studies of these engagements can be read by clicking on their respective logos below.



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When performance testing is not carried out, serious repercussions can occur. Here are three salient examples of website crashes you may have read about in the news:

Currys PC World & Black Friday – 2019

Two years ago, the huge savings available to customers on Black Friday drove a large amount of customers to the Currys website in a very short space of time. Eager to scout out bargains, the shoppers were instead greeted by '[website crashes, long loading times, and incorrect prices.](#)'

Sales went live on the website at 9:30pm on Thursday, with announcements being posted on company social media accounts. By Friday morning, the website was up and running again, but the damage was already done with regards to frustrated users and lost revenue.

In this case, stress testing would have been the most vital step in ensuring heavy user load could be handled without drops in performance.

Directgov & e-petitions – 2011

Upon launching a new website where citizens could express their views on political issues for debate in parliament, the UK government found that [crashes were occurring frequently](#) within the first day of it being live.

Our process

Users were flocking to Directgov – now GOV.UK – to sign petitions, but with more than 1000 unique visits every minute, the website failed to cope with the load. The Conservative government at the time mentioned that their site had received far more traffic than expected, given that the old e-petitions site under Labour had been relatively unpopular. This complacency, however, does nothing to assuage the rancour of citizens unable to express their voice.

Trading sites & the COVID-19 vaccine – 2020

Towards the end of 2020, the announcement of the trial success of Pfizer's coronavirus vaccine caused high demand for shares in the company. During what was the busiest trading day on record, over two million customers of firms such as Hargreaves Lansdown, AJ Bell and Fidelity were unable to execute trades as [websites crashed across the board](#).

According to a spokesman for IG Group, 'volumes in the 30 minutes after Pfizer released news on its vaccine were up to ten times those earlier in the day.' The result was that many traders suffered financially by being unable to capitalise on one a highly lucrative opportunity, damaging company reputation and losing a sizeable amount of fee-based revenue.

Such is the ubiquity of crashes that numerous websites have emerged to help users determine whether a site is currently 'down' or not.

One prominent example is Downdetector, which *The Atlantic* has characterised as '[the internet's panic room](#)'. Clearly, performance testing has never been more vital.

At Prolifics Testing, our Performance Testing services begin by us working in consultation with our clients to identify real life scenarios. These scenarios are then simulated using our set of open source and proprietary tools. A typical engagement includes a structured set of activities, designed to ensure consistency and provide the assurance you need that your infrastructure can cope with both planned and unplanned traffic.

Step 1: Plan

The first stage of a performance test engagement is to document a comprehensive test plan, detailing the scope of testing, transaction details and frequency, the number of users, transaction times, assumptions made, load generation environment, testing objectives, entry and exit criteria, test data, reporting structure and frequency, defect management, schedule, and contact details for all personnel on the project.

Step 2: Build

Once the plan is agreed, user journeys can then be recorded through the application under test using the selected tool. Session variables need to be correlated to ensure valid activity is simulated and data items are parameterised, in order to allow the entry of different data for each user journey through the system. Doing so maximises the realism of the simulation. User journeys are then grouped together to form scenarios to measure the expected use of the system.

Step 3: Environment

Server monitors are put in place and data is populated in the target database to realistic levels. Once complete, dry runs are carried out using the generated scenarios to ensure all elements of the test are working before proceeding to the next step.

Step 4: Execute

The tests that were laid out in the planning stage are run. This is likely to include normal load, peak load, soak, and stress tests. Typical problems at the unit level are identified, such as deadlock detection, memory leaks, query optimisation, architecture issues, etc. The team ensures that API response time meets the associated e2e SLA requirements.

Test Setup in Apache JMeter

Load Tests

Figure 1 (top right) shows the setup for a Peak Load test in Apache JMeter, using Ultimate Thread Group. The graph shows the ramp up, steady time, and ramp down of the users. In this example, the test is set to run with 200 users with a ramp up time of 300 seconds (5 minutes), steady state time of 3600 seconds (1 hour), and ramp down time of 240 seconds (4 minutes).

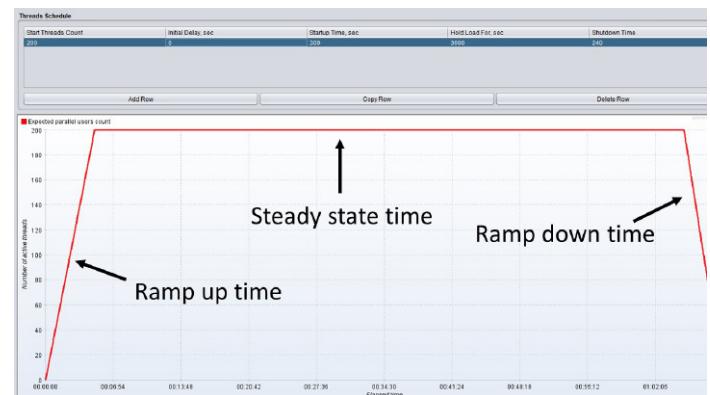


Fig. 1

Stress Tests

Figure 2 (bottom) shows the setup done for a stress test in JMeter, again using Ultimate Thread Group. Displayed is the incremental user load injection to the application, carried out to find the system breaking point. Continuous monitoring of the server and SLA stats is undertaken during this test.

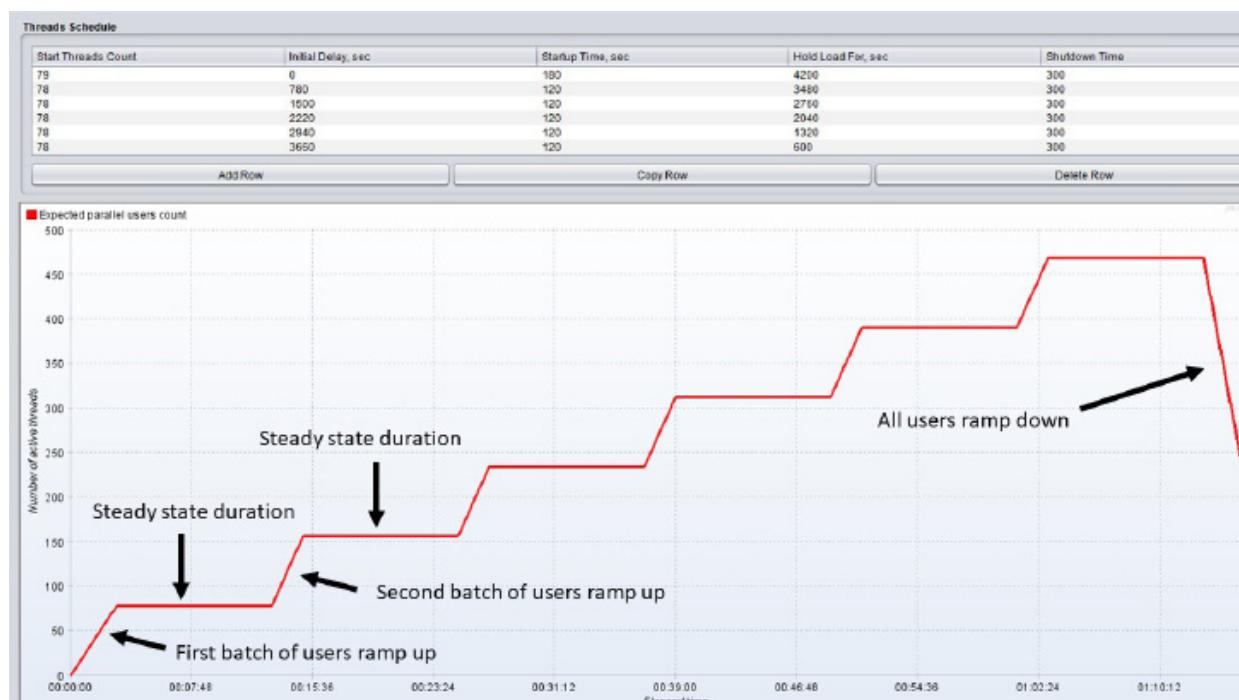


Fig. 2

Step 5: Analysis and Reporting

The final stage in the process is analysing the results, including transaction times, server resources, and network and database statistics, to provide a final report. Note that interim test results are also normally provided after each test run, in order for any bottlenecks or defects to be fixed and for the application to be fine-tuned.

What sets us apart

Accelerators

Our [specialist accelerators](#) have automated the entire software testing lifecycle in Manual, Functional, Automated, Performance and Security Testing. Through their use we can offer improvements in test design, management, data management, execution, automation and validation, as well as improved delivery of real-time analytics and dashboards.

Our Accelerators integrate with all the major test management tools, including Micro Focus Quality Center and Jira, and we can offer automated test case design for a range of major COTS applications including SAP, Oracle E-Business Suite, and Workday HCM. They also fully support Waterfall, Agile, Continuous Integration and DevOps processes.

You can read about some of our Performance Testing accelerators below:

Script Enhancer Accelerator

Using the robust VB.Net programming language, the Script Enhancer Accelerator is specifically built to reduce Performance Testing times by automating the customisation of the script by inserting fields such as Transaction Names, Error Handling, Think Times and Check Points.

Test Data Mining Accelerator

Performance tests can require significant amounts of data to be generated manually. Our approach boasts full automation of this process by using test data mining techniques from any available database and the automatic generation of the remaining data using scripts.

Infrastructure Monitoring Accelerator

Our Infrastructure Monitoring Accelerator is an agentless tool that uses versatile Python scripts to capture raw data from logs across applications, and web and database servers. This includes response times, throughputs, memory utilisation, CPU and more.



Tools

We're not tied to any testing tool providers, so are able to offer an impartial service that pairs the best tool for each project with your desired outcomes, taking into account the nature of your requirements and technical architecture.

Tests are run automatically alongside functional tests using continuous integration servers. We have particular expertise in designing and delivering performance test suites based on the Apache JMeter open-source platform, and integrating with Jenkins. We also partner with leading enterprise tool vendors, including Micro Focus and Radview.

Using these platforms, we are able to perform tests regularly, resulting in desired application performance throughout the development process. This largely reduces the likelihood of application rework further down the line, when performance problems are inevitably discovered.

Click [here](#) to view one of our consultants performing API Performance Testing using JMeter with integration to Grafana and Power BI, for realtime load test reporting.

Performance Engineering

Performance Engineering enables Performance Testing to be run as a part of Continuous Deployment and DevOps models. Using reliable and tested methods, together with the latest tools, our consultants design and implement integrated Performance Testing into your development process that evolves with applications, allowing development teams better, earlier visibility of potential performance problems, identifying and fixing issues at source.

This requires tests to be developed early and maintained in line with code drops from development but allows regular tests to be run automatically in a similar way to how automated Functional Tests are often run at the Unit and System levels.

Delivery

Performance Testing services can be performed either onsite or remotely, or most commonly, using a combination of the two. Initial scoping on client applications ensures we recommend the best tools for the job, which are supported by our own custom injectors and reporting server from the cloud.



Fig. 3

Our delivery models for Performance Engineering include a combination of onsite consulting and offsite delivery. The service includes handover, full training and ongoing support to suit your needs, balancing cost restrictions with offshore capabilities.

Using secure cloud infrastructure helps ensure we keep our costs low. Where cloud-based injectors are not suitable for a client (due to security concerns or on-premise systems), we can use machines on your networks so the whole test infrastructure is kept within your private infrastructure.

Bibliography

The Art of Application Performance Testing: From Strategy to Tools, Ian Molyneaux, 2014

"Calculating the cost of downtime", Atlassian, accessed January 2021: <https://www.atlassian.com/incident-management/kpis/cost-of-downtime>

"The Cost of Downtime", Gartner, July 2014: <https://blogs.gartner.com/andrew-lerner/2014/07/16/the-cost-of-downtime/>

"Performance Testing: Methodologies and Tools", H. Sarojadevi, 2011: <https://core.ac.uk/download/pdf/234676929.pdf>

"Currys PC World hit by Black Friday blackout as website 'crashes' leaving shoppers furious", Evening Standard, November 2019: <https://www.standard.co.uk/news/uk/currys-pc-world-black-friday-website-a4299891.html>

"Government's e-petition website crashes on first day", The Guardian, August 2011: <https://www.theguardian.com/politics/2011/aug/04/government-e-petition-website-crashes>

"Millions miss out as trading sites collapse", The Times, November 2020: <https://www.thetimes.co.uk/article/millions-miss-out-as-trading-sites-collapse-cbxfbpb0s>

"Where Everyone Goes When the Internet Breaks", The Atlantic, February 2020:
<https://www.theatlantic.com/technology/archive/2020/02/downdetector-websites-crash-ookla-outages-red-bit/607048/>

About us

Prolifics Testing is a specialist IT consultancy with a total focus on software testing. We deliver high-quality, flexible software QA and testing services to industry giants like McKesson, Deloitte and Lloyds Banking Group.

If you'd like to find out more about any of our services, feel free to [contact us](#) via our website.

Alternatively, you can drop us a quick call on +44 (0) 20 8905 2761.

