



**PerformanceLab**  
Software testing company



# PERFORMANCE TESTING

The solution for analyzing the behavior of an IT system under load





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IT system performance is an area that never loses relevance in advanced IT departments at major organizations. Each day banks, retailers, telecoms, insurance companies, and government agencies become more and more dependent on information systems. And each day IT systems grow more complexity and more integrated, which means that the performance of critical business processes depends on an ever increasing number of components and is becoming less and less predictable. This situation is dangerous, because at some point an IT manager is forced to recognize that he cannot guarantee business units will receive the required performance, responsiveness, and reliability of IT services. He doesn't know what the maximum load the IT system can handle is. He also doesn't know how any given change in the configuration (for example, installing a new version of the IT system or updating middleware) will affect performance.

Performance testing involves creating a test environment with a copy of the real IT system. This makes it possible to conduct experiments by creating a load on the system by emulating the simultaneous actions of hundreds and thousands of users, running "heavy" server operations, and simulating interaction with other IT systems.

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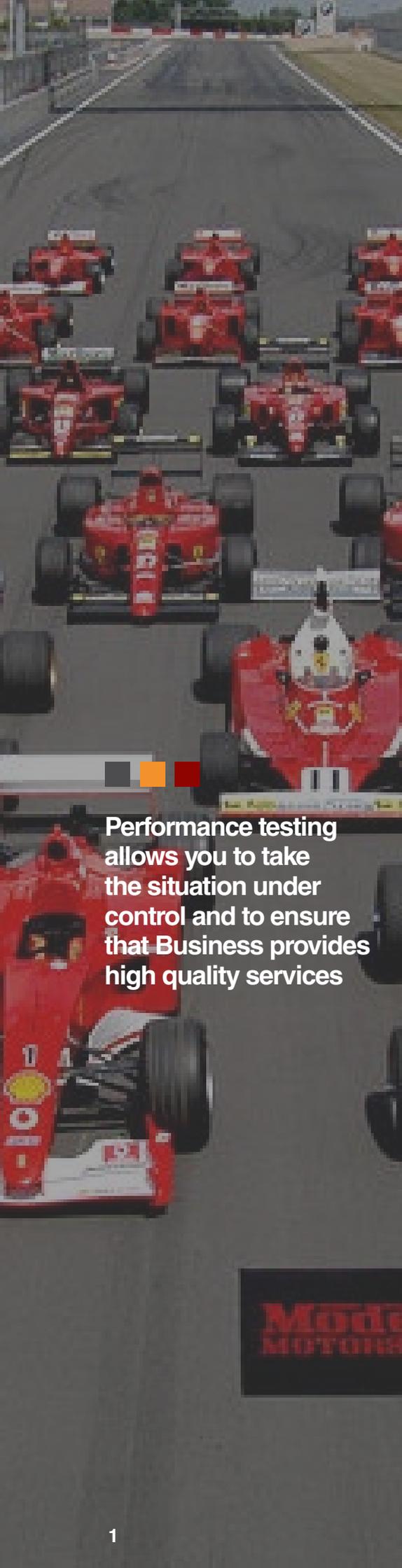
## Business advantages

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### Performance testing makes it possible to:

- Determine the maximum performance of IT systems and identify
  - the number of users that can work in the system simultaneously
  - the load conditions under which the responsiveness of critical business processes decreases
  - the load conditions under which an IT service becomes unavailable
- Measure the execution time of critical operations under various load conditions
- Discover the bottlenecks limiting an IT system's performance
- Compare different versions of an IT system, or different hardware/software configurations
- Find out if you are prepared for a period of high sales, online advertising, or new branch openings
- Learn the maximum database size that an IT system can handle

But, most importantly, performance testing lets you take control of the situation and guarantee high-quality service to your business.



**Performance testing allows you to take the situation under control and to ensure that Business provides high quality services**

**MOTUL  
MOTORS**

## Performance Lab's solution



By controlling the load level during testing, our engineers determine whether the system satisfies performance requirements

Our services have been developed with consideration given to our customers typical needs and include four basic types of performance testing.

### Load testing

In this classic form of performance testing an IT system is placed under a load using "virtual users", which emulate the actions of real users. The load is very similar to a real load, so this method can accurately estimate the maximum performance. Performance Lab uses special tools such as JMeter and LoadRunner to generate the load.

By controlling the load level during testing, our engineers determine whether the system satisfies performance requirements, such as number of operations per hour, response time, number of simultaneously active users, etc.

You need load testing if you want

- to reduce the risks of degraded performance, bugs, and failures in your IT system under load by finding performance problems and bottlenecks in advance.
- to compare the performance of different versions of an IT system, or different configurations of hardware/technologies.
- to simulate the expected increased load on a system due to the arrival of "peak season", a promotion, or business growth.
- to optimize future expenditures on infrastructure thanks to accurate information about the IT system's hardware needs at times of normal and peak load.

- to improve the performance of critical business processes.

### Stress testing

Stress testing evaluates the reliability and resilience of a system operating under stress load conditions. A stress load exceeds the maximum permissible level many times over, so we know in advance that the system will be unable to cope and will fail. Stress tests are performed to find out exactly what a system failure will look like: Does the system automatically recover after the failure? Are any critical data lost? Can interrupted user operations and system processes be completed?

### Volume testing

Volume testing determines the relationship between a system's performance and the size of a database. As a rule, the volume of data in any IT system grows with time, resulting in slower execution of operations that involve an application querying a database.

During volume testing, Performance Lab generates consistent test data in a test database. Any volume of data can be generated, which makes it possible to perform the required number of tests on different amounts of data. The customer receives accurate information about the database's threshold sizes (beyond which performance degrades). This provides the opportunity to optimize performance or set up procedures to archive or truncate databases.

Performance Lab engineers create a testing strategy after analyzing the system's technical documentation and business processes, and after interviewing the customer's specialists



## Stability testing

Stability testing makes it possible to simulate the behavior of a system under a sustained load (from several hours to several days).

Tests are run under average load conditions and help bring to light

memory leaks and buffer/array/table overflows. Furthermore, stability testing lets you be certain that processing times and response times are stable and will not deteriorate as time passes.

## Getting started with performance testing

If you've decided to hire us for performance testing work, we propose the following five-stage plan.

### Stage 1: Develop a testing strategy

Performance Lab engineers create a testing strategy after analyzing the system's technical documentation and business processes, and after interviewing the customer's specialists. We will do the following:

- collect and analyze statistics on the production environment
- collect and analyze statistics on the utilization of hardware resources in the production environment
- negotiate the performance requirements
- define business processes and load scenarios
- outline the interaction with external systems
- develop a checklist to assess the system's readiness for testing

The finished testing strategy is sent to the customer for approval.

### Define the load profile

When the testing strategy is created special attention is given to defining the load profile.

A load profile is a set of operations with specified intensity levels.

These operations may be determined based on statistical data or an analysis of the system requirements. Several load profiles are usually selected, each differing in its set of operations or the intensity level of the operations. Proper load testing requires choosing the operations that will put the greatest load on the system.

### Stage 2: Develop performance testing tools

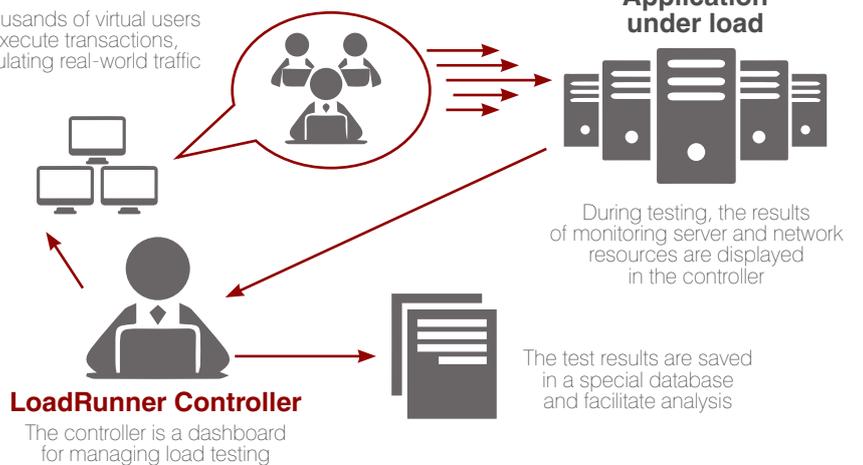
This is the most difficult stage from a technical standpoint.

Performance Lab engineers develop and debug the performance testing tools.

In order to obtain accurate test results, the version of the system on the test bed is fixed before work begins and is not changed during the course of the project. Making changes to the tested system during a project is only permitted to fix bugs that prevent the work from progressing. For the testing to succeed, the test bed must be available at least 95% of work hours.

## HOW LOADRUNNER WORKS

Thousands of virtual users execute transactions, emulating real-world traffic



In order to conduct the testing, Performance Lab specialists are given access to the test bed with rights for the roles and users being tested, and as OS and DMBS administrators.

Creating a test model consists of the following stages:

- develop load scripts and load scenarios,
- develop emulators for external systems (if necessary),
- create scripts to generate/ anonymize the database (if necessary),
- prepare test data,
- customize monitoring tools and conduct trial tests.

During this stage Performance Lab offers its customers the opportunity to use its proprietary "PLUS" technology, which can significantly reduce costs and improve the quality of work by utilizing ready-made performance testing tools such as a SOAP/REST-based ISO-8583 processing emulator, SOAP-based loan broker emulator, WebSphere log parser, MS SQL database anonymizer, and a test data generator for Visa and Mastercard clearing.

### Stage 3: Conduct the tests

Performance Lab specialists are given access to the load generation workstations for the purpose of conducting the testing.

During this stage, we do the following:

- run the tests in accordance with the approved load scenarios,
- process the results,
- assess the validity of the tests performed.

### Stage 4: Conduct a systems analysis and prepare the report

The test results are analyzed by Performance Lab specialists in order to generate conclusions and recommendations.

We do the following:

- analyze performance bottlenecks,
- prepare recommendations to optimize the system's code, architecture, and infrastructure, or to develop appropriate organizational rules,
- prepare a report with the test results, a list of detected problems, and our recommendations.



During this stage Performance Lab offers its customers the opportunity to use its proprietary "PLUS" technology, which can significantly reduce costs and improve the quality of work

### **Stage 5: Maintain the solution**

During this stage we analyze changes to the tested system in order to keep the performance testing solution up-to-date.

Performance Lab offers services to set up a maintenance process, which may include both comprehensive support of the created solution as well as training the customer's employees.

## **Why Performance Lab?**

Performance Lab is a widely recognized leader in performance testing. Our patented "PLUS" technology has no counterpart and supports testing not only systems using well-known protocols but also systems with proprietary protocols, systems with asynchronous calls, systems with complex and encrypted protocols, enterprise service buses, and web services. Performance Lab emphasizes not only a project's technical aspects but also how well it is managed.

The Performance Lab project office employs the PRINCE2 project management methodology in order to guarantee our customers achieve the project's objectives on time, on budget, and with excellent quality.

When working with us you can be certain that:

- Leading international performance testing practices will be utilized in your project.
- Performance problems and bottlenecks will be located and described.
- You will receive realistic recommendations for optimization that will let you increase performance (in our experience, it is not uncommon for our recommendations to boost an IT system's performance by more than 100-fold).
- The risks of degraded performance, bugs, and failures in your IT system will be minimized.
- The project's objectives will be achieved right on time.



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testing

## Case study: Top-10 bank

In connection with the planned migration to an in-house processing system, bank specialists identified risks associated with the performance and fault tolerance of the IT infrastructure



**Home Credit and Finance Bank (HFC Bank)** is a Russian commercial bank and a leader in the Russian consumer credit market. It has a presence in more than 2,000 Russian cities, with more than 31.6 million customers. HCF Bank is Russia's 8th largest consumer bank and 10th by volume of personal deposits.

To automate the back office for retail customer service, which sup-

ports retail transactions, personal accounts, and payments, the bank uses TranzWare CMS (a Compass Plus product).

The front-end solution, which is needed to manage terminal devices, route and authenticate transactions, and communicate with payment systems and third-party authorization hosts, runs on TranzWare Online.

### Challenge

In 2013 the bank decided to implement its own transaction processing. This significantly simplifies business processes and reduces costs when using external processing centers.

In connection with the planned migration to an in-house processing system, bank specialists identified risks associated with the performance and fault tolerance of the IT infrastructure, TranzWare CMS, and TranzWare Online, namely:

- A critical drop in the throughput of retail transactions.
- Potential interruptions in the handling of credit/debit card transactions.

As part of its mitigation of these risks, the bank decided to conduct benchmark tests to compare the performance of the TranzWare CMS and TranzWare Online systems before and after the introduction of changes to the in-house processing system. Performance Lab was hired to conduct performance testing.

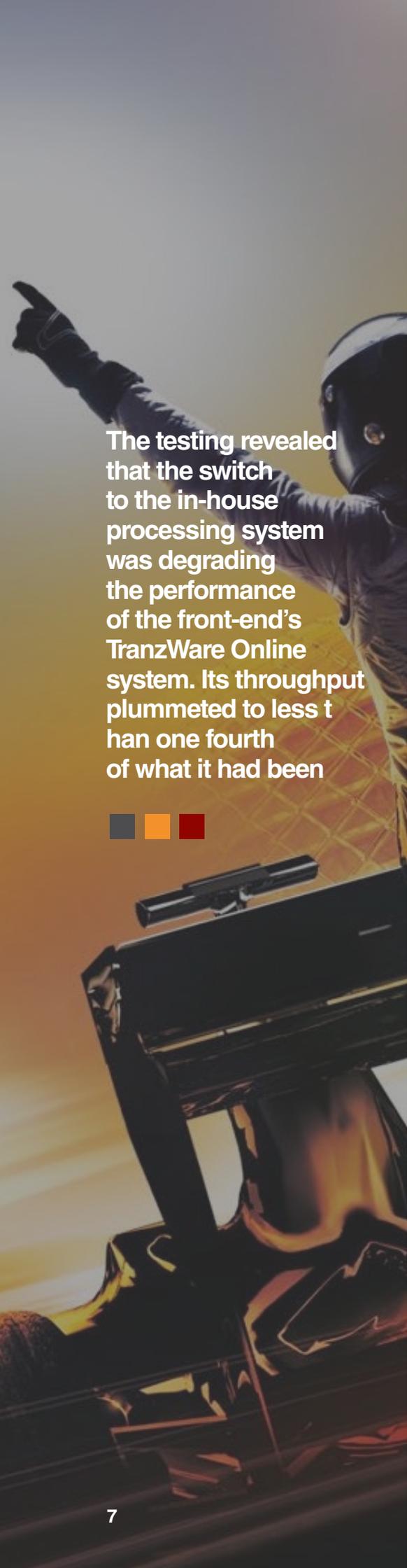
### Solution

Performance Lab proposed to focus on testing the performance of two system behavior profiles: "business day" and "day-end closing".

Analyzing the operational statistics of the live system revealed the primary sources of the load: business-user transactions and background processes being performed on a schedule. An analysis of the integrated communications helped determine the nature of the interaction with external systems and served as the basis for adding additional operations to the profiles.

Loads were emulated using tools such as LoadRunner, JMeter, and Citrix ICA. Performance Lab engineers used an ISO-8583 emulator, developed in-house, to generate test payment card transactions. During the project emulators of external systems were also developed to create additional load using JDBS, SOAP, Oracle AQ, and PL/SQL.

And tools in the form of a PL/SQL package and auxiliary LoadRunner scripts were developed to generate test data in a database.



**The testing revealed that the switch to the in-house processing system was degrading the performance of the front-end's TranzWare Online system. Its throughput plummeted to less than one fourth of what it had been**



A series of tests were run on the "old" configuration. Then the same series of tests were run on the "new" architecture, which was already using the bank's in-house processing system. This made it possible to compare the performance of the two configurations on a load representative of real operating conditions.

As the tests were run, Performance Lab specialists monitored the IT systems' performance characteristics under load. Parameters were changed at the level of system resources (CPU, Memory, I/O), databases and middleware, applications (code profiling), and business processes (operation response times).

Based on the systems analysis, Performance Lab's performance engineers discovered several bottlenecks.

### **Customer benefits**

The testing revealed that the switch to the in-house processing system was degrading the performance of the front-end's TranzWare Online system. Its throughput plummeted to less than one fourth of what it had been.

Performance Lab's performance engineers located the bottleneck causing this degradation. It turned out to be the CBA interface responsible for TranzWare Online's communication with the HomeR banking system. During the testing, a backlog in the CBA interface's message queue resulted in degraded performance for all types of transactions.

Moreover, the engineers found potential problems due to single-threaded processing of HomeR transactions on the TWO application server, as well as several functional bugs.

The findings presented by Performance Lab at the end of the project helped the bank decide to postpone deployment of its in-house processing system by 3 months, during which time the bottleneck was fixed by a developer. After all of the bugs were eliminated and the load testing was repeated, the in-house processing system was successfully introduced.



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## About Performance Lab

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**PERFORMANCE LAB** is global company specializing in software testing and quality assurance. We are among the world's top-30 QA companies.

Since 2008 we have worked in the financial and government sectors, retail, and telecommunications, helping our clients achieve substantially higher quality in their mission-critical IT systems. In 2014 our annual sales exceeded 10 million dollars.

Performance Lab has been recognized in the field of IT and telecommunications by the "Indeks Liderstva 2013" [Leadership Index 2013] russian employer ranking. This means that more than 300 of our employees in Moscow and Izhevsk gave us a high rating. We are proud to be one this list with companies such as IBM, Microsoft, Yandex, and MTS.

We perform the large number independent testing projects worldwide, thanks to our huge Center of Excellence, which is always growing. Our customers are industry leaders, such as Illumina, Splunk, MTS, VimpelCom, VTB and VTB-24, Alfa-Bank, Raiffeisenbank, Leto Bank, Rosbank, X5 Retail Group, M-Video, El Dorado, Lenta, and major government organizations, e.g. Pension Fund of the Russian Federation, Moscow City IT Department, and many other organizations.



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