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This document describes The Grinder which is a Java load testing framework. The reading material covers various areas of The Grinder, like agents, workers, property file, logging, console, TCPProxy, scripts, Jython, Clojure, instrumentation, script gallery, plug-ins, statistics, SSL and garbage collection. This document is for beginners and intermediaries.

Certified - The Grinder Testing

Training Material

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1. GRINDER PROJECT

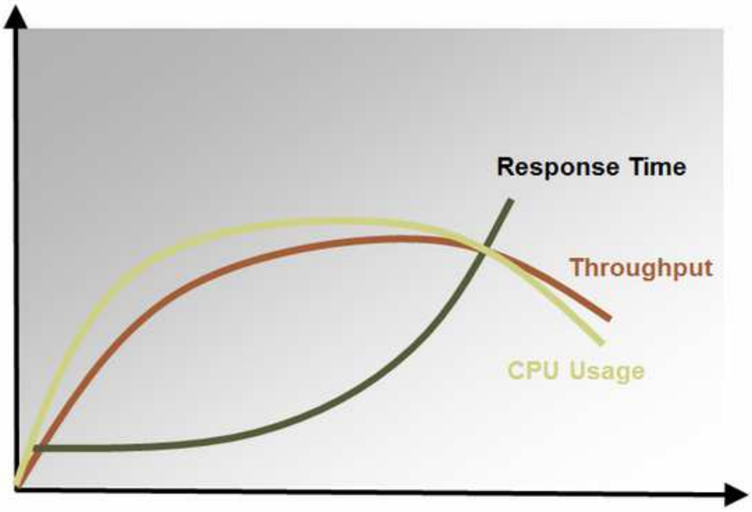
When project schedules are tight and releases frequent, the temptation to skimp on the load-testing cycle is great. However, not many customers have the loyalty or patience to put up with the performance issues likely to result from taking such ill-considered shortcuts. It's more likely to result in immediate and catastrophic system failures worthy of broadcast throughout the Twittersphere!

Perhaps we've exaggerated things a bit, but load testing is critically important because it answers four key performance questions:

- ✓ How well does my application scale?
- ✓ When does my application break?
- ✓ Can we handle the expected peak load with acceptable response time?
- ✓ How many resources do we need to handle expected and peak load?

Obviously, we must define an acceptable response time for each application, and this is something business, engineering, and operations must all agree on in advance. For instance, if business analysis shows that too many users leave when response time goes above 2 seconds for a catalog search, then engineering must optimize performance for this and operations must provide the required resources.

The figure below illustrates a typical response time, throughput, and CPU-usage graph. The higher the load on the system (throughput), the more CPU power is consumed to handle that additional load. When CPU resources (or any other system resource) are exhausted, we will see a rise in response time as the system takes longer to handle all incoming requests. When no more system resources are available, the system breaks. This results in even higher response times and lower throughput. Acceptable response time must fall to the left of the intersection point—ideally before CPU usage and throughput flatten out or start to fall (see below figure).



1.1. Load Testing

Load testing is the process of putting demand on a software system or computing device and measuring its response. Load testing is performed to determine a system's behavior under both normal and anticipated peak load conditions. It helps to identify the maximum operating capacity of an application as well as any bottlenecks and determine which element is causing degradation. When the load placed on the system is raised beyond normal usage patterns, in order to test the system's response at unusually high or peak loads, it is known as stress testing. The load is usually so great that error conditions are the expected result, although no clear boundary exists when an activity ceases to be a load test and becomes a stress test.

Load testing is usually a type of non-functional testing although it can be used as a functional test to validate suitability for use.

The term load testing is used in different ways in the professional software testing community. Load testing generally refers to the practice of modeling the expected usage of a software program by simulating multiple users accessing the program concurrently. As such, this testing is most relevant for multi-user systems; often one built using a client/server model, such as web servers. However, other types of software systems can also be load tested. For example, a word processor or graphics editor can be forced to read an extremely large document; or a financial package can be forced to generate a report based on several years' worth of data. The most accurate load testing simulates actual use, as opposed to testing using theoretical or analytical modeling.

Load testing lets you measure your website's QOS performance based on actual customer behavior. Nearly all the load testing tools and frame-works follow the classical load testing paradigm: when customers visit your web site, a script recorder records the communication and then creates related interaction scripts. A load generator tries to replay the recorded scripts, which could possibly be modified with different test parameters before replay. In the replay procedure, both the hardware and software statistics will be monitored and collected by the conductor, these statistics include the CPU, memory, disk IO of the physical servers and the response time, throughput of the System Under Test (short as SUT), etc. And at last, all these statistics will be analyzed and a load testing report will be generated.

Load and performance testing analyzes software intended for a multi-user audience by subjecting the software to different numbers of virtual and live users while monitoring performance measurements under these different loads. Load and performance testing is usually conducted in a test environment identical to the production environment before the software system is permitted to go live.

The specifics of a load test plan or script will generally vary across organizations. For example, in the bulleted list above, the first item could represent 25 VUsers browsing unique items, random items, or a selected set of items depending upon the test plan or script developed. However, all load test plans attempt to simulate system performance across a range of anticipated peak workflows and volumes. The criteria for passing or failing a load test (pass/fail criteria) are generally different across organizations as well. There are no standards specifying acceptable load testing performance metrics.

A common misconception is that load testing software provides record and playback capabilities like regression testing tools. Load testing tools analyze the entire OSI protocol stack whereas most regression testing tools focus on GUI performance. For example, a regression testing tool will record and playback a mouse click on a button on a web browser, but a load testing tool will send out hypertext the web browser sends after the user clicks the button. In a multiple-user environment, load testing tools can send out hypertext for multiple users with each user having a unique login ID, password, etc.

1.2. What is Grinder

The Grinder is a Java load testing framework that makes it easy to run a distributed test using many load injector machines. It is freely available under a BSD-style open-source license.

1.3. Key Features

- ✓ Generic Approach Load test anything that has a Java API. This includes common cases such as HTTP web servers, SOAP and REST web services, and application servers (CORBA, RMI, JMS, EJBs), as well as custom protocols.
- ✓ Flexible Scripting Test scripts are written in the powerful Jython and Clojure languages.
- ✓ Distributed Framework A graphical console allows multiple load injectors to be monitored and controlled, and provides centralised script editing and distribution.
- ✓ Mature HTTP Support Automatic management of client connections and cookies. SSL. Proxy aware. Connection throttling. Sophisticated record and replay of the interaction between a browser and a web site.

1.4. Dynamic Scripting

Test scripts are written using a dynamic scripting language, and specify the tests to run. The default script language is Jython, a Java implementation of the popular Python language.

The script languages provide the following capabilities:

Test any Java code - The Grinder 3 allows any code (Java, Jython, or Clojure) code to be encapsulated as a test. Java libraries available for an enormous variety of systems and protocols, and they can all be exercised using The Grinder.

Dynamic test scripting - The Grinder 2 worker processes execute tests sequentially in a fixed order, and there is limited support in some of The Grinder 2 plug-ins for checking test results. The Grinder 3 allows arbitrary branching and looping and makes test results directly available to the test script, allowing different test paths to be taken depending on the outcome of each test. The Grinder 2 HTTP plug-in's string bean feature provides simple support for requests that contain dynamic data. The Grinder 3 can use the full power of Jython or Clojure to create dynamic requests of arbitrary complexity.

The powerful scripting removes the need to write custom plug-ins that extend The Grinder engine. Although plug-ins are no longer responsible for performing tests, they can still be useful to manage objects that the tests use. For example, the standard HTTP plug-in manages a pool of connections for each worker thread, and provides an HTTPRequest object that makes use of these connections.

1.5. History

The Grinder was originally developed for the book Professional Java 2 Enterprise Edition with BEA WebLogic Server by Paco Gómez and Peter Zadrozny. Philip Aston took ownership of the code, reworked it to create The Grinder 2, and shortly after began work on The Grinder 3. The Grinder 3 provides many new features, the most significant of which is dynamic test scripting. Philip continues to enhance and maintain The Grinder.

In 2003, Peter, Philip and Ted Osborne published the book J2EE Performance Testing which makes extensive use of The Grinder 2.

Support for Clojure as an alternative script language was introduced in 3.6.

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