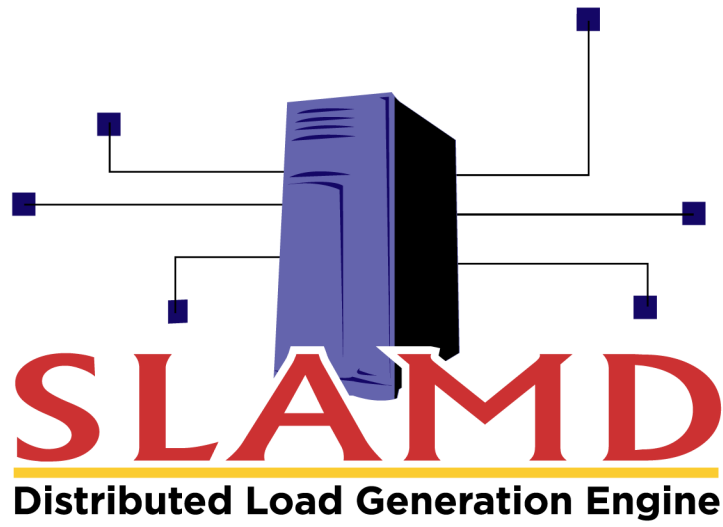


Quick Start Guide



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About the SLAMD Distributed Load Generation Engine

The SLAMD Distributed Load Generation Engine (SLAMD) is a Java-based application designed for stress testing and performance analysis of network-based applications. It was originally developed for benchmarking LDAP directory servers, but it is a very extensible framework that may be easily used for other forms of communications, including HTTP, SMTP, POP, IMAP, and TFTP. It is provided with several default workloads (called jobs), but new kinds of jobs can be developed using a simple but powerful Java API. SLAMD also has its own built-in scripting engine that may be used to create workloads using a custom scripting language, and support for new scripting languages may be added via the Bean Scripting Framework.

SLAMD offers a number of key features that makes it ideal for large-scale testing for network applications. Some of these features include:

- **Distributed Load Generation.** SLAMD was designed from the ground up to be able to harness the collective processing capabilities of multiple systems in order to ensure that client-side limitations do not artificially limit the amount of load that may be generated against the server.
- **Cross-Platform Compatibility.** SLAMD is a pure-Java application, capable of running on any system for which a Java 1.4 or higher runtime environment is available. It is known to work on many platforms, including Solaris, Linux, HP-UX, AIX, Mac OS X, and Windows.
- **Simple HTML-Based and Command-Line Interfaces.** The SLAMD server runs as a Web application and therefore may be accessed from any browser capable of rendering HTML 4.01. Access to the administrative interface does not require any client-side processing (e.g., JavaScript, applets, etc.), and it works well even with text-based browsers like Lynx. In addition, SLAMD provides command-line utilities for performing many tasks like scheduling jobs and obtaining results.
- **Easily Accessible Job Data.** The data collected in the course of running a job will be transmitted back to the SLAMD server and will be available both numerically and graphically in the administrative interface. The information may also be exported as tab-delimited text for easy import into other applications, and a report generation mechanism can be used to create user-friendly representations of the results in a number of formats.

- **Self-Optimizing Jobs.** The SLAMD server can run the same workload with varying amounts of client load in an attempt to automatically identify the combination that yields the best performance. In addition, it is possible to include additional constraints (e.g., based on response time or CPU utilization), as well as to define custom optimization algorithms to better determine what the "best" performance is.
- **Resource Monitoring.** In addition to providing a mechanism for collecting statistics specific to the workload being processed (e.g., the number of operations performed and the time required to process them), it is also possible to monitor system resources like CPU utilization, disk and network I/O, and memory consumption.

More information about the SLAMD Distributed Load Generation Engine may be found on its primary site located at <http://www.SLAMMD.com/>, or on the java.net site at <http://SLAMD2.dev.java.net/>.

Installing and Configuring the SLAMD Server Software

The SLAMD server provides a centralized point of access for the SLAMD environment. It is used to schedule jobs for processing, to access the results, and to coordinate the activities of the various kinds of client software. It is a Web application, and may be used either with the provided Tomcat Servlet engine or in any existing Web container.

Installation Prerequisites

The SLAMD server software has the following requirements:

- A Java 5.0 or higher runtime environment must be installed on the target system. SLAMD has been tested and verified to work properly on Java 5.0 and 6.0 releases.
- If the SLAMD server is to be run in an existing Web container, then that container should provide support for the Java Servlet API version 2.2 or higher.
- A Web browser capable of rendering HTML 4.01 for interaction with the SLAMD administrative interface. The browser software does not need to be installed on the SLAMD server system itself, but should be installed on any system that needs to access the administrative interface.
- Software capable of extracting ZIP compressed archives.

Installing with the Provided Tomcat Container

The `slamd-{buildid}.zip` file contains the SLAMD server software embedded within an Apache Tomcat Servlet engine. Using this archive is the easiest and fastest way to get the SLAMD server running, and it also includes the client software and a number of tools that can assist in various aspects of benchmarking and performance analysis of LDAP directory servers and other applications. This is the recommended method of running the SLAMD server and is the most thoroughly-tested configuration. In order to install the SLAMD server software, simply extract the `slamd-{buildid}.zip` archive in the desired location on the server system.

Running on a UNIX-Based System

To start the SLAMD server on a UNIX-based system, execute the `bin/startup.sh` shell script. In many cases (in particular, if the `JAVA_HOME` environment variable is set or an appropriate `java` command is in the path), no further configuration is required. If an error occurs while running the startup script, then you may explicitly specify which Java runtime environment to use in one of the following ways:

- Update the `PATH` environment variable so that it includes the directory with a suitable `java` command.
- Set the value of the `JAVA_HOME` environment variable to the root of the Java runtime environment installation.
- Edit the `tools/set-java-home.sh` script so that the `JAVA_HOME` environment variable is set automatically when the script is invoked.

Running on a Windows System

To start the SLAMD server on a Windows system, execute the `bin\startup.bat` batch file. This will be all that is necessary if the `JAVA_HOME` variable is defined in the environment (it is not sufficient to have the `java.exe` command in the path). If an error occurs, you may specify which Java runtime environment to use in one of the following ways:

- Set the value of the `JAVA_HOME` environment variable to the root of the Java runtime environment installation.
- Edit the `tools\set-java-home.bat` script so that the `JAVA_HOME` environment variable is set automatically when the script is invoked.

Installing in an Existing Web Container

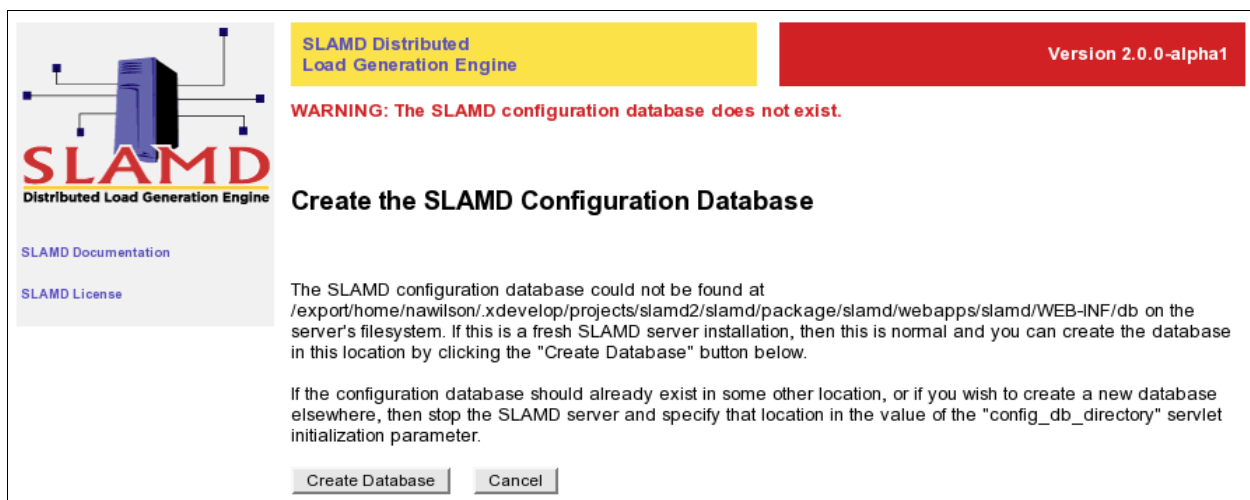
The `slamd-{buildid}.war` file contains the SLAMD server software in a standard Web archive format that may be installed in any Java EE Web container supporting at least the Servlet 2.2 API. The mechanism for deploying a Web application varies, so consult the documentation for the Web container to determine how to install a WAR file in your environment.

Note that installing in this manner will not include the client software, so that will need to be downloaded separately. It will also not include the additional tools that are provided with the full version of the SLAMD server embedded within Tomcat, so if they are needed then the full SLAMD server archive (contained in the `slamd-{buildid}.zip` file) should still be downloaded.

Accessing the SLAMD Administrative Interface

Once the SLAMD server software has been deployed and the associated Web container is running, then the administrative interface may be accessed using the `"/slamd/"` URI in that Web container. For example, if the server has been installed using the provided Tomcat engine and you will be using a browser on the same system as the server software, then you may access the administrative interface using a URL of <http://127.0.0.1:8080/slamd/>.

The first time the SLAMD administrative interface is accessed, it will be necessary to initialize the database used to store the configuration and job data. This may be accomplished by clicking the "Create Database" button as may be seen below:



Once the database has been created, then the SLAMD server should be fully functional. See the [Scheduling and Running Jobs](#) section for information about performing common tasks in the administrative interface.

Installing and Configuring the SLAMD Client Software

Because SLAMD is a distributed application, the server does not actually generate the load against the target application. Rather, this work is done by the clients. Multiple client systems may process a job concurrently to increase the total amount of load that can be generated.

The SLAMD client software contains two primary components: the standard SLAMD client, and the SLAMD client manager. The standard client is the component that actually generates load against the target application, and there may be multiple instances of this client running on a single system. The client manager is an application that can be used to create and destroy client instances. The primary benefit of the client manager software is that it can automatically reconnect to the SLAMD server if the connection is lost for some reason (e.g., the SLAMD server is restarted). If the client manager is used, then it is recommended that it be used to create and destroy clients rather than starting the clients individually outside of the client manager.

The SLAMD client software is included in the `slamd_client-{buildid}.zip` archive. This file is included in the full SLAMD server package (the `slamd-{buildid}.zip` archive), or it may be downloaded separately. To install the client software, simply extract the contents of the SLAMD client archive into the desired location on the client system(s).

Before the client may be used, it must be configured. This may be done by editing the `slamd_client.conf` configuration file. In most cases, the default values supplied will be sufficient, but you will need to specify at least the address of the SLAMD server. The properties most likely to be customized include:

- `SLAMD_ADDRESS` -- Specifies the address of the SLAMD server system.
- `ENABLE_REAL_TIME_STATS` -- Indicates whether the client should report in-progress statistical information while the job is running.
- `ENABLE_STAT_PERSISTENCE` -- Indicates whether the client should periodically save information collected by long-running jobs locally so that at least partial data will be available in the event that communication between the client and the server is lost.
- `AGGREGATE_CLIENT_THREADS` -- Indicates whether the client should aggregate the information from all threads used to run a job before sending the results to the SLAMD server. This will conserve space and memory on the SLAMD server system, but it will

not be possible to obtain information about the performance of each individual client thread (this information is not important in most cases).

- `RESTRICTED_MODE` -- Indicates whether the client will operate in restricted mode, in which case it will only be used to run jobs for which it has been explicitly requested.
- `AUTO_START_CLIENTS` -- Specifies the number of client instances that the client manager should automatically create when it establishes a connection to the SLAMD server.
- `MAX_CLIENTS` -- Specifies the maximum number of concurrent client instances that a SLAMD client manager should allow at any given time.
- `VERBOSE_MODE` -- Indicates whether the client will operate in verbose mode, providing additional information that may be useful for debugging problems but may have a small impact on the performance of the client.

When the `slamd_client.conf` file has been edited, the client may be started using the `start_client.sh` script on UNIX systems or `start_client.bat` batch file on Windows. Starting the client with no arguments will be sufficient in most cases, although any arguments provided on the command line will override those defined in the configuration file (e.g., invoking `./start_client.sh -v` will start the client in verbose mode even if the `VERBOSE_MODE` option is disabled in the configuration file). Use the `-h` argument to obtain a list of all of the command-line arguments that may be provided.

If the SLAMD client cannot find an appropriate Java environment to use, then you may either set the `JAVA_HOME` environment variable or edit the `tools/set-java-home.sh` script (or `tools\set-java-home.bat` on Windows) to provide the path to the Java installation to use.

In order to start the client manager software on UNIX systems, use the `start_client_manager.sh` script. The client manager software is currently not available on Windows systems because of a platform limitation (Windows does not provide the equivalent of the UNIX `exec` command that can run a separate command in the same process as the original command). This restriction will be removed in the near future, as the client manager software will be redesigned to work around the problem.

Once the SLAMD client or client manager has been started, then the "SLAMD Server Status" page in the administrative interface may be used to view information about those clients. In the case of the client managers, it is possible to request that client instances be created or destroyed through this interface, and individual load generation client instances may be disconnected as desired.

Installing and Configuring the SLAMD Resource Monitor Client Software

The SLAMD resource monitor client may be used to capture information about the environment in which jobs are being run. It can measure system resources like CPU utilization, disk and network I/O rates, and memory consumption, not only for the server(s) being tested, but also for the clients generating the load and any other systems that might be involved in some way. It can also be used to collect information about the application under load from an external standpoint (e.g., for the Sun Java System Directory Server, it may be used to monitor cache utilization, operations processed, and replication latency).

The SLAMD resource monitor client software is contained in the `slamd_monitor_client-{buildid}.zip` archive, which is included in the full SLAMD server archive or may be downloaded separately. To install the resource monitor client, simply extract the contents of this archive onto a system to be monitored in the desired location. Then edit the `slamd_monitor_client.conf` configuration file to define the settings to use to communicate with the SLAMD server. The settings are most likely to be customized include:

- `SLAMD_ADDRESS` -- Specifies the address of the SLAMD server system.
- `ENABLE_REAL_TIME_STATS` -- Indicates whether the client should report in-progress statistical information while the job is running.
- `ENABLE_STAT_PERSISTENCE` -- Indicates whether the client should periodically save information collected by long-running jobs locally so that at least partial data will be available in the event that communication between the client and the server is lost.
- `AUTO_RECONNECT` -- Indicates whether the client should automatically reconnect to the SLAMD server if the connection is lost.
- `VERBOSE_MODE` -- Indicates whether the client will operate in verbose mode, providing additional information that may be useful for debugging problems but may have a small impact on the performance of the client.

In addition to the settings in the `slamd_monitor_client.conf` file, each type of resource monitor should have its own configuration file, located in the `config` subdirectory. The properties in each of these configuration files is dependent upon the type of resource monitor described by that configuration. See the SLAMD Administration and Usage Guide for information about the configuration properties for each resource monitor.

In order to start the resource monitor client, use the `start_monitor_client.sh` command on UNIX-based systems or the `start_monitor_client.bat` command on Windows. In most cases, no command-line arguments are required, but they may be given if necessary to override the values from the configuration file. Use the `"-h"` argument to see complete usage information for the resource monitor client.

If the resource monitor client cannot find an appropriate Java environment to use, then you may either set the `JAVA_HOME` environment variable or edit the `tools/set-java-home.sh` script (or `tools\set-java-home.bat` on Windows) to provide the path to the Java installation to use.

Scheduling and Running Jobs

With the SLAMD server running and the various types of clients connected, it is possible to schedule jobs for processing. The easiest way to accomplish this is through the administrative interface. Follow the "Schedule a Job" link under the "Manage Jobs" heading of the navigation sidebar, and a list of the jobs available for use will be displayed, organized alphabetically by category and job name. Select the type of job to schedule and a form will be displayed that may be used to supply the necessary for use in running the job:

The screenshot displays the SLAMD Distributed Load Generation Engine administrative interface. The top header includes the SLAMD logo, the text "SLAMD Distributed Load Generation Engine", and the version "Version 2.0.0-alpha1". The main heading is "Schedule a New LDAP Weighted SearchRate Job". Below this, a note states: "Enter the following information about the LDAP Weighted SearchRate job. Note that parameters marked with an asterisk (*) are required to have a value. [Click here for help regarding these parameters.](#)".

The interface features a sidebar on the left with a "Manage Jobs" section containing links: "Schedule a Job", "View Pending Jobs (0)", "View Running Jobs (0)", "View Completed Jobs", "Optimizing Jobs", "Job Groups", "Real Job Folders", "Virtual Job Folders", "Import Job Data", "Export Job Data", "Migrate SLAMD 1.x Data", "View Job Classes", "Add a New Job Class", and "Install a Job Pack". Below this are links for "SLAMD Configuration", "SLAMD Server Status", "SLAMD Documentation", and "SLAMD License".

The main form area has a tab labeled "Show Advanced Scheduling Options". The form fields are as follows:

Place in Folder	Unclassified
Description	Test Weighted SearchRate
Start Time (YYYYMMDDhhmmss)	20060423202329
Stop Time (YYYYMMDDhhmmss)	
Duration	360
Number of Clients *	4
Monitor Clients if Available	<input checked="" type="checkbox"/>
Wait for Available Clients	<input checked="" type="checkbox"/>
Threads per Client *	10
Statistics Collection Interval	5
Directory Server Host *	directory.example.com
Directory Server Port *	389
Bind DN	
Bind Password	
Search Base	ou=People,dc=example,dc=com
Search Scope *	Whole Subtree

In most cases, a job will define a number of parameters that will need to be supplied in order to perform the associated workload (e.g., the address and port to use to communicate with the application that you want to test). Consult the SLAMD Job Reference Guide for information about the types of parameters that are available for each of these jobs. However, there is also a standard set of parameters that will always be displayed when scheduling a job. These standard parameters include:

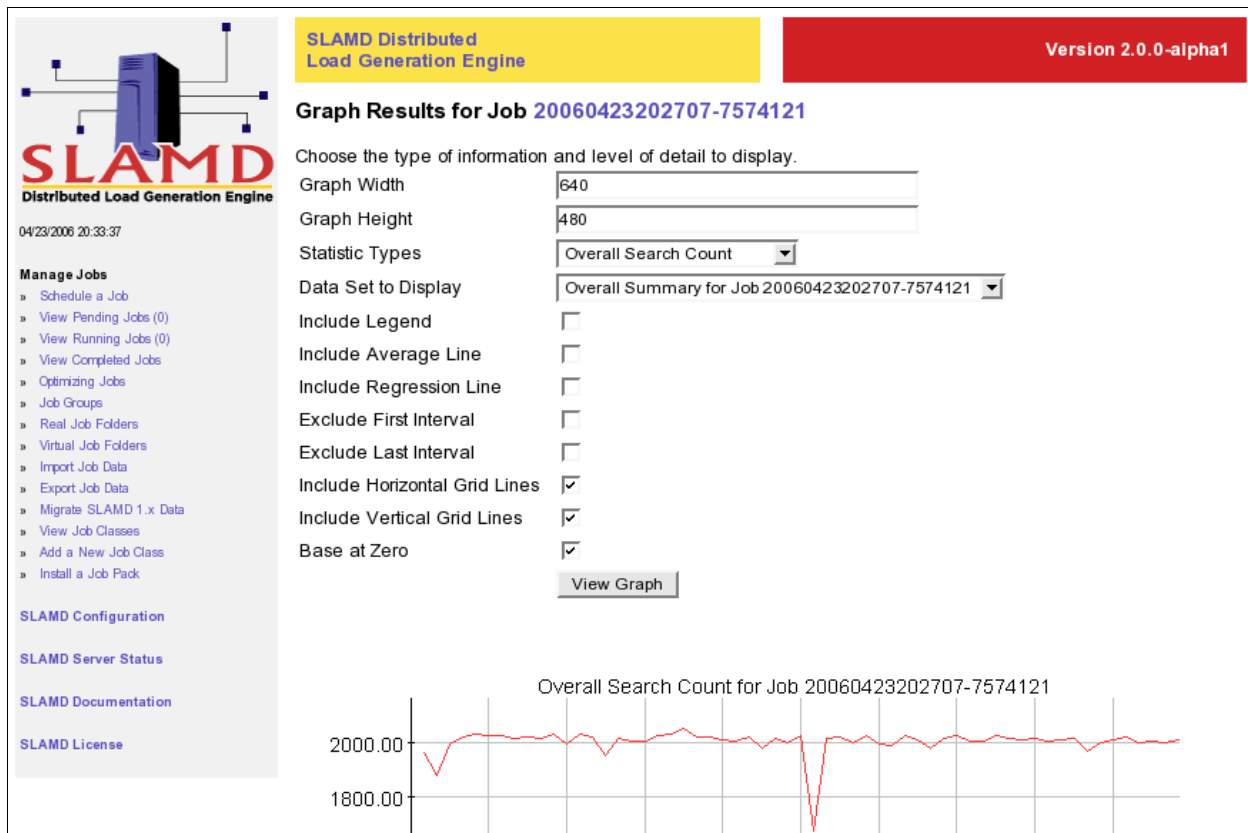
- **Place in Folder** -- This specifies the folder into which the job should be placed when it is scheduled. By default, only the "Unclassified" folder exists, but additional folders may be created to help organize the job information.
- **Description** -- This provides a brief description of the job, which may be used to distinguish it from other jobs in the same folder.
- **Start Time** -- This specifies the time that the job should start running. It should be in the form "YYYYMMDDhhmmss" (for example, if the job should start running at 12:30 p.m. on May 1, 2006, then the value should be "20060501123000"). If the provided start time is equal to the current time or if it is in the past, then the job will be eligible to start running immediately.
- **Stop Time** -- This specifies the time that the job should stop running, if it has not already stopped for some other reason. This is an optional parameter, and if it is not provided then the job will run until it has stopped on its own or until it has run for the maximum allowed duration (if defined). The format is the same as for the start time.
- **Duration** -- This specifies the maximum length of time in seconds that the job should be allowed to run. This is an optional parameter, and if it is not provided then the job will run until it has stopped on its own or until the stop time (if defined) is reached.
- **Number of Clients** -- This specifies the number of clients that should be used to run the job. This is a required parameter, but it may be hard-coded by the job in which case it will not be displayed.
- **Monitor Clients if Available** -- This indicates whether to automatically make use of a resource monitor client running on the client system(s) if one is available. This can be used to help ensure that the client(s) are not overloaded while generating load against the target application.
- **Wait for Available Clients** -- This indicates whether the SLAMD server should wait for the specified number of clients to become available. If this is not selected, then when the start time arrives the job will fail with an error if there are not enough clients available.
- **Threads per Client** -- This specifies the number of threads per client to use to generate load against the target application. This is a required parameter.
- **Statistics Collection Interval** -- This specifies the statistics collection interval in seconds to use when running the job. This controls the number of data points that will be available for the job after it has completed (e.g., the frequency of data points available when viewing a graph of the results). This is a required parameter, and it must be less than the total duration for the job (in many cases, a good value to choose would be a length of time that is one or two percent of the total job duration).

There are additional parameters that may be available by clicking the "Show Advanced Scheduling Options" button. More detailed information about all of these parameters may be obtained by following the link at the top of the page, or in the SLAMD Administration and Usage Guide.

Once all of the parameters have been provided, the "Schedule Job" button may be used to schedule the job for execution. It will be placed in the pending jobs queue so that it will be sent to the clients to begin processing when the start time arrives. When this happens, it will be placed in the list of running jobs. If a stop time or maximum duration was provided, then the estimated time remaining will be displayed when viewing that job until it has completed.

For many jobs, there may also be a "Test Job Parameters" option that can be used to help determine whether the provided parameters are acceptable. The specific tests performed by this option may vary between jobs, but in many cases it will attempt to ensure that the target application may be accessed using the provided information. Note that this test will be performed by the SLAMD server and not by the clients, so under certain conditions (e.g., if the server and clients are on different networks) then the test may not be successful even if the clients would be able to perform the requested processing.

When the job has completed running, then the results may be viewed through the administrative interface. The information will be displayed numerically in tables by default, but it may also be seen graphically by clicking the "Graph" button at the top of the page or the "Graph Statistics" option below the data. The data may also be exported to tab-delimited text by clicking the "Save Statistics" button so that it can be used in another application.



The completed job may also be cloned to easily re-schedule a job with the same or slightly altered parameters. The "Optimize Results" button may also be used to schedule the same workload as an optimizing job, which re-runs the same job repeatedly with varying numbers of threads per client in order to automatically find the amount of load that yields the best possible performance.

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