Wolfram *Mathematica* Tutorial Collection

SYSTEM ADMINISTRATION GUIDE

For use with Wolfram *Mathematica*® 7.0 and later.

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System Administration for Network Licenses

System Administration for Single-Machine Licenses

System Administration for Network Licenses

MathLM

What Is *MathLM*?

MathLM administers licenses for organizations running multiple instances of *Mathematica* with a network license. Network licenses have two very important advantages:

- Network licenses provide a cost-effective way of making *Mathematica* available to multiple client machines in a networked environment. Instead of a separate license for each machine, a network license allows a specified number of copies of *Mathematica* to run concurrently on the network.
- Network licenses provide a convenient way of using grid*Mathematica* to make powerful parallel computations on 16 or more kernels in a networked environment. Instead of a separate license for each machine hosting one or more of the 16 kernels, a network license allows the worker kernels to run concurrently on the network.

MathLM is installed on a single machine, known as the license server. Once *MathLM* is running, it acts as a gatekeeper for new *Mathematica* sessions. *MathLM* sets up the appropriate number of process slots for each class of computer covered by your network license agreement. *MathLM* monitors the number of copies of *Mathematica* in use and issues licenses to clients until all available licenses are in use.

The number of concurrent processes that may run over the entire network is printed on your license certificate. You can increase the number of processes allowed with a license upgrade from Wolfram Research. See the Wolfram *Mathematica* Increment Request Form on the web at wolfram.com/products/mathematica/processes for more information on increasing your process increments.

Mathematica consists of two components, the kernel and the front end. The *Mathematica* kernel performs computations. The *Mathematica* front end is the graphical notebook interface. *MathLM* keeps track of kernel and front end processes separately.

- The number n of processes printed on your network license certificate generally gives you n front end process slots and $4n$ kernel process slots per increment. See the Increment Request form on the web at wolfram.com/products/mathematica/processes for more information on increasing your process increments.
- The grid*Mathematica* network license certificate generally gives you 16 sub-kernel process slots (sixteen worker kernels).

A client *Mathematica* process must request a license from *MathLM* before it starts taking user input or performing calculations. In order for clients to run *Mathematica*, *MathLM* must be running on the license server at all times. If the client machine making the request is not of a type covered by the license, or if all the process slots are already in use, the client *Mathematica* process cannot be started.

Installing *MathLM*

Requirements

MathLM is available for Windows, all Unix and Linux platforms on which *Mathematica* is supported, and Mac OS X. Visit www.wolfram.com/products/mathematica/platforms.html for a complete list of platform availability. Each *MathLM* license server can support any combination of client machines, regardless of the platform on which *MathLM* itself is running. *MathLM* automatically supports both IPv4 and IPv6 environments.

The machine that you choose as a license server should be stable and should have a reliable TCP/IP connection to the clients you want to serve. As *MathLM* requires minimal processor and memory resources, an older machine with a reliable network connection would be an acceptable license server. Ideally, there should not be any intervening firewalls between the license server and the clients. If there is an intervening firewall, you will need to configure the network to allow traffic to an appropriate port through the firewall. The license server must be located at the physical site where your product is registered, as stipulated by your license agreement.

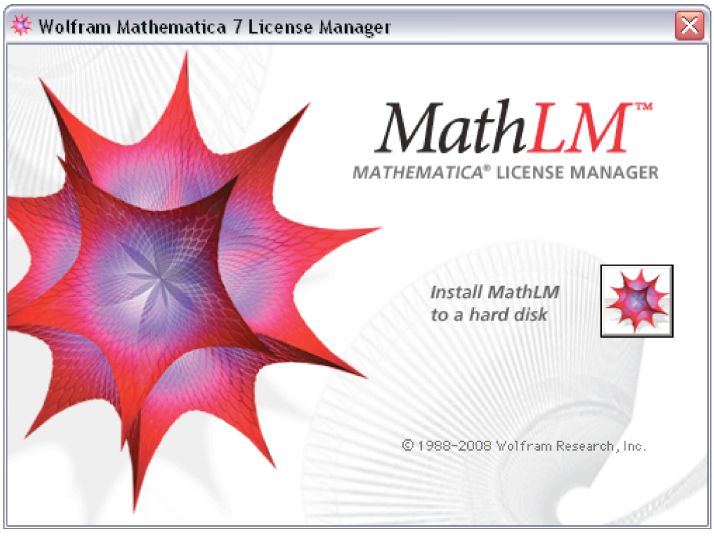
To install and run *MathLM*, you must register with Wolfram Research and receive a password. See "Registration and Passwords" for further information.

Installing MathLM on Windows

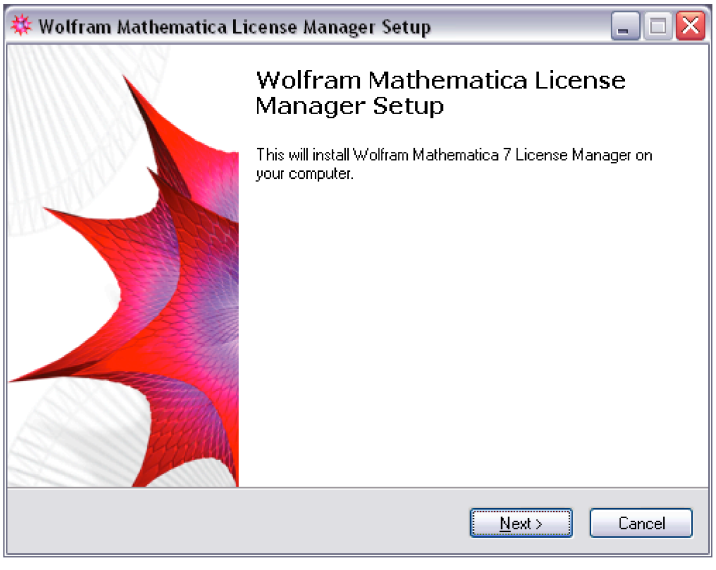
To install *MathLM* on Windows 2000/XP/Vista, you must have administrative privileges.

To Install MathLM on Windows:

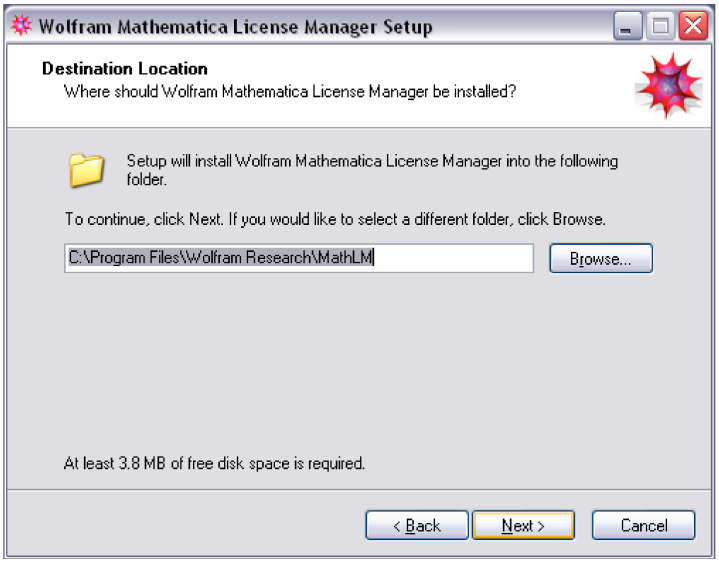
1. Insert the *MathLM* CD. The **Wolfram *Mathematica* 7 License Manager** window appears on your screen. Click the button labeled **Install MathLM to a hard disk**.



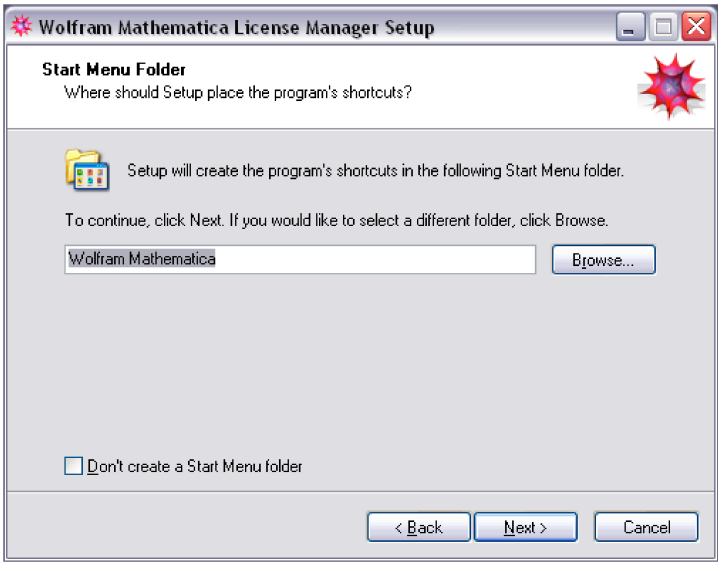
2. The **Wolfram *Mathematica* License Manager Setup** dialog appears on your screen. Click **Next** to begin the installation process.



3. By default, *MathLM* is installed in the directory C:\Program Files\Wolfram Research\MathLM. To choose another destination directory, click **Browse**. Click **Next** to continue.

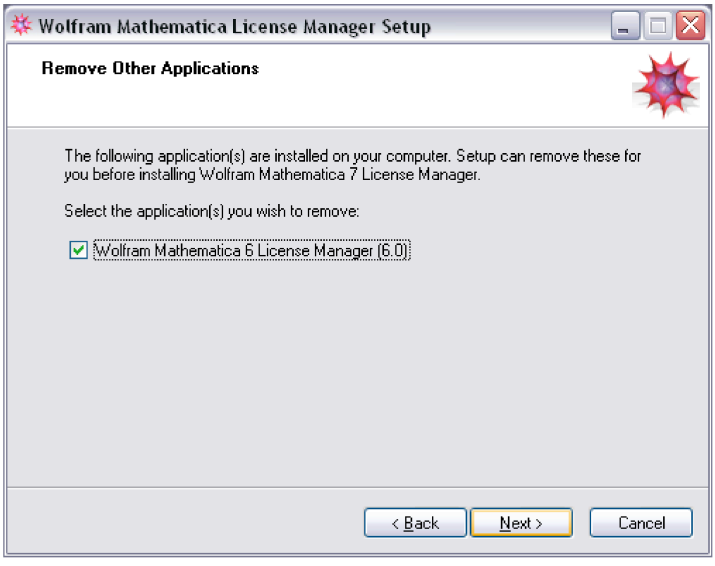


4. Click **Next** to add *MathLM* shortcuts to the **Start** menu in the Wolfram *Mathematica* folder.

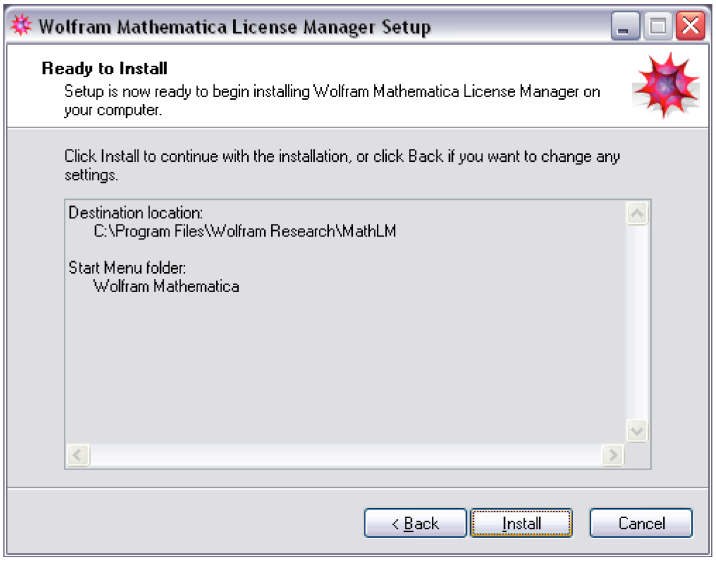


5. Select any previous *MathLM* installations you want to remove. Click **Next** to continue.

   Note: If you are installing over a previous version of *MathLM*, your existing mathpass file, custom settings, and *MonitorLM* configuration files will **not** be deleted.

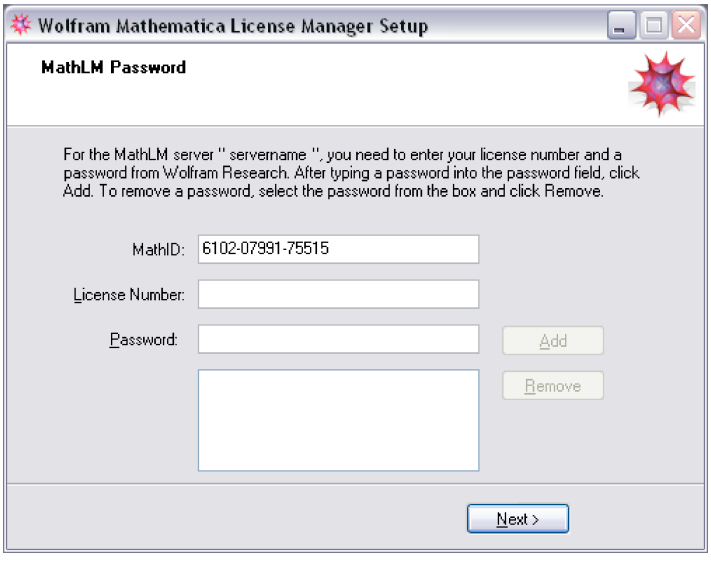


6. Click **Install** to install *MathLM*.

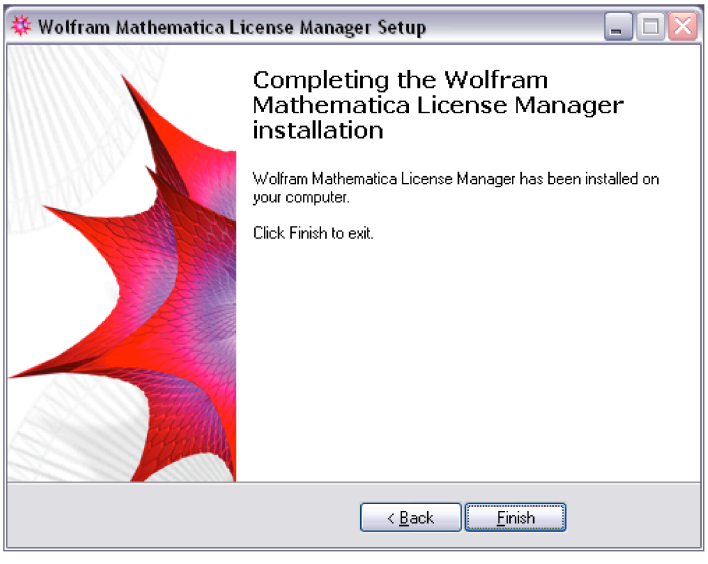


7. Your MathID number is displayed in the next dialog box. To obtain your password, contact Wolfram Research (see "Registration and Passwords" for details). You will need to provide your license number (located on your electronic or printed license certificate) and your MathID number.

Once you have your password, enter your license number and password in the dialog box. Click **Add** to add the new password to the list of recognized passwords. Click **Next** to continue.



8. The **Wolfram *Mathematica* License Manager Setup** dialog will tell you when it is finished installing *MathLM*. Click **Finish** to quit the installer.



After the installation is completed, *MathLM* will start automatically. For information on configuring *MathLM* with additional options, refer to "Launching *MathLM*".

Installing MathLM on Unix, Linux, and Mac OS X

To install and run *MathLM* on Unix and Linux, you may need `root` privileges. To install and run *MathLM* on Mac OS X, you must have administrative privileges.

To Install MathLM on Unix, Linux, and Mac OS X:

On Mac OS X, open the Terminal application and type the commands that follow in the **Terminal** window.

1. Insert the *MathLM* CD into the CD/DVD-ROM drive.
2. Mount the CD. For information on mounting a CD, see "Mounting a CD or DVD on Unix and Linux".

   Note: This step is not required on Mac OS X and some Linux and Unix platforms, as the operating system automatically handles mounting.
3. Change the directory to the appropriate subdirectory beneath the CD mount point. Note that the exact location of the CD mount point might be different on Unix and Linux platforms.

   Unix:

   `cd /`*`cdrom`*`/Unix`

   Mac OS X:

   ```
   cd /Volumes/MathLM/Macintosh
   ```
4. Type the following command and press Return.

   ```
   ./MathLMInstaller
   ```
5. Your machine name and MathID number are displayed. To obtain your password, contact Wolfram Research (see "Registration and Passwords" for details). You will need to provide your license number (located on your electronic or printed license certificate) and your MathID number.

   Once you have your password, type the letter `c` and press Return to proceed with the installation.

   ```
   ----------------------------------------------------------------
                      MathLM 7.0 Installer
   ----------------------------------------------------------------
   You can use this installer to install MathLM for the first time, or to
   install a new version when you already have a previous version installed.
   ```

```
To complete the installation, you will need a MathLM password.

To receive a password, register your copy of MathLM by going to
register.wolfram.com. You can also find registration instructions
in the file SysAdminGuide.pdf on the MathLM CD, or on the web at
http://reference.wolfram.com/network.

To register and get a password you will need to supply the
following information:

Machine name:  hostname
MathID:        dddd-ddddd-ddddd

Enter 'c' to continue or 'e' to exit the installer [c]:
```

6. Enter your *MathLM* license number as it appears on your electronic or printed license certificate. Then press Return.

```
Enter the license ID located on your electronic
or printed license certificate.
Your license ID should be of the form Lnnnn-nnnn, where
the n are digits.

Enter your license ID:
```

7. Enter your *MathLM* password. Then press Return.

```
Enter your MathLM password:
```

8. The installer prompts you to specify the directory in which *MathLM* should be installed. The default location is `/usr/local/Wolfram/MathLM`. Press Return to accept the default, or type in a new location and then press Return.

```
The installer will copy relevant files from the distribution
CD-ROM into your MathLM directory. If you specify a
directory that already contains MathLM, the installer
will update components to the latest available version. To install
MathLM from scratch, specify a directory that does not
already exist.

Enter the MathLM directory  [/usr/local/Wolfram/MathLM]:
```

Note: If you choose a directory that does not exist, the installer will create it for you. If a copy of *MathLM* already exists in the directory you specify, the installer will inform you before updating any files.

Note: If you are installing over a previous version of *MathLM*, your existing mathpass file, custom settings, and *MonitorLM* configuration files will **not** be deleted.

9. The installer prompts you to specify the directory in which symbolic links will be created. The default location is `/usr/sbin`. Press Return to accept the default, or type in a new location and then press Return.

```
The installer will copy relevant files from the distribution
CD-ROM into a linking directory. If you specify a directory
that already contains files from an older installation of
MathLM, the installer will update components to the latest
available version. To install MathLM from scratch, specify
a directory that does not already exist.

Enter the linking directory [/usr/sbin]:
```

   Note: If you choose a directory that does not exist, the installer will create it for you. If symbolic links to an older copy of *MathLM* already exist in the directory you specify, the installer will inform you before updating them.

10. The installer begins copying files from the CD. Each directory created is listed on your screen, and the location of the password file is displayed. If any error messages are generated during installation, they are logged to the installation directory.

11. Once the installation is complete, you must start *MathLM* manually. First, change directory to the location in which *MathLM* is installed (the default location is `/usr/local/Wolfram/MathLM`). Then issue one of the following commands.

    To start *MathLM*, type

    ```
    ./mathlm
    ```

    To start *MathLM* and log messages to a file, type

    ```
    ./mathlm -logfile filename
    ```

Only a few options are presented here. A full discussion of the command-line options for *MathLM* is given in "Launching *MathLM*".

Launching *MathLM*

Launching MathLM on Windows

Launching MathLM Manually

Once installed, *MathLM* starts running automatically by default each time the machine is rebooted. To start or stop *MathLM* manually, follow these instructions.

It is assumed here that *MathLM* is installed in the default location, C:\Program Files\Wolfram Research\MathLM.

To Start *MathLM* under Windows 2000/XP/Vista:

1. Open the Control Panel. (From the **Start** menu, choose **Settings ▸ Control Panel**.)
2. Double-click the Services icon located in the Administrative Tools folder. To change settings for services, you will need administrative privileges.
3. Select **Mathematica 7.0 License Manager** from the list of services.
4. Double-click the service name to open the **Properties** dialog box; then click **Start**.

   Alternatively, in a command prompt window run the command `net start mathlm`.

To Stop *MathLM* under Windows 2000/XP/Vista:

1. Double-click the Services icon located in the Control Panel\Administrative Tools folder. To change settings for services, you will need administrative privileges.
2. Select **Mathematica 7.0 License Manager** from the list of services.
3. Double-click the service name to open the **Properties** dialog box; then click **Stop**.

   Alternatively, in a command prompt window run the command `net stop mathlm`.

Starting MathLM Automatically

Under normal conditions, the installer will install *MathLM* as a service on the machine. This means *MathLM* will start automatically each time the machine is rebooted. You can manually change the settings that control whether *MathLM* starts when the machine is rebooted.

It is assumed here that *MathLM* is installed in the default location, C:\Program Files\Wolfram Research\MathLM.

To Start *MathLM* Each Time a Windows 2000/XP/Vista Machine Is Rebooted:

1. Open a command prompt window. (From the **Start** menu, choose **Programs ▸ Accessories ▸ Command Prompt**.)
2. Use the `cd` command to change directories to C:\Program Files\Wolfram Research\MathLM. Remember to use double quotes around directory names that include spaces.
3. Run `.\mathlm –install`.

If *MathLM* is already installed as a service but was previously disabled, you can enable it again using the following steps.

4. Double-click the Services icon located in the Control Panel\Administrative Tools folder. To change settings for services, you will need administrative privileges.
5. Select **Mathematica 7.0 License Manager** from the list of services and double-click.
6. In the dialog box that appears, set **Startup type** to **Automatic**.
7. Click **OK** to close the dialog box.

You can start or stop *MathLM* without rebooting the machine. The *MathLM* service will give no indication that it has started, but the operating system will report if it fails to start.

To Prevent *MathLM* from Starting Each Time a Windows 2000/XP/Vista Machine Is Rebooted:

1. Double-click the Services icon located in the Control Panel\Administrative Tools folder. To change settings for services, you will need administrative privileges.
2. Select **Mathematica 7.0 License Manager** from the list of services and double-click.
3. In the dialog box that appears, set **Startup type** to **Disabled**.
4. Click **OK** to close the dialog box.

   Alternatively, in a command prompt window run the command `.\mathlm -uninstall`. This will remove *MathLM* from the Service list.

Launching MathLM on Unix, Linux, and Mac OS X

To start *MathLM* on Unix and Linux, you may need `root` privileges. To start *MathLM* on Mac OS X, you must have administrative privileges.

You can start *MathLM* manually at any time using the command-line options listed in "Command-Line Options". However, it is typical to configure *MathLM* so it starts automatically when the system is rebooted.

Starting MathLM Automatically on Unix and Linux

To do this, create a new startup script containing the following lines, or add them to an existing system startup script.

```
if [ -f /usr/local/Wolfram/MathLM/mathlm];
then /usr/local/Wolfram/MathLM/mathlm -logfile filename;
fi
```

Starting MathLM Automatically on Mac OS X

To do this, you can write a startup item for *MathLM*. Startup items are programs (such as shell scripts) that are run during the last phase of booting a Mac OS X system. They can be configured to perform tasks such as clearing away temporary files or starting system daemons.

To Create a Startup Item for *MathLM*:

1. Create a directory called /MathLM in /Library/StartupItems. You might need to create the directory /Library/StartupItems first.
2. In /Library/StartupItems/MathLM, create a file called `MathLM` with the following contents. The name of the file must be the same as the name of the directory.

```
#!/bin/sh
. /etc/rc.common
##
#  This script will start up the Mathematica License Manager, mathlm.
##
if [  "${MATHLM:=-YES-}" = "-YES-" ]; then
 ConsoleMessage "Starting the Mathematica License Manager"
 /usr/local/Wolfram/MathLM/mathlm
else
 ConsoleMessage "The Mathematica License Manager was not started"
fi
```

3. Change permissions on the file to make it executable.

```
chmod 755 MathLM
```

4. In the same directory, /Library/StartupItems/MathLM, create a file called `StartupParameters.plist` with the following contents.

```
{
 Description = "Mathematica License Manager";
 Provides = ("MathLM");
 Requires = ("Core Services");
 OrderPreference = "None";
 Messages = {
    start = "Starting Mathematica License Manager";
    stop  = "Stopping Mathematica License Manager";
            };
}
```

5. Change permissions on the file to make it read-only.

```
chmod 644 StartupParameters.plist
```

6. Edit the /etc/hostconfig file, and add the following text in the Services section.

```
MATHLM=-YES-
```

7. To start *MathLM* without rebooting, run the following command.

```
SystemStarter start MathLM
```

MathLM Command-Line Options

The following are command-line options for *MathLM*.

`-foreground`	keep *MathLM* in the foreground and print server messages to `stdout`
`-help`	print the list of all command-line options and the MathID
`-language` *lang*	specify the language in which to display server messages
`-localtime`	use local time instead of GMT in server messages
`-logfile` *file*	write server messages to a specified log file
`-logformat` *string*	specify the format for displaying server messages
`-loglevel` *n*	specify the level of verbosity of server messages
`-mathid`	print the MathID of the machine running *MathLM*
`-noremotemonitor`	specify that *MathLM* cannot be remotely monitored via *MonitorLM*
`-pwfile` *file*	specify a file in which to look for *Mathematica* passwords
`-restrict` *file*	specify a policy file that describes how to allocate *Mathematica* licenses
`-timeout` *n*	return suspended licenses after a specified number of hours
`-trfile` *file*	specify a file that defines substitutions for the text of error messages

`mathlm` command-line options.

The following additional command-line option is accepted on Unix, Linux, and Mac OS X.

`-syslog`	log messages to `syslogd`

`mathlm` command-line options specific to Unix, Linux, and Mac OS X.

The following additional command-line options are accepted on Windows.

`-install`	install *MathLM* as a service program and automatically start the service
`-uninstall`	stop any currently running *MathLM* processes and remove *MathLM* from the list of services

`mathlm` command-line options specific to Windows.

With `-install`, any arguments given are stored as a part of the service and used when starting *MathLM* automatically.

Possible values for *lang* in `-language` are English, French, German and Japanese.

The four levels of verbosity in `-loglevel` are as follows.

1	report server startup/shutdown errors and print a successful startup message
2	report everything from level 1 and all runtime error messages
3	report everything from level 2, all license activity, and startup messages pertaining to the process ID and socket number
4	report everything from level 3, debugging information, and a license table for every license transaction

`-loglevel` verbosity levels.

If `-foreground` is specified, the default verbosity level is set to 4.

If `-logfile` is used without `-loglevel`, the default logging verbosity is set to 3.

If `-loglevel` is used without specifying a level, the verbosity defaults to 4.

The default format for log messages is the W3C common logfile format. *MathLM* log files can be imported using the `Import` format "`ApacheLog`".

Note: On Windows, a slash (`/`) or a dash (`-`) may be used to indicate options.

Logging *MathLM*

Enabling Logging

You can enable logging in two ways.

- Log server messages to `stdout` by using the option `-foreground` to keep `mathlm` in the foreground.
- Log server messages to a specific file using the option `-logfile` *file*.

The log file records messages as they occur, building up a detailed record of license activity over a period of time.

Logging supports both IPv4 and IPv6 environments with no additional configuration required.

Syntax of the Log File

By default, *MathLM* generates all log files in the W3C Common Logfile Format used by web servers such as Apache. However, you can customize the format by using the option `-logformat`. This option takes a string argument that specifies the format in which server messages are displayed. The string contains a series of commands of the form `%`*var*#, where

- *var* is a letter representing one of nine variables, such as the host, user, day, time, or event.
- # is a number defining a specific format for the variable *var*.

For example, `%y1` means that the year is displayed in two-digit format (e.g., 08), while `%y2` displays the year in four-digit format (e.g., 2008).

In addition to the `%`*var*# commands, the string can also include plain text such as brackets, dashes, quotation marks, and arbitrary comments. The text can be used to include comments and separators in the server messages for formatting purposes. All text included in the string appears literally in the server message with the following two exceptions: use `%q` to include a double quote ("), and use `%%` to include a percentage sign (%).

You must specify the type of messages that should be logged using the option `-loglevel`, as explained in "Launching *MathLM*".

Here is a list of variables that can be included in the string, along with their numeric values and formats.

Variable Name	*Possible Values*	*Description*
`%h#`	1 - IP address 2 - Hostname 3 - Fully qualified domain name	Host
`%u#`	1 - User ID 2 - Username	User
`%m#`	[1...31]	Day of Month
`%w#`	1 - Numeric [1 ... 7] 2 - Abbreviated [Sun ... Sat] 3 - Verbose [Sunday ... Saturday]	Day of Week
`%m#`	1 - Numeric [01 ... 12] 2 - Abbreviated [Jan ... Dec] 3 - Verbose [January ... December]	Month
`%y#`	1 - Two-digit [08] 2 - Four-digit [2008]	Year
`%t#`	1 - Twelve-hour (10:20:15) 2 - Twenty-four-hour (22:20:15) 3 - GMT offset (-0500)	Time
`%e#`	1 - Numeric 2 - Verbose	Event
`%r#`	1 - Numeric 2 - Verbose	Response

MathLM Logging Variables.

> **Note:** All Windows clients on a network have the same user ID (set to the number 65535 by default). Hence, the user ID setting is only meaningful for clients running Unix, Linux, or Mac OS X.

> **Note:** To use the GMT offset format (`%t3`), you must also use the `-localtime` option when starting *MathLM*.

Samples and Behavior

Running the command `mathlm -logfile log.txt`, without the option `-logformat`, generates messages in the default format. An example of messages in the default format, as contained in `log.txt`, follows.

```
hostname.domain.com - username [01/Sep/2008:22:01:35] "MathLM 7.0
executable launched" ".\mathlm" -
hostname.domain.com - username [01/Sep/2008:22:01:35] "Verbosity level
specified" "1" -
hostname.domain.com - username [01/Sep/2008:22:01:35] "Logging verbosity
level specified" "3" -
hostname.domain.com - username [01/Sep/2008:22:01:35] "Hostname"
"hostname.domain.com" -
```

The default format string, which mimics the Common Logfile Format, can be invoked by the following.

```
%h3 - %u2 [%d/%m2/%y2:%t2 %t3] %q%e2%q %q%r2%q -
```

To specify the Common Logfile Format manually, you must specify this string as the value of the `-logformat` option, as in the following command. The messages generated by this command are in the same format as the previous example.

```
mathlm -logfile log.txt -logformat "%h3 - %u2 [%d/%m2/%y2:%t2 %t3] %q%e2%q
%q%r2%q -"
```

By default, time is displayed in GMT. If you want local time to be displayed instead, you must use the `-localtime` command-line option with either the `%t1` tag or the `%t2` tag. The `%t3` tag should not appear in the format string if you want local time to be displayed.

An alternate format string using local time follows.

```
mathlm -logfile log.txt -localtime -logformat "%h1 - %u2 [%m1-%d-%y1: %t1]
%q%e2%q %q%r2%q -"
```

An example of server messages in this user-specified format, as contained in `log.txt`, is displayed here.

```
192.168.1.9 - username [09-16-08: 04:32:51 PM] "MathLM 7.0 executable
launched" ".\mathlm" -
192.168.1.9 - username [09-16-08: 04:32:51 PM] "Default (Common Logfile
Format) log format specified" "%h1 - %u2 [%m1-%d-%y1: %t1] %q%e2%q %q%r2%q
-" -
192.168.1.9 - username [09-16-08: 04:32:51 PM] "Verbosity level specified"
"1" -
192.168.1.9 - username [09-16-08: 04:32:51 PM] "Logging verbosity level
specified" "3" -
192.168.1.9 - username [09-16-08: 04:32:51 PM] "Hostname"
"hostname.domain.com" -
```

Note: Server messages in IPv6 networks will display IPv6 addresses automatically, with no additional configuration required.

Monitoring *MathLM*

What Is MonitorLM?

MonitorLM gives information on the total number of licenses available and checked out, the fully qualified domain name and username of those who have them checked out, and so on. *MonitorLM* can send output to the terminal, open a web browser, or write to a file. The output for *MonitorLM* is customizable by means of a configuration file. *MonitorLM* automatically supports IPv4 and IPv6 environments.

Starting MonitorLM

To start *MonitorLM*, change directory to the location in which *MathLM* is installed, and type `.\monitorlm` *servername* (on Windows) or `./monitorlm` *servername* (on Unix, Linux, or Mac OS X). The first argument of the `monitorlm` command specifies the name of the license server running *MathLM*. If you do not specify a server name explicitly, the local machine name is chosen as the default.

MonitorLM Command-Line Options

The following options are available using the `monitorlm` command. The syntax for specifying an option is `monitorlm` *servername options*.

`-file` *file*	specify file to which output should be directed
`-format` *f*	specify the format for the output of *MonitorLM*
`-localtime`	specify that all time references are in local time instead of GMT
`-template` *file*	specify the template file for the output of *MonitorLM*

`monitorlm` command-line options.

If `-file` is not set, *MonitorLM* will write to `stdout`.

The three possible output formats in `-format` are as follows:

text	send output in text format to stdout (default on Unix and Linux)
html	send output in HTML format and launch a web browser (default on Windows and Mac OS X)
cgi	send output in HTML format to stdout

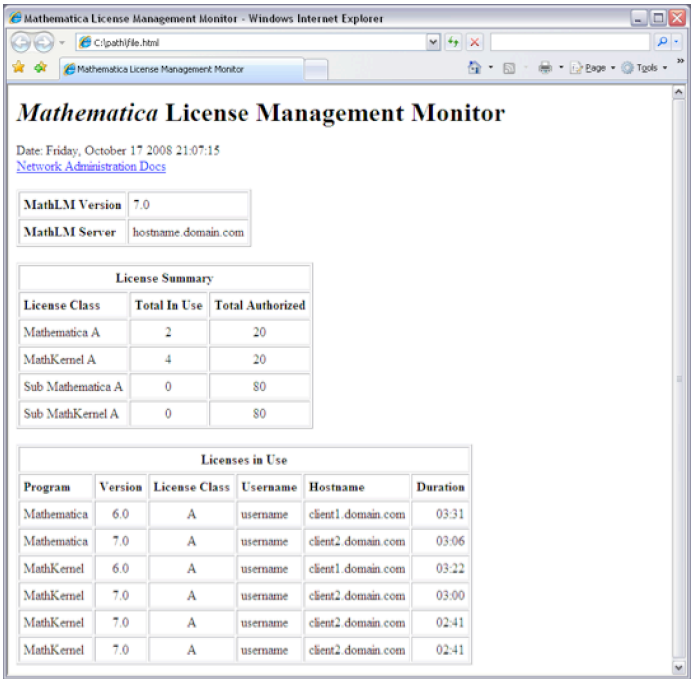
-format output formats.

The cgi format is used when *MonitorLM* is launched directly by a web browser.

This shows what the output of *MonitorLM* looks like, with -format set to text.

```
Online help is available at
http://reference.wolfram.com/network

MathLM Version 7.0
MathLM Server hostname.domain.com
Date : Thursday, October 17 2008 21:11:59

License Usage Summary:

                          License Total   Total
Program                   Class   in Use  Authorized
--------------------------------------------------

Mathematica               A       2       20
MathKernel                A       4       40


Sub Mathematica           A       0       80
Sub MathKernel            A       0       80

Licenses in Use:

                          License
Program         Version   Class   Username    Hostname
Duration
-------------------------------------------------------------------------
-
Mathematica     6.0       A       username    client1.domain.com  08:49
Mathematica     7.0       A       username    client2.domain.com  06:33
MathKernel      6.0       A       username    client1.domain.com  08:44
MathKernel      7.0       A       username    client2.domain.com  06:52
MathKernel      7.0       A       username    client2.domain.com  06:52
MathKernel      7.0       A       username    client2.domain.com  06:30
```

This shows what the output of *MonitorLM* looks like in a web browser, with `-format` set to `html`.



Mathematica License Management Monitor - Windows Internet Explorer

C:\path\file.html

Mathematica License Management Monitor

Mathematica License Management Monitor

Date: Friday, October 17 2008 21:07:15
Network Administration Docs

MathLM Version	7.0
MathLM Server	hostname.domain.com

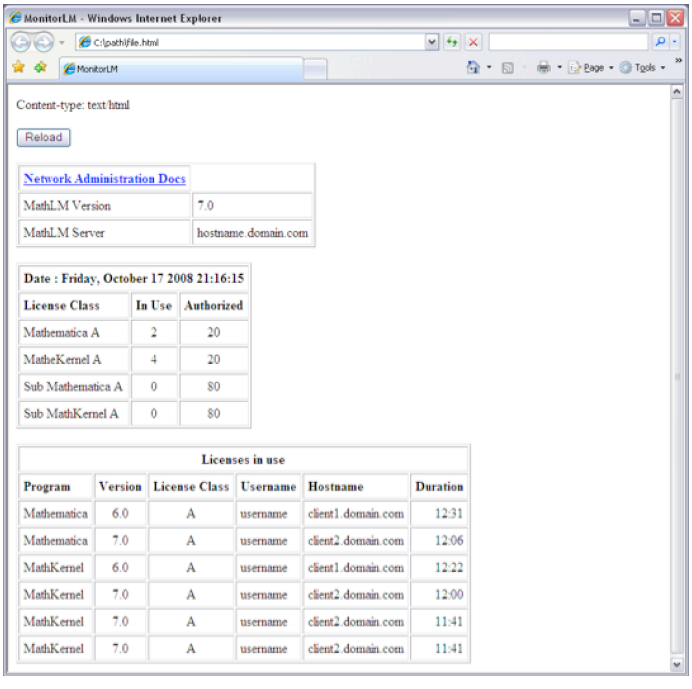
License Summary

License Class	Total In Use	Total Authorized
Mathematica A	2	20
MathKernel A	4	20
Sub Mathematica A	0	80
Sub MathKernel A	0	80

Licenses in Use

Program	Version	License Class	Username	Hostname	Duration
Mathematica	6.0	A	username	client1.domain.com	03:31
Mathematica	7.0	A	username	client2.domain.com	03:06
MathKernel	6.0	A	username	client1.domain.com	03:22
MathKernel	7.0	A	username	client2.domain.com	03:00
MathKernel	7.0	A	username	client2.domain.com	02:41
MathKernel	7.0	A	username	client2.domain.com	02:41

Note that when `-format` is set to `cgi`, the output of *MonitorLM* is sent to `stdout` in HTML format. This shows what that output looks like when displayed in a web browser.



MonitorLM - Windows Internet Explorer

C:\path\file.html

MonitorLM

Content-type: text/html

Reload

Network Administration Docs	
MathLM Version	7.0
MathLM Server	hostname.domain.com

Date : Friday, October 17 2008 21:16:15

License Class	In Use	Authorized
Mathematica A	2	20
MatheKernel A	4	20
Sub Mathematica A	0	80
Sub MathKernel A	0	80

Licenses in use

Program	Version	License Class	Username	Hostname	Duration
Mathematica	6.0	A	username	client1.domain.com	12:31
Mathematica	7.0	A	username	client2.domain.com	12:06
MathKernel	6.0	A	username	client1.domain.com	12:22
MathKernel	7.0	A	username	client2.domain.com	12:00
MathKernel	7.0	A	username	client2.domain.com	11:41
MathKernel	7.0	A	username	client2.domain.com	11:41

Customizing the Output of MonitorLM

You can customize the content and format of the output from *MonitorLM* by editing a template file. This is a plain text file, which can contain the following types of elements.

- Constant tags—These tags represent data that is static during the execution of *MonitorLM* and license-independent, such as the current date. Each of these tag names has the prefix `CONST`.
- Variable tags—These tags act as wrappers to constant tags. They are useful in defining the format for data to be output in series, such as a table of current *MathLM* users. They are useful for improving readability of the template file. Each of these tag names has the prefix `VAR`.
- Process-dependent tags—The value of these tags depends upon which *Mathematica* process is being displayed and includes data like the process owner's username and IP address. Each of these tag names has the prefix `PROC`.
- Repeated tags—These tags serve as placeholders for information regarding an unknown number of licenses. They are the only tags whose size is not predetermined. Only the checkout lines are repeated, and there is one checkout line per license. Each of these tag names has the prefix `REP`.
- Text wrappers—This is the text that a user can wrap around the tags, for presentation and formatting.

Each tag in the template file has the form `%`*var*#, where

- *var* represents a variable whose value is provided by the server.
- # is a number defining a specific format for the display of the variable *var*.

In addition to the `%`*var*# commands, the template file can also include plain text such as brackets, dashes, quotation marks, and arbitrary comments. The text can be used to include comments and separators in the server messages for formatting purposes. All text included in the string appears literally in the server message with the following two exceptions: use `%q` to include a double quote (`"`), and use `%%` to include a percentage sign (`%`).

Predefined Constant Tags

Here are two tables of constant tag names that can be included in the template file along with the numeric values for their possible formats.

Date Constant Tags

The following are Date Constant Tags for *MonitorLM*.

Tag Name	*Possible Values*	*Description*
%CONST_DATE_D#	[1...31]	Day of Month
%CONST_DATE_W#	1 - Numeric [1 ... 7] 2 - Abbreviated [Sun ... Sat] 3 - Verbose [Sunday ... Saturday]	Day of Week
%CONST_DATE_M#	1 - Numeric [1 ... 12] 2 - Abbreviated [Jan ... Dec] 3 - Verbose [January ... December]	Month
%CONST_DATE_Y#	1 - Two-digit [08] 2 - Four-digit [2008]	Year
%CONST_DATE_T#	1 - Twelve-hour [10:20:15]	Time

MonitorLM Date Constant Tags.

Server and Process Constant Tags

The following are Server and Process Constant Tags for *MonitorLM*.

Tag Name	*Description*
%CONST_SERVER_IP	*MathLM* IP address
%CONST_SERVER_HOST	*MathLM* hostname
%CONST_SERVER_DOMAIN	*MathLM* domain
%CONST_SERVER_FQDN	*MathLM* fully qualified domain name
%CONST_SERVER_VERSION	*MathLM* version
%CONST_CA_FE_AUTHORIZED	Number of class A front ends authorized
%CONST_CA_SUB_FE_AUTHORIZED	Number of class A sub-front end processes authorized
%CONST_CB_FE_AUTHORIZED	Number of class B front ends authorized
%CONST_CB_SUB_FE_AUTHORIZED	Number of class B sub-front end processes authorized
%CONST_TOTAL_FE_AUTHORIZED	Total number of front ends authorized
%CONST_TOTAL_SUB_FE_AUTHORIZED	Total number of sub-front end processes authorized
%CONST_CA_KE_AUTHORIZED	Number of class A kernels authorized
%CONST_CA_SUB_KE_AUTHORIZED	Number of class A sub-kernels processes authorized
%CONST_CB_KE_AUTHORIZED	Number of class B kernels authorized

%CONST_CB_SUB_KE_AUTHORIZED	Number of class B sub-kernel processes authorized
%CONST_TOTAL_KE_AUTHORIZED	Total number of kernels authorized
%CONST_TOTAL_SUB_KE_AUTHORIZED	Total number of sub-kernel processes authorized
%CONST_CA_FE_AVAILABLE	Number of class A front ends available
%CONST_CA_SUB_FE_AVAILABLE	Number of class A sub-front end processes available
%CONST_CB_FE_AVAILABLE	Number of class B front ends available
%CONST_CB_SUB_FE_AVAILABLE	Number of class B sub-front end processes available
%CONST_TOTAL_FE_AVAILABLE	Total number of front ends available
%CONST_TOTAL_SUB_FE_AVAILABLE	Total number of sub-front end processes available
%CONST_CA_KE_AVAILABLE	Number of class A kernels available
%CONST_CA_SUB_KE_AVAILABLE	Number of class A sub-kernel processes available
%CONST_CB_KE_AVAILABLE	Number of class B kernels available
%CONST_CB_SUB_KE_AVAILABLE	Number of class B sub-kernels processes available
%CONST_TOTAL_KE_AVAILABLE	Total number of kernels available
%CONST_TOTAL_SUB_KE_AVAILABLE	Total number of sub-kernel processes available
%CONST_CA_FE_OUT	Number of class A front ends in use
%CONST_CA_SUB_FE_OUT	Number of class A sub-front end processes in use
%CONST_CB_FE_OUT	Number of class B front ends in use
%CONST_CB_SUB_FE_OUT	Number of class B sub-front end processes in use
%CONST_TOTAL_FE_OUT	Total number of front ends in use
%CONST_TOTAL_SUB_FE_OUT	Total number of sub-front end processes in use
%CONST_CA_KE_OUT	Number of class A kernels in use
%CONST_CA_SUB_KE_OUT	Number of class A sub-kernel processes in use
%CONST_CB_KE_OUT	Number of class B kernels in use
%CONST_CB_SUB_KE_OUT	Number of class B sub-kernel processes in use
%CONST_TOTAL_KE_OUT	Total number of kernels in use
%CONST_TOTAL_SUB_KE_OUT	Total number of sub-kernels processes in use

MonitorLM Server and Process Constant Tags.

Note: A subprocess is equivalent to a computational process. See your electronic or printed license agreement for more details.

Customizable Variable Tags

The following are Customizable Variable Tags for *MonitorLM*.

Tag Name	*Possible Values*	*Description*
%VAR_DATE_AMPM	"A.M." "P.M."	Text to use for a.m. and p.m. when displaying time.
%VAR_MPROCESS	"*Mathematica*" "MathKernel" "SubMathematica" "SubMathKernel"	Title for *Mathematica* processes. The first string in quotes is the front end title, the second is the kernel title, the third is the sub-front end process title, and the fourth is the sub-kernel process title.
%VAR_LIC_CLASS	"Class A" "Class B"	Labels for each license class.
%VAR_CA_AUTHORIZED_HEADER	"Class A Authorized \t Front End \t Kernel"	Header for number of authorized class A licenses. Use with the predefined constant tags %CONST_CA_FE_AUTHORIZED and %CONST_CA_KE_AUTHORIZED.
%VAR_CA_SUB_AUTHORIZED_HEADER	"Class A Authorized \t Front End \t Kernel"	Header for number of authorized class A sub-process licenses. Use with the predefined constant tags %CONST_CA SUB_FE_AUTHORIZED and %CONST_CA SUB_KE_AUTHORIZED.
%VAR_CB_AUTHORIZED_HEADER	"Class B Authorized \t Front End \t Kernel"	Header for number of authorized class B licenses. Use with the predefined constant tags %CONST_CB_FE_AUTHORIZED and %CONST_CB_KE_AUTHORIZED.
%VAR_CB_SUB_AUTHORIZED_HEADER	"Class B Authorized \t Front End \t Kernel"	Header for number of authorized class B sub-process licenses. Use with the predefined constant tags %CONST_CB_SUB FE_AUTHORIZED and %CONST_CB_SUB KE_AUTHORIZED.
%VAR_TOTAL_AUTHORIZED_HEADER	"Total Authorized \t Front End \t Kernel"	Header for total number of authorized licenses. Use with the predefined constant tags %CONST_TOTAL_FE_AUTHORIZED and %CONST_TOTAL_KE_AUTHORIZED.

%VAR_TOTAL_SUB_AUTHORIZED_HEADER	"Total Authorized \t Front End \t Kernel"	Header for total number of authorized sub-process licenses. Use with the predefined constant tags %CONST_TOTAL_SUB FE_AUTHORIZED and %CONST_TOTAL_SUB KE_AUTHORIZED.
%VAR_CA_CHECKEDOUT_HEADER	"Class A Licenses in Use\nUsername \t Hostname \t Program \t Slot # \t Duration"	Header for information about class A licenses in use. Use with the repeated tag %REP_CA_CHECKOUT_LINE.
%VAR_CA_SUB_CHECKEDOUT_HEADER	"Class A Licenses in Use\nUsername \t Hostname \t Program \t Slot # \t Duration"	Header for information about class A sub-process licenses in use. Use with the repeated tag %REP_CA_CHECKOUT_LINE.
%VAR_CB_CHECKEDOUT_HEADER	"Class B Licenses in Use\nUsername \t Hostname \t Program \t Slot # \t Duration"	Header for information about class B licenses in use. Use with the repeated tag %REP_CB_CHECKOUT_LINE.
%VAR_CB_SUB_CHECKEDOUT_HEADER	"Class B Licenses in Use\nUsername \t Hostname \t Program \t Slot # \t Duration"	Header for information about class B sub-process licenses in use. Use with the repeated tag %REP_CB_SUB CHECKOUT_LINE.
%VAR_CHECKEDOUT_HEADER	"Licenses in Use\nUsername \t Hostname \t Program \t License Class \t Slot # \t Duration"	Header for information about all licenses in use. Use with the repeated tag %REP_GENERAL_CHECKOUT_LINE.
%VAR_SUB_CHECKEDOUT_HEADER	"Licenses in Use\nUsername \t Hostname \t Program \t License Class \t Slot # \t Duration"	Header for information about all sub-process licenses in use. Use with the repeated tag %REP_GENERAL_SUB CHECKOUT_LINE.

MonitorLM Customizable Variable Tags.

Note: The strings provided in this section are examples of possible values, not default settings. To use these tags, you must define them in your template.

Process-Dependent Tags

The following are Process-Dependent Tags for *MonitorLM*.

Tag Name	*Description*
%PROC_UID	User ID of *Mathematica* process owner
%PROC_USER	Username of *Mathematica* process owner
%PROC_IP	IP address of machine using *Mathematica* process
%PROC_HOST	Hostname of machine using *Mathematica* process

%PROC_DOMAIN	Domain of machine using *Mathematica* process
%PROC_FQDN	Fully qualified domain name of machine using *Mathematica* process
%PROC_SLOTNUM	Slot number of *Mathematica* process
%PROC_VERSION	Version of client
%PROC_DURATION	Time client has been running

MonitorLM Process-Dependent Tags.

Repeated Tags

The following are Repeated Tags for *MonitorLM*.

Tag Name	*Possible Values*	*Description*
%REP_CA_CHECKOUT_LINE	"%PROC_USER \t %PROC_HOST \t %VAR_MPROCESS \t %PROC_SLOTNUM \t %PROC_DURATION\n"	Class A checkout line. This specifies the format of each line in the table or block that lists the class A processes in use. Corresponds to the customizable variable tag %VAR_CA_CHECKEDOUT_HEADER.
%REP_CA_SUB_CHECKOUT_LINE	"%PROC_USER \t %PROC_HOST \t %VAR_MPROCESS \t %PROC_SLOTNUM \t %PROC_DURATION\n"	Class A sub-process checkout line. This specifies the format of each line in the table or block that lists the class A sub-processes in use. Corresponds to the customizable variable tag %VAR_CA_SUB_CHECKEDOUT_HEADER.
%REP_CB_CHECKOUT_LINE	"%PROC_USER \t %PROC_HOST \t %VAR_MPROCESS \t %PROC_SLOTNUM \t %PROC_DURATION\n"	Class B checkout line. This specifies the format of each line in the table or block that lists the class B processes in use. Corresponds to the customizable variable tag %VAR_CB_CHECKEDOUT_HEADER.

%REP_CB_SUB_CHECKOUT_LINE	"%PROC_USER \t %PROC_HOST \t %VAR_MPROCESS \t %PROC_SLOTNUM \t %PROC_DURATION\n"	Class B sub-process checkout line. This specifies the format of each line in the table or block that lists the class B sub-processes in use. Corresponds to the customizable variable tag %VAR_CB_SUB_CHECKEDOUT_HEADER.
%REP_GENERAL_CHECKOUT_LINE	"%PROC_USER \t %PROC_HOST \t %VAR_MPROCESS \t %VAR_LIC_CLASS \t %PROC_SLOTNUM \t %PROC_DURATION\n"	General checkout line. Use this if you do not want to separate classes. Corresponds to the customizable variable tag %VAR_CHECKEDOUT_HEADER.
%REP_GENERAL_SUB_CHECKOUT_LINE	"%PROC_USER \t %PROC_HOST \t %VAR_MPROCESS \t %VAR_LIC_CLASS \t %PROC_SLOTNUM \t %PROC_DURATION\n"	General sub-process checkout line. Use this if you do not want to separate classes. Corresponds to the customizable variable tag %VAR_SUB_CHECKEDOUT_HEADER.

MonitorLM Repeated Tags.

Note: The strings provided in this section are examples of possible values, not default settings. To use these tags, you must define them in your template.

Note: In the template file, the text wrappers and tags that make up the output to *MonitorLM* must follow a line containing only the keyword %TEXT with no whitespace before or after it. Definitions for customized variable tags must precede the %TEXT line. If no variable tags are customized, the %TEXT line can be the first line of the file.

Samples and Behavior

Here is a simple text file that shows only the number of processes authorized, available, and in use. This example does not need to define any variable definition tags.

```
%TEXT
Time/Date : [%CONST_DATE_T2] [%CONST_DATE_M3 %CONST_DATE_D, %CONST_DATE_Y2]
Front End Processes Authorized: %CONST_TOTAL_FE_AUTHORIZED
Kernel Processes Authorized: %CONST_TOTAL_KE_AUTHORIZED
Front End Processes Available: %CONST_TOTAL_FE_AVAILABLE
Kernel Processes Available: %CONST_TOTAL_KE_AVAILABLE
Front End Processes In Use: %CONST_TOTAL_FE_OUT
Kernel Processes In Use: %CONST_TOTAL_KE_OUT
```

The resulting output has the form shown here.

```
Time/Date : [00:05:26] [October 20, 2008]
Front End Processes Authorized: 5
Kernel Processes Authorized: 5
Front End Processes Available: 4
Kernel Processes Available: 4
Front End Processes In Use: 1
Kernel Processes In Use: 1
```

Here is a slightly more sophisticated example. It is identical to the preceding example except that it also lists the processes in use and customizes variable tags.

```
# Begin variable tag definitions
%VAR_MPROCESS = "FE" "KE"
%VAR_TOTAL_CHECKEDOUT_HEADER = "Slot\t Program\t User\t Host\n"
%REP_GENERAL_CHECKOUT_LINE = "%PROC_SLOTNUM\t %VAR_MPROCESS\t %PROC_USER\t
%PROC_HOST\n"

%TEXT
Time/Date : [%CONST_DATE_T2] [%CONST_DATE_M3 %CONST_DATE_D, %CONST_DATE_Y2]
Front End Processes Authorized: %CONST_TOTAL_FE_AUTHORIZED
Kernel Processes Authorized: %CONST_TOTAL_KE_AUTHORIZED
Front End Processes Available: %CONST_TOTAL_FE_AVAILABLE
Kernel Processes Available: %CONST_TOTAL_KE_AVAILABLE
Front End Processes In Use: %CONST_TOTAL_FE_OUT
Kernel Processes In Use: %CONST_TOTAL_KE_OUT

%VAR_TOTAL_CHECKEDOUT_HEADER
%REP_GENERAL_CHECKOUT_LINE
```

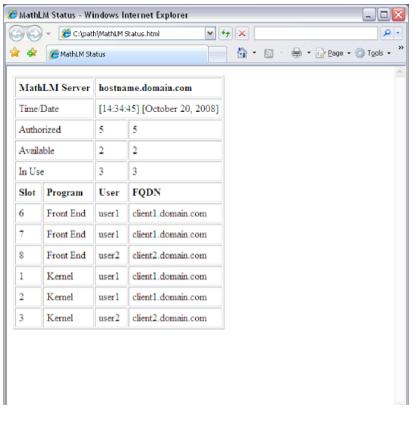
The resulting output has the form shown here.

```
Time/Date : [00:05:26] [October 20, 2008]
Front End Processes Authorized: 5
Kernel Processes Authorized: 5
Front End Processes Available: 4
Kernel Processes Available: 4
Front End Processes In Use: 1
Kernel Processes In Use: 1

Slot    Program   User       Host
6       FE        username   hostname
1       KE        username   hostname
```

The following example demonstrates HTML output. This is useful, for example, if you want to view the *MonitorLM* output in a web browser.

```
%VAR_MPROCESS = "Front End" "Kernel"
%VAR_TOTAL_CHECKEDOUT_HEADER = "<TR><TD><B>Slot</B></TD>
<TD><B>Program</B></TD> <TD><B>User</B></TD> <TD><B>FQDN</B></TD> </TR>\n"
%REP_GENERAL_CHECKOUT_LINE = "<TR> <TD>%PROC_SLOTNUM</TD>
<TD>%VAR_MPROCESS</TD> <TD>%PROC_USER</TD> <TD>%PROC_FQDN</TD> </TR>\n"

%TEXT
<HTML>
<HEAD> <TITLE> MathLM Status </TITLE> </HEAD>
<BODY>
<TABLE BORDER=1 CELLPADDING=5>
<TR><TD COLSPAN=2><B>MathLM Server</B></TD> <TD
COLSPAN=2><B>%CONST_SERVER_FQDN</B></TD> </TR>
<TR><TD COLSPAN=2>Time/Date</TD> <TD COLSPAN=2>[%CONST_DATE_T2]
[%CONST_DATE_M3 %CONST_DATE_D, %CONST_DATE_Y2]</TD> </TR>
<TR><TD COLSPAN=2>Authorized</TD> <TD>%CONST_TOTAL_FE_AUTHORIZED</TD>
<TD>%CONST_TOTAL_KE_AUTHORIZED</TD></TR>
<TR><TD COLSPAN=2>Available</TD> <TD>%CONST_TOTAL_FE_AVAILABLE</TD>
<TD>%CONST_TOTAL_KE_AVAILABLE</TD></TR>
<TR><TD COLSPAN=2>In Use</TD> <TD>%CONST_TOTAL_FE_OUT</TD>
<TD>%CONST_TOTAL_KE_OUT</TD></TR>

%VAR_TOTAL_CHECKEDOUT_HEADER
%REP_GENERAL_CHECKOUT_LINE

</TABLE>
</BODY>
</HTML>
```

The resulting output has the form shown here.



Restricting and Reserving Licenses

Writing a Restriction Script

Restriction scripts can be very useful in managing sitewide installations of *Mathematica*. They can be used to prevent access to *Mathematica* by unauthorized users on the network and to guarantee license availability to particular users. Restriction scripts are cross-platform compatible, support both IPv4 and IPv6, provide unambiguous control, and require no programming experience to write. The syntax of the restriction scripts is very similar to that of the `.htaccess` files used in web servers for controlling access to HTML files.

Reserved licenses are always reserved. They are inaccessible to all other users or machines, regardless of whether they are in use. Even if none of the specified users or machines are running *Mathematica*, the license pool for all other users and machines is effectively reduced by the number of reserved licenses.

The layout of a typical restriction script is as follows. Sample restriction scripts follow the definitions.

```
AuthName Sample
AuthGroupFile mathlmgroup.txt

# Precedence
order ( allow,deny | deny,allow )

# Machine restriction
allow from ( all | machines ... )
allow hostgroup machinegroups ...
deny from ( all | machines ... )
deny hostgroup machinegroups ...

# User restriction
allow user ( all | users ... )
allow group usergroups ...
deny user ( all | users ... )
deny group usergroups ...

# License reservation
reserve [count] from machines ...
reserve [count] hostgroup machinegroups ...
```

```
reserve [count] user users ...
reserve [count] group usergroups ...
reservesub [count] user users ...
reservesub [count] group usergroups ...
```

Defining the Terms

The following are terms for reserving and restricting *Mathematica* licenses.

Name	*Description*
`AuthName` *Sample*	Defines the name of the script.
`AuthGroupFile` *mathlmgroup*`.txt`	Specifies the file containing definitions for groups of users or machines. This line is only required in conjunction with the `group` or `hostgroup` keywords.
`order ( allow,deny | deny,allow )`	Defines the precedence of these two directives. The latter term takes precedence over the former. Also sets the default access state as the latter term. The default access state is applied to requests that do not match an explicit rule. The default value is `order deny,allow`.
`allow from ( all |` *machines* `... )`	Allows license requests from the listed hostnames, domains, IP addresses, and ranges of IP addresses.
`allow hostgroup` *machinegroups* `...`	Allows license requests from members of the listed machine groups.
`deny from ( all |` *machines* `... )`	Denies license requests from the listed hostnames, domains, IP addresses, and ranges of IP addresses.
`deny hostgroup` *machinegroups* `...`	Denies license requests from members of the listed machine groups.
`allow user ( all |` *users* `... )`	Allows license requests from the listed users.
`allow group` *usergroups* `...`	Allows license requests from members of the listed user groups.
`deny user (all |` *users* `... )`	Denies license requests from the listed users.
`deny group` *usergroups* `...`	Denies license requests from members of the listed user groups.
`reserve [`*count*`] from` *machines* `...`	Reserves *count* front end licenses and *count* kernel licenses for each of the listed hostnames, domains, IP addresses, and ranges of IP addresses.
`reserve [`*count*`] hostgroup` *machine-groups* `...`	Reserves *count* front end licenses and *count* kernel licenses for each member of the listed machine groups.

`reserve [`*count*`] user` *users* `...`	Reserves *count* front end licenses and *count* kernel licenses for each user in the list.
`reserve [`*count*`] group` *usergroups* `...`	Reserves *count* front end licenses and *count* kernel licenses for each user in the listed user groups.
`reservesub [`*count*`] from` *machines* `...`	Reserves *count* sub-front end licenses and *count* sub-kernel licenses for each of the listed hostnames, domains, IP addresses, and ranges of IP addresses.
`reservesub [`*count*`] hostgroup` *machinegroups* `...`	Reserves *count* sub-front end licenses and *count* sub-kernel licenses for each member of the listed machine groups.
`reservesub [`*count*`] user` *users* `...`	Reserves *count* sub-front end licenses and *count* sub-kernel licenses for each user in the list.
`reservesub [`*count*`] group` *usergroups* `...`	Reserves *count* sub-front end licenses and *count* sub-kernel licenses for each user in the listed user groups.

Terms for reserving and restricting licenses.

All the restriction script directives above automatically support IPv4 and IPv6 environments with no additional configuration required.

> **Note:** A subprocess or computation process is defined to be a process that does computations and only accepts or returns input to a controlling process. For more information see your electronic or printed license agreement.

License Reservations

The `reserve` and `reservesub` directives allow you to guarantee license availability to particular users or machines. It is important to note that reserved licenses are always reserved and are inaccessible to all other users or machines.

In some situations, it may be necessary to reserve unequal numbers of front end and kernel licenses. This can be accomplished by using the following additional directives: `reservefe`, `reservesubfe`, `reservekernel`, and `reservesubkernel`. The syntax for `reservefe` and `reservekernel` is identical to the syntax for `reserve` and the syntax for `reservesubfe` and `reservesubkernel` is identical to the syntax for `reservesub`.

Sub-process reservations such as `reservesub`, `reservesubfe`, and `reservesubkernel` are necessary when reserving kernels and front ends for either parallel or grid computing. Suppose a user on your network requires 16 parallel kernels to model a large dataset. Use the `reservesubkernel` directive to prevent other users from inadvertently disrupting the modeling process.

Sample Restriction Scripts

The following examples illustrate key features of restriction scripts.

Scripts without Groups

The following script will deny *Mathematica* license requests from `user1` and `hostname1`. License requests from all other users and machines will be allowed.

```
AuthName Sample1

order allow,deny
allow from all
deny from hostname1
allow user all
deny user user1
```

The following script will only allow license requests from users `user1` through `user5` in the range of `192.168.2.1` to `192.168.2.12`, as well as `192.168.0.1` and `192.168.0.5`. License requests from any other users or machines will be denied.

```
AuthName Sample2

order deny,allow
deny from all
allow from [192.168.2.1 192.168.2.12] 192.168.0.1 192.168.0.5
deny user all
allow user user1 user2 user3 user4 user5
```

Scripts with Groups

The following script imposes the same restrictions as the preceding script, but the users and machines are specified via groups and hostgroups.

```
AuthName Sample3
AuthGroupFile mathlmgroup1.txt

order deny,allow
deny from all
allow hostgroup group1
deny user all
allow group group2 group3
```

This is the file mathlmgroup1.txt. It defines one machine group and two user groups.

```
group1: 192.168.0.1 192.168.0.5 [192.168.2.1 192.168.2.12]
group2: user1 user2 user3
group3: user4 user5
```

Scripts Demonstrating Default Access State

The following script will allow license requests from all users and all machines except host1. If user1 requests a license while logged on to host1, the request will be allowed. This request matches both rules in this script, but the value of the order directive specifies that the allow directive has precedence. Note that a license request from user2 logged on to host1 would be denied.

```
AuthName Sample4

order deny,allow
deny from host1
allow user user1
```

The value of the order directive is the only difference between the preceding script and the following script, but the meaning of the script is reversed. This script only allows license requests from user1. A license request from user1 logged on to host1 will be denied. Such a request matches both rules, but the request is denied because the deny rule has precedence.

```
AuthName Sample5

order allow,deny
deny from host1
allow user user1
```

Scripts with License Reservations

The following script will allow all license requests. It reserves three kernel licenses for the address 192.168.0.1, and one front end license and one kernel license for user1. These licenses are always reserved and inaccessible to all other machines or users."

```
AuthName Sample6

order allow,deny
allow from all
allow user all
reservekernel 3 from 192.168.0.1
reserve user user1
```

The following script will allow all license requests. It reserves two front end licenses, two kernel licenses, and four kernel subprocess licenses for `user1`. This will guarantee `user1` the necessary resources for parallel computations. For more information on parallel computing see the "Parallel Computing Tools User Guide".

```
AuthName Sample7

order allow,deny
allow from all
allow user all
reservefe 2 user user1
reservekernel 2 user user1
reservesubkernel 4 user user1
```

The following script will only allow license requests from `user1`, `user2`, `hostname1`, `hostname2`, `domain1.com`, and addresses in the range `192.168.1.1` through `192.168.2.9`. It reserves three kernel licenses and three front end licenses for `hostname2`, another three kernel licenses and three front end licenses for the addresses from `192.168.1.1` to `192.168.2.9`, one kernel license and one front end license for `user1`, and one kernel license and one front end license for `user2`. In this script, a total of eight front end licenses and eight kernel licenses are reserved.

```
AuthName Sample8

order deny,allow
deny from all
allow from hostname1 hostname2 .domain1.com [192.168.1.1 192.168.2.9]
deny user all
allow user user1 user2

reserve 3 from hostname2 [192.168.1.1 192.168.2.9]
reserve user user1 user2
```

It may be easier to visualize the number of licenses being restricted in `Sample8` if you notice that the first instance of `reserve` can also be written in the following form.

```
reserve 3 from hostname2
reserve 3 from [192.168.1.1 192.168.2.9]
```

Scripts with License Reservations and Groups

The following script imposes the same restrictions and reservations as the `Sample6` script, but the users and machines are specified via groups and hostgroups.

```
AuthName Sample9
AuthGroupFile mathlmgroup2.txt

order deny,allow
deny from all
allow hostgroup group1 group2
deny user all
allow group group3

reservekernel 3 hostgroup group2
reserve group group3
```

This is the file `mathlmgroup2.txt`. It defines two machine groups and one user group.

```
group1: hostname1 .domain1.com
group2: hostname2 [192.168.1.1 192.168.2.9]
group3: user1 user2
```

Using a Restriction Script

To use a restriction script, run *MathLM* with the option `-restrict` followed by the pathname of the script. You can give the restriction script any filename (and extension) that you want. See "Launching *MathLM*" for details about command-line options.

MathLM must be restarted if the restriction script or `AuthGroupFile` is changed.

Troubleshooting *MathLM*

Diagnostics

The following techniques are useful for debugging problems with client connections to the license server.

- Launch *MathLM* with the option `-foreground`. This option allows you to see how requests are handled by *MathLM* in real time.

- Log *MathLM* messages to a file with an increased level of verbosity by launching *MathLM* with the options `-logfile` and `-loglevel`. This allows you to see how requests are handled by *MathLM* over a certain period of time.
- From a command line on the client, run the *Mathematica* kernel with the option `-lmverbose` and examine the messages produced. This option prints diagnostic information on connecting to the license manager.

Problems and Solutions

MathLM Cannot Find the Password File.

MathLM will not start if it cannot find the password file. In that case, the following error message will be displayed on your screen.

```
Faulty license entry.
No valid mathlm password entry or file found.
```

To successfully start *MathLM*, use the option `-pwfile` followed by the full pathname of the `mathpass` file.

The Client Cannot Connect to the License Server when Mathematica Is First Launched.

If this happens, the following dialog box appears.

You can choose one of two options:

Enter Password—brings up the front end password dialog box. See "Entering a Single-Machine Password" for details.

Quit—exits *Mathematica*. You are given the option of saving your work.

If you are running the kernel only, the following message will be displayed.

```
A password entry for a network license server was found,
but no license was returned. The license server may not be
responding, or no licenses are available from the server.
You may need to contact your system administrator to
start the license server, or wait until a license is
available.
```

You can press Ctrl+C to quit, or follow the instructions in "Entering a Single-Machine Password" to enter a single-machine password.

If these error messages are displayed, check that *MathLM* is running on the license server. If *MathLM* quits, it must be restarted in order to serve licenses. If there is a firewall between the license server and the client, verify that the firewall is configured to allow traffic through the proper port.

The Client Can Connect to the License Server, but Is Denied a License because the Process Limit Has Been Reached.

If this happens, the following dialog box appears to notify you of an error.

You can choose one of two options:

Enter Password—brings up the front end password dialog box. See "Entering a Single-Machine Password" for details.

Quit—exits *Mathematica*.

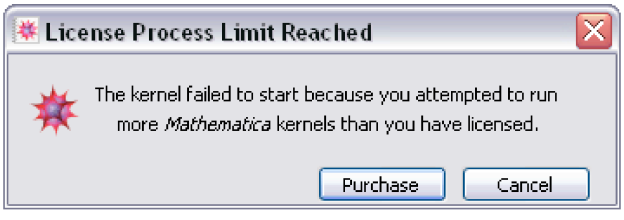
If you are running the kernel only, the following message will be displayed.

```
The n-process limit on the license you are trying
to run has been reached. Contact Wolfram Research or
an authorized Mathematica distributor for information
on upgrading your license configuration.
```

You can press Ctrl+C to quit, or follow the instructions in "Entering a Single-Machine Password" to enter a single-machine password.

You can purchase additional licenses by contacting Wolfram Research.

The Client Can Connect to the License Server, but Is Denied a Kernel because the Kernel Process Limit Has Been Reached.



You can choose one of two options:

Purchase—links to the Wolfram *Mathematica* Process Increment Request Form web page.

Cancel—aborts the kernel launch.

If you are running the kernel only, the following message will be displayed.

```
The n-process limit on the license you are trying
to run has been reached. Contact Wolfram Research or
an authorized Mathematica distributor for information
on upgrading your license configuration.
```

You can press Ctrl+C to quit, or follow the instructions in "Entering a Single-Machine Password" to enter a single-machine password.

You can purchase additional licenses by contacting Wolfram Research. See the Increment Request form on the web at wolfram.com/products/mathematica/processes for more information on increasing your process increments.

If you are running *Mathematica* using a network license, see "Restricting and Reserving Licenses" for more information on guaranteeing kernel availability to particular users.

MonitorLM Shows that There Are Available Licenses, but the Client Is Denied a License because the Process Limit Has Been Reached.

If this happens, there are reserved licenses that are not in use. If necessary, you can reclaim an unused reserved license by removing the relevant line from the restriction script and restarting *MathLM*.

The Client Can Connect to the License Server, but Is Denied a License Based on a Restriction Script.

If *MathLM* is configured to use a restriction script and an unauthorized client requests a license, the following message will be displayed.

You can choose one of two options:

Enter Password—brings up the front end password dialog box. See "Entering a Single-Machine Password" for details.

Quit—exits *Mathematica*.

If you are running the kernel only, the following message will be displayed.

```
A password entry for a network license server was found,
but no license was returned. The license server may not be
responding, or no licenses are available from the server.
You may need to contact your system administrator to
start the license server, or wait until a license is
available.
```

You can press Ctrl+C to quit, or follow the instructions in "Entering a Single-Machine Password" to enter a single-machine password.

If the client that was denied should be allowed to request a license, edit the restriction script and restart *MathLM*.

The Connection to the License Server Is Lost after the Client Is Connected to It.

Once *Mathematica* is running, the client contacts the license server every two minutes to refresh its license. If three successive attempts to contact the license server are unsuccessful, a dialog box will appear informing you that the license server could not be contacted. This happens six to eight minutes after the connection to the license server is lost.

If you are running the front end, the following dialog box appears.

You can choose one of two options:

Enter Password—brings up the front end password dialog box. See "Entering a Single-Machine Password" for details.

Quit—exits *Mathematica*. You are given the option of saving your work.

If you are running the kernel only, you will receive the following prompt to indicate that the connection has been lost.

```
Lost connection to server>
```

You may attempt to connect to the license server again, or you may exit *Mathematica*.

```
Your options are:
    retry (or r) to retry server
    exit (or quit) to exit Mathematica
```

Technical Support

For further assistance, check the Technical Support FAQs on the web at support.wolfram.com. If you are a Site License Administrator, additional Site License Documentation is available at site.wolfram.com. If you do not find the information you need, please contact Technical Support by sending email to support@wolfram.com or by calling +1-217-398-6500. Include your license number in all correspondence. Your license number is located on your electronic or printed license certificate. It is also available after installation by going to the **Help** menu and clicking **About Mathematica**. You must be a registered user in order to receive installation support. You must have a current *Premier Service* subscription to receive Technical Support.

Mathematica

Windows

Installing Mathematica on Windows

Installing Mathematica for Network Licenses

Requirements

Mathematica is available for Windows, Unix, Linux, and Mac OS X. For a complete list of platform availability, visit www.wolfram.com/products/mathematica/platforms.html. Any supported machine can act as a client for running *Mathematica*, provided the following two conditions are met:

- The client has access to the *Mathematica* files, either locally or from a file server on the network.
- The license server running *MathLM* is available on the TCP/IP network.

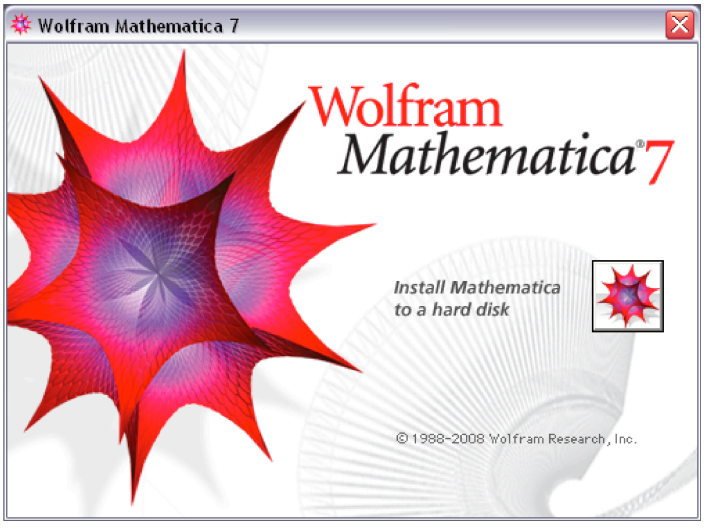
A license server can also function as its own client. However, this is not recommended. If the machine has to be rebooted for any reason, the serving of licenses to all other clients on the network may be disrupted.

Before you install *Mathematica* as a license server client, *MathLM* should already be installed and running on a license server on the network (see "Installing *MathLM*" for details). To complete the *Mathematica* installation, you will need to know the name or IP address of the license server running *MathLM*.

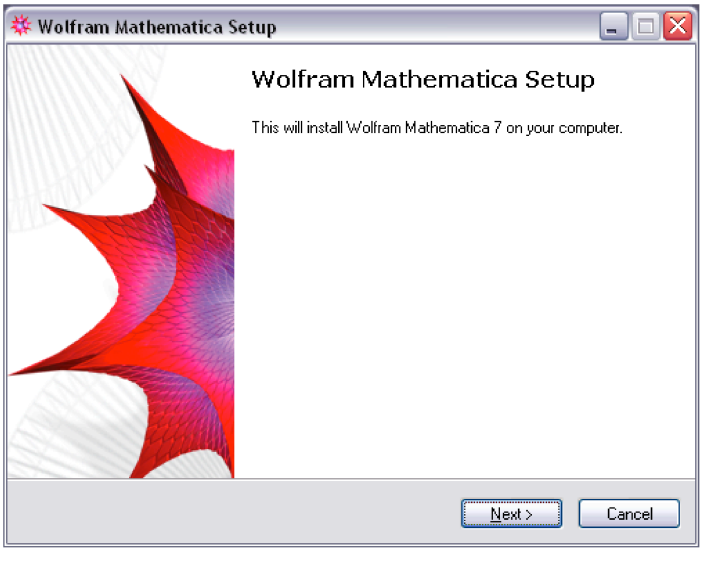
To install *Mathematica* on Windows 2000/XP/Vista, you must have administrative privileges.

To Install *Mathematica*:

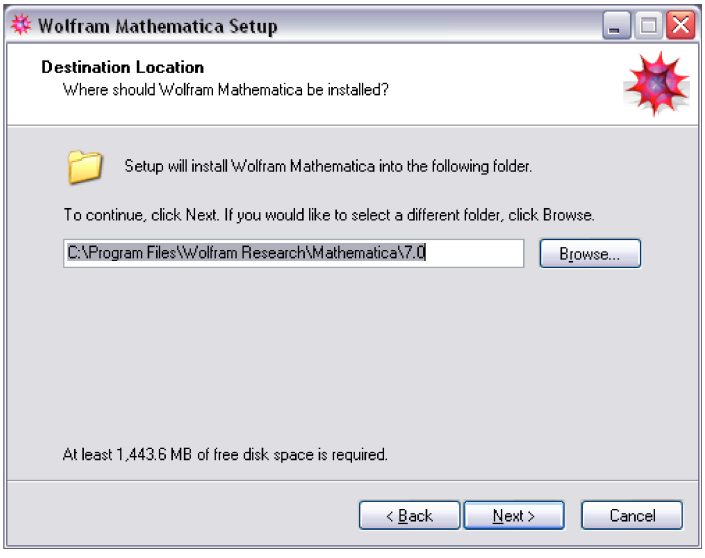
1. Insert the *Mathematica* DVD. The **Wolfram *Mathematica* 7** window appears on your screen. Click the button labeled **Install *Mathematica* to a hard disk**.



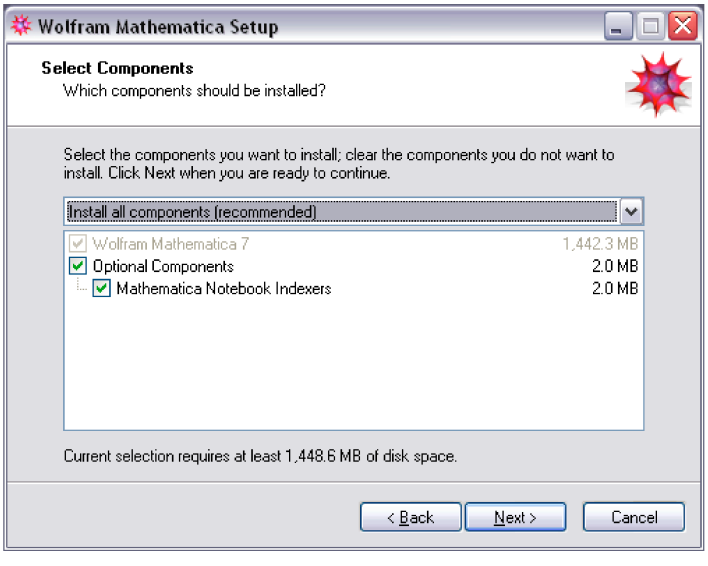
2. The **Wolfram *Mathematica* Setup** dialog appears on your screen. Click **Next** to begin the installation process.



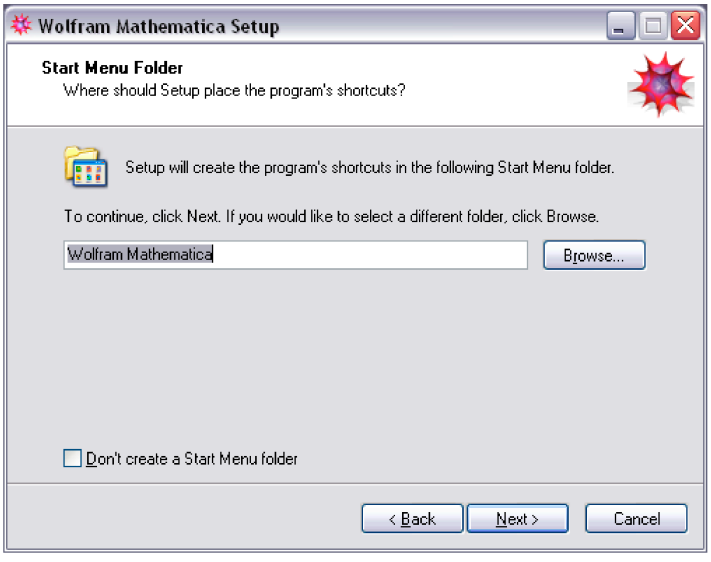
3. By default, *Mathematica* is installed in the directory C:\Program Files\Wolfram Research\Mathematica\7.0. To choose another destination directory, click **Browse**. Click **Next** to continue.



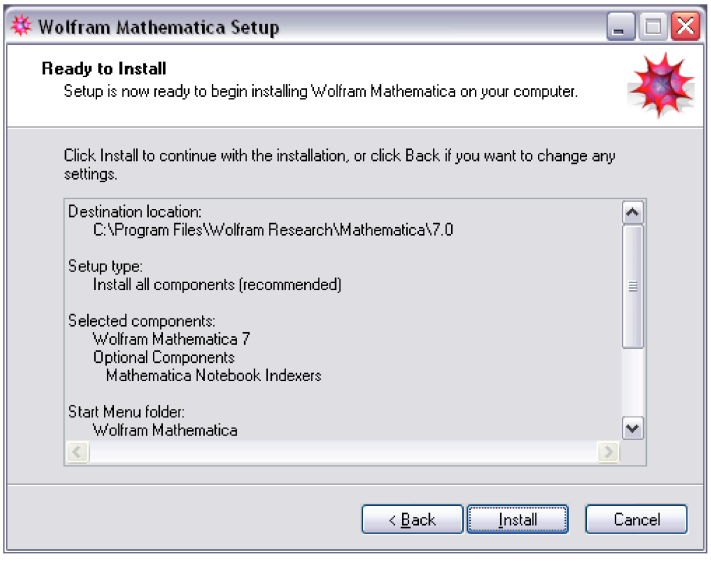
4. *Mathematica* is configured to automatically install all optional components. To chose another configuration, de-select any components by clicking on the corresponding check box. Click **Next** to continue.



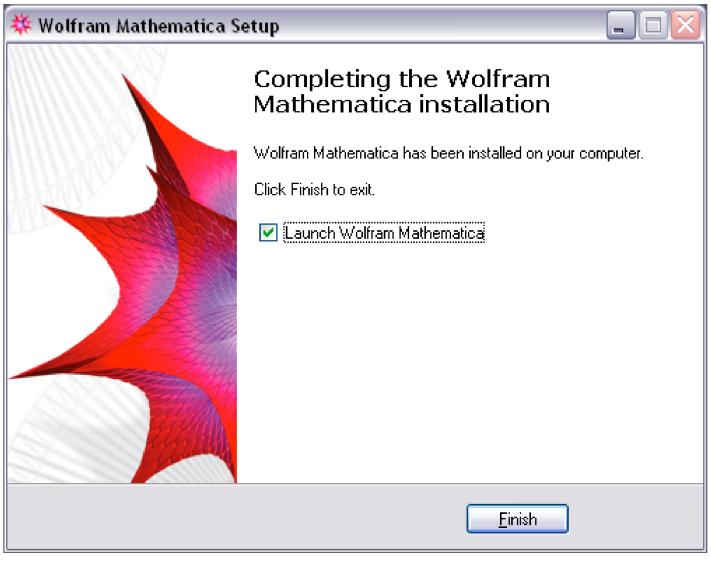
5. Click **Next** to add *Mathematica* shortcuts to the **Start** menu in the Wolfram *Mathematica* folder. If you would like to select a different folder, click **Browse**.



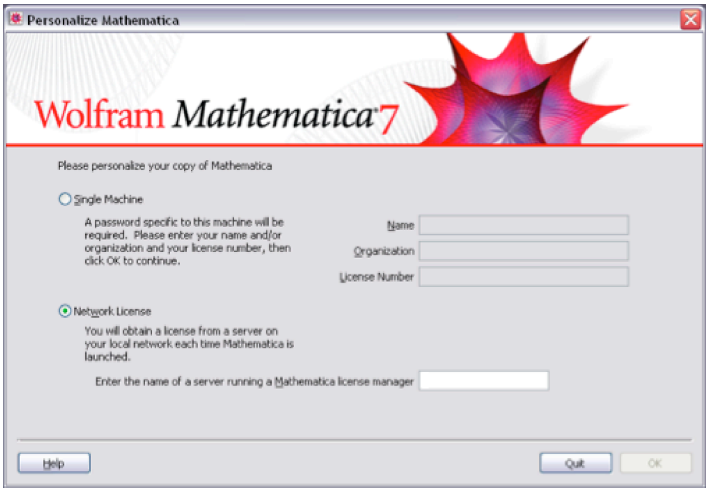
6. Click **Install** to install *Mathematica*.



7. Click **Finish** to complete the installation and launch *Mathematica*.



8. *Mathematica* starts up and the following password dialog box appears. Select **Network License**. Then enter the name or IP address of the license server running *MathLM* in the text field provided.



9. Click **OK**. You are now ready to start using *Mathematica*.

Installing Mathematica for Single-Machine Licenses

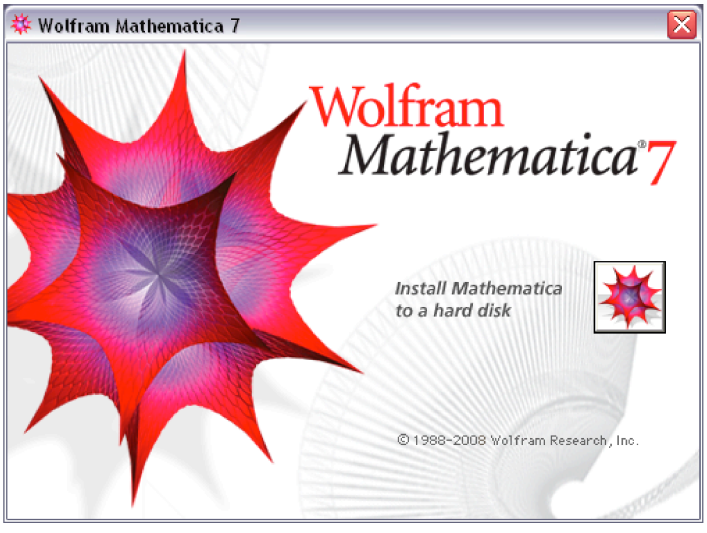
Follow these instructions to install a standalone copy of *Mathematica* that does not get a license from a license server. Depending on your license type, this may require contacting Wolfram Research to purchase additional licenses.

To run *Mathematica*, you must register with Wolfram Research and receive a password. See "Registration and Passwords" for further information.

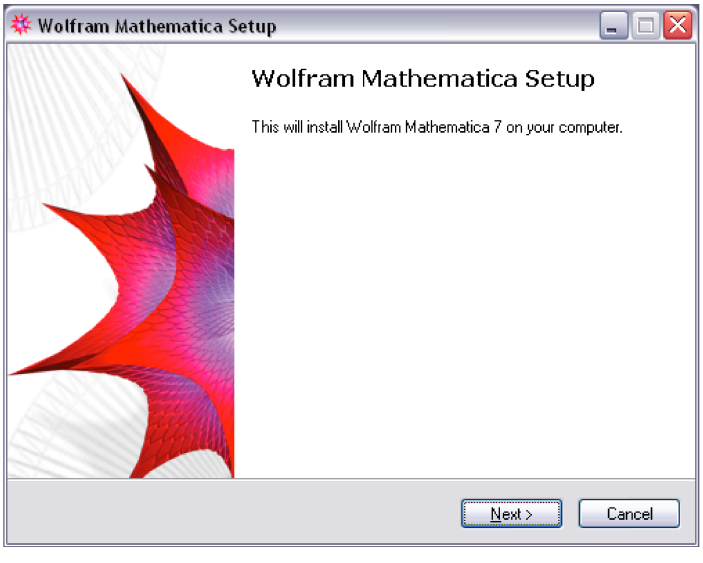
To install *Mathematica* on Windows 2000/XP/Vista, you must have administrative privileges.

To Install a Single-Machine Copy of *Mathematica* on Windows:

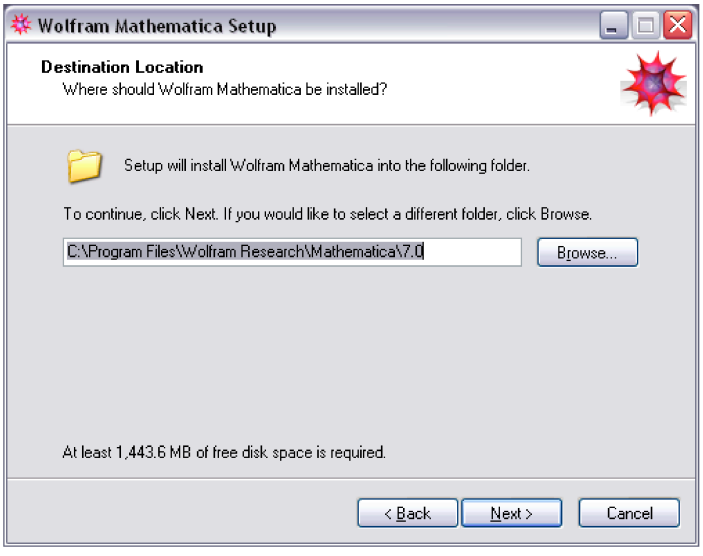
1. Insert the *Mathematica* DVD. The **Wolfram *Mathematica* 7** window appears on your screen. Click the button labeled **Install *Mathematica* to a hard disk**.



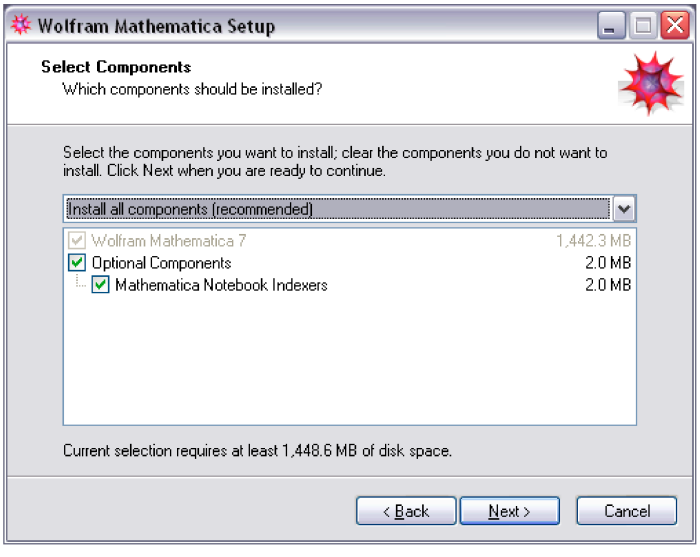
2. The ***Wolfram Mathematica*** **Setup** dialog appears on your screen. Click **Next** to begin the installation process.



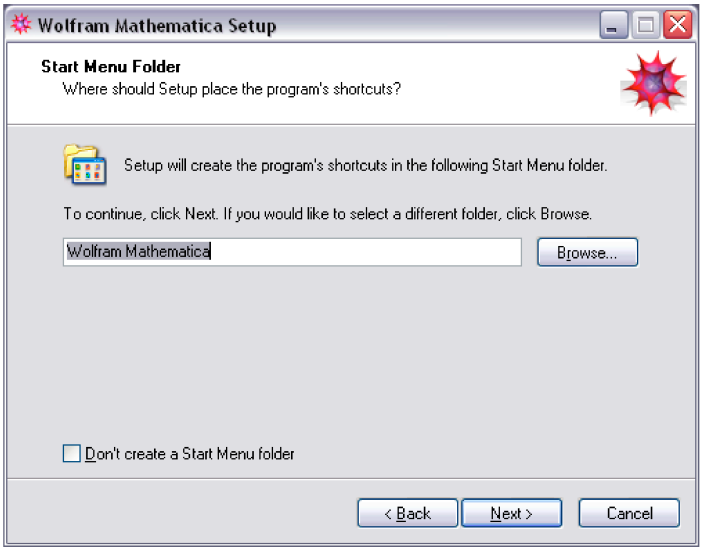
3. By default, *Mathematica* is installed in the directory C:\Program Files\Wolfram Research\Mathematica\7.0. To choose another destination directory, click **Browse**. Click **Next** to continue.



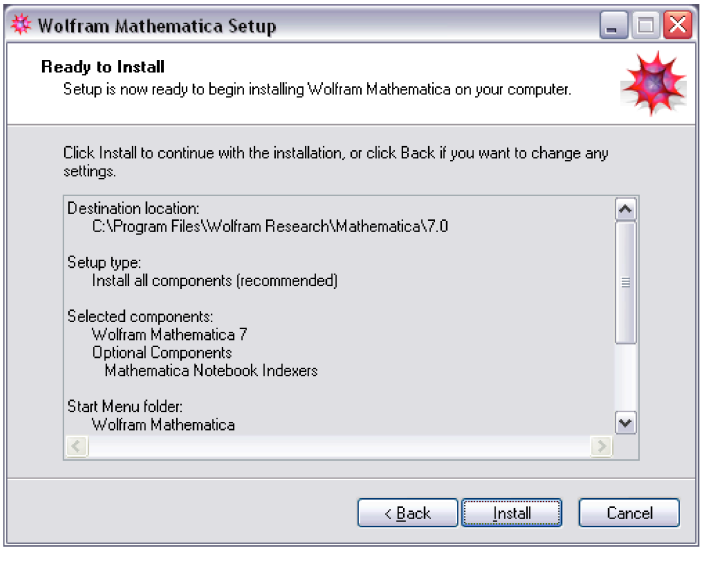
4. *Mathematica* is configured to automatically install all optional components. To chose another configuration, de-select any components by clicking on the corresponding check-box. Click **Next** to continue.



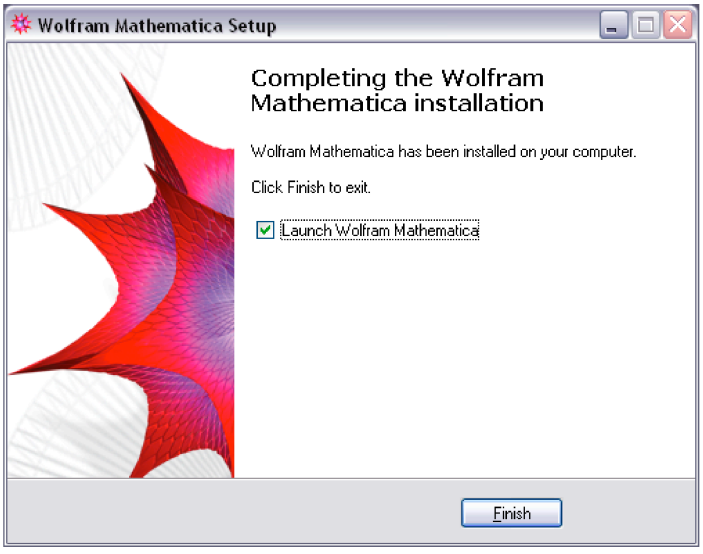
5. Click **Next** to add *Mathematica* shortcuts to the **Start** menu under Wolfram *Mathematica*.



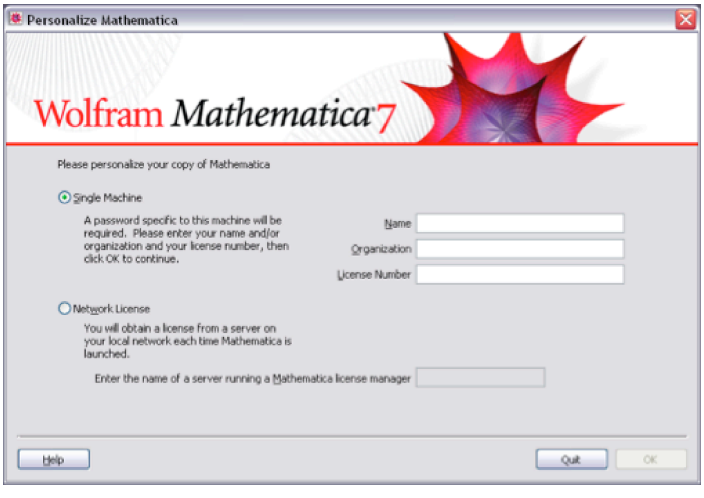
6. Click **Install** to install *Mathematica*.



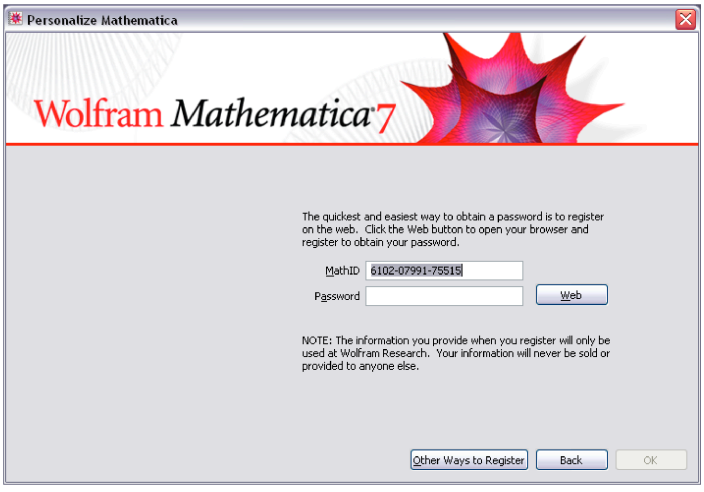
7. Click **Finish** to complete the installation and launch *Mathematica*.



8. *Mathematica* starts up and the following password dialog box appears. Select **Single Machine**. Then enter your name, the name of your organization, and your license number (located on your electronic or printed license certificate) in the text fields provided. Click **OK** when you are done.



9. The following dialog box appears showing the MathID number for your machine. To obtain your password, click the **Web** button, go to register.wolfram.com, or contact Wolfram Research (see "Registration and Passwords" for further information). You will need to supply your license number and your MathID number.



10. Enter your password and click **OK**. You are now ready to start using *Mathematica*.

Installing Mathematica from a File Server

One convenient way to install *Mathematica* is to run the installer remotely from a file server. This is an efficient way of making *Mathematica* available to a large number of users without having to supply a DVD to each one.

Installing *Mathematica* from a file server requires first copying the installer executable and all files in the *Mathematica* distribution from the DVD onto the file server.

1. Insert the *Mathematica* DVD into the drive on the file server. Open a **My Computer** window, then right-click the DVD in the list and select **Open**.
2. An Explorer window appears showing the contents of the DVD. Select the Windows folder.
3. Copy the Windows folder from the DVD to a location on the file server accessible to external users over the network.

Once this step is complete, you can install the *Mathematica* files on each client.

4. From the client, connect to the file server and open the Windows directory that was created on the file server.
5. Double-click the file Setup.exe to launch the installer.
6. Follow the same steps as for installing from a DVD (see "Network License" and "Single-Machine License").

Installing Mathematica from a Script

If you are installing *Mathematica* on multiple machines, it can be time-consuming to respond to all of the installer prompts on each individual machine. By supplying command-line options to the installer, you can customize various features of the installation process or automate it entirely.

`/dir="C:\`*path*`\`*here*`"`	specify the installation directory
`DisableShellVerbs`	disable file associations for .m, .nb, .nbp, etc. (enabled by default)
`/group="`*start menu folder name*`"`	specify the start menu folder name
`/noicons`	disable creation of start menu folder and shortcuts
`/norestart`	do not restart the system, even if necessary
`/restartexitcode=`*code*	specify the installer exit code to return if restart is necessary
`/silent`	force an automatic installation and suppress installation windows
`/suppressmsgboxes`	suppress installer message boxes (only effective when used in conjuction with `/silent`)

Mathematica Installer supported command-line options.

To Create a Script That Performs a Silent *Mathematica* Installation:

The following instructions explain how to write a simple script to silently install *Mathematica* from a file server. These instructions require that you have a mathpass file with a valid password. See "Registrations and Passwords" for more information on sitewide mathpass configurations.

1. Follow the instructions in the first part of "Installing *Mathematica* from a File Server" to copy the installer and files from the DVD to a file server.
2. Copy your mathpass file to the same directory on the file server as the installer and *Mathematica* files.
3. Open Notepad (**Start Menu ▸ Programs ▸ Accessories ▸ Notepad**) and type the following lines into a new file.

```
@echo off
echo Installing Mathematica...
\\server\math\setup.exe /silent /suppressmsgboxes /log="C:\Windows\Temp\install.log"
echo Creating password file...
copy \\server\math\mathpass "C:\Directory\Name"
echo Mathematica installation complete.
```

4. Change all instances of `\\server\math` to the pathname of the network share where the *Mathematica* installation files and mathpass file were copied.

5. Change `"C:\Directory\Name"` to the directory listed here for your version of Windows. Be sure to enclose the name of the directory in quotes.

   Windows 2000/XP—
   `"C:\Documents and Settings\All Users\Application Data\Mathematica"`

   Windows Vista—`"C:\ProgramData\Mathematica"`

   Note: These directories are the values of `$BaseDirectory` for different versions of Windows. See "Configuration Files on Windows" for further information.

6. To save the file, choose **File ▸ Save**. Save the file in the same directory as the *Mathematica* installation files. Type the filename install.bat, and choose **All Files** from the **Save as type** popup menu. Click **Save**, then quit Notepad.

To Perform a Silent *Mathematica* Installation:

1. On the client, open a **Command Prompt** window, type the pathname of the install.bat file, and press Enter. For example, if the network share is called \\server\math, type:

   ```
   \\server\math\install.bat
   ```

   The following messages are displayed.

   ```
   Installing Mathematica...
   Creating password file...
   Mathematica installation complete.
   ```

2. The installation is now complete. If you see any messages other than those printed here, check the file C:\Windows\Temp\install.log on the client machine for further information.

Installing *Mathematica* in this way eliminates the need to take the DVD to each client machine, and saves time by allowing you to run a simple script instead of responding to the installer questions.

Launching Mathematica on Windows

Launching Mathematica Locally

To run *Mathematica* using a network license, both the client machine and the license server must be on the network, and *MathLM* must be running.

To Launch *Mathematica*:

From the **Start** menu, choose **Programs ▸ Wolfram Mathematica ▸ Mathematica 7**.

Alternatively, you can open an Explorer window, go to the Program Files\Wolfram Research\Mathematica\7.0 directory, and double-click the *Mathematica* icon.

To Launch Only the *Mathematica* Kernel:

From the **Start** menu, choose **Programs ▸ Wolfram Mathematica ▸ Mathematica 7 Kernel**.

Alternatively, you can open an Explorer window, go to the Program Files\Wolfram Research\Mathematica\7.0 directory, and double-click the **MathKernel** icon.

To Launch the *Mathematica* Kernel inside a Command Prompt Window:

Open a command prompt window and change directory to the top-level *Mathematica* installation directory. Type `.\math` and press Enter.

Launching Mathematica from a File Server

You can also run *Mathematica* directly from a file server, without installing files locally. To do this, install *Mathematica* on the file server and make the installation directory accessible to the client machines. Running *Mathematica* from a file server differs from running a local copy in several ways. These differences and appropriate steps for working around them are listed here.

- The *Mathematica* fonts will not be available for use by other applications. It is therefore required that you manually install the fonts on your system. The fonts are found in SystemFiles\Fonts\Windows in the *Mathematica* layout. To install these fonts so they can be used by all other Windows applications, open the Fonts control panel, choose **Install New Font** under the **File** menu, and specify the location of the fonts in the **Add Fonts** dialog box that appears.
- The *MathLink* libraries will not be available for use by other applications. Therefore, you need to copy the *MathLink* libraries to the appropriate locations on your system. For 32-bit Windows systems, the *MathLink* libraries consist of seven files: ml32i1.dll, ml32i2.dll, ml32i3.dll, mlmap32.mlp, mlshm32.mlp, mltcp32.mlp, and mltcpip32.mlp, which are located in SystemFiles\Links\MathLink\DeveloperKit\Windows\SystemAdditions in the *Mathematica* layout. Copy these files to the WINNT\System32 folder on Windows 2000, or the Windows\System32 folder on Windows XP/Vista. For 64-bit Windows platforms, the *MathLink* libraries consist of twelve files: ml32i1.dll, ml32i2.dll, ml32i3.dll, mlmap32.mlp, mlshm32.mlp, mltcp32.mlp, and mltcpip32.mlp, which are located in SystemFiles\Links\MathLink\DeveloperKit\Windows\SystemAdditions, and ml64i2.dll, ml64i3.dll, mlshm64.mlp, mltcp64.mlp, mltcpip64.mlp, which are located in SystemFiles\Links\MathLink\DeveloperKit\Windows-x86-64\SystemAdditions. Copy the first seven files to the Windows\Syswow64 folder and the other five files to the Windows\System32 folder.

- The proper file associations will not be set up for *Mathematica*. You can set these associations manually by using the **Folder Options** dialog box under the **Tools** menu of the Explorer window. You will need to specify the MIME type as application/mathematica and the file extension as `.nb`.
- A **Start** menu entry for *Mathematica* will not be created automatically. You can add this manually by editing the **Start** menu settings in the dialog box that appears when you choose **Settings** ▸ **Taskbar and Start Menu** under the **Start** menu.

Mathematica Command-Line Options

Following are several useful command-line options for the *Mathematica* kernel. See "Launching *Mathematica* on Windows: Locally" for instructions on running the kernel.

Command-Line Options

`-lmverbose`	print diagnostic information to `stderr`
`-mathlink`	specify that the kernel should be run in *MathLink* mode
`-noprompt`	specify that no banner or In/Out prompts should be printed
`-password` *str*	specify a password to use instead of the password or passwords stored in the mathpass file
`-pwfile` *file*	specify the name of a file that has a valid password
`-run`	specify a command to be run on startup as an argument

Mathematica command-line options.

The option `-lmverbose` is usefull for debuggin problems related to the license server

The option `-mathlink` can also be used as a command-line option for the *Mathematica* front end. See www.wolfram.com/solutions/mathlink for additional information about *MathLink*.

The mode set by `-noprompt` is useful for running a sequence of commands from a batch file.

The string for `-password` should have the form "*!servername*" or "*machinename mathid licensenumber password*".

Testing the Installation on Windows

The following simple commands allow you to test the installation of *Mathematica*. Running these commands does not guarantee that the installation was successful, but a failed command can indicate that a serious problem occurred during installation.

You should run these tests from a regular user account and not from an account with administrative privileges.

To run *Mathematica* using a network license, both the client machine and the license server must be on the network and *MathLM* must be running.

If you run into problems when doing these tests, see the troubleshooting tips in "Troubleshooting on Windows". If you do not find the answer there, check the Technical Support website at support.wolfram.com/mathematica.

To Test the Kernel:

1. To start the kernel, choose **Programs** ▸ **Wolfram Mathematica** ▸ **Mathematica 7 Kernel** from the **Start** menu.

   ```
   In[1]:=
   ```

2. Type `N[Pi, 20]` and press Enter. The number in the output should match the output shown here.

   ```
   In[1]:= N[Pi, 20]

   Out[1]= 3.1415926535897932385

   In[2]:=
   ```

3. To exit the kernel, type `Exit` and press Enter.

To Test the Front End:

1. Launch *Mathematica* by choosing **Programs** ▸ **Wolfram Mathematica** ▸ ***Mathematica 7*** from the **Start** menu.

   A splash screen with initialization information appears briefly, after which an empty notebook and the **Welcome Screen** appear.

2. Type `N[Pi,20]`. Then hold down the Shift key and press Enter to evaluate. This should send the command to the kernel and return the same result as before. The `In[1]` and `Out[1]` labels are prepended once the evaluation is completed.

In the notebook window, there should be a horizontal line across the notebook; this is the horizontal insertion bar. If you do not see one, move the pointer until it becomes a horizontal I-beam and click once to see the insertion bar.

3. Press the Esc key. You should see three small horizontal lines in a column (⋮). Type `int` and press Esc again. You should see an integral sign (∫). As an additional font check, typing `\[CheckmarkedBox]` and `\[CirclePlus]` should print the symbols ☑ and ⊕, respectively. If the symbols show up correctly, the fonts have been properly installed.

4. From the **Help** menu, choose **Documentation Center**. The *Mathematica* Documentation Center should appear.

Configuration Files on Windows

Mathematica stores preference settings and initialization data in two directories, `$BaseDirectory` and `$UserBaseDirectory`. Within each of these directories are several possible subdirectories with titles such as FrontEnd, Kernel, and Licensing.

Global settings that affect all users are stored in subdirectories of the directory `$BaseDirectory`. The default value of `$BaseDirectory` for different versions of Windows is shown in the following table. To redefine the location of global preference settings and initialization data, set the environment variable MATHEMATICA_BASE.

Windows 2000/XP	C:\Documents and Settings\All Users\Application Data\Mathematica
Windows Vista	C:\ProgramData\Mathematica

Location of the directory `$BaseDirectory` for different versions of Windows.

Settings that only affect a particular user are stored in subdirectories of the directory `$UserBaseDirectory`. The default value of `$UserBaseDirectory` for different versions of Windows is shown in the following table. To redefine the location of user preferences and initialization data, set the environment variable MATHEMATICA_USERBASE.

Windows 2000/XP	C:\Documents and Settings*username*\Application Data\Mathematica
Windows Vista	C:\Users*username*\AppData\Roaming\Mathematica

Location of the directory `$UserBaseDirectory` for different versions of Windows.

Settings in the directory `$UserBaseDirectory` override global settings defined in the directory `$BaseDirectory`.

In the pathnames that follow, replace the variables $BaseDirectory and $UserBaseDirectory with the appropriate directories for your system. To find their locations on your system, evaluate the command $BaseDirectory (or $UserBaseDirectory) in a *Mathematica* notebook.

Kernel

The initialization files used by the kernel contain *Mathematica* commands that are evaluated at startup, such as function definitions, packages to load, and kernel option settings. These commands are also available to the *Mathematica* front end.

$BaseDirectory\Kernel\init.m

This file is used to initialize the kernel and therefore should store any kernel commands that are appropriate for all users running the kernel.

$UserBaseDirectory\Kernel\init.m

This file stores user-specific commands used to initialize the kernel.

Kernel initialization files are not created automatically.

Front End

Front end initialization files store preference settings such as the values of global options in the Option Inspector. These files are automatically updated by *Mathematica* when you change a setting in the front end. To make changes to this file, make your changes from within *Mathematica* rather than editing the file directly.

$BaseDirectory\FrontEnd\init.m

This file stores systemwide defaults used by all *Mathematica* front ends. The settings in this file affect all users. "Systemwide Defaults on Windows" explains how to implement changes to this global file.

$UserBaseDirectory\FrontEnd\init.m

This file defines settings within the front end that are specific to each user.

Front end initialization files are created automatically.

Front End Caches

The front end stores certain information about system settings in caches specific to each user. The default location for front end caches is shown here.

Windows 2000/XP	C:\Documents and Settings*username*\Local Settings\Application Data\Mathematica\FrontEnd\7.0 Caches
Windows Vista	C:\Users*username*\AppData\Local\Mathematica\FrontEnd\7.0 Caches

Location of the front end caches for different versions of Windows.

Passwords

Passwords are stored in the mathpass file, described in further detail in "Registration and Passwords". In the following pathname, replace the variable `$InstallationDirectory` with the directory where you installed *Mathematica*. The default value of `$InstallationDirectory` on Windows is C:\Program Files\Wolfram Research\Mathematica\7.0. To find the value of `$InstallationDirectory` on your system, evaluate the command `$InstallationDirectory` in a *Mathematica* notebook.

`$BaseDirectory`\Licensing\mathpass

This is the default location for the global password file.

`$InstallationDirectory`\Configuration\Licensing\mathpass

This is an alternative location for the global password file.

`$UserBaseDirectory`\Licensing\mathpass

While this is not normally the location for the password file, a user-specific `mathpass` file can be stored here.

Systemwide Defaults on Windows

If you have installed *Mathematica* in a location where multiple users can run it (for example, on a file server or multi-user machine), then you can set up systemwide defaults for the *Mathematica* front end and kernel. This is ideal for setting up *Mathematica* for use in computer labs and classrooms. If you share the directory `$BaseDirectory` across the network, these defaults will also take effect on local installations that use the shared `$BaseDirectory`.

In the pathnames that follow, replace the variables $BaseDirectory and $UserBaseDirectory with the appropriate directories for your system. To find their locations on your system, evaluate the command $BaseDirectory (or $UserBaseDirectory) in a *Mathematica* notebook.

To Set Up a Configuration File for the Front End:

1. Launch *Mathematica*, and set up any changes to the front end that you need. For example, you may want to modify default file locations, language options, or menu settings.
2. Quit *Mathematica*.
3. Copy the file $UserBaseDirectory\FrontEnd\init.m to the directory $BaseDirectory\FrontEnd.

These settings will now be used by the front end unless overridden by the local init.m file stored in the user's $UserBaseDirectory\FrontEnd directory.

To Set Up a Configuration File for the Kernel:

1. Launch *Mathematica*, and create a new file.
2. Add any *Mathematica* commands that should be evaluated on startup. For example, you may want to add a function definition or display a message at startup. Enter all the commands in the same cell, separating commands with semicolons.
3. Make this cell an initialization cell by selecting the cell bracket and then choosing **Cell ▸ Cell Properties ▸ Initialization Cell**.
4. When you have finished making your changes, choose **File ▸ Save** and select **Mathematica Package** from the **Save as type** popup menu. Then save the file as $BaseDirectory\Kernel\init.m.

These commands will be evaluated when users launch *Mathematica*. If you added a function definition, that function will be available to all users.

If you have created systemwide defaults you want to carry over to new local installations, you can add lines to an installation script to copy preconfigured init.m files as part of a new installation. For information about installation scripts, see "Installing *Mathematica* on Windows". To copy systemwide defaults, add a line to the script similar to the line that copies the mathpass file.

Troubleshooting on Windows

Passwords

If the front end password dialog box appears when you launch *Mathematica*, either *Mathematica* could not locate the mathpass file or there was no valid password in the mathpass file. To resolve this problem, first check that there is a mathpass file in one of these directories: `$BaseDirectory`\Licensing, `$InstallationDirectory`\Configuration\Licensing, or `$UserBaseDirectory`\Licensing. To find the exact location of these directories on your machine, evaluate the command `$BaseDirectory` (or `$InstallationDirectory` or `$UserBaseDirectory`) in a notebook. If you did not find a mathpass file in these locations, follow the instructions in "Entering a Single-Machine Password" to reenter your password.

If there is a mathpass file in one of those directories, the password or passwords are invalid. Make sure that your MathID number matches the MathID number used to issue your password. If your MathID number changes, you will need to contact Customer Service to get a new password. Contact information is provided in "Registration and Passwords".

Front End Preferences

Front end preferences, such as the locations of recently opened and saved files, are stored in a front end initialization file called init.m. This file is located in `$UserBaseDirectory`\FrontEnd. The default value of `$UserBaseDirectory` for different versions of Windows is listed in "Configuration Files on Windows". To find the exact location of this directory on your machine, evaluate the command `$UserBaseDirectory` in a notebook.

If you need to reset the front end preferences to their default values, hold down Shift+Ctrl during startup. This will cause the initialization file to be rebuilt automatically.

Caches

Information about your *Mathematica* system layout, such as the locations of text resource files, is stored in caches. These caches are located in C:\Documents and Settings*username*\Local Settings\Application Data\Mathematica\FrontEnd\7.0 Caches\ on Windows 2000/XP and in C:\Users*username*\AppData\Local\Mathematica\FrontEnd\7.0 Caches\ on Vista.

A corrupted cache may cause the front end to produce an error or quit immediately on startup. The most convenient way to restore the caches to their default values is to hold down

Shift+Ctrl during startup. This will cause the *Mathematica* caches and the initialization file to be rebuilt automatically. If you want to rebuild your caches but retain your preferences, hold down Shift during startup. This will delete and rebuild the cache without rebuilding your front end initialization file.

Technical Support

For further assistance, check the Technical Support FAQs on the web at support.wolfram.com. If you are a Site License Administrator, additional Site License Documentation is available at site.wolfram.com. If you do not find the information you need, please contact Technical Support by sending email to support@wolfram.com or by calling +1-217-398-6500. Include your license number in all correspondence. Your license number is located on your electronic or physical copy of the license certificate. It is also available after installation by going to the **Help** menu and clicking **About Mathematica**. You must be a registered user in order to receive installation support. You must have a current *Premier Service* subscription to receive Technical Support.

Unix and Linux

Installing Mathematica on Unix and Linux

Installing Mathematica for Network Licenses

Requirements

Mathematica is available for Windows, Unix, Linux, and Mac OS X. For a complete list of platform availability, visit www.wolfram.com/products/mathematica/platforms.html. Any supported machine can act as a client for running *Mathematica*, provided the following two conditions are met:

- The client has access to the *Mathematica* files, either locally or from a file server on the network.
- The license server running *MathLM* is available on the TCP/IP network.

A license server can also function as its own client. However, this is not recommended. If the machine has to be rebooted for any reason, the serving of licenses to all other clients on the network may be disrupted.

Before you install *Mathematica* as a license server client, *MathLM* should already be installed and running on a license server on the network (see "Installing *MathLM* on Windows", and "Installing *MathLM* on Unix, Linux, and Mac OS X" for details). To complete the *Mathematica* installation, you will need to know the name or IP address of the license server running *MathLM*.

To install *Mathematica* on Unix and Linux, you may need `root` privileges.

To Install *Mathematica*:

1. Mount the CD or DVD. For information on mounting a CD/DVD, see "Mounting a CD or DVD on Unix and Linux".

   Note: This step may not be required on some Linux and Unix platforms, as some operating systems automatically handle mounting.

2. Change directory to */cdrom*`/Unix/Installer`. Note that the exact location of the CD/DVD mount point might be different for your platform.

   ```
   cd /cdrom/Unix/Installer
   ```

3. Run the installer.

   ```
   ./MathInstaller
   ```

   ```
   ------------------------------------------------------------
                  Wolfram Mathematica 7 Installer
   ------------------------------------------------------------

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   WARNING: Wolfram Mathematica is protected by copyright law and
   international treaties. Unauthorized reproduction or distribution may
   result in severe civil and criminal penalties and will be prosecuted to
   the maximum extent possible under law.
   ```

4. (Unix only) You are asked to select the platforms for which you are doing the installation. Select one or more of the available options and press Enter to continue.

   ```
   For which of the following platforms would you like to install
   Mathematica?

   Type your selection (multiple choices can be separated with spaces), or
   press
   ENTER to select (1):
   ```

5. The installer prompts you to specify the directory in which *Mathematica* should be installed. The default location is `/usr/local/Wolfram/Mathematica/7.0`. Press Enter to accept the default, or type in a new location and then press Enter.

   ```
   Enter the installation directory, or press ENTER to select
   /usr/local/Wolfram/Mathematica/7.0:
   ```

   Note: If you specify a directory that does not exist, the installer will give you the option of creating the directory. If a copy of *Mathematica* already exists in the directory you specify, the installer will inform you before overwriting the files.

Note: If you are installing over a previous version of *Mathematica*, your existing mathpass file and custom settings will **not** be deleted.

6. Once you have answered all the questions, the installer begins copying files from the CD/DVD to the directory you specified. The progress is indicated by a progress bar on the screen.

```
Now installing...

[***************                                                ]
```

7. You are asked for the location in which to copy the executable scripts. You should choose a directory that is present on each user's PATH. The scripts are also installed in the `Executables` subdirectory of the *Mathematica* installation directory. Type a location or accept the default and press Enter.

```
Type the directory path in which the Mathematica scripts will be created,
or press ENTER to select /usr/local/bin:
```

Note: The installer checks to see if any other *Mathematica* scripts exist in the specified directory. If they do, you are given the chance to rename the scripts.

8. You are given several options for configuring the password. Type `2` and press Enter to run *Mathematica* using a network license.

```
Please choose how you want to configure the password for Mathematica 7.0.

(1) Single machine
    Install a password specific to this machine. Mathematica will launch
    and you can enter your password.

(2) Network license
    Obtain a license from a MathLM license server on your network each time
    Mathematica is launched.

(3) Enter license information later
    Input your password and register when you start Mathematica.

Type your selection, or press ENTER to select (1):2
```

9. Type the hostname of the server running *MathLM*, as given by the `hostname` command. In some cases, this includes the domain name. Or, enter the IP address of the *MathLM* server. Press Enter to continue.

```
Enter the hostname of the machine on which your MathLM license manager
is running:
```

Note: The installer does not attempt to verify the server name you type. If you prefer, you may type any arbitrary text here and press Enter. This creates the `mathpass` file with an invalid password entry. You may then edit the `mathpass` file manually to add a correct password later. More information on the `mathpass` file is given in "Registration and Passwords".

10. The installer creates the `mathpass` file and displays its location. The installation is now complete.

```
Configuring Network Password...

Adding password file entry to /usr/share/Mathematica/Licensing/mathpass...

Installation complete.
```

The installer also adds an additional menu folder named **Wolfram** to the desktop menu. Inside the folder is an item named ***Mathematica*** that points to the most recently installed version of *Mathematica*. File associations are also modified such that .nb files are now associated with the most recently installed version of *Mathematica*.

Installing Mathematica for Single-Machine Licenses

Follow these instructions to install a standalone copy of *Mathematica* that does not get a license from the license server. Depending on your license type, this may require contacting Wolfram Research to purchase additional licenses.

To run *Mathematica*, you must register with Wolfram Research and receive a password. See "Registration and Passwords" for further information.

To install *Mathematica* on Unix and Linux, you may need `root` privileges.

To Install a Single-Machine Copy of *Mathematica* on Unix and Linux:

1. Mount the CD or DVD. For information on mounting a CD/DVD, see "Mounting a CD or DVD on Unix and Linux".

   Note: This step may not be required on some Linux and Unix platforms, as some operating systems automatically handle mounting.

2. Change directory to */cdrom*`/Unix/Installer`. Note that the exact location of the CD/DVD mount point might be different for your platform.

   `cd /`*cdrom*`/Unix/Installer`

3. Run the installer.

   `./MathInstaller`

```
------------------------------------------------------------
                Wolfram Mathematica 7 Installer
------------------------------------------------------------

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WARNING: Wolfram Mathematica is protected by copyright law and
international treaties. Unauthorized reproduction or distribution may
result in severe civil and criminal penalties and will be prosecuted to
the maximum extent possible under law.
```

4. (Unix only) You are asked to select the platform for which you are doing the installation. Select one of the available options and press Enter to continue.

```
For which of the following platforms would you like to install
Mathematica?

Type your selection (multiple choices can be separated with spaces), or
press
ENTER to select (1):
```

5. The installer prompts you to specify the directory in which *Mathematica* should be installed. The default location is `/usr/local/Wolfram/Mathematica/7.0`. Press Enter to accept the default, or type in a new location and then press Enter.

```
Enter the installation directory, or press ENTER to select
/usr/local/Wolfram/Mathematica/7.0:
```

Note: If you specify a directory that does not exist, the installer will give you the option of creating the directory. If a copy of *Mathematica* already exists in the directory you specify, the installer will inform you before overwriting the files.

Note: If you are installing over a previous version of *Mathematica*, your existing mathpass file and custom settings will **not** be deleted.

6. Once you have answered all the questions, the installer begins copying files from the CD/DVD to the directory you specified. The progress is indicated by a progress bar on the screen.

```
Now installing...
[***************                                              ]
```

7. You are asked for the location in which to copy the executable scripts. You should choose a directory that is present on each user's PATH. The scripts are also installed in the `Executables` subdirectory of the *Mathematica* installation directory. Type a location or accept the default and press Enter.

```
Type the directory path in which the Mathematica scripts will be created,
or press ENTER to select /usr/local/bin:
```

Note: The installer checks to see if any other *Mathematica* scripts exist in the specified directory. If they do, you are given the chance to rename the scripts.

8. You are given several options for configuring the password. Type 1 and press Enter to run *Mathematica* using a single-machine license.

```
Please choose how you want to configure the password for Mathematica 7.0.

(1) Single machine
    Install a password specific to this machine. Mathematica will launch
    and you can enter your password.

(2) Network license
    Obtain a license from a MathLM License Server on your network each
time
    Mathematica is launched.

(3) Enter license information later
    Input your password and register when you start Mathematica.

Type your selection, or press ENTER to select (1):1
```

9. Your machine name and MathID number are displayed. To obtain your password, contact Wolfram Research (see "Registration and Passwords" for details). You will need to supply your MathID number and the license number located on your electronic or physical copy of the license certificate.

```
Configuring Single-Machine Password...

Mathematica 7.0 for operating system
Copyright 1988-2008 Wolfram Research, Inc.

You will need to get a password from your
license certificate or from Wolfram Research
(register.wolfram.com).
Machine name: hostname
MathID: xxxx-xxxxx-xxxxx

You will need a valid license ID and password in order
to proceed. Go to http://register.wolfram.com or
http://reference.wolfram.com/singlemachine for more
information.
```

10. Enter your name, the name of your organization, your license number (located on your electronic or physical copy of the license certificate), and your password, and press Enter when you are done.

```
Enter your name:

Enter the name of your organization:

Enter your license ID [format Lxxxx-xxxx]:

Enter your password:
```

11. The installer creates the `mathpass` file and displays its location. The installation is now complete.

```
Creating password file entry in
/usr/share/Mathematica/Licensing/mathpass.

See http://reference.wolfram.com/password if
Mathematica is installed on multiple machines
and you need to set up a single, sitewide
password file.
```

The installer also adds an additional menu folder named **Wolfram** to the desktop menu. Inside the folder is an item named ***Mathematica*** that points to the most recently installed version of *Mathematica*. File associations are also modified such that .nb files are now associated with the most recently installed version of *Mathematica*.

Installing Mathematica from a File Server

One convenient way to install *Mathematica* on a client is to run the installer remotely from a file server. This is an efficient way of making *Mathematica* available to a large number of users without having to supply a CD/DVD to each one. You can install *Mathematica* from a file server on a client running any supported Unix or Linux platform. It is not necessary that the client platform be the same as the file server platform.

To install *Mathematica* from a file server, you first must make the installer and *Mathematica* files available to the clients. You can do this by copying the contents of the CD/DVD to the file

server and exporting the directory, or by exporting the CD/DVD mount point on the file server. Then, mount the directory with the *Mathematica* distribution on the client and change to this directory, and run `MathInstaller` to install *Mathematica* on the client machines. (Note that you must run `MathInstaller` from the directory in which it is located.) If you are installing *Mathematica* in a mixed-platform environment, you may need to use the `MathInstaller` option `-platform` to ensure that the correct files for your platform are installed.

Installing Mathematica from a Script

If you are installing *Mathematica* on multiple machines, it can be time-consuming to respond to all of the installer prompts on each individual machine. By supplying command-line options to the `MathInstaller` command, you can customize various features of the installation process or automate it entirely.

`-auto`	force the installation to proceed automatically without prompting the user for any information
`-createdir=`*value*	specify whether or not to create the directories specified by the options `-targetdir` and `-execdir`
`-execdir=`*dir*	specify the path to be used for the symbolic links to the executable scripts
`-help`	display information about the installer options
`-method=`*type*	define the type of installation you would like to perform
`-overwrite=`*value*	specify whether the installer should overwrite any files that already exist in the target directory
`-platforms=`*value*	specify the system ID of the Unix platform or platforms (e.g., Linux, Solaris, and so forth) for which you want to do the installation
`-selinux=`*value*	specify whether the installer should attempt to modify the security context of any included libraries so that it will function properly
`-silent`	force an automatic installation (equivalent to the `-auto` option)
`-targetdir=`*dir*	specify the installation directory
`-verbose`	display detailed information about the files and directories being installed

`MathInstaller` command-line options.

> **Note:** Default values are used for any options that are not specified explicitly on the command line.

Valid input for `-createdir` is `y` for yes or `n` for no. By default, this value is set to `y`.

The default directory for `-execdir` is `/usr/local/bin`. This option only works with an automatic installation.

The values for `-method` may vary by product. When this option is applicable, the values can be determined by running the installer. The default value for this option is `Full`.

Valid input for –overwrite is y for yes or n for no. By default, this value is set to y. This option only works with an automatic installation.

The default for –platforms is the system you are installing on, if that information is available to the installer. This option only works with an automatic installation.

Valid input for –selinux is y for yes or n for no. By default, this value is set to n.

The option –silent suppresses any output from being displayed on the screen. The output is instead written to a file named InstallerLog–*number*. If the installation is unsuccessful, the log file is saved in the /tmp directory. Otherwise, the file is moved to the target directory and renamed InstallerLog.

The directory specified for –targetdir corresponds to the value of the global variable $InstallationDirectory. The default value is /usr/local/Wolfram/Mathematica/7.0. This option only works with an automatic installation.

To complete the installation in one step, run a command like the following.

```
./MathInstaller –auto –targetdir=/home/mathematica
```

This allows you to complete the installation automatically in one step, while still being able to customize various details such as the directory to install to. You are not prompted to enter your password using this method, so you will need to enter a password the first time *Mathematica* is launched.

If you are doing many installations, you might find it convenient to include the MathInstaller command with all the relevant options in a shell script. Running the shell script is then an easy way to do an identical customized installation on multiple machines. You can further simplify the installation process by including a line in your script that copies an existing mathpass file to the appropriate location on the newly installed machine. Note that MathInstaller must be run from the directory in which it is located, so your script may require a command to change directory. See "Registrations and Passwords" for information on sitewide mathpass configurations.

Launching Mathematica on Unix and Linux

Launching Mathematica Locally

To run *Mathematica* using a network license, both the client machine and the license server must be on the network and *MathLM* must be running.

To Launch *Mathematica*:

Make sure that you are running *MathLM*. Then, from a shell, type `mathematica` and press Enter.

Alternatively, if you are running X, an additional menu folder named **Wolfram** has already been added to the desktop menu. In the folder, an item named ***Mathematica*** points to the most recently installed version of *Mathematica*. File associations have also been modified such that .nb files now associate with the most recently installed version of *Mathematica*.

To Launch Only the *Mathematica* Kernel:

From a shell, type `math` and press Enter.

Launching Mathematica from a File Server

Rather than installing *Mathematica* on every client machine, you can install *Mathematica* on a file server and export the installation directory to the clients. To display the front end, the clients must have access to the *Mathematica* fonts. For information about configuring the X server on the client machines to find the *Mathematica* fonts, see "Fonts on Unix and Linux". Once the fonts are properly configured, the client machines can run *Mathematica* as though it were a local installation.

Mathematica Command-Line Options

math

The `math` command starts the kernel from within a shell. The kernel is the part of *Mathematica* that handles calculations. This is also used by the front end.

Command-Line Options

`-initfile` *file*	specify the name of a file containing startup commands
`-lmverbose`	print diagnostic information to `stderr`
`-mathlink`	specify that the kernel should be run in *MathLink* mode
`-noinit`	specify that no initialization file should be read at startup
`-password` *str*	specify a password to use instead of the password or passwords stored in the mathpass file
`-pwfile` *file*	specify the name of a file that has a valid password
`-run`	specify a command to be run on startup as an argument

`math` command-line options.

The option -lmverbose is usefull for debuggin problems related to the license server

The option -mathlink can also be used as a command-line option for the *Mathematica* front end. See www.wolfram.com/solutions/mathlink for additional information about *MathLink*.

The string for -password should have the form "*!servername*" or "*machinename mathid licensenumber password*".

mathematica

The mathematica command runs the X front end. In order for the front end to run, the DISPLAY environment variable must be set and the front end must be able to locate the fonts included with *Mathematica*.

Command-Line Options

-backgroundTaskDelay *n*	specify the time (in milliseconds) that the front end delays background tasks while waiting for input
-cleanStart	ignore stored caches and rebuild the front end preferences file
-copyright	display copyright information on the command line
-dontUpdatePrefs	prevent changes to the user's preference settings
-font *f*	specify the font used in menus, buttons, etc.
-help	display a list of all command-line options
-lmverbose	print diagnostic information to stderr when connecting to *MathLM*
-mathlink	make the front end run as a child process that is capable of accepting *MathLink* packets
-nogui	prevent the display of any kind of window or dialogs
-noSplashScreen	prevent the splash screen from being displayed on startup
-noTrueTypeFont	prevent the use of TrueType font in the display
-preferencesDirectory *dir*	specify the location where preference settings are stored
-primaryModifierMask *mask*	specify the primary mask to be used as the command key
-pwfile *file*	specify a file in which to look for *Mathematica* passwords
-pwpath *p*	specify the search path for a password file
-secondaryModifierMask *mask*	specify the secondary mask to be used as the command key
-singleLaunch	allow only one copy of the front end per display