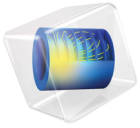

COMSOL Multiphysics

Installation Guide

5.2a

COMSOL

COMSOL Multiphysics Installation Guide

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Version: COMSOL 5.2a

Contact Information

Visit the Contact COMSOL page at www.comsol.com/contact to submit general inquiries, contact Technical Support, or search for an address and phone number. You can also visit the Worldwide Sales Offices page at www.comsol.com/contact/offices for address and contact information.

If you need to contact Support, an online request form is located at the COMSOL Access page at www.comsol.com/support/case. Other useful links include:

- Support Center: www.comsol.com/support
- Product Download: www.comsol.com/product-download
- Product Updates: www.comsol.com/support/updates
- COMSOL Blog: www.comsol.com/blogs
- Discussion Forum: www.comsol.com/community
- Events: www.comsol.com/events
- COMSOL Video Gallery: www.comsol.com/video
- Support Knowledge Base: www.comsol.com/support/knowledgebase

Part number: CM010002

Contents

Before you Begin 9

Installation Media Options 9

System Requirements 10

Previous Installations 10

Software License Agreement 11

License Types 11

License Management Tools 14

COMSOL Access 15

Installing on Windows 16

Installation over the Internet 16

Downloading and Installing the COMSOL Software 19

Installation from a USB Flash Drive 20

Running the COMSOL Installer 20

Removing (Uninstalling) the COMSOL Installation 37

Installing Software Updates 39

Automated Installation 40

Product Updates and Library Updates 41

LiveLink™ *for* Excel® Installations 42

LiveLink™ *for* SOLIDWORKS®: Add-In for SOLIDWORKS . . . 42

LiveLink™ *for* Inventor®: Add-in for Autodesk Inventor 43

LiveLink™ *for* AutoCAD® Installations 43

LiveLink™ *for* PTC® Pro/ENGINEER®: Changing the Installation

Path 44
LiveLink™ *for* PTC® Creo® Parametric™: Add-in for PTC Creo Parametric 45
LiveLink™ *for* Revit®: Add-in for Revit 45
LiveLink™ *for* Solid Edge®: Add-in for Solid Edge 46
Cluster Installation 46
License Manager Installation on Windows 48
What is the FlexNet® License Manager? 48
System Requirements for the FlexNet® License Manager 49
FlexNet® License Manager Software Components 49
FlexNet® License Manager Documentation 49
The License File 50
Installing the License Manager 54
Starting the License Manager 55
Verifying that the License Manager is Running 57
Starting COMSOL 57
Changing the License 57
Troubleshooting License Errors 58
Running COMSOL on Windows 59
The COMSOL Folder on The Windows Start Menu 59
Running COMSOL on Windows® 10 60
Starting COMSOL for a Classkit License 61
Creating Desktop Shortcuts Manually 61
Running COMSOL in Client-Server Mode 63

Running COMSOL in Batch Mode 65
Multicore Settings 65
Running COMSOL on Clusters 66
Running COMSOL on the Cloud 67
Running COMSOL with MATLAB 68
Installing on OS X 69
Installation Over the Internet 69
Downloading and Installing the COMSOL Software 72
Installation from USB Flash Drive 73
Running The COMSOL Installer 74
Automated Installation 74
Removing (Uninstalling) the COMSOL Installation 74
Product Updates and Application Library Update 74
Changing the Path to the MATLAB® Installation 75
License Manager Installation on OS X 76
FlexNet License Manager Software Components 76
FlexNet License Manager Documentation 76
The License File 77
Installing the License Manager 77
Starting the License Manager 79
Verifying that the License Manager is Running 80
Starting COMSOL 80
Changing the License 80
Troubleshooting License Errors 81

Running COMSOL on OS X 82
The COMSOL Applications 82
Running COMSOL from a Terminal Window 83
Running a Classkit License 83
Running COMSOL in Client-Server Mode 83
Running COMSOL in Batch Mode 85
Multicore Settings 86
Running COMSOL on Clusters 86
Running COMSOL on the Cloud 87
Installing on Linux 88
Installation Over the Internet 88
Downloading and Installing the COMSOL Software 89
Installing from a DVD 91
Installation from USB Flash Drive 91
Running The COMSOL Installer 92
Web Browser for Viewing the Documentation 93
Automated Installation 93
Removing (Uninstalling) the COMSOL Installation 93
Product Updates and Application Library Update 94
Changing the Path to the MATLAB® Installation 94
Cluster Installation 95
License Manager Installation on Linux 96
FlexNet License Manager Software Components 96
FlexNet License Manager Documentation 96

The License File 97
Installing the License Manager 97
Starting the License Manager 99
Verifying that the License Manager is Running 101
Starting COMSOL 101
Changing the License 101
Troubleshooting License Errors 102
Running COMSOL on Linux 103
Running COMSOL 103
Multicore Settings 103
Running COMSOL in Batch Mode 104
Running COMSOL in Client-Server Mode 105
Running a Classkit License 106
Running COMSOL on Clusters 106
Running COMSOL on the Cloud 108
Running COMSOL with MATLAB 108
Troubleshooting License Errors 109

Before you Begin

Welcome to the *COMSOL Multiphysics Installation Guide*, which provides instructions on how to install COMSOL Multiphysics® and its add-on products. In addition to this manual, several on-line resources are available which are relevant for installation:

- System Requirements: www.comsol.com/system-requirements
- Support Knowledge Base: www.comsol.com/support/knowledgebase
- Support Center: www.comsol.com/support
- COMSOL Software License Agreement: www.comsol.com/comsol-license-agreement
- Product Download: www.comsol.com/product-download
- Product Updates: www.comsol.com/support/updates
- COMSOL Video Gallery: www.comsol.com/video

Installation Media Options

There are four installation media options for COMSOL 5.2a:

- Installation over the Internet:
  - This option requires Internet access from the computer where COMSOL is to be installed.
- Installation from a downloaded DVD image:
  - This option requires Internet access from any computer for downloading the DVD image file with an `.iso` file extension.
- Installation from a DVD given to you by a COMSOL representative:
  - This option requires access to a DVD reader on the computer where COMSOL is to be installed.
- Installation from a USB Flash Drive given to you by a COMSOL representative:
  - This option requires a USB port on the computer where COMSOL is to be installed.

Installation using any of these four options is explained later in this document.

System Requirements

COMSOL is a cross-platform software that runs on the Windows®, Mac®, and Linux® operating systems. A variety of hardware platforms are supported, including graphics cards. Before installing, make sure your computer meets the current system requirements listed at: www.comsol.com/system-requirements.

There is also a current list of compatible software versions for:

- External function C compiler
- COMSOL API when used with Java®
- LiveLink™ *for* MATLAB®
- LiveLink™ *for* Excel®
- CAD Import Module
- Design Module
- LiveLink™ *for* SOLIDWORKS®
- LiveLink™ *for* Inventor®
- LiveLink™ *for* AutoCAD®
- LiveLink™ *for* Revit®
- LiveLink™ *for* PTC® Creo®Parametric™
- LiveLink™ *for* PTC®Pro/ENGINEER®
- LiveLink™ *for* Solid Edge®
- File Import *for* CATIA® V5

Previous Installations

Previous installations of COMSOL on your computer are not affected by your new COMSOL 5.2a installation except that double-clicking a Model MPH-file opens in the latest installation (unless otherwise specified during installation). You can continue to use other versions or uninstall them independently of the latest installation.

In this guide, the term COMSOL 5.2a refers not only to COMSOL Multiphysics 5.2a but also to any of the add-on products, as well as COMSOL Server 5.2a and its add-ons.

Software License Agreement

For the complete software license agreement with details on the license conditions, please refer to the COMSOL Software License Agreement. The PDF can be downloaded from this link: www.comsol.com/sla. The license agreement is also available in your installation folder.

- On Windows, it is located at:

```
C:\Program Files\COMSOL\COMSOL52a\Multiphysics\doc
\pdf\COMSOL_Multiphysics\COMSOL_SoftwareLicenseAgreement.pdf
```

and can also be accessed from the Windows Start menu, under **COMSOL Multiphysics 5.2a>COMSOL Documentation**.

- On Mac, it is located at:

```
/Applications/COMSOL52a/Multiphysics/doc/pdf/COMSOL_Multiphysics/
COMSOL_SoftwareLicenseAgreement.pdf
```

- On Linux, it is located in the installation directory, for example:

```
/usr/local/comsol52a/multiphysics/doc/pdf/COMSOL_Multiphysics/
COMSOL_SoftwareLicenseAgreement.pdf
```

License Types

There is a variety of license options, and the steps involved when installing can differ depending on which license type you have acquired. No license type restricts usage to just one operating system but you are able to choose to install on either Windows, Mac, or Linux. A COMSOL Multiphysics model file saved on one platform can be opened on another. Certain license types come with restrictions; make sure you know which license type you have before proceeding with the installation.

All COMSOL licenses allow for multicore/multiprocessor shared-memory computing. How many cores or processors you can utilize is only limited by your hardware configuration and operating system. In the COMSOL Desktop you control the number of processors from the **File** menu (Windows) or **Options** menu (Mac and Linux), under **Preferences>Multicore and Cluster Computing**.

For a full description and definition of the different license types, see the *COMSOL Software License Agreement*. All of the license types may not be available in your region.

COMSOL Multiphysics

The following is an overview of the license types for COMSOL Multiphysics:

Named Single User License (NSL)

The COMSOL Multiphysics software may be installed and operated on up to four (4) individual computers, provided it is only accessible to, and operated by, a single licensed user designated by us as the Named User for that license and provided that the Named User may concurrently use the software on only two (2) of those computers at any given time. The NSL version of the software may not be accessed or used over a network or remotely.

CPU-Locked Single User License (CPU)

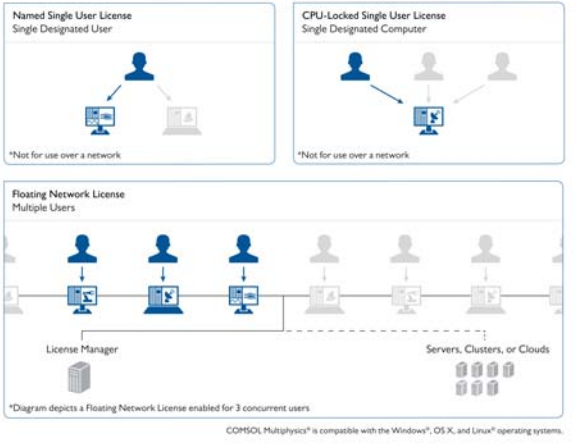
You can install the COMSOL Multiphysics software on one designated computer and different users can take turns using the software on that computer, one session at a time. The CPU version of the software may not be accessed or used over a network or remotely.

Floating Network License (FNL)

Licensed per concurrent user, you can install the software on as many machines on your network as you want for use within your country or territory. COMSOL Multiphysics software can run on local computers with the network being used only for license authentication, or alternatively you can run the software on a remote computer over your network. Cluster and cloud computing is supported on Windows® and Linux® platforms.

Class Kit License (CKL)

As many as 30 students and teachers can simultaneously use the software for a class over a school network. Students may use the software for homework use, and teachers may use the software for lesson preparation.



COMSOL Server

The following is an overview of the license types for COMSOL Server:

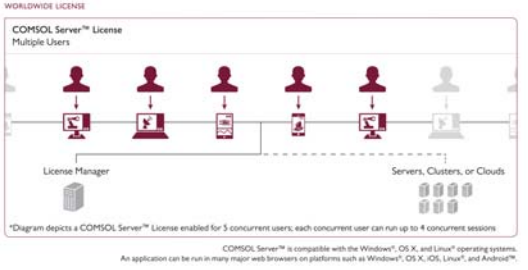
COMSOL Server License (CSL)

Licensed on a concurrent user basis. Each concurrent user may run up to four concurrent sessions. The CSL version of the software enables you to run applications built with the Application Builder. The CSL allows you to host and run those applications within your organization and also to those outside your organization who time share your concurrent user slots, worldwide. Applications can be accessed through a major web browser on a variety of operating systems or a COMSOL client for the Windows® operating system. See System Requirements for detailed requirements.

Academic Server License (ASL)

Licensed on a 300 concurrent user basis. Each concurrent user may run up to four concurrent sessions. The ASL version of the software enables you to run applications built with the Application Builder. The ASL allows you to host and

run those applications for students, faculty, and staff of your academic institution or of any other academic institution, worldwide.



License Management Tools

The FlexNet License Manager Software

Depending on your region and operating system, any of the above license types may require that the FlexNet license manager software is installed and started before running COMSOL. The FlexNet license manager comes bundled with any COMSOL installation. You can view the contents of the license file (`license.dat`) that you received from your COMSOL representative by opening it with a text editor or word processing software. If the file contains a line starting with the word SERVER, then the FlexNet license manager is required. For a Floating Network License, the purpose of the FlexNet license manager software is to count the number of concurrent users and to give an error message if the number of users exceeds the licensed number of concurrent users. Depending on your region and operating system, the FlexNet license manager software might also be needed for a Single User License. In that case, the purpose of the license manager software is to lock the COMSOL session to a COMSOL authorized computer. See License Manager Installation on Windows for more information. The COMSOL software products and the license manager can be installed in any order, except if you are installing based on a port number and host name. In that case, the license manager software needs to be installed and started before installing COMSOL.

Dongle Hardware Lock

Depending on your region and operating system, any of the above license types might require a dongle (hardware lock). If you have received a dongle to use with COMSOL, please refer to instructions given to you by your COMSOL representative.

COMSOL Access

COMSOL Access is a service provided by COMSOL that gives you access to additional content on www.comsol.com and allows you to:

- Download products
- Update products (restricted to customers with an active subscription)
- Edit contact and license information
- Access the Knowledge Base (unabridged access to all parts is restricted to customers with an active subscription)
- Contact technical support
- Manage event registrations
- Manage abstract submissions to the COMSOL Conference
- Access to the COMSOL Exchange on-line model sharing
- Participate in the Community Discussion Forum

Registering with COMSOL Access is required for product download and installation.

Installation over the Internet

Installation of a Trial License over the Internet

A trial license can be given to you with the intention to test the software without any payment obligation for noncommercial and nonproduction use. This option is not available in all regions.

Installation of a Single User Trial License on Windows requires a license passcode. A passcode has a form similar to:

```
9FFF3FFFF7F5-TYUS-140917-17074436-384661755
```

This is usually sent to you by a COMSOL representative by email. Once you locate your passcode, follow these steps to prepare for download and installation:

1. Click the link for downloading the software as given in the software download email from your COMSOL representative. This link is identical or similar to: http://www.comsol.com/product-download.
2. If you have not already created a COMSOL Access account, you are prompted to create it. When you have created the account, you can enter your trial passcode to associate it with your account information.

   If you already created a COMSOL Access account, you can associate the license file with your account on the COMSOL Access page under Manage Licenses at www.comsol.com/access/licenses.
3. Follow the web-based instructions to download the software.
4. Continue with the instructions in the section Downloading and Installing the COMSOL Software.

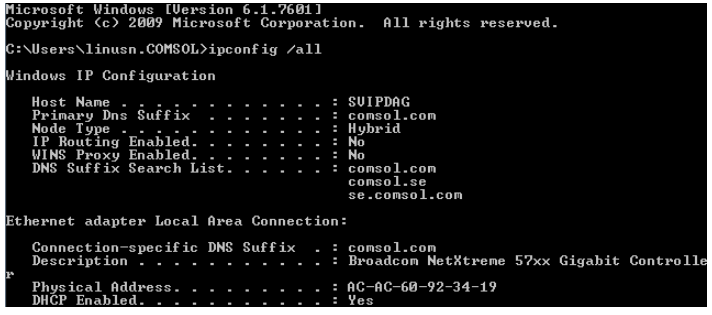
Installation of a Paid-for License over the Internet

Installation of any paid-for license on Windows requires a license file that is sent to you by your COMSOL representative by email. To be able to generate the license file, information about your hardware is needed in the form of a hostid (host ID). The hostid is used to lock the license to your hardware and needs to be sent by you to a COMSOL representative prior to the license file being generated.

Obtaining the Hostid

Follow these steps to obtain a hostid:

1. First open the command window by pressing the keyboard Window button+R. If you don't have a Window button, click the **Start** button, enter `cmd` in the search box, and press OK or Return.
2. Enter `ipconfig /all` at the command prompt and press `Return`. The displayed information looks similar to this:



3. The hostid you are looking for is here called Physical Address, also known as Ethernet address or MAC address.

   To place the number on the Windows clipboard, right-click the text in the command window and select **Mark** in the menu, mark with the mouse, and press Return. Alternatively, you can type the command:

   ```
   getmac /FO LIST /V | clip
   ```

   which also places the information on the Windows clipboard.

4. Now press Ctrl+V to paste the hostid to the text body of an email to be sent to a COMSOL representative.

Obtaining the Host Name

If you have been informed by your COMSOL representative that you need to run the FlexNet license manager for your installation, then you also need the Host Name. The Host Name is encircled in the screen shot above. If your network administrator prefers to use a fixed IP address for this particular computer, this IP Address can be optionally used in place of the Host Name. For more information on license manager installation see License Manager Installation on Windows.

Hostid for PCs with Wireless Adapters

If you plan to install on a computer with a wireless network adapter, you need the physical address of both the wireless and the Ethernet adapter. If the COMSOL representative asks you for the hard disk serial number instead of the hostid, type `vol` at the Windows command line prompt. The output looks like

```
Volume Serial Number is 2C9F-5930
```

Obtaining the License File from a COMSOL Representative

Send the hostid information, as well as Host Name, if applicable, in an email to your COMSOL representative, who responds with an email including an attached license file (`license.dat`). Save this file to any location on your computer. You need to refer to it during installation. The license file is a text file and below is an example of the contents of a `license.dat` file for a Single User License on Windows. This example license file shows that the licensed products are COMSOL Multiphysics, Particle Tracing Module, Subsurface Flow Module, and LiveLink™ *for* Excel®.

```
#--------------------------------------------------------------------
# COMSOL 5.2a NSL License No: 1234567 Windows/Mac
# Visit www.comsol.com/install for latest installation instructions
#--------------------------------------------------------------------
FEATURE SERIAL LMCOMSOL 5.2a permanent uncounted \
          VENDOR_STRING=C,18000100200 HOSTID=ANY sort=100 SN=1234567 \
          TS_OK SIGN=8045890A6FE4
FEATURE COMSOL LMCOMSOL 5.2a permanent uncounted HOSTID="70f2b12f4dfd \
          0116b8cc761a" PLATFORMS="i86_n x64_n i86_mac x64_mac" \
          SN=2076312 SIGN=E607EB680852
FEATURE PARTICLETRACING LMCOMSOL 5.2a permanent uncounted \
          HOSTID="70f1a12f4dfc 0026b9cc760a" PLATFORMS="i86_n x64_n \
          i86_mac x64_mac" SN=2076312 SIGN=3835733C6290
FEATURE SUBSURFACEFLOW LMCOMSOL 5.2a permanent uncounted \
          HOSTID="70f1a12f4dfc 0026b9cc760a" PLATFORMS="i86_n x64_n \
          i86_mac x64_mac" SN=2076312 SIGN=3A9BA162C9E4
FEATURE LLEXCEL LMCOMSOL 5.2a permanent uncounted HOSTID="70f1a12f4dfc \
          0026b9cc760a" PLATFORMS="i86_n x64_n i86_mac x64_mac" \
          SN=2076312 SIGN=EE9C11E44356
FEATURE COMSOLGUI LMCOMSOL 5.2a permanent uncounted \
          HOSTID="70f1a12f4dfc 0026b9cc760a" PLATFORMS="i86_n x64_n \
          i86_mac x64_mac" SN=2076312 SIGN=0D0A83382550
```

A Single User License file can normally not be edited or changed in any way by the user but has to be identical to the one sent to you by a COMSOL representative. If you were sent a license file that requires a license manager, then minor edits are required. For information on the type of license file required for installations using a license manager, see The License File.

Registering with COMSOL Access

Once you have saved your license file, follow these steps to register or login to COMSOL Access to start the installation:

1. Click the link for downloading the software as given in the software download email from your COMSOL representative. This link is identical or similar to: www.comsol.com/product-download.

2 If you haven't already created a COMSOL Access account, you are prompted to create it. When you have created the account, point to your license file (`license.dat`) to associate it with your account information.

   If you already created a COMSOL Access account, then you can associate the license file with your account on the COMSOL Access page under Manage Licenses at www.comsol.com/access/licenses.

3 Continue with the instructions in the next section.

Downloading and Installing the COMSOL Software

1 Go to the web page www.comsol.com/product-download. To download the COMSOL installer, you must first create a COMSOL Access account as described in the section Installation over the Internet.

2 You are now given the options of downloading the COMSOL online installer or the COMSOL offline installer (an ISO image).

If you have problems downloading (such as **Error downloading file. Connection refused: connect**), please review this knowledge base entry: www.comsol.com/support/knowledgebase/1149. If you still have problems, contact your local COMSOL representative or technical support from the Support Center page www.comsol.com/support.

Starting the Online Installer for Installation over the Internet

The COMSOL Installer is a user interface tool that guides you through the installation process. Start the COMSOL Installer by running the downloaded file `COMSOL52a_win.exe`. The COMSOL 5.2a Installer window should now appear. Next, continue with the instructions in the section Running the COMSOL Installer.

Installation from Downloaded ISO Image

1 Download the offline installer. The file to download is called `COMSOL52a_dvd.iso`.

2 When you have downloaded the ISO image, burn the ISO image to a disc to be able to install. In Windows 8 or later you have the option of directly mounting

the ISO image by right-clicking on the ISO image and selecting **Mount** and then continuing directly with the installation. In all supported Windows versions you can also burn a disc by right-clicking on the ISO image and selecting **Open with** and then **Windows Disc Image Burner**. For Window Vista, you need a dedicated disc image burning software or disc image mounting software to use this option.

INSTALLING FROM A DVD OR MOUNTED DVD IMAGE

This section also applies if you have received a DVD from a COMSOL representative. The COMSOL Installer is a user interface tool that guides you through the installation process. Once you have inserted the COMSOL DVD into the DVD drive (or mounted the image), the COMSOL Installer window should appear automatically; if not, run the file `setup.exe` on the installation DVD. The COMSOL 5.2a Installer window should now appear. Now continue with the instructions in the section Running the COMSOL Installer.

Installation from a USB Flash Drive

This section applies if you have received a USB Flash Drive from a COMSOL representative.

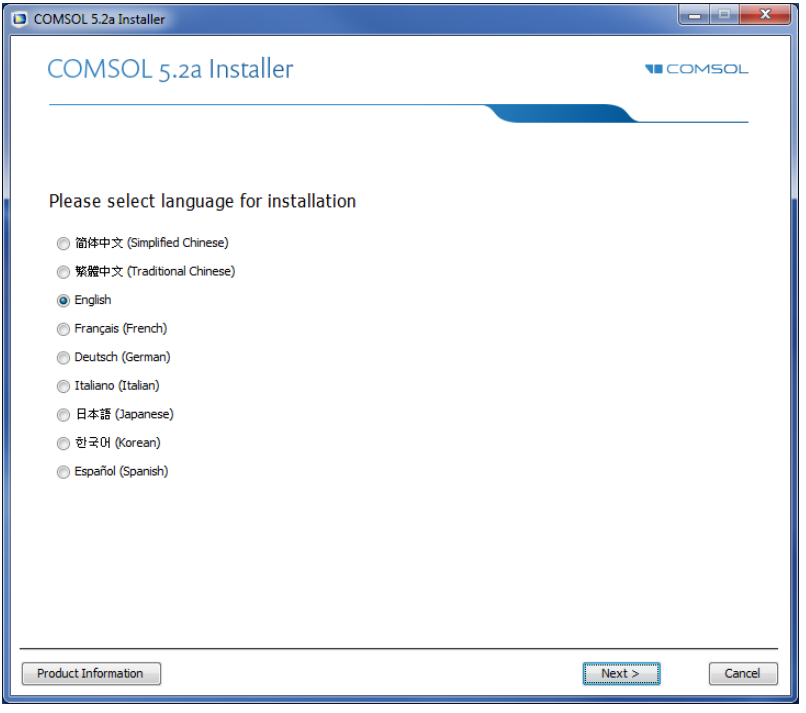
STARTING THE INSTALLER FROM A USB FLASH DRIVE

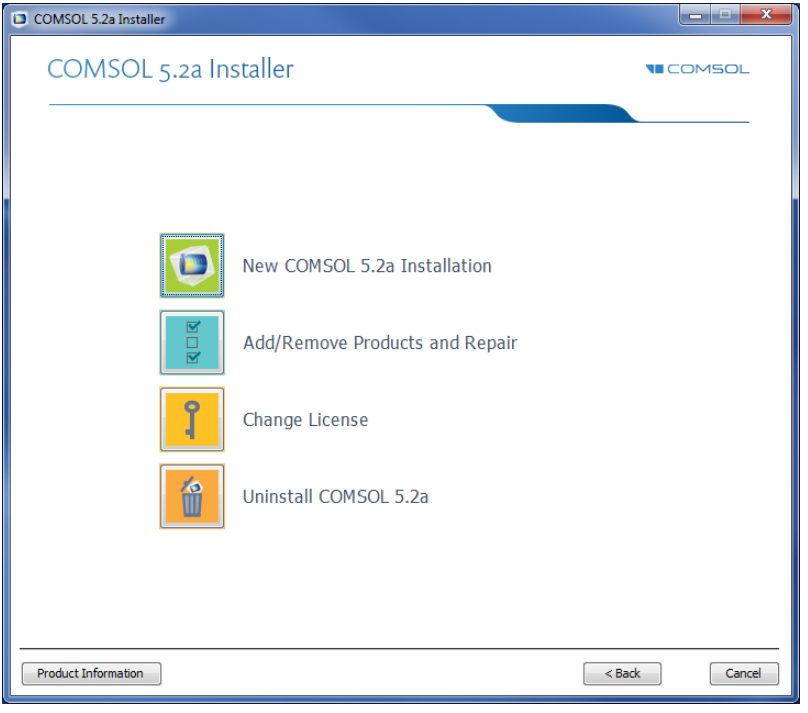
The COMSOL Installer is a user interface tool that guides you through the installation process. Insert the USB Flash Drive into a USB port on your computer. The COMSOL Installer window should appear automatically; if not, run the file `setup.exe` on the USB Flash Drive. The COMSOL 5.2a Installer window should now appear. Now continue with the instructions in the section Running the COMSOL Installer below.

Running the COMSOL Installer

The steps for running the COMSOL Installer are independent of the installation media option you used. If you have followed the above instructions, the COMSOL Installer should now appear.

1 Select your language for the installation and click **Next**. The language selected is also your default language in COMSOL. You may also need to install the fonts for the languages that you want to use when running COMSOL.





2 In the COMSOL Installer, select one of the following options:

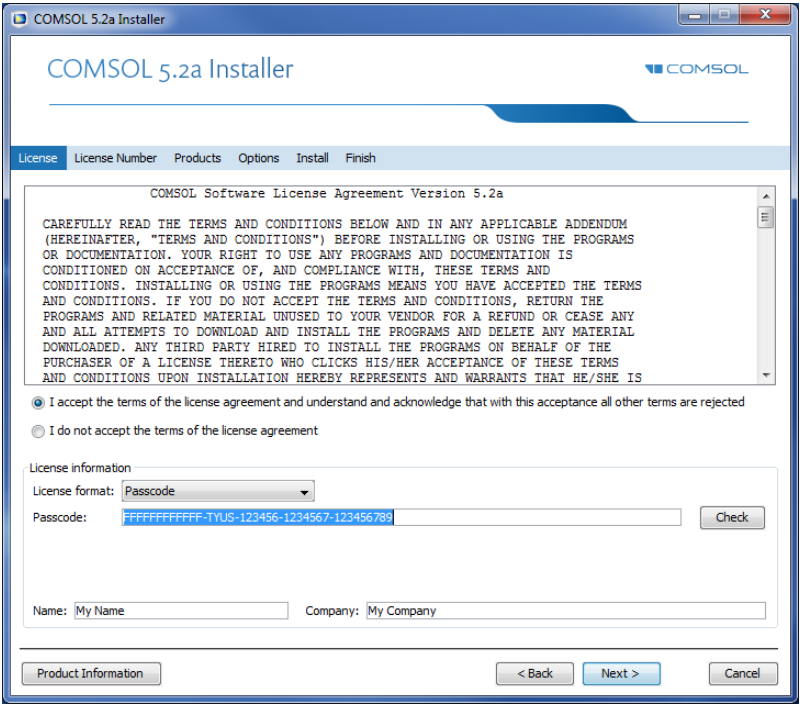
- Click **New COMSOL 5.2a Installation** and proceed to Step 3 (License Page) to make a new installation.
- Click **Add/Remove Products and Repair** and proceed to Step 5 (Platform Page) to change or repair an existing installation. For example, use Add/Remove Products and Repair when adding or removing documentation files for products installed or when adding or removing a product that your license includes.
- Click **Change License** and proceed to Step 3 (License Page) to update the license of an existing installation. Use this option when COMSOL is installed and you get a new license file. The installer then removes products not licensed any more and lets you go through the Add/Remove Products procedure to add or remove products for the new license. If your trial license has expired you can use the Change License option to re-enable a paid-for license.
- Click **Uninstall COMSOL 5.2a** to remove an existing installation. For instructions on this option, proceed to Removing (Uninstalling) the

COMSOL Installation.

You can change the path to the existing installation by pressing the F1 key.

License Page

3 After selecting one of the four options, the following is displayed:



After reading the license agreement, click the **I accept the terms of the license agreement** button and specify the license. Use one of the following license formats, depending on which license you have:

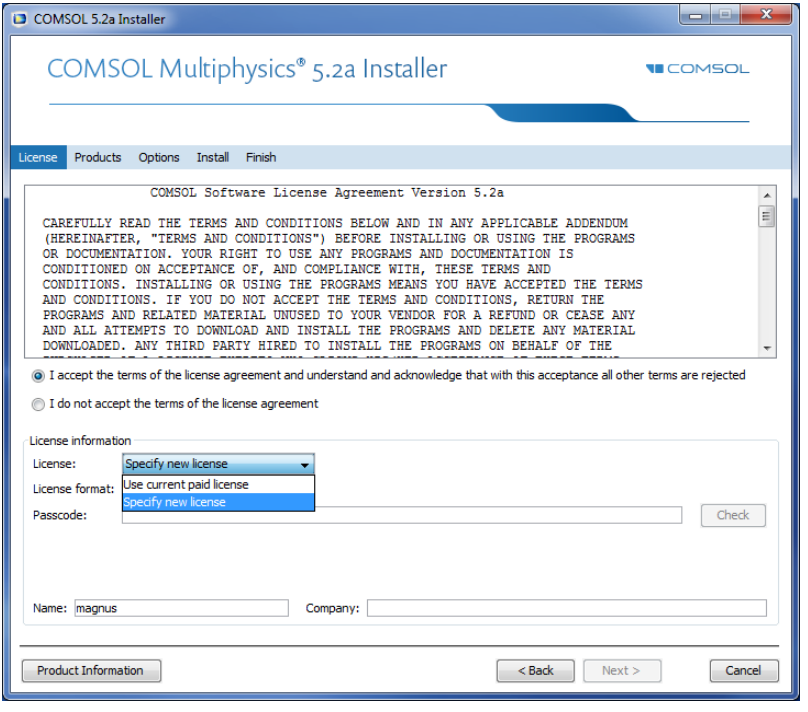
- **Passcode**: Use this option for a Single-User Trial License. Enter your passcode, which is a series of characters and numbers that has a form similar to FFFFFFFFFFFF-TYUS-123456-1234567-123456789. Note that the passcode is case sensitive.
- **License file**: Use this option for any type of regular paid-for license installation. Enter the path to an existing license file or click **Browse** to select the file

`license.dat`. This license file is sent to you by a COMSOL representative, typically by email.

- **Port number** and **Host Name**: Use this option if your license administrator has given you a port number and Host Name for a license manager for COMSOL that is running somewhere on your organization's network. Enter the **Host Name** of the computer or server running the license manager and its license manager port number.
- **Three-server redundancy**: Use this option if your license administrator has given you three port numbers and Host Names for the three-server redundancy license manager option. Enter the **Host Names** and license server port numbers of the three-server redundant configuration.

Change License

If **Change License** was selected in Step 2, a menu in the upper-left area of the Installer lets you choose to use an existing paid license or a trial license, or you can choose to specify a new license.

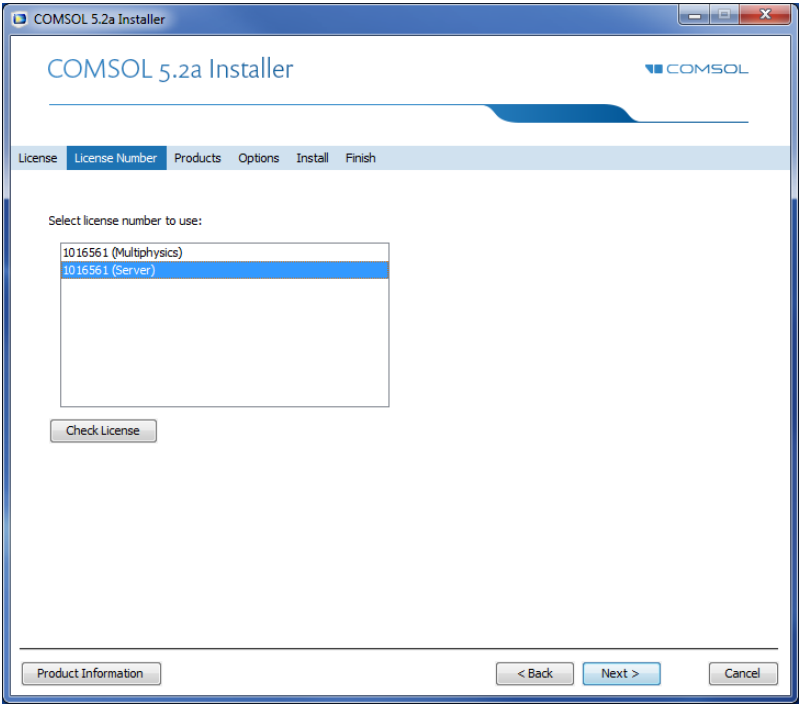


Click **Next** and proceed to Step 5 if you want to change to a license with different products. Otherwise, proceed to Step 10.

4 Click **Next**.

License Number Page

This page only appears if you have a license file corresponding to several different licenses (a so-called merged license file). From the list of license numbers, select the one you want to install. Both COMSOL Multiphysics licenses and COMSOL Server licenses can appear here. The license number choice you make here will affect the available products on the next page.



Products Page

5 Select the COMSOL products to install, which applications and documentation to install, and specify the path to the COMSOL installation folder.

In the list of products under **Select products to install**, all products that your license includes are selected. In addition, the **License Manager** check box is selected. Depending on your region and operating system, the license type may require that the FlexNet license manager software is installed and started before running COMSOL (see License Management Tools). In some cases, however,

the FlexNet license manager software is installed automatically during the COMSOL installation.

From the options under **Application libraries**, choose one of the following installation options for application libraries:

- **Install application libraries for selected products** (the default) to install the application libraries for the licensed products that you have selected.
- **Install application libraries for all products** to install the application libraries for all COMSOL products. You have then the possibility to browse and open applications from all products' application libraries.
- **Do not include application libraries** to not install any application libraries. You can choose to download selected applications after the installation using the Application Library Update.

From the options under **Documentation**, choose one of the following installation options for the product documentation:

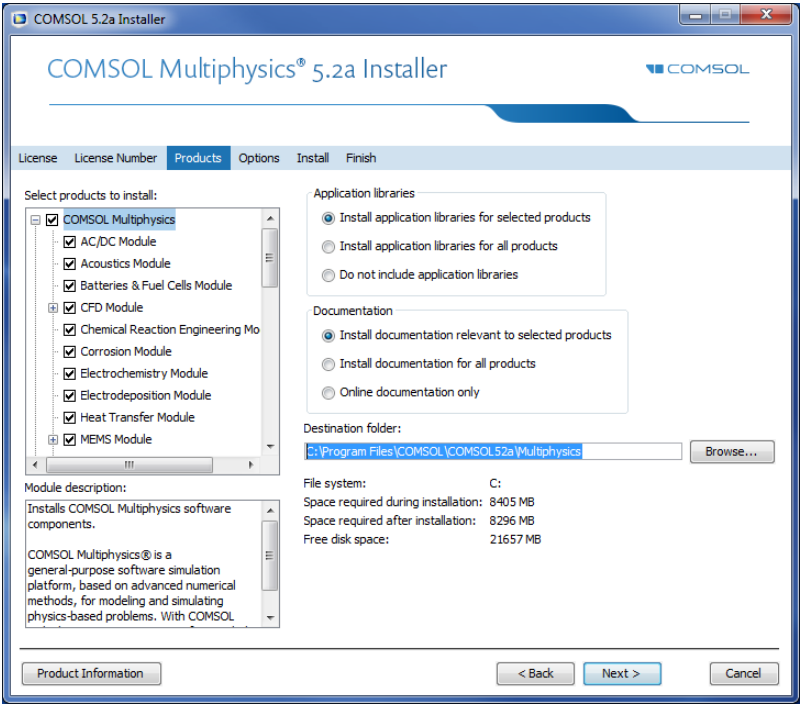
- **Install documentation relevant to selected products** (the default) to install the documentation for the licensed products that you have selected. For some products, documentation for other relevant products is also installed, so that you get access to documentation for functionality included in the licensed products but covered in other products' documentation.
- **Install documentation for all products** to install the documentation for all COMSOL products. You have then the possibility to view and search all

COMSOL documentation, including documentation for products not included in your license.

- **Online documentation only** to not install any documentation. You can still view documentation and access context help using online documentation provided by COMSOL, but no documentation files are installed on your computer.

Under Destination folder, a default installation destination is suggested; for Windows, typically `C:\Program Files\COMSOL\COMSOL52a\Multiphysics`.

Click **Browse** or type another destination directory if needed.



If **Change License** was selected earlier and you are changing the license of an already existing installation, you need to pay attention to which check boxes are selected. If you are adding products not previously part of your installation, but added with the new license file, then you need to verify the selection of the check boxes for the corresponding installation components. (If you do not, the license information is still correct but the software components needed to run the products will be missing.)

Add/Remove Products and Repair

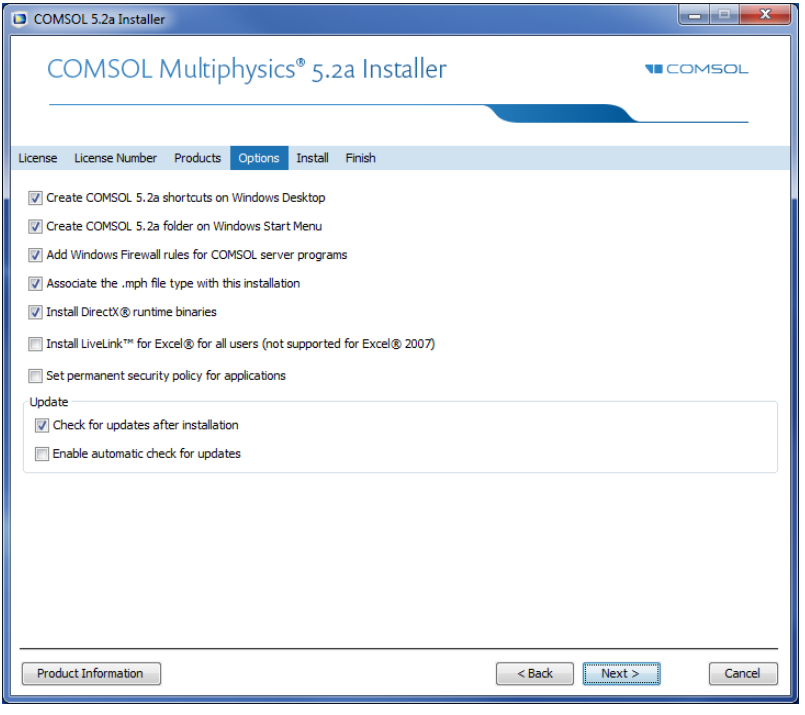
- If **Add/Remove Products and Repair** or **Change License** was selected in Step 2, the Products page includes a **Repair all selected products** check box. If you select this check box, the selected set of products determines which software components, documentation, and models are to be added or removed. Products that are selected are added if not previously installed, and products

that are not selected are removed if previously installed. The selected set only affects those products that you have licensed..

You can also add, remove, and repair COMSOL products from the installed instance. When adding or repairing products, you can select to download the files from the Internet or to provide the original DVD.

6 Click **Next**.

OPTIONS PAGE



7 On this page, you can set the following installation options:

- **Create COMSOL 5.2a shortcuts on Windows Desktop**.
- **Create COMSOL 5.2a folder in the Windows Start Menu**.
- **Add Windows Firewall rules for COMSOL server programs**. This check box adds firewall rules that allows COMSOL server programs to open ports and

communicate over the computer network. If you clear this check box, you may get a warning from the Microsoft Firewall when you start a COMSOL server, or a COMSOL server may not work as expected when you run it as a Windows service.

- **Associate the .mph file type with this COMSOL installation**.

  If this check box is selected, you can open COMSOL models by double-clicking them.

- **Install Microsoft DirectX® runtime binaries**.

  Clear the **Install Microsoft DirectX® runtime binaries** check box if you previously experienced problems using DirectX on your computer. DirectX can be used by COMSOL for accelerated graphics rendering. If you clear this check box, then you still have two graphics options: OpenGL or software rendering. Once installation is complete, you can change the graphics rendering method from the Preferences dialog box on the Options menu in the COMSOL Desktop.

For a Floating Network License, you can access COMSOL with a Windows Remote Desktop connection. This way of accessing COMSOL is only supported with the software rendering graphics option.

- **Install LiveLink™ for Excel® for all users (not supported for Excel® 2007)**. If you select this check box, the installation of LiveLink™ *for* Excel® is global to the machine and is available no matter which user is logged on. Otherwise, the installation is only available to the current user (this is the only supported option for Excel 2007).
- **Set permanent security policy for applications**. If you select this option, the next page in the installer provides security options that you can set permanently; see Security Page. If you set a permanent security policy, the

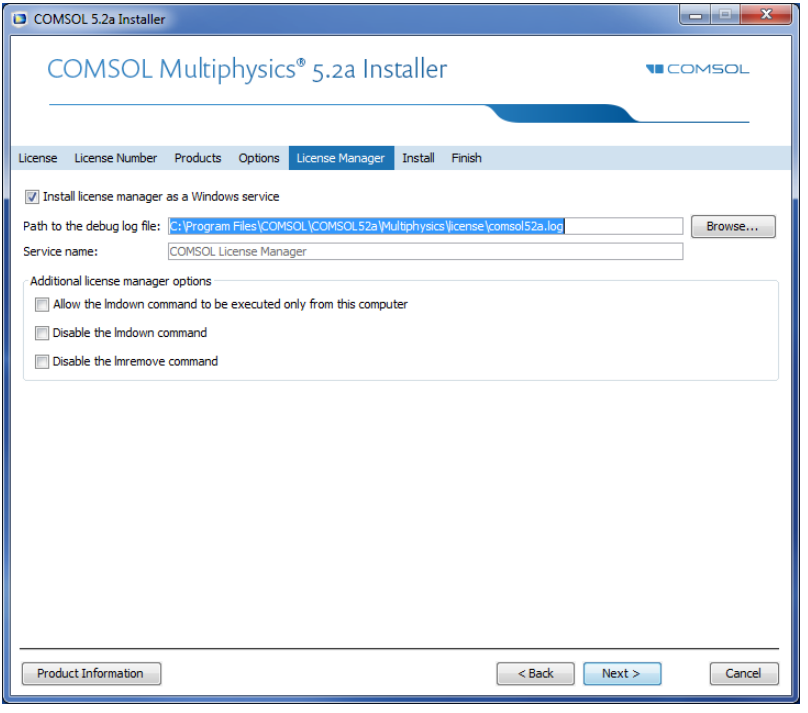
security settings in the **Preferences** dialog box is not available when you run COMSOL.

The following two options are available under **Update**:

- **Check for updates after installation**. This option is selected by default. The installer then checks and applies all updates that are available for the version that you install.
- **Enable automatic updates after installation**. Select this check box if you want COMSOL to automatically check for and apply available software updates.
- If you install over the Internet using a proxy server, you can specify the host name, port number, and, optionally, a username and password if required. If you do not enter a port number, COMSOL uses port 443, which is the default port setting for the HTTPS protocol. These settings do not appear if you do not perform an installation via the Internet.
- For the LiveLink™ products *for* MATLAB®, PTC® Pro/ENGINEER®, and PTC® Creo® Parametric™, specify the path to their respective installation folders.

8 Click **Next**.

License Manager Page



9 The **License Manager** page appears if the COMSOL Installer installed the FlexNet license manager and your computer has been designated to run the license server. If this page does not appear you can manage the license server using LMTOOLS; see Starting the License Manager. This page contains the

following options:

- The **Install license manager as a Windows service** check box is selected by default; if you clear the check box, the license manager will not be available as a Windows service.
- The **Path to the debug log file** field contains a file path to the location of the license manager debug log file (default: `C:\comsol.log`). Click **Browse** to browse to and choose another file path.
- The **Service name** field shows the service name, `LMCOMSOL`, for information only.
- Under **Additional license manager options**, you can select any of the following check boxes:

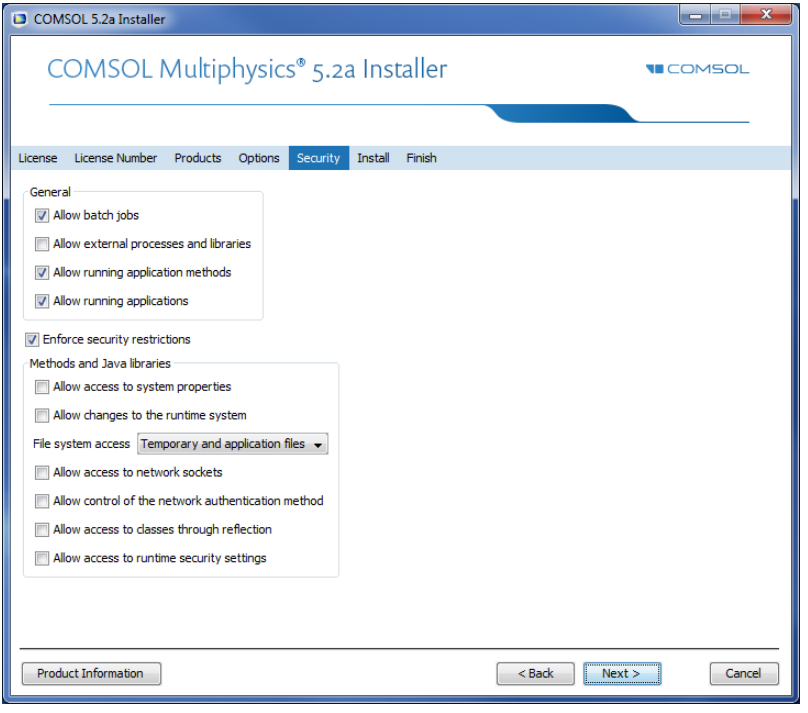
  Select the **Allow the lmdown command to be executed only from this computer** check box to restrict the access to the `lmdown` command, which you can use to shut down the license manger, to this computer only.

  Select the **Disable the lmdown command** check box to make the `lmdown` command unavailable.

  Select the **Disable the lmremove command** check box to make the `lmremove` command, which you can use to remove a user's license, unavailable.

Security Page

10 The **Security** page is only available if you have selected the **Set permanent security policy for applications** check box.



COMSOL includes security settings for controlling access to, for example, system properties, file systems, and runtime security settings from methods and external libraries, primarily for use in applications created using the Application Builder. The following security settings are available on the **Security** page in the installer:

- Select the **Allow batch jobs** check box to allow batch jobs. This restriction affects the Batch, Batch Sweep, Cluster Computing, and Cluster Sweep nodes in the COMSOL Desktop model tree.
- Select **Allow external processes and libraries** to allow applications to start external processes on the computer. This includes using the built-in `executeOS()` method. You need to select this check box to call functions written in

MATLAB (requires LiveLink™ *for* MATLAB®). This setting also allows external C libraries to be called from methods in an application.

- Select **Allow running application methods** to allow running applications that include methods. If you clear this check box, it is not possible to run methods in applications.
- Select **Allow running applications** to allow running applications in general. If you clear this check box, it is not possible to run any applications.

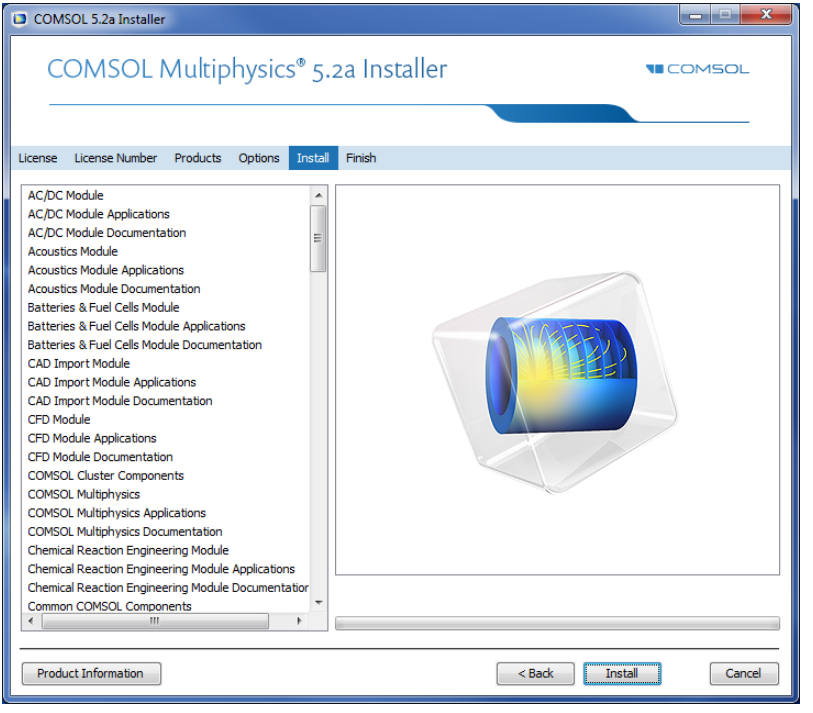
By default, all check boxes above except the **Allow external processes and libraries** check box are selected.

- The **Enforce security restrictions** check box is selected by default. If selected, this check box enforces the following restrictions on methods and Java libraries under **Methods and Java libraries**:
- Select the **Allow access to system properties** check box to read and write values to system properties such as `System.getProperty("cs.np")` which can be used to determine the number of cores that COMSOL Multiphysics currently uses.
- Select the **Allow changes to the runtime system** check box to allow methods and Java libraries to change the runtime system — for instance, by modifying class loaders.
- From the **File system access** list, select **Temporary and application files** (the default) to restrict methods and Java libraries to only have access to such files, or select **All files** to allow methods and Java libraries to access all files that you have permissions to access on the file system.
- Select the **Allow access to network sockets** check box to allow methods and Java libraries to open sockets for network access.
- Select the **Allow control of the network authentication method** check box to allow methods and Java libraries to control the network authentication method used.
- Select the **Allow access to classes through reflection** check box to allow access to all members in a class through reflection.
- Select the **Allow access to runtime security settings** check box to allow methods and Java libraries to access security settings.

All check boxes above are cleared by default, enforcing those security restrictions.

11 Click **Next**.

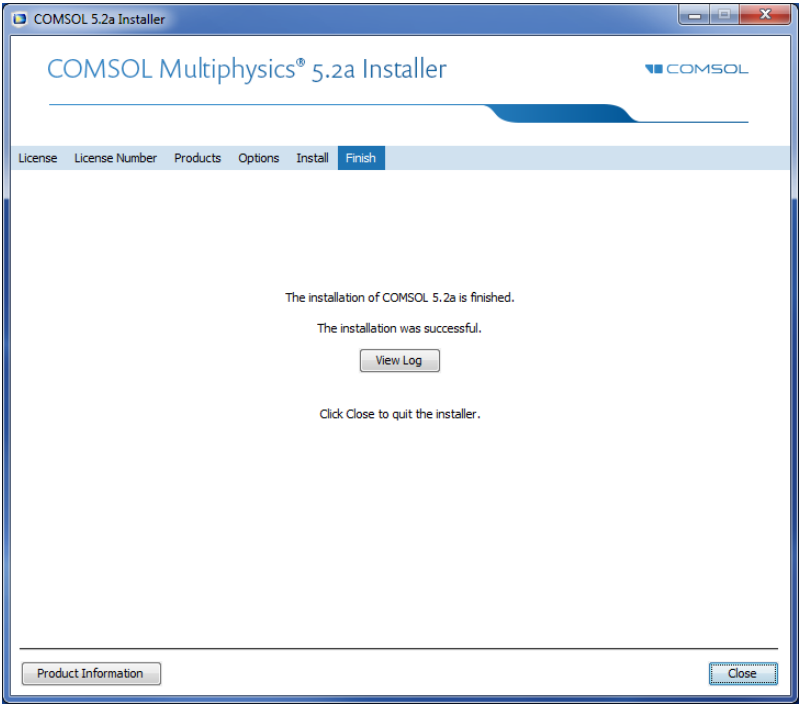
INSTALL PAGE



12 When you click **Install** the utility now installs or updates COMSOL. The installation process might take several minutes. A full installation including all products typically takes more than 15 minutes to complete. If you are installing over the Internet, the installation time depends on your Internet connection speed. The Finish page in Step 13 appears automatically when the installation process is finished.

Finish Page

13 This window appears when the installation is finished.



If warning or errors were detected, click **View Log** to open a window that shows the installation log. Do not hesitate to contact technical support if you encountered any errors and remember to send the installation log file along with your technical support inquiry.

14 Click **Close** to quit the installer.

For information on how to run COMSOL after installation, see Running COMSOL on Windows. If you are installing on a Mac, see Running COMSOL on OS X. If you are installing on Linux, see Running COMSOL on Linux.

Removing (Uninstalling) the COMSOL Installation

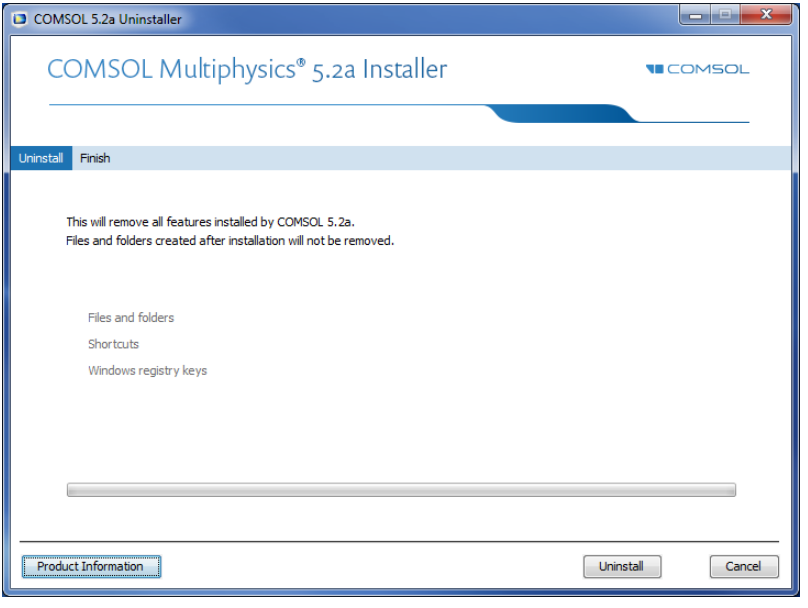
To remove a COMSOL installation from your system, you can uninstall using the COMSOL Installer's uninstallation option. The uninstaller deletes all old version

COMSOL files and directories on the system that were installed by the COMSOL installer. Additional files and folders created after installation are not removed.

If COMSOL is run with MATLAB, close MATLAB before starting the uninstaller. If MATLAB is active, the utility cannot remove certain files.

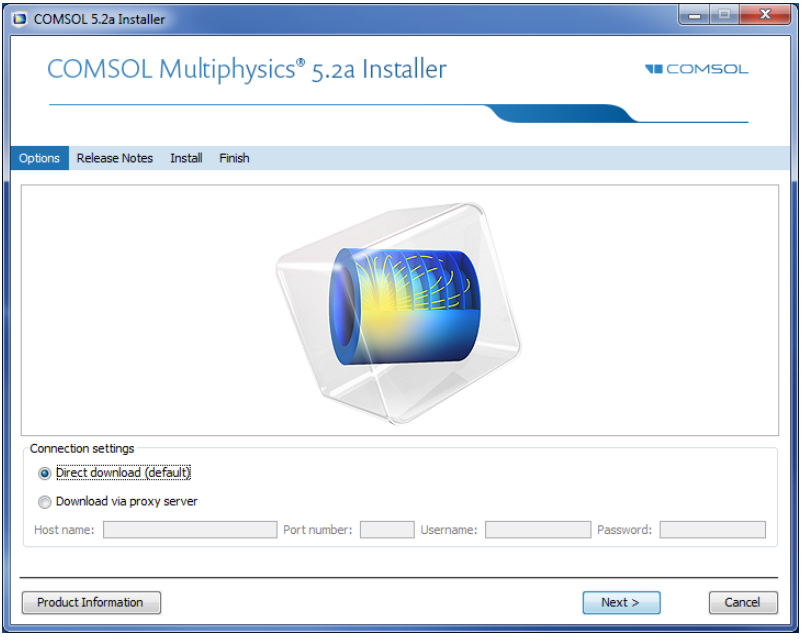
You can start the COMSOL Uninstaller in a few different ways:

- From the Windows Start Menu, open the **Control Panel** and select **Uninstall a program**. Find COMSOL Multiphysics 5.2a in the list and select **Uninstall**.
- From the Windows Start Menu under COMSOL Multiphysics 5.2a, select **Uninstall**.
- Insert the COMSOL DVD and start the COMSOL Uninstaller. Click **Uninstall COMSOL 5.2a** to start removing the installation. Click **Finish** to quit the installer when the uninstallation is complete.
- In Windows 8 and later, go to the **All apps** page and click the COMSOL Launchers folder. In that folder you find the option to uninstall.



Installing Software Updates

COMSOL provides software updates that improve the software and correct issues. To check if an update is available, choose **Check For Product Updates** from the **Help** menu. If an update is available, an **Update** dialog box appears. Click **Download** to download the update directly, or click **Browse Update** to open the COMSOL website where you can read about and download the update. To check for updates automatically each time you start COMSOL Multiphysics, select the **Check for updates at launch** check box under **Product updates** on the **Updates** page in the **Preferences** dialog box. When the update installation starts (close any running instance of COMSOL first) you see the following installation window:



If a COMSOL process is running when you start an update installation, you must instead first choose one of the following options:

- **Cancel**: Stop the update so that you can close any running instances of COMSOL and then perform the update again.
- **Try Again**: Restart the update process, if you have closed any running instances of COMSOL.
- **Continue Anyway**: Proceed with the upgrade, ignoring any running instances of COMSOL.

You can use a direct download (the default) or download via a proxy server. If you download via a proxy server, specify the host name and port number for the proxy and, if required, a username and password. Other alternative are to launch an update from the COMSOL folder in the Start menu or to launch `setup.exe` from the COMSOL installation directory.

As an alternative, you can update COMSOL without starting the update from inside COMSOL Multiphysics. To do this, from the Windows Start Menu under COMSOL Multiphysics 5.2a, select **Update**. This launches the update program. On Windows 8, go to the **All apps** page and click the COMSOL Launchers folder. In that folder you find the update program.

Automated Installation

You can install COMSOL using an automated installation process with minimal user interaction. This method requires installation from a DVD or DVD image. An answer file then responds to questions while the installer is running. The answer file is a text file with a specific format that contains predefined settings that the COMSOL installer uses. Start the installation by running

```
<path to DVD>\setup.exe -s <path to answer file>
```

where `<answer file path>` is the path to your answer file. A template answer file, `setupconfig.ini`, with detailed usage information is available on the DVD.

Automated Removal (Uninstallation) of COMSOL

You can uninstall COMSOL using an answer file:

1. Edit the answer file and set `uninstall` to `1`.
2. Run `<path to COMSOL>\bin\win64\setup.exe -s <path to answer file>`

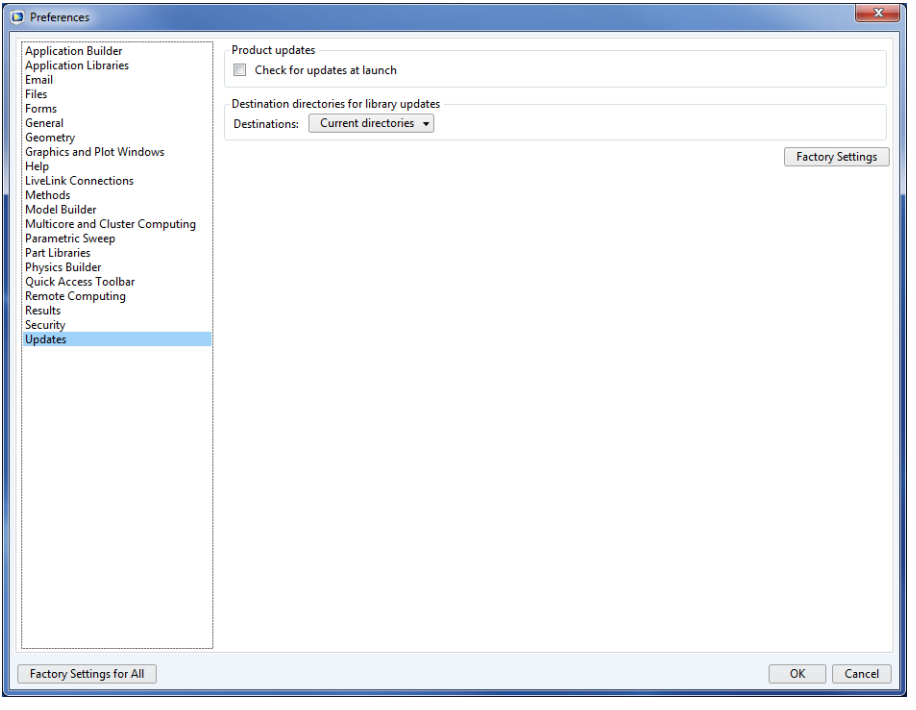
where `<path to answer file>` is the path to your answer file. If you attempt to enter the command using Windows Command Prompt (`cmd`), make sure you execute the command outside the `<path to COMSOL>` directory or any subdirectory.

Product Updates and Library Updates

COMSOL periodically releases product updates with improvements and corrections to reported problems. By default, COMSOL checks for updates at startup. You can turn this feature on and off from the COMSOL Desktop Preferences window. Here you can also configure settings for the Application Library Update.

The Application Libraries for the COMSOL products are updated on a regular basis by COMSOL. To open the Application Library Update window from the File>Help menu (Windows users) or from the Help menu (Mac and Linux users), select Update COMSOL Application Library.

This connects you to the COMSOL Application Library Update website where you can access the latest updates. This includes files that have been added or improved since the latest product release.



Using the **Updates** section in the **Preferences** dialog box you can configure proxy server settings as well as application and documentation directories for the Application Library Update. See the *COMSOL Multiphysics Reference Manual*

for more information, including command-line options for the Application Libraries.

In a similar way, you can also update the COMSOL Part Libraries. To open the Part Library Update window from the File>Help menu (Windows users) or from the Help menu (Mac and Linux users), select Update COMSOL Part Library.

LiveLink™ *for* Excel® Installations

If you have licensed LiveLink™ *for* Excel®, several tools are accessible from a COMSOL tab in the Excel ribbon for working with a COMSOL model from an Excel worksheet. You can, for example, extract model definitions and results. You can also change model definitions in the worksheet, then update and re-compute the model.

Whenever you open a COMSOL model from Excel, a COMSOL Multiphysics Server is started where the model is loaded. The data transfer between Excel and the COMSOL Multiphysics Server application is performed using a TCP/IP communication protocol, which accepts only local connections.

LiveLink™ *for* SOLIDWORKS®: Add-In for SOLIDWORKS

If you have licensed LiveLink™ *for* SOLIDWORKS®, the COMSOL Installer registers an add-in called the LiveLink for COMSOL (5.2a). This add-in should appear in the SOLIDWORKS user interface, listed in the Add-Ins dialog box, accessible from the Tools menu.

The add-in provides tools for preparing your SOLIDWORKS design for simulation with COMSOL. For example, you can create selections on the geometry and set up dimensional parameters. Those selections and parameters, together with the geometry, are synchronized with the COMSOL model.

The add-in enables two modes of setting up simulations based on the SOLIDWORKS design:

- In one mode you can run SOLIDWORKS and the COMSOL Desktop side-by-side and synchronize the geometry between the two.
- In another mode you can work with COMSOL simulations inside SOLIDWORKS. This latter mode is called the One-Window interface. Only

one version of the One-Window interface can be active at a time. If you have several COMSOL versions installed, make sure that the latest version of LiveLink for COMSOL is selected from the **COMSOL>One-Window Version** menu inside SOLIDWORKS. If required, restart SOLIDWORKS after changing the One-Window interface version.

If COMSOL cannot connect to SOLIDWORKS, you can re-install COMSOL, or follow the instructions from the following link:
http://www.comsol.com/support/knowledgebase/1122.

LiveLink™ *for* Inventor®: Add-in for Autodesk Inventor

If you have licensed LiveLink™ *for* Inventor®, the installer registers an add-in for Autodesk Inventor called the LiveLink for COMSOL (5.2a). This add-in should appear in the Add-In Manager dialog box that is accessible from the Options tab of the Tools panel in the Autodesk Inventor user interface.

The add-in provides tools for preparing your Inventor design for simulation with COMSOL. For example, you can set up dimensional parameters that, together with the geometry, are synchronized with the COMSOL model.

The add-in enables two modes of setting up simulations based on the Inventor design:

- In one mode you can run Inventor and the COMSOL Desktop side-by-side and synchronize the geometry between the two.
- In another mode you can work with COMSOL simulations inside Inventor. This latter mode is called the One-Window interface.

If COMSOL cannot connect to Inventor, you can re-install COMSOL, or follow the instructions from the following link:

http://www.comsol.com/support/knowledgebase/1163.

LiveLink™ *for* AutoCAD® Installations

If you have licensed LiveLink™ *for* AutoCAD®, the installer registers an add-in with AutoCAD. This add-in is loaded on start-up of AutoCAD and provides

functionality for synchronizing the geometry between AutoCAD and COMSOL. When the add-in is loaded a COMSOL Multiphysics tab appears in AutoCAD.

If for some reason the COMSOL Multiphysics tab does not appear try to reinstall LiveLink for AutoCAD.

LiveLink™ *for* PTC® Pro/ENGINEER®: Changing the Installation Path

If you have licensed LiveLink™ *for* PTC® Pro/ENGINEER®, you need to provide the installation path for PTC Pro/ENGINEER or PTC Creo Elements/Pro during the install process. The installer registers an add-in with PTC Pro/ENGINEER called LiveLink for COMSOL (5.2a). The add-in should be listed in the Auxiliary Applications dialog box that is accessible from the Tools menu in the PTC Pro/ENGINEER user interface. The add-in provides functionality for selecting dimensional parameters that can be synchronized with COMSOL.

After the installation you can configure the interface to work with a different PTC Pro/ENGINEER installation. Go to the Preferences window, which you can access from the Options menu inside the COMSOL Desktop. There find the LiveLink products section and edit the PTC Pro/ENGINEER installation folder. It should point to the root directory of the PTC Pro/ENGINEER installation, typically

```
C:\Program Files\proeWildfire 5.0
```

or, for an installation of PTC Creo Elements/Pro,

```
C:\Program Files\PTC\Creo Elements\Pro5.0
```

If you have installed both LiveLink for PTC Pro/ENGINEER and LiveLink for PTC Creo Parametric, you can use only one of those during a COMSOL Multiphysics modeling session. The default is to connect to PTC Creo Parametric. To connect to PTC Pro/ENGINEER select LiveLink for PTC Pro/ENGINEER from the Use list.

Restart COMSOL for the changes to take effect.

Note that changing the PTC Pro/ENGINEER installation folder in the Preferences window does not re-register the add-in with that PTC Pro/ENGINEER installation. To do this you can reinstall COMSOL, or follow the instructions from the following links “Parameter Selection is not available in the PTC Pro/ENGINEER user interface”:

http://www.comsol.com/support/knowledgebase/1159

If COMSOL cannot connect to PTC Pro/ENGINEER Wildfire 4.0, follow the instructions from the following link:

http://www.comsol.com/support/knowledgebase/1162

LiveLink™ *for* PTC® Creo® Parametric™: Add-in for PTC Creo Parametric

If you have licensed LiveLink™ *for* PTC® Creo® Parametric™, you need to provide the path to the common files folder in the PTC Creo Parametric installation during the installation process.

It should point to the common files directory of the PTC Creo Parametric installation, which is typically for PTC Creo Parametric 2.0

```
C:\Program Files\PTC\Creo 2.0\Common Files\M040
```

and for PTC Creo Parametric 3.0

```
C:\Program Files\PTC\Creo 3.0\M190\Common Files
```

Based on this path the COMSOL Installer registers an add-in that is loaded by PTC Creo Parametric. Subsequent changes to the location of the COMSOL or PTC Creo Parametric installations will cause the loading of the add-in, and the connection between COMSOL and PTC Creo Parametric to fail. Updating PTC Creo Parametric will have the same result.

To re-register the add-in with the PTC Creo Parametric installation you can reinstall LiveLink for PTC Creo Parametric, or follow the instructions from the following link:

http://www.comsol.com/support/knowledgebase/1158.

LiveLink™ *for* Revit®: Add-in for Revit

If you have licensed LiveLink™ *for* Revit®, the installer registers an add-in for Revit Architecture. When the add-in is loaded a tab called COMSOL Multiphysics appears in Revit Architecture. The COMSOL Multiphysics tab will not appear if the add-in cannot be loaded by Revit Architecture. This can happen if, for example, the COMSOL installation is moved to a different location. To restore the add-in you can reinstall LiveLink for Revit.

LiveLink™ *for* Solid Edge®: Add-in for Solid Edge

If you have licensed LiveLink™ *for* Solid Edge®, the installer creates an add-in to Solid Edge called LiveLink for COMSOL (5.2a). This add-in should appear in the Add-In Manager dialog box that is accessible in the Solid Edge user interface if you click the Applications button, then select Add-Ins from the menu.

When the add-in is active a COMSOL Multiphysics tab appears in Solid Edge. Use the Parameter Selection tool from the tab to select dimensional parameters that, together with the geometry, are synchronized between Solid Edge and COMSOL.

If COMSOL cannot connect to Solid Edge, you can re-install COMSOL, or follow the instructions from the following link "Error: Failed to connect to Solid Edge":

http://www.comsol.com/support/knowledgebase/1160

Cluster Installation

COMSOL supports two mutual modes of parallel operation: shared-memory parallel operations and distributed-memory parallel operations, including cluster support. This section is dedicated to distributed-memory parallel installation.

COMSOL can distribute computations on compute clusters using the MPI model. One large problem can be distributed across many compute nodes. Also, parametric sweeps can be distributed with individual parameter cases distributed to each cluster node.

LICENSE MANAGER

COMSOL requires a Floating Network License for running on clusters. Please check the license file for the CLUSTERNODE feature, which needs to be present to enable the cluster computing functionality. The license manager needs to be accessible from all nodes in the cluster. Therefore it is often a good idea to have it run on the head node.

INSTALLATION FOLDER

The COMSOL installation folder should be shared between all compute nodes and the head node.

FEATURES

During installation, make sure the Cluster Components feature is selected.

ACCESS TO CLUSTER (WINDOWS SERVER ONLY)

If you work on a desktop PC, install COMSOL on that PC. Before you start, you need to install Windows HPC Pack on the PC. This software is free and enables you to access the cluster from your PC.

For more information on installing and running COMSOL on clusters, see Running COMSOL on Clusters and the *COMSOL Multiphysics Reference Manual*.

License Manager Installation on Windows

Depending on your region and operating system, you might be required to install and run the FlexNet license manager software in order to run COMSOL.

What is the FlexNet® License Manager?

COMSOL uses the FlexNet license manager version 11 from Flexera Software, Inc. for license management. (FlexNet was formerly called FLEXlm™.)

The license manager comes bundled with any COMSOL installation. The COMSOL software products and the license manager can be installed in any order, unless you are installing based on a port number and Host Name. In that case, the license manager software needs to be installed and started before installing COMSOL.

Installation of any paid-for license on Windows requires a license file (`license.dat`), which is sent to you by a COMSOL representative by email. You can view the contents of the license file by opening it with a text editor or word processing software. If the file contains a line starting with the word SERVER, then the FlexNet license manager is required. For a Floating Network License, the purpose of the license manager software is to count the number of concurrent users and to give an error message if the number exceeds the licensed number of concurrent users. Depending on your region and operating system, the license manager software might also be needed for Single User Licenses. In that case, the purpose of the license manager software is to lock a COMSOL session to a computer that is authorized by COMSOL.

The FlexNet license manager supports a heterogeneous network of Windows, Linux, and OS X computers. Both the license manager and the COMSOL software can run on either Windows, Linux, or Mac platforms. In this context, the computer where the license manager is installed is called the license server and any computer that has the COMSOL products installed is called a client. Any type of computer can function as a license server, such as a laptop, desktop, workstation or a centrally located server. COMSOL can be installed anywhere, typically on a local PC or on a file server where users access the program over a network. A single computer can function as both license server and client, holding both the license manager and COMSOL.

Even though the license manager and COMSOL can be installed in any order, a full test of the installation cannot be done until both are installed.

System Requirements for the FlexNet® License Manager

Before starting the installation process, check that your system meets all necessary requirements as listed at: www.comsol.com/system-requirements. For COMSOL, all requirements need to be met. If you are running the license manager on a license server where you did not intend to run COMSOL, the system requirements are less stringent. The license server only needs to meet the listed hardware and operating system requirements. For the license manager, memory and graphics requirements do not need to be met. The license manager is a much less CPU- and memory-demanding application than COMSOL.

FlexNet® License Manager Software Components

The license manager consists of four software components:

- License manager daemon (`lmgrd.exe`)
- Vendor daemon (`LMCOMSOL.exe`)
- FlexNet utility program (`lmutil.exe`)
- FlexNet Control Panel (`lmtools.exe`)

The two daemons (`lmgrd.exe` and `LMCOMSOL.exe`) run on the license server. When a user starts COMSOL on a client computer, communication is established through the network from the client to the license server and the license manager daemon (`lmgrd.exe`). That daemon in turn makes a request to the vendor daemon (`LMCOMSOL.exe`), which releases licenses according to information in the `license.dat` file. The FlexNet utility program and FlexNet Control Panel are used for handling license server management tasks.

FlexNet® License Manager Documentation

For detailed information on the FlexNet license manager software, choose File>Help>Documentation (Windows) or select Help>Documentation (Mac and Linux). Then scroll to the bottom of the page to locate a PDF copy of the *FlexNet License Administration Guide* for FlexNet Publisher. You can also find the FlexNet documentation on your hard drive. The default folder location is

```
C:\Program Files\COMSOL\COMSOL52a\Multiphysics\doc\pdf\COMSOL_Multiphysics\FlexNet
```

The License File

The license file has the same structure on all platforms: Windows, OS X, and Linux. In this section, the most important parts of the license file are explained. Below is an example of the contents of a `license.dat` file:

```
#-----------------------------------------------------------------
# COMSOL 5.2a FNL License No: 1234567
# Visit www.comsol.com/install for latest installation instructions
#-----------------------------------------------------------------
SERVER apollo.thecompany.com 0050569e1b87 1718
USE_SERVER
VENDOR LMCOMSOL port=1719
FEATURE SERIAL LMCOMSOL 5.2a permanent uncounted \
    VENDOR_STRING=C,5701108 HOSTID=ANY BORROW=720 SN=1234567 TS_OK \
    SIGN=0C3A8BF6722E
INCREMENT COMSOL LMCOMSOL 5.2a permanent 4 SUPERSEDE DUP_GROUP=UHD \
    ISSUED=6-JUN-2012 BORROW=720 SN=1234567 SIGN=123456789ABC
INCREMENT COMSOLGUI LMCOMSOL 5.2a permanent 4 SUPERSEDE DUP_GROUP=UHD \
    ISSUED=6-JUN-2012 BORROW=720 SN=1234567 SIGN=123456789ABC
INCREMENT HEATTRANSFER LMCOMSOL 5.2a permanent 2 SUPERSEDE \
    DUP_GROUP=UHD ISSUED=6-JUN-2012 BORROW=720 SN=1234567 \
    SIGN=123456789ABC
INCREMENT CLIENTSERVER LMCOMSOL 5.2a permanent 4 SUPERSEDE \
    DUP_GROUP=UHD ISSUED=6-JUN-2012 BORROW=720 SN=1234567 \
    SIGN=123456789ABC
INCREMENT CLUSTERNODE LMCOMSOL 5.2a permanent 4 SUPERSEDE DUP_GROUP=U \
    ISSUED=6-JUN-2012 BORROW=720 SN=1234567 SIGN=123456789ABC
INCREMENT COMSOLBATCH LMCOMSOL 5.2a permanent 2 SUPERSEDE \
    DUP_GROUP=UHD ISSUED=6-JUN-2012 BORROW=720 SN=1234567 \
    SIGN=123456789ABC
INCREMENT HEATTRANSFERBATCH LMCOMSOL 5.2a permanent 2 SUPERSEDE \
    DUP_GROUP=UHD ISSUED=6-JUN-2012 BORROW=720 SN=1234567 \
    SIGN=123456789ABC
```

THE COMMENT LINES

Comment lines can be included in the license file by starting them with the hash symbol #. These lines have no effect on the license server or client.

THE SERVER LINE

In the `license.dat` file, the contents of the line starting with `SERVER` should contain:

- The Host Name of the license server. In the example above, the Host Name is `apollo.thecompany.com`. This name can be edited by the user.
- The hostid of the license server. In the example above, the hostid is `0050569e1b87`. This number cannot be edited by the user.
- A port number. In the example above, the port number is 1718.This number can be edited by the user.

Confirm that the license server Host Name is the actual name of your license server (the computer that you intend to run the FlexNet license manager software on); otherwise, change it by editing the file. The default port number (1718) can be changed in the unlikely event that another program is already using that port number (you then get an error message indicating this when starting the license manager). If the default port number 1718 is being used, change it to any other number between 1025 and 64,000.

THE USE_SERVER LINE

The USE_SERVER line, with no arguments, does not impact the license manager but has implications for the client. When a COMSOL client sees the USE_SERVER line, it ignores everything in the license file except the preceding SERVER lines and transfers checkout validation to the vendor daemon. This means that if you are running COMSOL on one computer, and the license manager on a different computer, then your license file can only contain two lines: the SERVER line and the USE_SERVER line.

THE VENDOR LINE

The VENDOR line defines the name of the LMCOMSOL vendor daemon. This name cannot be changed. The vendor daemon is a process that has to be running together with the license manager and is automatically started when the license manager is started. The LMCOMSOL vendor daemon requires its own port number. In the example above, the default port number 1719 is shown.

If the license manager is running on a computer with an active firewall and the COMSOL client is outside of that firewall, at least two port numbers must be opened up in the license server's firewall to allow client computers to connect to the license manager and the vendor daemon.

Using the example license file above, configure the firewall to allow access to the port numbers 1718 and 1719. If you have chosen other port numbers and modified the `license.dat` file accordingly, configure the firewall to allow access

to your chosen port numbers. If you are unsure about which port numbers are free or how to enable firewall port access, contact your system administrator.

You cannot modify anything in the `license.dat` file except the license server name and (if necessary) port numbers, or the license might not work.

THE SERIAL LINE

The SERIAL line contains information on the license type, license number, and the products included in the license.

THE INCREMENT AND FEATURE LINES

The INCREMENT or FEATURE lines contain a product name, version, expiration date, and the number of available licenses. The example file above shows that the user has a perpetual (permanent) COMSOL 5.2a Floating Network License allowing four concurrent users of COMSOL Multiphysics and two concurrent users of the Heat Transfer Module. The number after "SIGN=" at the end of each INCREMENT line contains a license key. Long lines can be broken by a continuation character (\).

The Feature Names

The following table contains the FEATURE names for all products in the COMSOL 5.2a product suite:

PRODUCT/FEATURE	FEATURE NAME
COMSOL Multiphysics	`COMSOL`
COMSOL Server	`COMSOLSERVER`
COMSOL Multiphysics GUI	`COMSOLGUI`
COMSOL Multiphysics Floating Network License	`CLIENTSERVER, CLUSTERNODE`
AC/DC Module	`ACDC`
Acoustics Module	`ACOUSTICS`
Batteries & Fuel Cells Module	`BATTERIESANDFUELCELLS`
CAD Import Module	`CADIMPORT, CADREADER`
CFD Module	`CFD`
Chemical Reaction Engineering Module	`CHEM`
Corrosion Module	`CORROSION`
Design Module	`DESIGN`
ECAD Import Module	`ECADIMPORT`
Electrochemistry Module	`ELECTROCHEMISTRY`

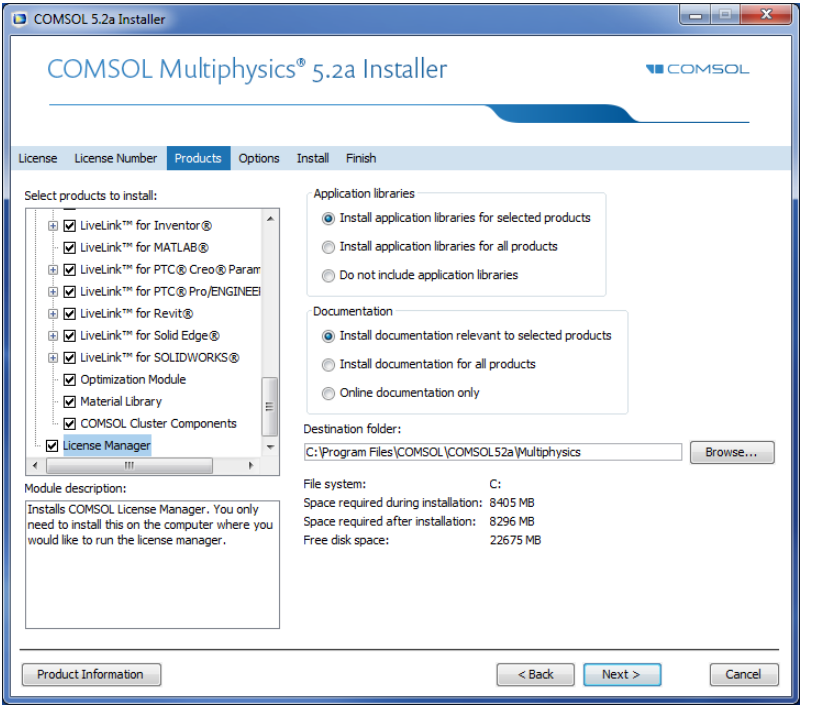
PRODUCT/FEATURE	FEATURE NAME
Electrodeposition Module	ELECTRODEPOSITION
Fatigue Module	FATIGUE
File Import for CATIA V5	CATIA5
Geomechanics Module	GEOMECHANICS
Heat Transfer Module	HEATTRANSFER
LiveLink™ *for* AutoCAD®	LLAUTOCAD
LiveLink™ *for* PTC® Creo® Parametric™	LLCREOPARAMETRIC
LiveLink™ *for* Excel®	LLEXCEL
LiveLink™ *for* Inventor®	LLINVENTOR
LiveLink™ *for* MATLAB®	LLMATLAB
LiveLink™ *for* Revit®	LLREVIT
LiveLink™ *for* PTC® Pro/ENGINEER®	LLPROENGINEER
LiveLink™ *for* Solid Edge®	LLSOLIDEDGE
LiveLink™ *for* SOLIDWORKS®	LLSOLIDWORKS
MEMS Module	MEMS
Microfluidics Module	MICROFLUIDICS
Mixer Module	MIXER
Molecular Flow Module	MOLECULARFLOW
Multibody Dynamics Module	MULTIBODYDYNAMICS
Nonlinear Structural Materials Module	NONLINEARSTRUCTMATERIALS
Optimization Module	OPTIMIZATION
Particle Tracing Module	PARTICLETRACING
Pipe Flow Module	PIPEFLOW
Plasma Module	PLASMA
Ray Optics Module	RAYOPTICS
RF Module	RF
Semiconductor Module	SEMICONDUCTOR
Structural Mechanics Module	STRUCTURALMECHANICS
Subsurface Flow Module	SUBSURFACEFLOW
Wave Optics Module	WAVEOPTICS

In addition, the following postfix additions are available:

- BATCH is a postfix for all COMSOL Multiphysics features to support batch processes running on separate computers, normally used only for floating network licenses.
- CSL is a postfix corresponding to COMSOL Server license for different COMSOL products.
- BACSL is a postfix corresponding to BATCH for COMSOL Multiphysics but issued for COMSOL Server licenses.

Installing the License Manager

The FlexNet license manager is automatically installed when installing COMSOL unless otherwise specified on the Products page of the COMSOL Installer; see Products Page. In some cases, it is also automatically configured to run as a service. The check box for the license manager components can be found last in the list of software components, as seen in the picture below:



If you do not intend to run the license manager software on the computer for which you are installing COMSOL, you can clear this check box during installation. The license manager components require about 8 MB amount of hard disk space.

If you want to install COMSOL on the same computer as the license manager, first perform a complete COMSOL installation including the license manager software components. When finished, skip the remainder of this section and continue with Starting the License Manager.

To install only the license manager, follow the installation instructions for COMSOL earlier in this document and on the Products page and clear all check boxes except the one for the license manager

AUTOMATED LICENSE MANAGER INSTALLATION

Alternatively, the license manager can be installed using an automated installation process with minimal user interaction; see Automated Installation. Set `licmanager = 1` in the answer file to install the license manager. Also, it is possible to automatically configure the license manager to run as a service on Windows.

Starting the License Manager

The license manager can be started manually, or it can be configured to start automatically as a service each time the computer is rebooted.

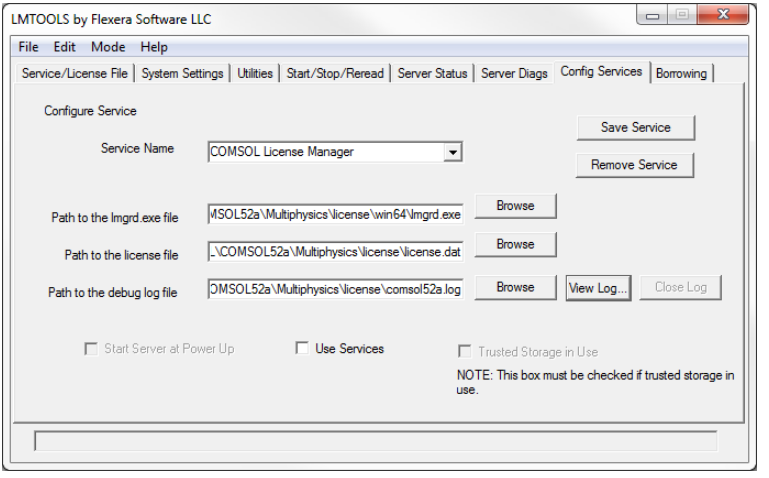
The installer can set up the license manager to start automatically; in case it did, you can skip the following section.

STARTING THE MANAGER AUTOMATICALLY AS A SERVICE

To set up the license manager as a service from the FlexNet Control Panel (LMTOOLS):

1. Locate the `COMSOL52a\license\win64` folder and run `lmtools.exe`. Alternatively, run **LMTOOLS** from the Windows **Start** menu, available under **COMSOL Multiphysics 5.2a>License Tools>LMTOOLS**.
2. On the **Service/License File** page choose **Configuration using Services**.

3 Click the **Configure Services** tab.



4 Make an entry in the **Service Name** field, for example, COMSOL License Manager.

5 Specify the full paths to `lmgrd.exe` and `license.dat` by browsing to their locations on your hard drive. The default location for `lmgrd.exe` is `C:\Program Files\COMSOL\COMSOL52a\Multiphysics\license\win64\lmgrd.exe`, and for the license file, it is `C:\Program Files\COMSOL\COMSOL52a\Multiphysics\license\license.dat`. For the debug log file, you can use any name of your choice, for example, `comsol52a.log`. For convenience you can place this next to your license file at: `C:\Program Files\COMSOL\COMSOL52a\Multiphysics\license\comsol52a.log`.

Make sure your Windows user account has read/write permission for the folder of the debug log file, otherwise the debug log file is not created.

6 Select the **Use Services** check box (this might not be possible on all platforms, but it is recommended when available) and then the **Start Server at Power Up** check box.

7 Click **Save Service**. The license manager now starts at automatically when you reboot the license server computer. If you want to start the license manager right away without restarting the license server computer, click **Start Server** on the **Start/Stop/Reread** page of the FlexNet Control Panel.

Starting the License Manager Manually

To start the license manager manually, browse to the `license\win64` folder. Now, in a Windows command window enter

```
lmgrd -c ..\license.dat -l ..\comsol52a.log
```

The license manager is now ready to distribute licenses over the network. It writes debug information to the log file `COMSOL52a\Multiphysics\license\comsol52a.log`.

Verifying that the License Manager is Running

Once you start the license manager, it is good practice to verify that the license manager service is running. Start the Windows Task Manager and go to the Services page. Check that the LMCOMSOL service is running.

Starting COMSOL

After the installation is complete and the license manager daemons are running on the license server, you can start using COMSOL. For more information on how to run COMSOL, see Running COMSOL on Windows.

Changing the License

If you have received a new license file — for example, when adding COMSOL products to an existing license — replace the current license file with the new one. Double-check the contents of this file to make sure it lists the products that the license includes. See also The Feature Names.

When the license file has changed, you must restart the license manager; otherwise, it continues to use the old license file still in memory.

RESTARTING THE LICENSE MANAGER

To restart the license manager, follow these steps:

1. In the Windows Start menu, choose **COMSOL Multiphysics 5.2a>License Tools>LMTOOLS**.
2. In the FlexNet Control Panel, click, in this order, **Stop Server** and **Start Server**.

OBTAINING A HOSTID

If you need to verify the hostid of the license server, you can follow the steps for Obtaining the Hostid. Alternatively, if COMSOL is already installed on the license server, you can determine the hostid by running the `lmhostid` command

```
COMSOL52a/Multiphysics/license/win64/lmutil lmhostid
```

The hostid is typically the Ethernet address (also called a MAC address) of the network card of your computer. An Ethernet address has six bytes, each with two hexadecimal digits. Thus, the full hostid has twelve hexadecimal digits. Alternatively, the hostid can be the volume serial number of your C hard drive. The volume serial number has 4 bytes, each with two hexadecimal digits. In this case, the full hostid has eight hexadecimal digits.

Troubleshooting License Errors

If you have questions or problems with your installation, see Troubleshooting License Errors.

After the installation is finished there is a COMSOL Multiphysics 5.2a shortcut icon on the Windows desktop:

as well as a COMSOL Multiphysics 5.2a folder on the Windows Start menu. To start COMSOL Multiphysics, double-click the desktop icon or select COMSOL Multiphysics 5.2a from the Windows Start menu. For instructions about running COMSOL on Windows 8 and Windows 10, see Running COMSOL on Windows® 10.

Cross-Platform User Interface

The default user interface for COMSOL is a Windows application. There is also a cross-platform user interface that you can start by going to the `bin\win64` folder in the COMSOL installation directory and double-clicking `comsolxpl.exe`. The cross-platform user interface is identical to the interface on Linux and OS X.

The COMSOL Folder on The Windows Start Menu

Depending on which COMSOL products and software components you have licensed and installed, the COMSOL Multiphysics 5.2a folder on the Start menu contains a selection of the items in the following list:

- COMSOL Multiphysics 5.2a: Starts the COMSOL Desktop.
- Model Animations: Launches a web browser with a selection of model animations at: www.comsol.com/showroom/animations
- Uninstall: Starts the COMSOL Uninstaller. For more information, see Removing (Uninstalling) the COMSOL Installation.
- Update: Starts the COMSOL Installer in update mode.

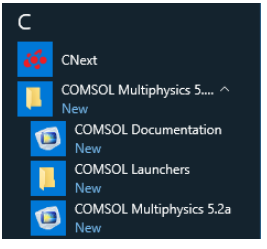
- Client-Server
  - COMSOL Multiphysics Client 5.2a: Starts a COMSOL Multiphysics Client that can be connected to a COMSOL Multiphysics Server.
  - COMSOL Multiphysics Server 5.2a: Starts a COMSOL Multiphysics Server that a COMSOL Multiphysics Client can connect to.

  For more information on running COMSOL in client-server mode, see Running COMSOL in Client-Server Mode.
- COMSOL with MATLAB: This is available if you have licensed the LiveLink *for* MATLAB®. It starts MATLAB and sets up all necessary paths. It also starts a COMSOL Multiphysics Server connected to MATLAB. See also Running COMSOL with MATLAB.
- Documentation: Opens a folder that contains COMSOL documentation shortcuts.
- License Tools: Starts the FlexNet license manager control panel (LMTOOLS). For more information, see License Manager Installation on Windows.

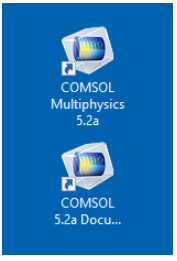
Running COMSOL on Windows® 10

On Windows 10, COMSOL can be started from three different locations:

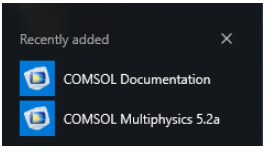
- There is a COMSOL Multiphysics tile on the Windows Start Menu:



- There are two icons on the Window Desktop for COMSOL Multiphysics and COMSOL Documentation (clicking COMSOL Documentation opens a standalone COMSOL Documentation window in a separate process):

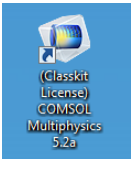


- The Windows All apps page shows recently added COMSOL programs:



Starting COMSOL for a Classkit License

If you have a Classkit License, you start it by double-clicking its dedicated Windows desktop icon:



For Windows 8, corresponding tiles and desktop icons are added.

Creating Desktop Shortcuts Manually

Sometimes it is necessary to create the COMSOL shortcuts manually, for example, when COMSOL is installed on a shared network drive.

1 Locate the COMSOL executable. Its default location is

```
C:\Program Files\COMSOL\COMSOL52a\Multiphysics\bin\win64\comsol.exe
```

2 Right-click `comsol.exe` and select **Create shortcut**, which creates a shortcut with a default name **comsol.exe - Shortcut**. If this shortcut is not created on the Desktop, then move it there by drag-and-drop.

Creating a Desktop Shortcut Manually for the Cross-Platform User Interface

The cross-platform user interface for COMSOL that is available on Mac and Linux has a slightly different look-and-feel than the user interface for Windows. You can get access to the cross-platform user interface from

```
C:\Program Files\COMSOL\COMSOL52a\Multiphysics\bin\win64\comsolxpl.exe
```

assuming that the default installation location has not changed by you during installation.

To create a shortcut to the cross-platform user interface, right-click `comsolxpl.exe` and select **Create shortcut**, which creates a shortcut with a default name **comsolxpl.exe - Shortcut**. If this shortcut is not created on the Desktop, then move it there by drag-and-drop.

Creating Desktop Shortcuts Manually for a Classkit License

If you manually create a desktop shortcut for a Classkit License, then, in addition to the steps above, the shortcut's Target needs to be modified with additional options. Right-click the **COMSOL** shortcut icon and select **Properties**. Change the text string in the **Target** field to

```
"C:\Program Files\COMSOL\COMSOL52a\Multiphysics\bin\win64\comsol.exe"
-Dcs.ckl
"C:\Program Files\COMSOL\COMSOL52a\Multiphysics\bin\win64\
comsolclasskit.ini"
```

(The complete text string must be written on a single row.)

Here, `C:\Program Files\COMSOL\COMSOL52a\Multiphysics` represents the default COMSOL installation directory and this can be changed in the Target field text string if your installation is placed in a different folder.

Running COMSOL in Client-Server Mode

When you start COMSOL by, for example, double-clicking the Windows desktop icon, COMSOL is run as a single application that includes both the COMSOL Multiphysics Client and COMSOL Multiphysics Server, as explained later in this section. However, the COMSOL client-server architecture lets you access the COMSOL Multiphysics Server — the COMSOL computational engine — as a separate process. For example, the COMSOL Desktop can act as a COMSOL Multiphysics Client when connected to a COMSOL Multiphysics Server.

The license server is not the same as a COMSOL Multiphysics Server. The license manager can run on a computer different from both the ones used by COMSOL Desktop and COMSOL Multiphysics Server.

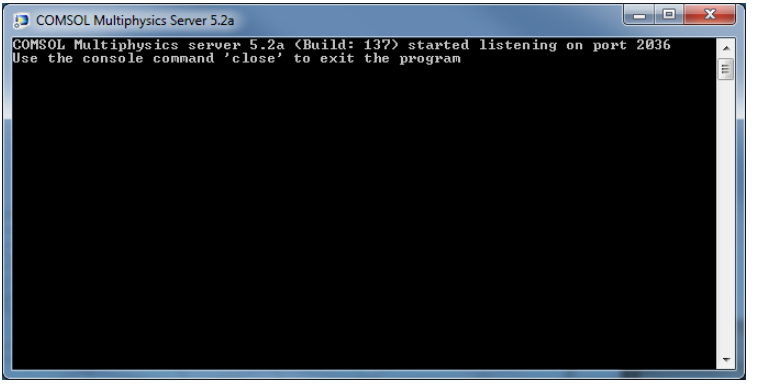
You need a Floating Network License to run the COMSOL Multiphysics Server and the COMSOL Multiphysics Client on separate computers. However, any COMSOL license is sufficient for running the Client and the Server on the same computer.

The Client and Server need not run on the same platform. For example, you can run the COMSOL Desktop on Windows connecting to a COMSOL Multiphysics Server on a Linux or Mac computer. This enables offloading heavy-duty computations from your personal laptop or desktop to run just the COMSOL Desktop graphical user interface. A typical use would be to run the COMSOL Multiphysics Server on a computer with large amounts of memory (RAM) and processing power and to use your personal computer for pre- and postprocessing with the COMSOL Desktop.

STARTING A COMSOL MULTIPHYSICS SERVER

The COMSOL Multiphysics server is a single user server allowing multiple sessions by the same user, one session at a time. To start the COMSOL Multiphysics Server, click COMSOL Multiphysics Server in the Client-Server folder underneath your COMSOL Multiphysics folder on the Windows Start menu. (On Windows 8 you find this on the All apps page under COMSOL Launchers.) When you start the COMSOL Multiphysics Server from the Windows Start menu, a command window appears asking you for a username and password. You can use any username and password of your choice, it is only used for

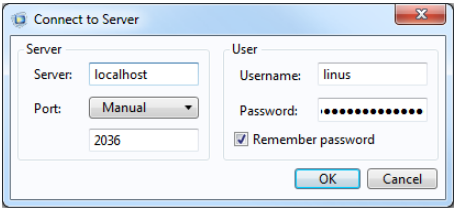
connecting a COMSOL Multiphysics Client with a COMSOL Multiphysics Server.



When the COMSOL Multiphysics Server starts, it listens for a COMSOL Multiphysics Client connection on the port listed in the command window. In the example above it is port 2036.

CONNECTING A COMSOL CLIENT TO A COMSOL MULTIPHYSICS SERVER

You can start a COMSOL Multiphysics Client session by clicking COMSOL Multiphysics Client in the Client-Server folder underneath your COMSOL folder on the Windows Start menu. (On Windows 8 you find this on the All apps page under COMSOL Launchers.) You can also connect to a COMSOL Multiphysics server from the COMSOL Desktop by selecting Connect to Server from the File menu. When you start the Client, a Connect to Server window appears prompting you for a computer name (Server) where the COMSOL Multiphysics Server is running, Port number, Username, and Password.



Once you have filled out this information and clicked OK, the COMSOL Multiphysics Server command window indicates that a COMSOL Multiphysics Client has connected. For more information on running COMSOL in Client-Server mode, see the *COMSOL Multiphysics Reference Manual*.

Running COMSOL in Batch Mode

You can submit COMSOL batch jobs from the COMSOL Desktop and the command line. To run a COMSOL batch job, you need to make the Batch feature visible: in the Model Builder tree, click the Show button ( ) and select Advanced Study Options. In the Model Builder, right-click a Study node and select Batch to create batch jobs. From the Windows command window, you can start batch jobs using the `comsolbatch` command. This is an example of how such a command could look like:

```
comsolbatch -inputfile in.mph -outputfile out.mph
```

To run a specific study add the command line option `-study <tag>`, where `<tag>` is the tag of the study to run, for instance, `std1`. To see the tag, click the toolbar button **Model Tree Node Text** in the **Model Builder** and select **Tag**.

The *COMSOL Multiphysics Reference Manual* has a dedicated section on running COMSOL from the Windows command window, including a list of COMSOL commands and associated syntax.

Multicore Settings

COMSOL supports two modes of parallel operation: shared-memory parallel operations and distributed-memory parallel operations, including cluster support. This section covers shared-memory processing, or multithreading, which is important for the performance of COMSOL computations. Some terms that are frequently used when describing multithreading are:

- *Core*: The core is a processor core used in shared-memory parallelism by a computational node with multiple processors.
- *Speedup* is how many times faster a job runs on *N* cores compared to 1 core, on a specific compute node. The speedup depends on the simulation type, the hardware used, and hardware drivers used.

In Windows, the default number of processor cores used by COMSOL is the total number of available physical cores. For example, if you have a 2 x dual core machine, 4 cores are used in parallel by a COMSOL process.

Here is how to find out how many processor cores your Windows machine has:

Window 8 And Later

1. Start the Windows Task Manager (press Ctrl-Shift-Esc or right-click the taskbar and choose Start Task Manager).
2. On the **Performance** page, click **CPU**. The number of cores can be seen as the number next to **Cores**.

Windows 7 and Windows Vista

1. In the Windows file browser, right-click **Computer** or **My Computer**, select **Properties**.
2. Click **Advanced system settings**. Go to the **Advanced** tab.
3. Click the **Environment Variables** button and look in the System variables list. Look for NUMBER_OF_PROCESSORS and check its value. This is actually the number of cores. If you have two processors with 2 cores each, this number is 4. Alternatively, start a Windows command window and type

```
WMIC CPU Get DeviceID,NumberOfCores
```

If you want COMSOL to leave out one or more processor cores you can set the number of cores used for a computational job in the **Preferences** dialog box on the **Multicore and Cluster Computing** page (by first selecting the **Number of cores** check box and then entering the number of processor cores to use).

You can also change the default behavior of COMSOL by setting the environment variable `COMSOL_NUM_THREADS` to the desired number of cores. See the *COMSOL Multiphysics Reference Manual* for more information.

Running COMSOL on Clusters

You can launch COMSOL cluster jobs from the COMSOL Desktop and the command line. To run COMSOL on a cluster, you need to make the cluster features visible: in the Model Builder tree, click the Show button ( ) and select Advanced Study Options. Then in the Model Builder, right-click a Study node and select Cluster Computing or Cluster Sweep to create cluster jobs. Cluster computing requires a Floating Network License.

The following terms occur frequently when describing the hardware for cluster computing and shared-memory parallel computing:

- Compute node: The compute nodes are where the distributed computing occurs. Each distributed COMSOL process resides in a compute node and

communicates with other compute nodes using MPI (message-passing interface).

- Host: The host is a physical machine (hardware) with a network adapter and unique network address. The host is part of the cluster. It is sometimes referred to as a physical node.
- Core: The core is a processor core used in shared-memory parallelism by a computational node with multiple processors.

The number of used hosts and the number of computational nodes are usually the same. For some special problem types, like very small problems with many parameters, it might be beneficial to use more than one computational node on one host.

A tutorial for cluster testing is included in the Application Libraries window under COMSOL Multiphysics>Tutorials>micromixer_cluster.

QUICK TROUBLESHOOTING

- Your first step is to make sure you have the latest release installed. Check that you have COMSOL 5.2a or later. Also make sure to install the latest product updates.
- For Windows HPC Server, log in to each node with remote desktop and start the COMSOL Desktop GUI. No error messages should be displayed.
- If you get the error message "Process status indicates that process is running," then cancel any running jobs in the Windows HPCS Job manager or other scheduler that you use. In the COMSOL Desktop, locate the External Process page at the bottom right. Click the Clear Status button.

For more information about how to run COMSOL in parallel on Windows clusters, see the *COMSOL Multiphysics Reference Manual*. For installation on Clusters, see Cluster Installation.

Running COMSOL on the Cloud

COMSOL supports cloud computing using Windows through Amazon Elastic Compute Cloud™ (Amazon EC2)™. See *Running COMSOL on the Amazon Cloud*. This PDF can be accessed online: www.comsol.com/ec2_manual.

Running COMSOL with MATLAB

Running COMSOL with MATLAB requires a LiveLink™ *for* MATLAB® license. To run COMSOL with MATLAB, double-click the COMSOL Multiphysics 5.2a with MATLAB icon on the desktop.

Alternatively, start COMSOL with MATLAB from the Start menu by pointing to Programs, then to COMSOL 5.2a, and then select COMSOL Multiphysics 5.2a with MATLAB. For Windows 8 and later, corresponding tiles and desktop icons are added, and you can click COMSOL Multiphysics 5.2a with MATLAB on the start screen to launch COMSOL.

Running COMSOL with MATLAB starts a COMSOL Multiphysics Server and a MATLAB Desktop. The COMSOL Desktop is not involved. You can change the path to the MATLAB installation in the Preferences window accessed from the Options menu of the COMSOL Desktop. For more information, see the LiveLink™ *for* MATLAB® documentation.

STARTING COMSOL WITH MATLAB USING THE GRAPHICS SERVER

To display the plot in a COMSOL graphics window you need to run COMSOL with MATLAB using the graphics server. To do so, append the flag `-graphics` to the COMSOL with MATLAB target path.

Installation Over the Internet

INSTALLATION OF A TRIAL LICENSE OVER THE INTERNET

A trial license can be given to you with the intention to test the software without any payment obligation for noncommercial and nonproduction use. This option is not available in all regions.

Installation of a Single User Trial License on Mac requires a license passcode. A passcode has a form similar to:

```
FFFFFFFF-TYUS-123456-1234567-123456789
```

This is usually sent to you by your COMSOL representative by email. Once you locate your passcode, follow these steps to prepare for download and installation:

1. Click the link for downloading the software as given in the software download email from your COMSOL representative. This link is identical or similar to: http://www.comsol.com/product-download.
2. If you haven't already created a COMSOL Access account, you are prompted to create it. When you have created the account, you can enter your trial passcode to associate it with your account information.

   If you already created a COMSOL Access account, you can associate the license file with your account on the COMSOL Access page under Manage Licenses at www.comsol.com/access/licenses.
3. Follow the web-based instructions to download the software.
4. Continue with the instructions in the section Downloading and Installing the COMSOL Software.

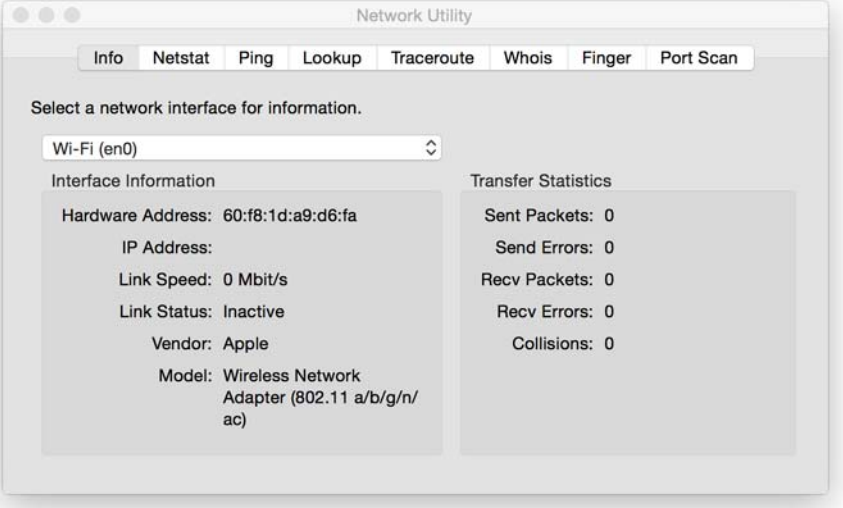
INSTALLATION OF A PAID-FOR LICENSE OVER THE INTERNET

Installation of any paid-for license on Mac requires a license file that is sent to you by your COMSOL representative by email. To be able to generate the license file, information about your hardware is needed in the form of a hostid (host ID). The hostid is used to lock the license to your hardware and needs to be sent by you to a COMSOL representative prior to the license file being generated.

Obtaining the Hostid

Follow these steps to obtain a hostid:

1. Launch the application **Network Utility** found in the **Applications/Utilities** folder or the **/System/Library/CoreServices/Applications** folder (on OS X Mavericks and OS X Yosemite).
2. Click the **Info** tab to the left.
3. Select **Network Interface (en0)**. This corresponds to your Ethernet card, WiFi card, or Thunderbolt port.
4. The hostid is the Hardware Address, as shown in the figure below, but with the colons (:) removed. If you plan to install on a computer with a wireless network card, report the hardware address for both Network Interface (en0) and Network Interface (en1).



Obtaining the Host Name

If you have been informed by your COMSOL representative that you need to run the FlexNet license manager for your installation, then you also need the Host Name. To get the Host Name, launch the **Terminal** application; then enter `hostname` at the terminal prompt.

If your network administrator prefers to use a fixed IP address for this particular computer, this IP Address could be optionally used in place of the Host Name. For more information on license manager installation, see License Manager Installation on OS X.

Obtaining the License File from a COMSOL Representative

Send the hostid information, as well as Host Name, if applicable, in an email to your COMSOL representative, who responds with an email including an attached license file (`license.dat`). Save this file to any location on your computer. You need to refer to it during installation. The license file is a text file. Below is an example of the contents of a `license.dat` file for a Single User License on Mac. This example license file shows that the licensed products are COMSOL Multiphysics, Particle Tracing Module, Subsurface Flow Module, and LiveLink™ *for* Excel®.

```
#--------------------------------------------------------------------
# COMSOL 5.2a NSL License No: 1234567 Windows/Mac
# Visit www.comsol.com/install for latest installation instructions
#--------------------------------------------------------------------
FEATURE SERIAL LMCOMSOL 5.2a permanent uncounted \
          VENDOR_STRING=C,18000100200 HOSTID=ANY sort=100 SN=1234567 \
          TS_OK SIGN=8045890A6FE4
FEATURE COMSOL LMCOMSOL 5.2a permanent uncounted HOSTID="70f2b13f4dfd \
          0116b8cc761a" PLATFORMS="i86_n x64_n i86_mac x64_mac" \
          SN=2076312 SIGN=E607EB680852
FEATURE PARTICLETRACING LMCOMSOL 5.2a permanent uncounted \
          HOSTID="70f1a12f4dfc 0026b9cc760a" PLATFORMS="i86_n x64_n \
          i86_mac x64_mac" SN=2076312 SIGN=3835733C6290
FEATURE SUBSURFACEFLOW LMCOMSOL 5.2a permanent uncounted \
          HOSTID="70f1a12f4dfc 0026b9cc760a" PLATFORMS="i86_n x64_n \
          i86_mac x64_mac" SN=2076312 SIGN=3A9BA162C9E4
FEATURE LLEXCEL LMCOMSOL 5.2a permanent uncounted HOSTID="70f1a12f4dfc \
          0026b9cc760a" PLATFORMS="i86_n x64_n i86_mac x64_mac" \
          SN=2076312 SIGN=EE9C11E44356
FEATURE COMSOLGUI LMCOMSOL 5.2a permanent uncounted \
          HOSTID="70f1a12f4dfc 0026b9cc760a" PLATFORMS="i86_n x64_n \
          i86_mac x64_mac" SN=2076312 SIGN=0D0A83382550
```

A Single User License file can normally not be edited or changed in any way by the user but has to be identical to the one sent to you by a COMSOL representative. However, if you were sent a license file that requires a license manager, then minor edits are required. For information on the type of license file required for installations using a license manager, see The License File.

Registering with COMSOL Access

Once you have saved your license file, follow these steps to register or login to COMSOL Access and to start the installation:

1. Click the link for downloading the software as given in the software download email from your COMSOL representative. This link is identical or similar to: www.comsol.com/product-download.

2 If you haven't already created a COMSOL Access account, you are prompted to create it. While creating the account, point to your license file (`license.dat`) to associate it with your account information.

   If you already created a COMSOL Access account, then you can associate the license file on the COMSOL Access page with your account under Manage Licenses at www.comsol.com/access/licenses/.

3 Continue with the instructions in the next section.

Downloading and Installing the COMSOL Software

1 Go to the web page www.comsol.com/product-download. To download the COMSOL installer, you must first create a COMSOL Access account as described in the section Installation over the Internet.

2 You are now given the options of downloading the COMSOL online installer or the COMSOL offline installer (a DVD image).

If you have problems downloading (such as **Error downloading file. Connection refused: connect**), please review this knowledge base entry: www.comsol.com/support/knowledgebase/1149. If you still have problems, contact your local COMSOL representative or technical support from the Support Center page www.comsol.com/support.

Starting the Online Installer for Installation over the Internet

The COMSOL Installer is a user interface tool that guides you through the installation process. The file to download is called `COMSOL52a_mac.dmg`. Start the COMSOL Installer by first mounting the downloaded file by double-clicking it. Then run the COMSOL Installer using the `COMSOL Setup` application. The COMSOL 5.2a Installer window should now appear. Next, continue with the instructions in the section Running The COMSOL Installer below.

Installation from A Downloaded DVD Image

1 Download the DVD image. The file to download is called `COMSOL52a_dvd.iso`.

2 When you have downloaded the DVD image, you can install directly from the downloaded DVD image by double-clicking it to mount it. Alternatively, burn the DVD image to a disc to install. If you want to burn the DVD image to a disc:

   a Launch the **Disk Utility** application from **Applications/Utilities**.

   b Click the **Burn** toolbar button. Select the DVD image in the file dialog box and open it.

   c Insert an empty DVD in the DVD drive and click **Burn** in the dialog box in **Disk Utility**.

STARTING THE INSTALLER FROM A DVD OR MOUNTED DVD IMAGE

This section also applies if you have received a DVD from a COMSOL representative. The COMSOL Installer is a user interface tool that guides you through the installation process. To start the installer:

1 Insert the COMSOL DVD into the DVD drive (or mount the image).

2 Launch the COMSOL Installer application from the Finder.

3 The COMSOL 5.2a Installer window appears. Now continue with the instructions in the section Running The COMSOL Installer below.

Installation from USB Flash Drive

This section applies if you have received a USB Flash Drive from a COMSOL representative.

STARTING THE INSTALLER FROM A USB FLASH DRIVE

The COMSOL Installer is a user interface tool that guides you through the installation process. To start the installer:

1 Connect the USB Flash Drive to your computer.

2 Launch the COMSOL Installer application from the Finder.

3 The COMSOL 5.2a Installer window appears. Now continue with the instructions in the section Running The COMSOL Installer below.

Running The COMSOL Installer

The steps for running the COMSOL Installer are independent of the installation media option you used. If you have followed the above instructions, the COMSOL Installer should now appear. Now continue with the instructions for Windows in the section Running the COMSOL Installer.

Automated Installation

You can install COMSOL using an automated installation process with minimal user interaction. This method requires installation from DVD or DVD image. The documentation on how to create an answer file is available in the template, `setupconfig.ini`, which is available on the DVD. When an answer file is created, start the installation by running

```
<path to DVD>/setup -s <answer file path>
```

where `<answer file path>` is the path to the answer file.

Removing (Uninstalling) the COMSOL Installation

The COMSOL 5.2a installation adds files only in the COMSOL52a folder. To remove the COMSOL installation, delete the COMSOL52a folder including all subfolders. The following file may also be added by the installer: `/Library/LaunchDaemons/com.comsol.lmcomsol.plist`.

Product Updates and Application Library Update

COMSOL periodically releases product updates with improvements and corrections to reported problems. By default, COMSOL checks for updates at startup. You can turn this feature on and off from the COMSOL Desktop Preferences window. Here you can also configure settings for the Application Library Update.

The COMSOL Application Library is updated on a regular basis by COMSOL. To open the Application Library Update window from the File>Help menu (Windows users) or from the Help menu (Mac and Linux users), select Update COMSOL Application Library.

This connects you to the COMSOL Application Update website where you can access the latest updates. This includes files that have been added or improved since the latest product release.

Using the Updates section in the Preferences dialog box, which you open from the COMSOL Desktop, you can configure proxy server settings as well as application and documentation directories for the Application Library Update. See the *COMSOL Multiphysics Reference Manual* for more information including command-line options for the Application Libraries.

As an alternative, you can update COMSOL without starting the update from inside COMSOL Multiphysics. To do this, run `COMSOL Update.app`.

Changing the Path to the MATLAB® Installation

You can change the path to the MATLAB installation in the **Preferences>LiveLink Connections** window accessed from the **Options** menu of the COMSOL Desktop. For more information, see the LiveLink™ *for* MATLAB® documentation.

License Manager Installation on OS X

Many of the instructions for installing the FlexNet license manager are similar to those for Windows. This section covers only the differences when installing on OS X. For general information on the license manager software, see License Manager Installation on Windows.

FlexNet License Manager Software Components

The license manager consists of the following software components:

- License manager daemon (`lmgrd`)
- Vendor daemon (`LMCOMSOL`)
- FlexNet utility program (`lmutil` and others)

The two daemons (`lmgrd` and `LMCOMSOL`) run on the license server. When a user starts COMSOL on a client computer, communication is established through the network from the client to the license server and the license manager daemon (`lmgrd`). That daemon in turn makes a request to the vendor daemon (`LMCOMSOL`), which releases licenses according to information in the `license.dat` file. The FlexNet utility programs are used to handle license server management tasks.

FlexNet License Manager Documentation

For detailed information on the FlexNet license manager software, from the File menu choose Help>Documentation (Windows) or select Help>Documention (Mac and Linux) and scroll to the bottom of the page to locate a PDF copy of the *FlexNet License Administration Guide*.

The License File

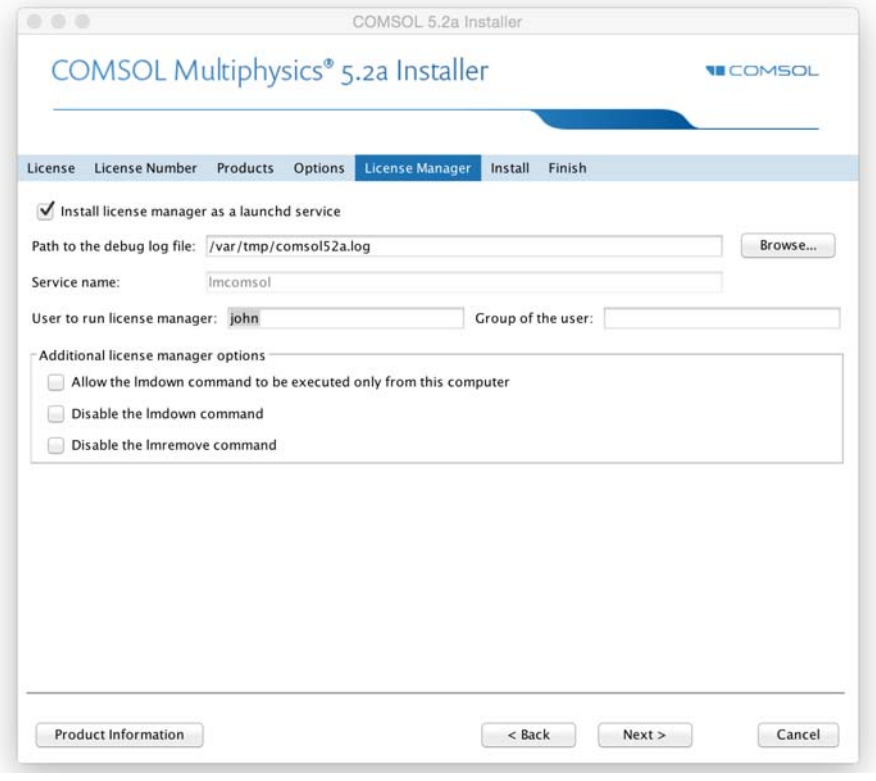
The license file for use on OS X is identical to that of Windows. See The License File for more information.

Installing the License Manager

The FlexNet license manager is automatically installed when installing COMSOL unless otherwise specified on the Products page of the COMSOL Installer; see Products Page. The check box for the license manager components can be found last in the list of software components.

If you want to install COMSOL on the same computer as the license manager, first perform a complete COMSOL installation including the license manager software components. See License Manager Page for the license manager settings in the

installer. For OS X, this page contains additional settings:



In the **User to run license manager** field, enter the username for a user on the computer that will run the license manager. If this field is empty, the root user runs the license manager, which is not recommended form a security point of view. Optionally, specify a group that the user belongs to in the **Group of the user** field.

When finished, skip the remainder of this section and continue with Starting the License Manager.

To install only the license manager, follow the installation instructions for COMSOL earlier in this document and, on the Products page, clear all check boxes except the one for the license manager.

AUTOMATED LICENSE MANAGER INSTALLATION

Alternatively, the license manager can be installed using an automated installation process with minimal user interaction; for this option, see Automated Installation. Set `licmanager = 1` in the answer file to install the license manager.

Starting the License Manager

Either start the license manager manually or let it run automatically at startup.

STARTING THE LICENSE MANAGER MANUALLY

To start the license manager manually:

1. Launch the Terminal application.
2. Change directory to the `license/maci64` directory:

   ```
   cd /Applications/COMSOL52a/Multiphysics/license/maci64
   ```

3. Then enter

   ```
   ./lmgrd -c ../license.dat -l /var/tmp/comsol52a.log
   ```

The server is now ready to distribute licenses over the network. It writes any debug information to the log file `/var/tmp/comsol52a.log`.

STARTING THE LICENSE MANAGER AUTOMATICALLY AT STARTUP

By following these steps, the license manager does not need to be started manually:

1. Copy the template file `com.comsol.lmcomsol.plist` to `/Library/LaunchDaemons`. An example:

   ```
   sudo cp
   /Applications/COMSOL52a/Multiphysics/license/maci64/com.comsol.lmcomsol.plist
   /Library/LaunchDaemons/
   ```

   Typically, the template file must be edited: the `lmgrd` and `license.dat` paths should be updated, and a user different from `root` specified for running the service.
2. Open the file `/Library/LaunchDaemons/com.comsol.lmcomsol.plist` in a text editor, for example, TextEdit, and make the necessary edits.
3. Set the correct permissions for the file:

   ```
   sudo chmod 600 /Library/LaunchDaemons/com.comsol.lmcomsol.plist
   ```

4. Enable and start the daemon. An example:

   ```
   sudo launchctl load -w /Library/LaunchDaemons/com.comsol.lmcomsol.plist
   ```

The following commands provide an example of an uninstallation of the daemon:

```
sudo launchctl unload -w /Library/LaunchDaemons/com.comsol.lmcomsol.plist
sudo launchctl remove /Library/LaunchDaemons/com.comsol.lmcomsol.plist
sudo rm -rf /Library/LaunchDaemons/com.comsol.lmcomsol.plist
rm /var/tmp/comsol52a.log
```

Verifying that the License Manager is Running

Once you start the license manager, it is good practice to verify that the license manager processes are running. Start the Activity Monitor and check for the vendor daemon (`LMCOMSOL`) and the license manager (`lmgrd`) in the list of processes.

Starting COMSOL

After the installation is complete and the license manager daemons are running on the license server, you can start using COMSOL. For more information on how to run COMSOL, see Running COMSOL on OS X.

Changing the License

If you have received a new license file — for example, when adding COMSOL products to an existing license — replace the current license file with the new one. Double-check the contents of this file to make sure it lists the products that the license includes.

When the license file has changed, you must restart the license manager; otherwise, it continues to use the old license file still in memory.

RESTARTING THE LICENSE MANAGER

To restart the license manager:

1. Launch the Terminal application.
2. Change the directory to the `license/maci64` (64-bit)

```
cd /Applications/COMSOL52a/Multiphysics/license/maci64
```

3. Enter the commands

```
./lmdown -c ../license.dat
./lmgrd -c ../license.dat -l /var/tmp/comsol52a.log
```

OBTAINING A HOSTID

If you need to verify the hostid of the license server, you can follow the steps in Obtaining the Hostid. Alternatively, if COMSOL is already installed on the license server, you can determine the hostid by executing the `lmhostid` command

```
COMSOL52a/Multiphysics/license/maci64/lmhostid
```

The hostid is typically the Ethernet address (also called a MAC address) of the network card of your computer. An Ethernet address has six bytes, each with two hexadecimal digits. Thus, the full hostid has twelve hexadecimal digits.

Troubleshooting License Errors

If you have questions or problems with your installation, see Troubleshooting License Errors.

The COMSOL Applications

After the installation is finished there are several COMSOL applications available. How many are available depends on which products and licenses you have:

COMSOL Multiphysics This is the primary application for running COMSOL Multiphysics. It launches COMSOL Multiphysics as a standalone application.

COMSOL Multiphysics (Classkit License) This application launches COMSOL Multiphysics for a Classkit License. This application is only available if you have a Classkit License.

COMSOL with MATLAB Use this application for running COMSOL with LiveLink™ *for* MATLAB®. This application is only available if you have a LiveLink™ *for* MATLAB® license.

COMSOL Multiphysics Server This application launches the Terminal application and starts a COMSOL Multiphysics Server in a terminal window.

COMSOL Update This application checks for available product updates on www.comsol.com

COMSOL Setup This application makes it possible to add, remove, and repair COMSOL products and to change the license.

The COMSOL applications do not work if moved outside the COMSOL folder. Create an alias if, for example, a desktop icon is required.

Running COMSOL from a Terminal Window

COMSOL can also be launched from a terminal window using the shell script `COMSOL52a/Multiphysics/bin/comsol`.

To run the `comsol` command more easily, include the `COMSOL52a/bin directory` in the path or make a symbolic link from `/usr/bin/comsol` to the `comsol` script. Those with administrator privileges can create a symbolic link with the command

```
sudo ln -s /Applications/COMSOL52a/Multiphysics/bin/comsol /usr/bin/comsol
```

(assuming COMSOL is installed in the Applications folder). This command asks for a password before creating the link.

The `comsol` command must not be moved from the `COMSOL52a/Multiphysics/bin` folder. The COMSOL applications also use this script.

Running a Classkit License

To start COMSOL using a Classkit License, start COMSOL from the terminal window using the `-ckl` option, for example,

```
comsol -ckl
```

Running COMSOL in Client-Server Mode

When you start COMSOL by, for example, launching the COMSOL Multiphysics application, COMSOL is run as a single application that includes the functionality of both the COMSOL Multiphysics Client and COMSOL Multiphysics Server, as explained later in this section. However, the COMSOL client-server architecture lets you access the COMSOL Multiphysics Server — the COMSOL computational engine — as a separate process. For example, the COMSOL

Desktop can act as a COMSOL Multiphysics Client when connected to a COMSOL Multiphysics Server.

The license server is not the same as a COMSOL Multiphysics Server. The license manager can run on a computer different from both the ones used by COMSOL Desktop and COMSOL Multiphysics Server.

You need a Floating Network License to run the COMSOL Multiphysics Server and the COMSOL Multiphysics Client on separate computers. However, any COMSOL license is sufficient for running the Client and the Server on the same computer.

The Client and Server need not run on the same platform. For example, you can run the COMSOL Desktop on Mac connecting to a COMSOL Multiphysics Server on a Windows or Linux computer. This enables offloading heavy-duty computations from your personal laptop or desktop to run just the COMSOL Desktop graphical user interface. A typical use would be to run the COMSOL Multiphysics Server on a computer with large amounts of memory (RAM) and processing power and to use your personal computer for pre- and postprocessing with the COMSOL Desktop.

STARTING A COMSOL MULTIPHYSICS SERVER

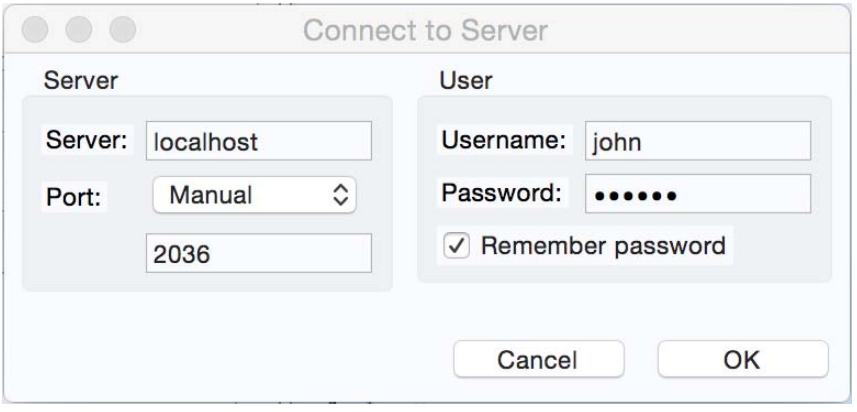
To start the COMSOL Multiphysics Server, run the COMSOL Multiphysics Server application. A terminal window appears asking you for a username and password. You can use any username and password of your choice, it is only used for connecting a COMSOL Multiphysics Client with a COMSOL Multiphysics Server.

When the COMSOL Multiphysics Server starts, it listens for a COMSOL Multiphysics Client connection on the port listed in the command window.

Connecting a COMSOL Multiphysics Client to a COMSOL Multiphysics Server

You can start a COMSOL Multiphysics Client session from the COMSOL Desktop by selecting **Connect to Server** from the **File** menu in the COMSOL Desktop. When you start the Client, a Connect to Server window appears

prompting you for a computer name (Server) where the COMSOL Multiphysics Server is running, Port number, Username, and Password.



Once you have filled out this information and clicked **OK**, the COMSOL Multiphysics Server terminal window displays information that a COMSOL Multiphysics Client has connected. For more information on running COMSOL in Client/Server mode, see the *COMSOL Multiphysics Reference Manual*.

Running COMSOL in Batch Mode

You can submit COMSOL batch jobs from the COMSOL Desktop and the command line. To run a COMSOL batch job, you need to make the Batch feature visible: in the Model Builder tree, click the **Show** button ( ) and select **Advanced Study Options**. In the Model Builder, right-click a **Study** node and select **Batch** to create batch jobs. From the terminal window, you can start batch jobs using the `comsol batch` command. This is an example of how such a command could look:

```
comsol batch -inputfile in.mph -outputfile out.mph
```

To run a specific study add the command line option `-study <tag>`, where `<tag>` is the tag of the study to run, for instance, `std1`. To see the tag, click the toolbar button **Model Tree Node Text** in the **Model Builder** and select **Tag**.

The *COMSOL Multiphysics Reference Manual* includes a dedicated section on running COMSOL from the terminal window, including a list of COMSOL commands and associated syntax.

Multicore Settings

COMSOL supports two modes of parallel operation: shared-memory parallel operations and distributed-memory parallel operations, including cluster support for Windows and Linux. This section covers shared-memory processing, or multithreading, which is important for the performance of COMSOL computations. Some terms that are frequently used in when describing multithreading are:

- *Core*: The core is a processor core used in shared-memory parallelism by a computational node with multiple processors.
- *Speedup* is how many times faster a job runs on *N* cores compared to 1 core, on a specific compute node. The speedup depends on the simulation type, the hardware used, and hardware drivers used.

On OS X, the default number of processor cores used by COMSOL is the total number of available physical cores. For example, if you have a 2 x dual core machine, 4 cores are used in parallel by a COMSOL process.

SHARED-MEMORY OPTIONS

From the terminal window, use the `comsol` command option `-np` to control the number of cores and processors used. The default is to use all available cores and processors. For example:

```
comsol -np 2
```

launches COMSOL using 2 cores (if available).

You can experiment to find the options that work best for your configuration. For more information see the *COMSOL Multiphysics Reference Manual*.

Running COMSOL on Clusters

You can launch COMSOL cluster jobs from the COMSOL Desktop and the command line. To run COMSOL on a cluster, you need to make the cluster feature visible: in the Model Builder tree, click the **Show** button ( ) and select **Advanced Study Options**. Then in the Model Builder, right-click a **Study** node and

select **Cluster Computing** or **Cluster Sweep** to create cluster jobs. Cluster computing requires a Floating Network License.

COMSOL cannot be run on a cluster running OS X; however, you can use the Cluster Computing or Cluster Sweep feature to connect to a Windows or Linux cluster.

A tutorial model for cluster testing is included in the Application Libraries window under **COMSOL Multiphysics>Tutorial models>micromixer_cluster**.

For more information about how to run COMSOL in parallel on clusters, see the *COMSOL Multiphysics Reference Manual*. For installation on Clusters, see Cluster Installation for Windows and Cluster Installation for Linux.

Running COMSOL on the Cloud

COMSOL supports cloud computing using OS X through Amazon Elastic Compute Cloud™ (Amazon EC2)™. See *Running COMSOL on the Amazon Cloud*. This PDF can be accessed online: www.comsol.com/ec2_manual.

Installation Over the Internet

INSTALLATION OF A PAID-FOR OR TRIAL LICENSE OVER THE INTERNET

Installation of any paid-for license on Linux requires a license file, which is sent to you by your COMSOL representative by email. To be able to generate the license file, information about your hardware is needed in the form of a hostid (host ID). The hostid is used to lock the license to your hardware and needs to be sent by you to a COMSOL representative prior to the license file being generated.

A trial license can be given to you with the intention to test the software without any payment obligation for noncommercial or nonproduction use. This option is not available in all regions. For installation of a Single User Trial License on Linux, you can follow the same instructions as for a paid-for license.

Obtaining the Hostid

Follow these steps to obtain a hostid:

1 Start a Terminal window.

2 Enter `cat /sys/class/net/*/address`

This displays all physical Ethernet addresses (also called MAC addresses) which consists of six bytes displayed as six pairs of hexadecimal digits such as 00:40:05:16:E5:25. Choose one that does not consist of zeros only.

Obtaining the Host Name

If you have been informed by a COMSOL representative that you need to run the FlexNet license manager for your installation, then you also need the Host Name:

1 To get the Host Name, start a Terminal window.

2 Enter `hostname` at the terminal prompt.

If your network administrator prefers to use a fixed IP address for this particular computer, this IP Address can be optionally used in place of the Host Name. For more information on license manager installation see License Manager Installation

on Linux.

Obtaining the License File from a COMSOL Representative

Send the hostid information, as well as Host Name, if applicable, in an email to your COMSOL representative, who responds by email including an attached license file (`license.dat`). Save this file to any location on your computer. You need to refer to it during installation. A trial license file for Linux cannot normally be edited or changed in any way by the user but has to be identical to the one sent to you by a COMSOL representative. However, if you were sent a license file that requires a license manager, then minor edits are required. For information on the type of license file required for installations using a license manager, see The License File.

Registering with COMSOL Access

Once you have saved your license file, follow these steps to register or login to COMSOL Access and to start the installation:

1. Click the link for downloading the software as given in the software download email from your COMSOL representative. This link is identical or similar to: www.comsol.com/product-download
2. If you haven't already created a COMSOL Access account, you are prompted to create it. While creating the account, point to your license file (`license.dat`) to associate it with your account information.

   If you already created a COMSOL Access account, then you can associate the license file on the COMSOL Access page with your account under Manage Licenses at www.comsol.com/access/licenses.
3. Continue with the instructions in the next section Downloading the COMSOL Installer.

Downloading and Installing the COMSOL Software

1. Go to the web page www.comsol.com/product-download. To download the COMSOL installer, you must first create a COMSOL Access account as described in the section Installation over the Internet.

2 You are now given the options of downloading the COMSOL online installer or the COMSOL offline installer (a DVD image).

If you have problems downloading (such as **Error downloading file. Connection refused: connect**), please review this knowledge base entry: www.comsol.com/support/knowledgebase/1149. If you still have problems, contact your local COMSOL representative or technical support from the Support Center page www.comsol.com/support.

Starting the Online Installer for Installation over the Internet

The COMSOL Installer is a user interface tool that guides you through the installation process. The file to download is called `comsol52a_lnx.tar.gz`. Start the COMSOL Installer by first extracting the downloaded file and then running the `setup` script. The COMSOL 5.2a Installer window should now appear. Next, continue with the instructions in the section Running The COMSOL Installer. below.

Installation from Downloaded DVD Image

1 Download the DVD image. The file to download is called `COMSOL52a_dvd.iso`.

2 When you have downloaded the DVD image, burn the DVD image to a disc. Use a DVD burning tools or command such as `cdrecord` to burn the DVD. Alternatively, directly mount the DVD using a loopback device:

```
mount -o loop COMSOL52a_dvd.iso /mnt
```

Starting the Installer from a DVD or Mounted DVD Image

The COMSOL Installer is a user interface tool that guides you through the installation process. To start the installer:

1 Make sure the COMSOL DVD is in the DVD drive (or mount the image).

2 Type `/mnt/setup`

The COMSOL 5.2a Installer window appears. Now continue with the instructions in the section Running The COMSOL Installer below.

Installing from a DVD

This section applies if you have received a DVD from a COMSOL representative.

The COMSOL Installer is a user interface tool that guides you through the installation process. To start the installer:

1. Insert the COMSOL 5.2a DVD into the DVD drive.
2. If the DVD is not mounted automatically by your operating system, use the `mount` command to mount it.
3. To start the installation, enter the command

   `sh` *`drivepath`*`/setup`

   where *`drivepath`* is the mount point of the DVD drive, for example `/media/cdrom`.

   You might have to mount the DVD with the option `-o exec` if your Linux mounts the DVD without execute options by default.

The COMSOL 5.2a Installer window appears. Now continue with the instructions in the section Running The COMSOL Installer below.

Installation from USB Flash Drive

This section applies if you have received a USB Flash Drive from a COMSOL representative.

STARTING THE INSTALLER FROM A USB FLASH DRIVE

The COMSOL Installer is a user interface tool that guides you through the installation process. To start the installer:

1. Connect the USB Flash Drive to your computer.
2. If the USB Flash Drive is not mounted automatically by your operating system, use the `mount` command to mount it.
3. To start the installation, enter the command

   `sh` *`drivepath`*`/setup`

   where *`drivepath`* is the mount point of the USB Flash Drive, for example `/media/usb`.

   You might have to mount the USB Flash Drive with the option `-o exec` if your Linux mounts the USB Flash Drive without execute options by default.

4 The COMSOL 5.2a Installer window appears. Now continue with the instructions in the section Running The COMSOL Installer below.

Running The COMSOL Installer

The steps for running the COMSOL Installer are independent of the installation media option you used. If you have followed the above instructions, the COMSOL Installer should now appear. For a detailed description and screen shots of the different COMSOL Installer steps, see the instructions for Windows in the section Running the COMSOL Installer. The procedure for running the COMSOL Installer on Linux is similar and summarized below with the differences from installation on Windows highlighted:

1 When the installer window appears, click **New Installation**.

2 Read the license agreement, select **I accept the terms of the license agreement,** specify **License information**, and then click **Next**.

3 If you have a Named Single User License and you are installing the software on the license server, a dialog box opens up and you are asked to enter the user to bind the license to.

4 Select the products to install and specify the path to the COMSOL installation directory.

5 Click **Next**.

6 If you have licensed LiveLink™ *for* MATLAB®, then specify the MATLAB root folder.

7 Click **Next**.

8 Click **Install** to start the installation.

9 When the installation process is finished, the **Finish** window appears. If errors arose during installation, this window issues a notification. The installer also writes a log entry into the text file `comsolsetup.log`, which resides in the specified installation directory. Click **Close** to quit the installer. If you installed from DVD, use the unmount and eject commands to unmount and eject the DVD. Some Linux configurations automatically unmount and eject the DVD when you press the DVD drive button.

10 To make sure all users can easily start COMSOL, include the `comsol52a/bin` directory in all users' paths or make a symbolic link from `/usr/local/bin/comsol` to the `comsol` command (see the Linux `ln` command).

The installer can do this step automatically if you run the installer as an administrator..

You may also need to install the fonts (using the normal Linux distribution methods) for the languages that you want to use when running COMSOL.

Web Browser for Viewing the Documentation

The file `browser` in the bin directory attempts to start common web browsers that are available with the supported Linux versions. Edit the file in any text editor to adjust it for your preferred web browser. The variable `BROWSERS` in this file contains a list of web browsers in order of preference. If you want to make a specific browser the preferred web browser, put it first in the list.

Automated Installation

You can install COMSOL using an automated installation process with minimal user interaction. This method requires installation from DVD or DVD image. The documentation on how to create an answer file is available in the template, `setupconfig.ini`, which is available on the DVD. When you have created an answer file, start the installation by running

```
<path to DVD>/setup -s <answer file path>
```

where `<answer file path>` is the path to your answer file.

Removing (Uninstalling) the COMSOL Installation

The COMSOL 5.2a installation adds files only in the `comsol52a` directory. To remove the COMSOL installation, simply delete the `comsol52a` directory including all subdirectories. The installer may also add the following files:

```
/usr/local/bin/comsol
/usr/local/bin/comsol-5.2
/usr/share/applications/comsol-multiphysics-5.2.desktop
~/.local/share/applications/comsol-multiphysics-5.2.desktop
/usr/lib/systemd/system/lmcomsol.service
```

Product Updates and Application Library Update

COMSOL periodically releases product updates with improvements and corrections to reported problems. By default, COMSOL checks for updates at startup. You can turn this feature on and off from the COMSOL Desktop Preferences window. Here you can also configure settings for the Application Library Update.

The COMSOL Application Library is updated on a regular basis by COMSOL. To open the Application Library Update window from the File>Help menu (Windows users) or from the Help menu (Mac and Linux users), select Update COMSOL Application Library.

This connects you to the COMSOL Application Update website where you can access the latest updates. This includes applications that have been added or improved since the latest product release.

Using the Updates section in the Preferences dialog box, which you open from the COMSOL Desktop, you can configure proxy server settings as well as application and documentation directories for the Application Library Update. See the *COMSOL Multiphysics Reference Manual* for more information including command-line options for the Application Libraries.

Changing the Path to the MATLAB® Installation

You can change the path to the MATLAB installation in the **Preferences>LiveLink Connections** window accessed from the **Options** menu of the COMSOL Desktop. For more information, see the LiveLink™ *for* MATLAB® documentation.

Cluster Installation

COMSOL supports two modes of parallel operation: shared-memory parallel operations and distributed-memory parallel operations, including cluster support. This section is dedicated to distributed-memory parallel installation.

COMSOL can distribute computations on compute clusters using the MPI model. One large simulation can be distributed across many compute nodes. Also, parametric sweeps can be done with individual parameter cases distributed to each cluster node.

SYSTEM REQUIREMENTS

The installation instructions above can also be followed for clusters. COMSOL supports shared-memory parallelism and distributed-memory parallelism on 64-bit Linux. For details on system requirements, see www.comsol.com/system-requirements.

LICENSE MANAGER

COMSOL requires a Floating Network License for running on clusters. Please check the license file for the CLUSTERNODE feature, which needs to be present to enable the cluster computing functionality. The license manager needs to be accessible from all nodes in the cluster. Therefore it is often a good idea to have it run on the head node.

INSTALLATION FOLDER

The COMSOL installation folder should be shared between all compute nodes and the head node.

FEATURES

During installation, make sure the Cluster Components feature is selected.

ACCESS TO CLUSTER

If you work on a computer that is not on the cluster, install COMSOL on that computer. Typically, you use a scheduler to launch jobs on the cluster. Make sure the scheduler client software is installed on that computer. You can configure the installation to use the scheduler by changing the `comsol.ini` file according to the section on MPI Options in the *COMSOL Multiphysics Reference Manual*.

For more information on installing and running COMSOL on clusters, see Running COMSOL on Clusters and the *COMSOL Multiphysics Reference Manual*.

License Manager Installation on Linux

You do not need to install the license manager if you are installing a trial version. The paid-for version on Linux, however, always requires a running license manager. Many of the instructions for installing the FlexNet license manager are similar to those for Windows. This section covers only the differences when installing on Linux. For general information on the license manager software, see License Manager Installation on Windows. In some cases, however, the COMSOL installation also installs and configures the license manager.

FlexNet License Manager Software Components

The license manager consists of the following software components:

- License manager daemon (`lmgrd`)
- Vendor daemon (`LMCOMSOL`)
- FlexNet utility program (`lmutil and others`)

The two daemons (`lmgrd` and `LMCOMSOL`) run on the license server. When a user starts COMSOL on a client computer, communication is established through the network from the client to the license server and the license manager daemon (`lmgrd`). That daemon in turn makes a request to the vendor daemon (`LMCOMSOL`), which releases licenses according to information in the `license.dat` file. The FlexNet utility programs are used to handle license server management tasks.

FlexNet License Manager Documentation

For detailed information on the FlexNet license manager software, click the button (File menu) and choose Help>Documentation (Windows) or select Help>Documentation (Mac and Linux) and scroll to the bottom of the page to locate a PDF copy of the *FlexNet License Administration Guide*.

The License File

The license file for use on Linux is identical to that for Windows, except in the case of a Named Single User License, which is described below. See The License File for general license file information.

LICENSE FILES FOR NAMED SINGLE USER LICENSE

If you have a Named Single User License the installer automatically creates an options file that binds the license to the named user. This section describes the format of the options file and how the `license.dat` file points to the options file.

Below is an example of an options file, `LMCOMSOL.opt`, for a user "philip" who has access to COMSOL Multiphysics, the Structural Mechanics Module, and the CAD Import Module. Notice that to access COMSOL Multiphysics, the options file must include both the `COMSOL` and the `COMSOLGUI` features:

```
INCLUDE COMSOL USER philip
INCLUDE COMSOLGUI USER philip
INCLUDE CADIMPORT USER philip
INCLUDE CADREADER USER philip
INCLUDE STRUCTURALMECHANICS USER philip
```

Each `INCLUDE` row in the `LMCOMSOL.opt` file has a corresponding `FEATURE` row in the `license.dat` file (with the `USER_BASED` keyword). The second item on each `FEATURE` row is the name of the feature for which you have a license.

For more information on which FEATURE items are available, see The License File.

The `license.dat` file needs to point to the options file. The path to the options file is indicated by the `options` keyword. If your options file is placed here:

```
/usr/local/comsol52a/multiphysics/license/LMCOMSOL.opt
```

then the `VENDOR` row in `license.dat` should read

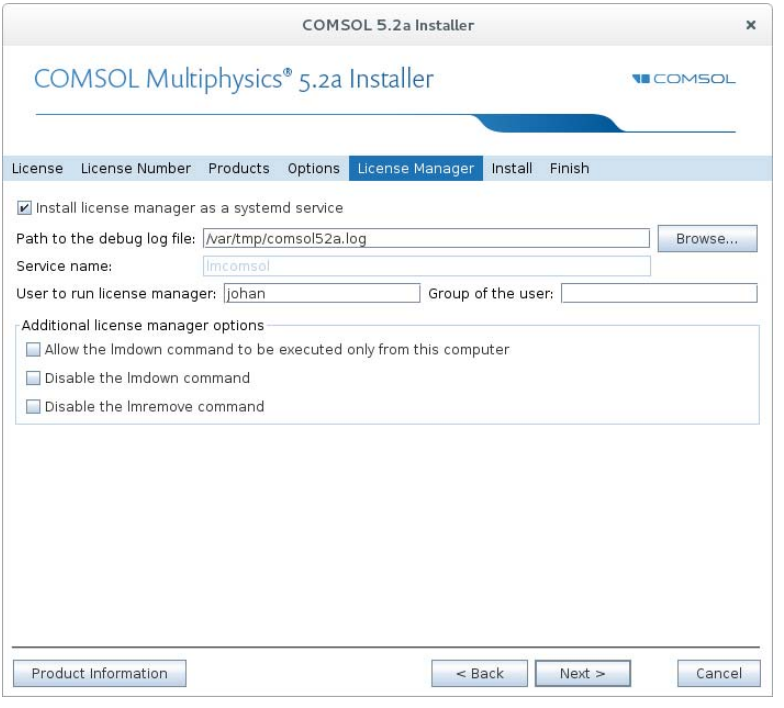
```
VENDOR LMCOMSOL port=1719
options=/usr/local/comsol52a/multiphysics/license/LMCOMSOL.opt
```

Installing the License Manager

The FlexNet license manager is automatically installed when installing COMSOL unless otherwise specified on the Products page of the COMSOL Installer; see Products Page. In some cases, it is also automatically configured to run as a service.

The check box for the license manager components can be found last in the list of software components.

If you want to install COMSOL on the same computer as the license manager and you did not choose to install the license manager as a service, first perform a complete COMSOL installation including the license manager software components. See License Manager Page for the license manager settings in the installer. For Linux, this page contains additional settings:



In the **User to run license manager** field, enter the username for a user on the computer that will run the license manager. If this field is empty, the root user runs the license manager, which is not recommended form a security point of view. Optionally, specify a group that the user belongs to in the **Group of the user** field.

When finished, skip the remainder of this section and continue with Starting the License Manager below.

To install only the license manager, follow the installation instructions for COMSOL earlier in this document and on the Products page, clear all check boxes except the one for the license manager.

AUTOMATED LICENSE MANAGER INSTALLATION

Alternatively, the license manager can be installed using an automated installation process with minimal user interaction, see Automated Installation. Set `licmanager = 1` in the answer file to install the license manager. It is also possible to automatically configure the license manager to run on systemd-based Linux distributions.

Starting the License Manager

You can start the license manager manually or it can run automatically at boot.

The installer can set up the license manager to start automatically; in case it did, you can skip the following section.

STARTING THE LICENSE MANAGER MANUALLY

To start the license manager manually, make the `license/$arch` directory the current directory and enter

```
./lmgrd -c ../license.dat -l /var/tmp/comsol52a.log
```

The server is now ready to distribute licenses over the network. It writes any debug information to the log file `/var/tmp/comsol52a.log`.

STARTING THE LICENSE MANAGER AUTOMATICALLY AT BOOT

In order for the license manager to start automatically at boot, you need to add Bourne shell commands to the appropriate boot script. You must be a superuser (root) to edit boot scripts. In some cases, however, the COMSOL Installer automatically installs and configures the license manager.

For security reasons, it is recommended that the daemons are not started as root. Instead, use a dedicated username to start the license manager.

For Linux distributions that use `systemd`, use the `lmcomsol.service` file, located in the `comsol52a/license/glnxa64` directory, to start the license manager. To use `lmcomsol.service`, do the following steps:

1 Update the path to `lmgrd`, `license.dat`, and `comsol.log` in case you have different locations for these files.

2 Optionally, replace `username` with an actual username. Preferably do not use `root`; instead, use the account used to install COMSOL or another account with access to both the `lmgrd` executable and the log file location above.

3 Create a `/usr/tmp` directory if it does not exist and set its permissions to 1777 with the `chmod 1777 /usr/tmp` command.

4 Copy the `lmcomsol.service` file to `/usr/lib/systemd/system/` and run the `systemctl enable lmcomsol` and `systemctl start lmcomsol` commands to activate the license manager.

For older Linux distributions, without `systemd`, the procedure for editing boot scripts on each supported Linux distribution appears in the following table:

PLATFORM	PROCEDURE

SuSe Linux	The following instructions should work for SuSE Linux distributions:
	In the `comsol52a/multiphysics/license/glnxa64` directory, enter the commands
	`cp rc.lm /etc/init.d/comsol52alm`
	`chmod 755 /etc/init.d/comsol52alm`
	Edit `/etc/init.d/comsol52alm`, replacing `dir` with the full path to the `glnxa64` directory, and replace `username` with an actual username.
	Now create the following link
	`cd /etc/init.d/rc5.d`
	`ln -s ../comsol52alm S91comsol52alm`

Debian Linux	The following instructions should work for Debian Linux distributions: Copy the file `comsol52a/multiphysics/license/glnxa64/lm_comsol` to `/etc/init.d` Edit `/etc/init.d/lm_comsol`. Update the `FP` and `MYUSER` variables as indicated in the file. Use the utility `update-rc.d` to automatically update the system's `init` script links: `update-rc.d lm_comsol start 99 2 3 4 5 . stop 1 0 1 6 .` This means that the COMSOL license manager is started by runlevels 2, 3, 4, and 5, and stopped by runlevels 0, 1, and 6. Enter man update-rc.d for more information on init scripts.
Linux, General	The following instructions should work for most Linux distributions: Copy the file `comsol52a/multiphysics/license/glnxa64/rc.lm` and paste it at the end of `/etc/rc.d/rc.local`. Replace `dir` in the code fragment with the full path to the `glnxa64` platform directory, and replace `username` with an actual username.

Verifying that the License Manager is Running

Once you start the license manager, it is good practice to verify that the license manager processes are running. Use administrative commands such as `top` or `ps` to check that both the vendor daemon (LMCOMSOL) and the license manager (lmgrd) are running. On Linux distributions that include `systemd`, if the license manager is installed as a service according to the instructions, you can run `service lmcomsol status` instead.

Starting COMSOL

After the installation is complete and the license manager daemons are running on the license server, you can start using COMSOL. For more information on how to run COMSOL, see Running COMSOL on Linux.

Changing the License

If you have received a new license file — for example, when adding COMSOL products to an existing license — replace the current license file with the new one. Double-check the contents of this file to make sure it lists the products that the license includes.

When the license file has been changed, you must restart the license manager; otherwise, it continues to use the old license file still in memory.

RESTARTING THE LICENSE MANAGER

To restart the license manager, make the `license/$arch` directory under the COMSOL installation directory the current directory, then enter the following commands:

```
./lmdown -c ../license.dat
./lmgrd -c ../license.dat -l /var/tmp/comsol52a.log
```

When installed as a service on Linux distributions with `systemd` according to the instructions, you stop it with the `service lmcomsol stop` command and start it with the `service lmcomsol start` command.

OBTAINING A HOSTID

If COMSOL is already installed on your license server, you can determine the hostid by executing the `lmhostid` command

```
comsol52a/multiphysics/license/glnxa64/lmhostid
```

Troubleshooting License Errors

If you have questions or problems with your installation, see Troubleshooting License Errors.

LINUX STANDARD BASE LIBRARIES

If you get the following error:

```
./lmgrd: Command not found.
```

or

```
./lmgrd: No such file or directory
```

it might be because some required libraries are missing. The license manager in COMSOL 5.2a is built with FlexNet 11.13.1.3, which requires LSB (Linux Standard Base) 3.0 or later in order to start. These error messages indicate that the license server is missing these required libraries. To solve this problem, install the package that provides LSB support for your Linux distribution:

- For Debian and Ubuntu: `lsb-core`. Installation command:
  `sudo apt-get install lsb-core`
- For Red Hat®: `redhat-lsb`. Installation command:
  `sudo yum install redhat-lsb`
- For OpenSUSE: `lsb`. Install using the YaST package manager.

Some modern Linux distribution do not provide `lsb-core`. The workaround in such a case is to create a symlink by running the following command as root or with sudo: `ln -s /lib64/ld-linux-x86-64.so.2 /lib64/ld-lsb-x86-64.so.3`.

In order for the help system to work on Linux, some packages need to be installed; for details, see www.comsol.com/system-requirements.

Running COMSOL

If you are running a Linux version with a graphical desktop environment, you might find a COMSOL Multiphysics icon that you can simply click to start COMSOL in the menus. Alternatively, using a terminal window, you can run the `comsol` command. If it is not available, ask your system manager to make it available to you, or, if you have administrative privileges on your Linux system, add the `comsol` command to the search path. The setup can do this automatically for you during installation if you run it with root privileges. The `comsol` command is located in the bin folder in the COMSOL installation directory. This is a typical example of a command that adds `comsol` to the search path is (assuming you are logged in as root):

```
ln -s /usr/local/comsol52a/multiphysics/bin/comsol /usr/bin/comsol
```

Multicore Settings

COMSOL supports two modes of parallel operation: shared-memory parallel operations and distributed-memory parallel operations, including cluster support for Windows and Linux. This section covers shared-memory processing, or multithreading, which is important for the performance of COMSOL computations. Some terms that are frequently used in when describing multithreading are:

- *Core*: The core is a processor core used in shared-memory parallelism by a computational node with multiple processors.

- *Speedup* is how many times faster a job runs on *N* cores compared to 1 core, on a specific compute node. The speedup depends on the simulation type, the hardware used, and the hardware drivers used.

On Linux, the default number of processor cores used by COMSOL is the total number of available physical cores. For example, if you have a 2 x dual core machine, 4 cores are used in parallel by a COMSOL process.

SHARED-MEMORY OPTIONS

From the Terminal window, use the `comsol` command option `-np` to control the number of cores and processors used. The default is to use all available cores and processors. For example:

```
comsol -np 2
```

launches COMSOL using 2 cores (if available).

You might need to experiment to find the options that work best for your configuration. For more information see the *COMSOL Multiphysics Reference Manual*.

Running COMSOL in Batch Mode

You can submit COMSOL batch jobs from the COMSOL Desktop and the command line. To run a COMSOL batch job, you need to make the Batch feature visible: in the Model Builder tree, click the **Show** button ( ) and select **Advanced Study Options**. In the Model Builder, right-click a **Study** node and select **Batch** to create batch jobs. From a terminal window, you can start batch jobs using the `comsol batch` command. This is an example of such a command:

```
comsol batch -inputfile in.mph -outputfile out.mph
```

To run a specific study add the command line option `-study` <*tag*>, where <*tag*> is the tag of the study to run, for instance, `std1`. To see the tag, click the toolbar button **Model Tree Node Text** in the **Model Builder** and select **Tag**.

The *COMSOL Multiphysics Reference Manual* has a dedicated section on running COMSOL from a terminal window, including a list of COMSOL commands and associated syntax.

Running COMSOL in Client-Server Mode

When you start COMSOL by, for example, entering the `comsol` command with no additional arguments, COMSOL is run as a single application that includes the functionality of both the COMSOL Multiphysics Client and COMSOL Multiphysics Server, as explained later in this section. However, the COMSOL client-server architecture lets you access the COMSOL Multiphysics Server — the COMSOL computational engine — as a separate process. For example, the COMSOL Desktop can act as a COMSOL Multiphysics Client when connected to a COMSOL Multiphysics Server.

The license server is not the same as a COMSOL Multiphysics Server. The license manager can run on a computer different from both the ones used by COMSOL Desktop and COMSOL Multiphysics Server.

You need a Floating Network License to run the COMSOL Multiphysics Server and the COMSOL Multiphysics Client on separate computers. However, any COMSOL license is sufficient for running the Client and the Server on the same computer.

The Client and Server need not run on the same platform. For example, you can run the COMSOL Desktop on Windows connecting to a COMSOL Multiphysics Server on a Linux computer. This enables offloading heavy-duty computations from your personal laptop or desktop to run just the COMSOL Desktop graphical user interface. A typical use would be to run the COMSOL Multiphysics Server on a computer with large amounts of memory (RAM) and processing power and to use your personal computer for pre- and postprocessing with the COMSOL Desktop.

STARTING A COMSOL MULTIPHYSICS SERVER

To start the COMSOL Multiphysics Server from a terminal window, run the `comsol` command with the `mphserver` argument:

```
comsol mphserver
```

You are then prompted for a username and password. You can use any username and password of your choice, it is only used for connecting a COMSOL Multiphysics Client with a COMSOL Multiphysics Server.

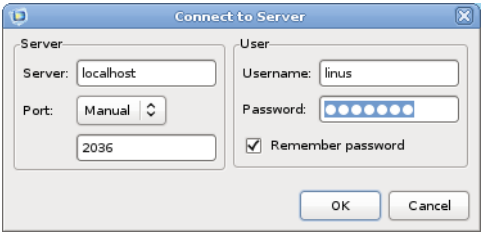
When the COMSOL Multiphysics Server starts, it listens for a COMSOL Multiphysics Client connection on the port listed in the command window.

Connecting a COMSOL Multiphysics Client to a COMSOL Multiphysics Server

You can start a COMSOL Multiphysics Client session from the COMSOL Desktop by selecting **Connect to Server** from the **File** menu in the COMSOL Desktop. You can also start a COMSOL Multiphysics Client session from a terminal window by running the `comsol` command with the `client` argument:

```
comsol client
```

When you start the Client, a Connect to Server window appears prompting you for a computer name (Server) where the COMSOL Multiphysics Server is running, Port number, Username, and Password:



Once you have filled out this information and clicked **OK**, the COMSOL Multiphysics Server terminal window displays information that a COMSOL Multiphysics Client has connected. For more information on running COMSOL in Client/Server mode, see the *COMSOL Multiphysics Reference Manual*.

Running a Classkit License

To start COMSOL using a Classkit License, start COMSOL using the `-ckl` option:

```
comsol -ckl
```

Running COMSOL on Clusters

You can launch COMSOL cluster jobs from the COMSOL Desktop and the command line. To run COMSOL on a cluster, you need to make the cluster feature visible: in the Model Builder tree, click the **Show** button ( ) and select **Advanced Study Options**. Then in the Model Builder, right-click a **Study** node and

select **Cluster Computing** or **Cluster Sweep** to create cluster jobs. Cluster computing requires a Floating Network License.

The following terms occur frequently when describing the hardware for cluster computing and shared memory parallel computing:

- Compute node: The compute nodes are where the distributed computing occurs. Each distributed COMSOL process resides in a compute node and communicates with other compute nodes using MPI (message-passing interface).
- Host: The host is a physical machine (hardware) with a network adapter and unique network address. The host is part of the cluster. It is sometimes referred to as a physical node.
- Core: The core is a processor core used in shared-memory parallelism by a computational node with multiple processors.

The number of used hosts and the number of computational nodes are usually the same. For some special simulation types, like very small simulations with many parameters, it might be beneficial to use more than one computational node on one host.

A tutorial model for cluster testing is included in the Application Libraries window under **COMSOL Multiphysics>Tutorial models>micromixer_cluster**.

QUICK TROUBLESHOOTING

- Your first step is to make sure you have the latest release installed. Check that you have COMSOL 5.2a or later and make sure to install the latest product updates.
- If you get the error message **Process status indicates that process is running**, then cancel any running jobs in the scheduler that you use. In the COMSOL Desktop, locate the **External Process** page at the bottom right. Click the **Clear Status** button.

For more information about how to run COMSOL in parallel on Linux clusters, see the *COMSOL Multiphysics Reference Manual*. For installation on Clusters, see Cluster Installation.

Running COMSOL on the Cloud

COMSOL supports cloud computing using Linux through Amazon Elastic Compute Cloud™ (Amazon EC2)™. See *Running COMSOL on the Amazon Cloud*. This PDF can be accessed online: www.comsol.com/ec2_manual.

Running COMSOL with MATLAB

Running COMSOL with MATLAB starts a COMSOL Multiphysics Server and a MATLAB Desktop. No COMSOL graphical user interface is involved. For a tutorial, see the *LiveLink for MATLAB User's Guide*.

To launch MATLAB and connect it to a COMSOL Multiphysics Server, run the command

```
comsol mphserver matlab
```

Starting COMSOL with MATLAB using the graphics server

To display the plot in a COMSOL graphics window you need to run COMSOL with MATLAB using the graphics server. To do so, start COMSOL with MATLAB from a terminal window with the `-graphics` flag:

```
comsol mphserver matlab -graphics
```

Required Programs for Running COMSOL with MATLAB

The `xterm` program is necessary for the command `comsol mphserver matlab`. The `csh` program is needed to call MATLAB functions from COMSOL.

- To install the missing packages on Debian and Ubuntu, type
  ```
  sudo apt-get install xterm csh
  ```
- To install the missing packages on RedHat Enterprise and Fedora, type
  ```
  sudo yum install xterm tcsh
  ```
- To install the missing packages on OpenSUSE, type
  ```
  sudo zypper install xterm tcsh
  ```

Troubleshooting License Errors

If you have questions or problems with your installation, start by checking the COMSOL Support Knowledge Base at www.comsol.com/support/knowledgebase/ for up-to-date information about installation and license issues. If this does not help, then please contact COMSOL technical support at support@comsol.com.

THE COMSOL SUPPORT KNOWLEDGE BASE

The most important Knowledge Base entries for installation questions and license errors are the following:

SUBJECT	KNOWLEDGE BASE ENTRY
Could not obtain license for COMSOL Multiphysics GUI	www.comsol.com/support/knowledgebase/903
Running COMSOL in parallel on clusters	www.comsol.com/support/knowledgebase/1001
Updating the COMSOL License Manager	www.comsol.com/support/knowledgebase/1022
COMSOL Installation Companion	www.comsol.com/support/knowledgebase/1077
Error: An error has occurred. See the log file C:\Users...	www.comsol.com/support/knowledgebase/1083
Selecting hardware for clusters	www.comsol.com/support/knowledgebase/1116
Error: Error downloading file. Connection refused: connect	www.comsol.com/support/knowledgebase/1149

You can also view videos about installation at: www.comsol.com/video/browse/installation.

LICENSE ERRORS

This section summarizes the most common post-installation error messages generated by COMSOL, and it gives some advice how to troubleshoot them. For a complete list of error messages, see the FlexNet license manager documentation. This documentation is shipped with your COMSOL installation; see FlexNet® License Manager Documentation on where to find it.

If you need to review the license manager log file, or send it to COMSOL technical support, this is where you usually find it (depending on choices you made during the installation):

- Windows: `C:\Program Files\COMSOL52a\Multiphysics\license\comsol52a.log` or `C:\comsol.log`.
- OS X: `/var/tmp/comsol52a.log`
- Linux: `/var/tmp/comsol52a.log`

If you need to access the license file, this is where you usually find it:

- Windows: `C:\Program Files\COMSOL52a\Multiphysics\license\license.dat`
- OS X: `/Applications/COMSOL52a/Multiphysics/license/license.dat`
- Linux: `/usr/local/comsol52a/multiphysics/license/license.dat`

ERROR MESSAGE	EXPLANATION
License error	A general license error has occurred. Check the error message for details that might help solve the problem. If you need help in interpreting the information, see the FlexNet License Manager documentation or send the complete error message to support@comsol.com.
License error: -1. Cannot find license file.	The license file is missing or your system settings don't allow you to read the file. Review the license manager installation steps above and check that you have administrative rights on your computer.
License error: -2. Invalid license file syntax.	There is a formatting problem with your license file. This can happen if you edit it with a word processing software such as Microsoft Word which inserts extra (invisible) characters. Use a plain text editor instead (on Windows: Notepad, WordPad, or similar). Formatting problems can also happen if the file is corrupted while being copied or emailed from one computer to another.
License error: -4. Licensed number of users already reached.	The license manager has detected that all available licenses of a certain COMSOL product have been used by other users. Contact your license administrator and report this problem. You might need more licenses of one of the add-on products.
License error: -5. No such feature exists.	The license manager has encountered a problem during startup. Check the license manager log file for error messages. Please send the log file to support@comsol.com if you want help in interpreting the information. NOTE: The license manager creates the log file. If there is no log file, make sure to first start the license manager. Please refer to one of the License Manager Installation sections of this manual for instructions how to install and start the COMSOL license manager.

ERROR MESSAGE	EXPLANATION
License error: -10. Feature has expired.	This error message indicates that you have a time-limited (trial) license and that your license has expired. Contact your license administrator to see if a more recent license file is available. You can also contact a COMSOL representative to renew your time-limited license.
License error: -12. Invalid returned data from license server system.	Check that no firewall on the COMSOL client is preventing the connection from the COMSOL client to the license server. Temporarily disable any firewall on the COMSOL client to see if that helps. Check that no firewall on the license server is preventing the connection from the COMSOL client computer to the license manager, or the connection from the lmgrd daemon and the LMCOMSOL daemon. If the problems remain, send the license manager log file to support@comsol.com.

ERROR MESSAGE	EXPLANATION

License error: -15. Cannot connect to license server system.	The COMSOL license manager has not been installed or started yet. If the first line of your license.dat file looks like this:
	`SERVER mylicserver 000123456789 1718`
	a license manager is required. Please refer to the License Manager Installation sections of this manual for instructions on how to install and start the COMSOL license manager.
	Check that no firewall on the COMSOL client is preventing the connection from the COMSOL client to the license server. Temporarily disable any firewall on the COMSOL client to see if that helps.
	Check that no firewall on the license server is preventing the connection from the COMSOL client computer to the license manager.
	Check that the `license.dat` file on the COMSOL client computer points to the correct license server host name. First, find the `license.dat` according to the instructions above.
	Check that the first line has the correct license server Host Name. For example, if your license server Host Name is `apollo`, the first row in the license.dat file should look like this:
	`SERVER apollo 000123456789 1718`
	If the COMSOL client computer does not recognize `apollo` as a proper Host Name, it might help to instead use the fully qualified domain name (`apollo.thecompany.com`) or the IP address. If neither of these work, there might be a problem with DNS or the HOSTS file on the client. Please ask your system administrator for advice on how to connect with TCP/IP to the license server.
	Finally, the license manager might have encountered a problem during startup. Check the license manager log file for error messages.
	NOTE: The log file is created by the license manager after it has been started.
	Please send the log file to support@comsol.com if you want help in interpreting the information.

License error: -39. User/host not on INCLUDE list for feature.	The error means that your username does not match the one listed in the license-manager options file, `LMCOMSOL.opt`. To get access to COMSOL, ask your license/system administrator for help. When the username in the options file is changed, the license manager must be shut down and restarted to give the new user immediate access to COMSOL.

ERROR MESSAGE	EXPLANATION
License error: -88. System clock has been set back.	The software has detected that a system clock has been set back. Please make sure that your computer's clock is set to the current local time and date. If the problem remains check that there are no files on your hard drive that have a future date.
License error: -96. License server machine is down or not responding.	Please make sure that the SERVER host name in the `license.dat` file is valid and that the TCP/IP network connection between the application computer and the license server is working properly. This error could also indicate that your firewall is not configured properly in order to let the license manager and vendor daemon network traffic through (typically ports 1718 and 1719). It could also indicate problems with other network security settings. Contact your systems administrator for help.
License error: -97. The desired vendor daemon is down.	The license manager has encountered a problem during startup. Check the license manager log file for error messages. NOTE: The log file is created by the license manager after it has been started. Please send the log file to support@comsol.com if you want help in interpreting the information.

Index

A
add feature *22*
application libraries, installing *26*
Application Library Update
configuring on Linux *94*
configuring on Mac *74*
configuring on Windows *41*
AutoCAD
LiveLink for *43*
Autodesk Inventor
LiveLink for *43*
automated installation
Linux *93*
Mac *74*
Windows *40*
automated license manager installation
Linux license server *99*
Mac license server *78*
Windows license server *55*

B
boot script *100*
Bourne shell commands *99*
`browser`, Linux file *93*

C
change license, with COMSOL installer *22*
changing the license
Linux *101*
Mac *80*
Windows *57*
Classkit License
desktop shortcuts *62*
Linux *106*
Mac *83*
Windows *61*
cluster computing
Linux *107*
Mac *87*
Windows *66*
comment line, license file *50*
Community Discussion Forum *15*
compute node *66*
COMSOL Access *15*
COMSOL Client
Mac *84*
Windows, connecting *64*
`comsol` command, Linux *103*
`comsol` command, Mac *83*
COMSOL Conference *15*
COMSOL Exchange *15*
COMSOL Multiphysics Client
Linux, connecting *106*
Mac, connecting *84*
Windows *60*
Windows, running *63*
COMSOL Multiphysics Server
Linux, running *105*
Linux, running with MATLAB *108*
Linux, starting *105*
Mac *82*
Mac, running *83*
Mac, starting *84*
Windows *60*
Windows, running *63*
Windows, running with MATLAB *68*
COMSOL Software License Agreement *11*
COMSOL Video Center *9*
core *67*
CPU-Locked Single User License *12*
Creo Parametric
LiveLink for *45*
cross-platform user interface *59, 62*
csh program *108*

D DirectX runtime binaries *30*
documentation, installing *26*
dongle *14*
downloading product *9*
Mac *69*
Mac, DVD *72, 90*
troubleshooting *109*
Windows *16*
Windows, DVD *19*

E errors, license *109*
Ethernet address
Linux *88*
Mac *81*
Windows *17*
Windows, changing license and *58*

F FEATURE line, license file *52*
FEATURE names *52*
FlexNet
control panel *49*
License Administration Guide, Linux *96*
License Administration Guide, Mac *76*
License Administration Guide, Windows *49*
license manager, troubleshooting *109*
license manager, Windows *48*
management, Linux *96*
management, Mac *76*
management, Windows *49*
utility program, Linux *96*
utility program, Mac *76*
utility program, Windows *49*
Floating Network License
definition *12*
Linux, client servers and *105*
Linux, clusters and *107*
Linux, clusters installation and *95*
Mac, client server and *84*
Mac, clusters and *87*
management software *14*
Windows, client server and *63*
Windows, cluster installation and *46*
Windows, clusters and *66*
Windows, definition *48*

H hard disk serial number *17*
hardware address *70*
hardware lock *14*
host *67*
hostid
Linux, changing licenses *102*
Linux, Internet installations *88*
Mac, changing licenses *81*
Mac, Internet installations *70*
Windows, changing licenses *58*
Windows, Internet installations *17*
Windows, license server and *51*

I INCREMENT line, license file *52*
installation
Linux *88*
Mac *69*
media options *9*
OS X *69*
previous *10*
Windows *16*
installation, quick selections *26*

K Knowledge Base *9*
COMSOL Access, and *15*
troubleshooting *109*

L License Agreement *9*
license agreement *11*
license errors *109*
license file
comment line *50*
FEATURE line *52*
FlexNet, and *14*

INCREMENT line *52*
Mac, obtaining *71*
SERIAL line *52*
SERVER line *51*
troubleshooting *110*
USE_SERVER line *51*
VENDOR line *51*
Windows, obtaining *18*
license manager
automated installation on Linux *99*
automated installation on Mac *78*
automated installation on Windows *55*
daemon, Linux *96*
daemon, Mac *76*
daemon, Windows *49*
files for installation, Linux *97*
files for installation, Mac *77*
files for installation, Windows *54*
installing files, Linux *97*
installing files, Mac *77*
installing files, Windows *54*
Linux, log file *99*
Linux, starting *99*
log file *56*
log file, troubleshooting *110*
Mac, log file *79*
Mac, starting *79*
Windows, log file *57*
Windows, starting *55*
license server
Linux, and *96*
Linux, client server and *105*
Mac, and *76*
Windows, and *24*
Windows, client server and *63*
license, changing
Linux *101*
Mac *80*
Windows *57*
`license.dat` FlexNet, and *14*
`license.dat` Linux *97*
`license.dat` Linux, changing *101*
`license.dat` Mac *76*
`license.dat` Mac, changing *80*
`license.dat` troubleshooting *110*
`license.dat` Windows *50*
`license.dat` Windows, FlexNet and *49*
Linux Standard Base *102*
LiveLink for
AutoCAD *43*
Autodesk Inventor *43*
Creo Parametric *45*
Pro/ENGINEER *44*
Solid Edge *45, 46*
SolidWorks *42*
`lmgrd.exe` Linux *96*
`lmgrd.exe` Mac *76*
`lmgrd.exe` Windows *49*
`lmhostid`
Linux *102*
Mac *81*
`lmutil`
Windows *58*
`lmutil` Linux *96*
`lmutil` Mac *76*
`lmutil` Windows *49*
log file, license manager *56*
log file, Linux *99*
log file, Mac *79*
log file, troubleshooting *110*
log file, Windows *57*
LSB *102*

M MAC address
Linux installations *88*
Mac installations *81*
Windows installations *17, 58*

MATLAB
Linux, changing path to *94*
Mac, changing path to *75*
running COMSOL Multiphysics on Linux with *108*
running COMSOL Multiphysics on Mac with *82*
running COMSOL Multiphysics on Windows with *68*
Windows, changing path to *68*
merged license file *25*
multicore computing *11*
multiprocessor computing *11*

N Named Single User License
definition *12*
Linux, and *92, 97*

O operating system *11*
options file *97*

P passcode *16*
physical address *17*
port number *24*
previous installation *10*
Pro/ENGINEER
LiveLink for *44*
product downloads *9*
COMSOL Access, and *15*
Mac *69*
Mac, DVD *72, 90*
troubleshooting *109*
Windows *16*
Windows, DVD *19*
product updates *9*
COMSOL Access, and *15*
proxy server
for software updates *40*
Linux installations *94*
Mac installations *75*
Windows installations *31*

Q quick selections, for installation *26*

R Remote Desktop *30*
remove feature *22*
root *99*

S SERIAL line, license file *52*
SERVER line, license file *51*
shared-memory computing *11*
software license agreement *11*
Solid Edge
LiveLink for *45, 46*
SolidWorks
LiveLink for *42*
system requirements *9, 10*

T technical support, contacting *109*
technical support, website *9*
three-server redundancy *24*
trial license
Linux *88*
Mac *69*
Windows *16*
troubleshooting license errors *109*
tutorials, installation *109*
tutorials, videos *9*

U unattended installation
Linux *93*
Mac *74*
Windows *40*
uninstalling COMSOL
Linux *93*
Mac *74*
Windows *37*
updates, product *9*
COMSOL Access *15*
USE_SERVER line, license file *51*
user interface, cross-platform *59, 62*
utility program, Linux *96*
utility program, Mac *76*
utility program, Windows *49*

V vendor daemon
Linux installations *96*
Mac installations *76*
Windows installations *49*
VENDOR line, license file *51*
videos
installation *109*
tutorials *9*
volume serial number *17*

W web browsers, for Linux *93*
Windows Remote Desktop *30*

X xterm program *108*