755 Phoenix Drive, Ann Arbor MI, 48108, USA
Phone: 734 668-2930 • Fax: 734 668-2877 • Email: info@carsim.com
carsim.com

Licensing for High-Performance Computing (HPC)

Starting with the 2020 software release, VehicleSim (VS) products (BikeSim®, CarSim®, TruckSim®, and SuspensionSim®) support a lightweight licensing mechanism that is well-suited for High-Performance Computing (HPC) installations, especially on Cloud or Virtualized hardware with ephemeral lifetimes. When using HPC Licensing, VS Math Models can be run on fresh machine installations with minimal license setup. Licenses are managed by a central networked server.

In this configuration, a single license server machine can support 1000+ concurrent solver instances running on remote machines, depending on the software package and seat count available at your organization.

HPC Licensing is supported by all solver products (BikeSim®, CarSim®, TruckSim®, and SuspensionSim®) and works on both Windows and Linux operating systems.

Note This memo uses CarSim example, but the instructions are interchangeable with BikeSim, TruckSim, and SuspensionSim software products.

Topology

The key difference of HPC Licensing, compared to traditional FlexNet network licensing, is that the CarSim License Manager (`cs-lm-cli`) program moves from the simulation machine to the "License Server Machine," and the CarSim License Manager program functions as the license server instead of FlexNet (Figure 1).

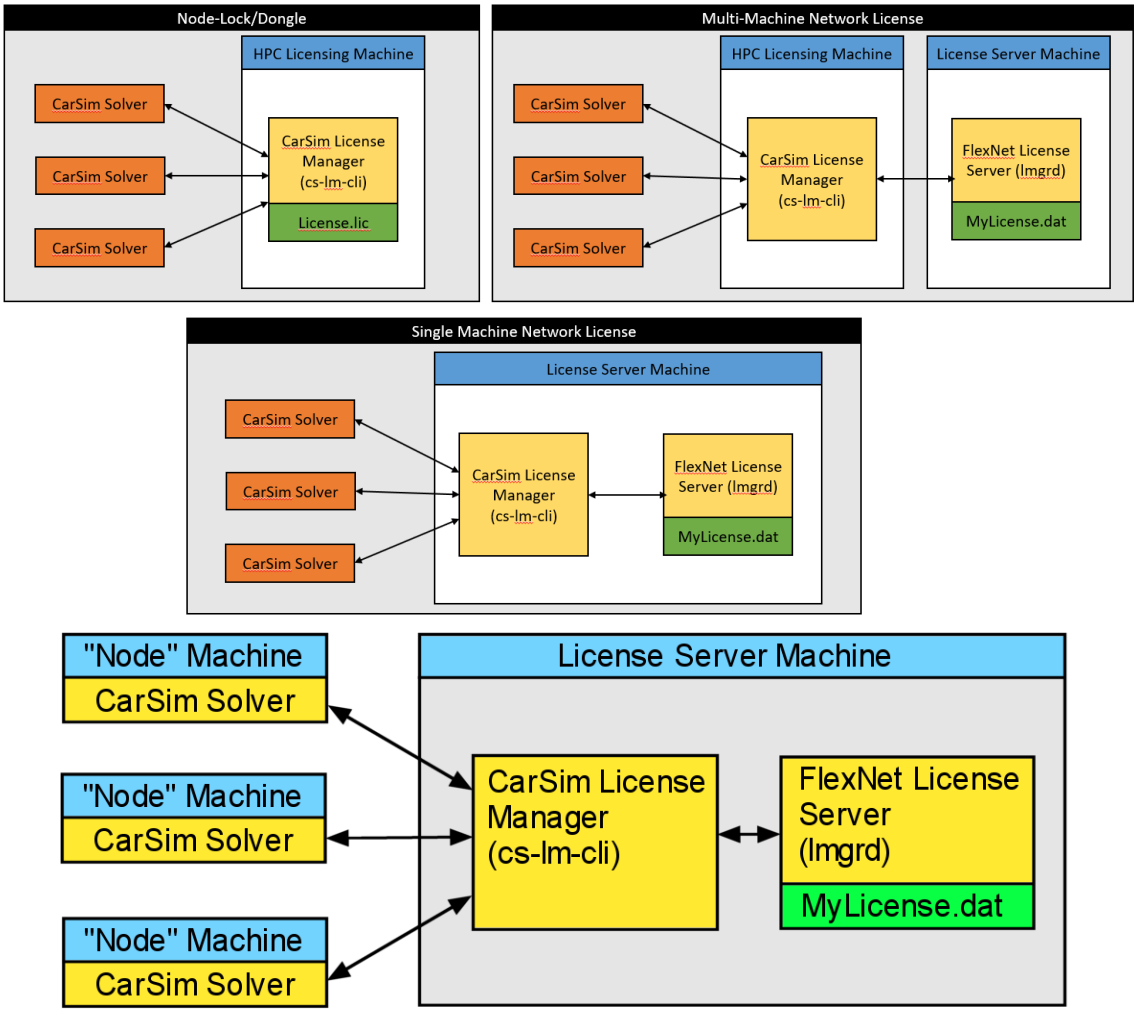

Figure 1. HPC Licensing topology diagram.

In this configuration, the simulation machines are freed from license configuration and setup concerns.

HPC Licenses are counted and managed by the CarSim License Manager, acting as a server. When a simulation machine runs the CarSim solver, one `carsimhpc` license feature is requested from the license server machine and is held by the solver for the duration of the simulation run.

In the case of simultaneous simulations on one machine, each process requires one `carsimhpc` license feature.

HPC License Server Setup

A specially configured `cs-lm-cli` process runs on a designated license server machine and coordinates license access for all instances of CarSim participating in the HPC licensing system. The server requires a FlexNet Server instance and a license file provided by Mechanical Simulation.

For instructions on setting up the license server machine, skip ahead to the sections for FlexNet Setup and HPC License Server Setup.

Table 1. Example Network Server Installers

File Name	Description
`Setup_NetworkLicense_2021.1_r12345.exe`	Windows Installer
`mechsimlicserver_2021.1_Redhat_x86_64_r12345.tar.gz`	Red Hat & CentOS Installer (Linux)
`mechsimlicserver_2021.1_Ubuntu_x86_64_r12345.tar.gz`	Ubuntu Installer (Linux)

FlexNet Setup

All HPC License Server installations are ultimately backed by the FlexNet licensing architecture, as is the case for other Mechanical Simulation software.

FlexNet setup should take place on the designated server machine using one of the installation packages listed in *Table 1. Example Network Server Installers*.

The FlexNet licensing can take the form of a node lock, dongle, or network-style license, and this license will be installed on the machine you have designated as the HPC License Server.

In the case of a FlexNet network license, the CarSim License Manager and FlexNet Network License Server software may reside on different machines, but this guide will demonstrate installation on the same machine for the sake of simplicity.

Node Lock License

A node lock license takes the form of a license file (`*.lic`) supplied by Mechanical Simulation and is tied to a machine's unique identity. You will place the license file in a common location on the machine.

For Windows:

```
C:\FlexLM\K123456.lic
```

For Linux:

```
~/.config/mechsim/K123456.lic
```

Dongle License

A dongle license takes the form of a paired license file (`*.lic`) and hardware dongle supplied by Mechanical Simulation. The license file is tied to the unique ID of the hardware dongle. You will connect the dongle to a USB port and place the license file in a common location on the machine.

For Windows

```
C:\FlexLM\K123456.lic
```

For Linux (CentOS and RedHat only)

```
~/.config/mechsim/K123456.lic
```

Network License

A network license takes the form of a license file (`*.dat`) supplied by Mechanical Simulation and is tied to a machine's unique identity and network host name. FlexNet network license server software ("`lmgrd`") runs on the network server machine and serves licenses to multiple clients using Mechanical Simulation software. You will be installing the license file and FlexNet license server on your designated machine. The following documents are offered with the FlexNet License Server installer and offer detailed instructions for setting up the FlexNet server.

For Windows: **FlexNet Network License Setup.pdf**

For Linux: **License Server Linux Guide.pdf**

HPC License Server Setup

The HPC License Server is typically set up on the same machine running the FlexNet server (see FlexNet Setup). The command line version of the CarSim License Manager functions as the HPC License server once HPC mode is enabled via configuration file.

Example Windows Program Location

```
C:\Program Files (x86)\CarSim2020_Prog\Programs\cs-lm-cli.exe
```

Example Linux Program Location(s)

```
/opt/carsim_2020/bin/cs-lm-cli
```

```
/opt/mechsimlicserver_2020/bin/cs-lm-cli
```

When HPC mode is enabled, all loaded license features will be made available to HPC clients via the network. Note that in this mode, license features will not be available for usage on the local machine unless the HPC licensing mechanism is being used.

The CarSim License Manager functionality is controlled via configuration files in the following locations:

Windows Configuration File Location

```
C:\FlexLM\
```

Linux Configuration File Location

```
~/.config/mechsim/
```

Configuration files are either installed by the installer program, or will be generated automatically the first time you run the CarSim License Manager (*Table 1*).

Table 2. Contents of license directory.

Item	Type	Note
`license_source.cfg`	Text File	Configures the License Manager to work with network licenses or license files
`requested_licenses.cfg`	Text File	Configures which licenses will be used
`hpc.cfg`	Text File	Configures settings for HPC licensing mode
`K*******.lic`	License File(s)	(Optional) Installed by user

Configuring the License Source

For a FlexNet network license, the license source should be the hostname of the FlexNet License Server preceded by an "@" symbol. Open `license_source.cfg` in a text editor, and replace the contents with a hostname of the following format:

```
@serverhostname
```

You may reference the license file (*.dat) supplied by Mechanical Simulation to find the hostname.

For a Node Lock or Dongle license, the license source should be the path to the license file or its parent directory. Open `license_source.cfg` in a text editor, and replace the contents with one of the following paths, depending on your operating system:

Windows

```
C:\FlexLM\
```

Linux

```
~/.config/mechsim/
```

Alternatively, you can use the `-configpath` commandline parameter to specify a custom configuration path.

Configuring the Requested Licenses List

The requested license list contains a list of license features and seat counts you would like to make available via the HPC License Server. Open `requested_licenses.cfg` in a text editor, and type a list of feature names followed by seat counts, in the following style:

```
carsimhpcus         10
carsimtrailerus     1
carsimsmous         1
```

You may reference the license file (`*.lic` or `*.dat`) supplied by Mechanical Simulation to see the license features available to you.

Note that the seat count for `carsimhpcus` ultimately determines the maximum number of concurrent solver simulations in the above example.

Configuring HPC Mode

HPC settings are configured by the `hpc.cfg` file.

Windows

```
C:\FlexLM\hpc.cfg
```

Linux

```
~/.config/mechsim/hpc.cfg
```

To enable HPC licensing, open the file in a text editor, and change the following value from "False" to "True:

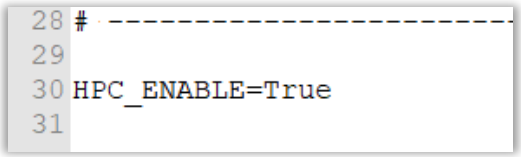

Figure 2. View of hpc.cfg file.

Start CarSim License Manager, and you will see a special message showing that it is running as an HPC Licensing Server.

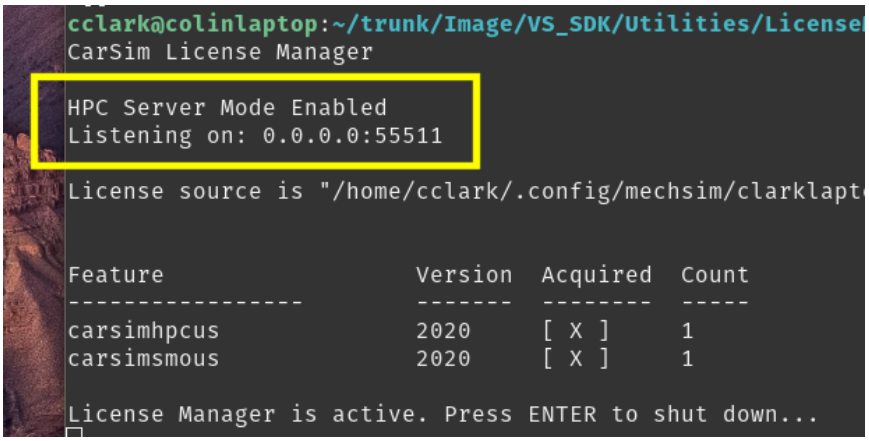

Figure 3. View of cs-lm-cli in HPC Licensing mode.

To bind to a specific network adapter or network port, use the following keywords in the `hpc.cfg` file:

```
HPC_SERVER_PORT=[Integer 0-65535]

HPC_ENABLE=[True/False]
```

HPC License Server as a Service/Daemon

We recommend running the HPC License Server (`cs-lm-cli`) as a daemon process, such that it comes online automatically when the machine boots.

On Linux, run the `installLicDaemon.sh` or `configure_cs-lm-cli_daemon.sh` script located in the `/Install/` area of the unpacked installer tarball directory, and `cs-lm-cli` will be installed as a daemon.

On Windows, running `cs-lm-cli.exe` as a service is currently unsupported, but the server can be started manually or by script in a command prompt window.

Inspecting Logs

Log files for the HPC License Server are written to the following locations:

Windows Log File Location

```
%APPDATA%\mechsim\cs-lm-cli.log
```

Linux Log File Location

```
/var/log/cs-lm-cli.log
```

Running Simulations

The sole requirement for running the solver in HPC Licensing mode is to supply the HPC License server network address, which causes the solver to seek licenses from the server rather than locally. There are three methods available.

Command Line Argument

The command line interface wrapper for CarSim (`carsim-cli`) supports the `hpclicensingaddress` command line argument, and it is used as follows:

```
carsim-cli --hpclicensingaddress 192.168.0.1
```

VS API

The C API function `vs_set_hpc_licensing_address()` is used to set the HPC server address from within a program hosting the solver library (`.dll` or `.so`).

Figure 4 shows an example of its usage.

```
char solverPath[FILENAME_MAX] = "";
vs_get_dll_path("simfile.sim", solverPath)
int solverLib = vs_load_library(solverPath);
vs_get_api(solverLib, solverPath);

vs_set_hpc_licensing_address("192.168.0.1");

vs_setdef_and_read("simfile.sim", NULL, NULL);
vs_initialize(0, NULL, NULL);
vs_run("simfile.sim");
```

Figure 4. Example of C code using vs_set_hpc_licensing_address().

Par File Keyword

The keyword HPC_LICENSING_ADDRESS is used to set the HPC license server address from either the parse file (`*.par`) data or from the VehicleSim Browser in a yellow field.

Figure 5 shows an example of its usage.

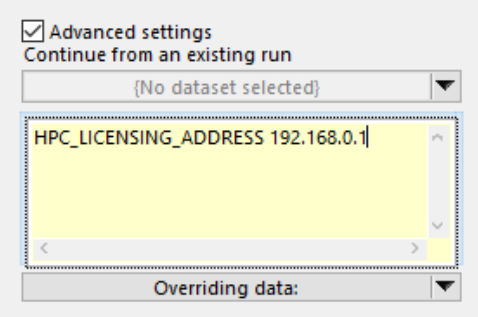

Figure 5. Example of HPC_LICENSING_ADDRESS in the VS Browser.

Running

If HPC Licensing is configured correctly, you may execute a simulation run via your chosen method (e.g. VS Browser, CarSim Command Line Wrapper, custom wrapper). There is no distinction between a run using local licensing vs HPC Licensing.

The solver will request the "`carsimhpc`" (or similar) license feature from the HPC License Server and hold it for the duration of the run.

If the solver has trouble obtaining the license, you will see an error message that shows the expected address of the HPC Licensing server (Figure 6).

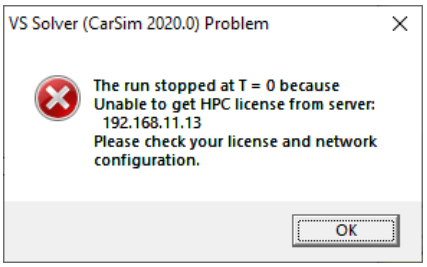

Figure 6. Example of HPC_LICENSING_ADDRESS in the VS Browser.