MapleSim Server Administrator Guide

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Overview

About MapleSim Server

MapleSim Server provides an easy web deployment option for your MapleSim-based solutions. The MapleSim Server allows engineers throughout your organization to explore MapleSim simulation models from a web browser, even if they do not have MapleSim.

Docker Container for MapleSim Server

The MapleSim Server server is intended to be deployed in the Docker container generated by the MapleSim Server installer. Running it requires the Docker container engine. We recommend using the latest stable release of Docker. The Docker container contains all the dependencies of the MapleSim Server binary. The Docker container can also be deployed to various cloud hosting environments.

For more information on where to obtain the Docker engine for your platform, installing MapleSim Server and running the MapleSim Server container see the **MapleSim Server Installation Guide**.

Note: Attempting to run MapleSim Server outside of the Docker container is not supported.

MapleSim Server Resources

Since MapleSim Server is built on and shares much if its content with MapleNet (including APIs), some additional documentation is listed below to help you further explore MapleNet.

Resource	Description
MapleSim Server Installation Guide	System requirements and installation instructions for MapleSim Server. The **MapleSim Server Installation Guide** is available in the **Install.html** file located either on your MapleSim Server installation DVD or the folder where you installed MapleSim Server.
MapleNet Services Guide	Outline of MapleNet services. Information on limitations of services provided as well as a summary of MapleNet API endpoints.
MapleNet API Programming Guide	A detailed description of the MapleNet API with examples.

For additional resources, visit **http://www.maplesoft.com/site_resources**.

Getting Help

To request customer support or technical support, visit **http://www.maplesoft.com/support**.

Customer Feedback

Maplesoft welcomes your feedback. For comments related to the MapleSim Server product documentation, contact doc@maplesoft.com.

1 Basics of Running MapleSim Server

1.1 Glossary of Variables Used in This Chapter

The following variables are used in this chapter, and should be replaced with the correct values:

`SIMLICENSEFILE:` The location of the MapleSim license file (on the host machine).

`LICENSEFILE`: The location of the MapleNet license file (on the Docker host)

`HOSTPORT:` The port on the host machine on which MapleNet should accept connections

`IMAGETAG:` The tag of the Docker image created by the installer

`CONTENTDIR`: The directory containing content for hosting by MapleSim Server (on the Docker host)

`MAPLEONLINECDNURL`: The URL of a Content Delivery Network hosting the MapleNet JavaScript libraries

`MATHJAXCDNURL`: The URL of a Content Delivery Network hosting the Math Jax JavaScript package

`HOSTADDRESS:` Is either the ip address or machine address of the machine running the MapleSim Server Docker container

`CONTAINERID:` The container id obtained from running `docker container ls`

Additional documentation for the configuration variables used in these examples is available in the Configuration section of the Administrators Guide

1.2 Loading the MapleSim Server Docker Image

After you have installed MapleSim Server, you must load the MapleSim Server image into Docker.

To load the MapleSim Server image:

1. Open a command prompt and navigate to the MapleSim Server installation folder, before running this command.
2. Run the following command:

```
docker load --input MapleSimServer-2021.1.tar
```

Note: This process could take several minutes.

Next, find the MapleSim Server container image tag using the command:

`docker images`.

You are now ready to start MapleSim Server.

1.3 Starting MapleSim Server

Starting MapleSim Server Using the docker run Command

To start MapleSim Server, run the following Docker command:

```
docker un --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly
--mount type=bind,source=$SIMLICENSEFILE,target=/maple/toolbox/MapleSim/license/MapleSim.dat,readonly
```

```
--mount type=bind,source=$CONTENTDIR,target=/webroot/content
--publish $HOSTPORT:8080
--rm -e MAPLENET_WEBSERVER_ENABLEDIRECTORYLISTING=true maplesoft/maplesimserver:$IMAGETAG
```

(1.1)

In this example:

`$LICENSEFILE`	=	"/home/qa/maplenet/2021.1/license/license.dat"
`$SIMLICENSEFILE`	=	"/home/qa/maplenet/2021.1/license/license.dat"
`$CONTENTDIR`	=	"/home/qa/Desktop/Worksheets"
`$HOSTPORT`	=	8080
`$IMAGETAG`	=	2019.2-1460361

Note: If `$LICENSEFILE` contains spaces, then you must enclose the path in quotation marks. For example, `source="C:\Program Files\MapleNet\2021\license.dat".`

To test if MapleSim Server is running properly navigate to `http://$HOSTADDRESS:8080` in your browser.

You should see a page displayed with a link to a Maple demo worksheet.

For more information on using the `docker run` command, see https://docs.docker.com/engine/reference/command-line/run/

Starting MapleSim Server Using a docker compose File

Alternatively, you can specify MapleSim Server options using a docker compose (YAML) file:

```
version: 3.7

    services:
        maplesimserver:
            image: maplesoft/maplesimserver:$IMAGETAG
        ports:
        - "$HOSTPORT:8080"
        volumes:
        - type: "bind"
            source: $LICENSEFILE
            target: "/maple/license/license.dat"
            read_only: true
        - type: "bind"
            source: $SIMLICENSEFILE
            target: "/maple/toolbox/MapleSim/license/MapleSim.dat"
            read_only: true
```

The command used to deploy MapleSim Server is

```
docker stack deploy maplenet --compose-file <path to above file>
```

To test if MapleSim Server is running properly navigate to `http://$HOSTADDRESS:8080` in your browser.

You should see a page displayed with a link to a Maple demo worksheet.

For more information on the `docker stack` command, see https://docs.docker.com/engine/reference/command-line/stack/.

For more information on docker compose files, see https://docs.docker.com/compose/gettingstarted/

Replacing the Landing Page

The MapleSim Server container, by default, includes a landing page, *index.html*. Located at the bottom of the MapleSim Server file directory. To replace this page, mount a directory from your host machine, with the replacement landing page (called index.html) onto your MapleSim Server Docker container, mapping it to the directory containing your current index.html file. For more information on mounting host machine directories into the MapleSim Server Docker container, see *Basic Document Hosting (page 23)*.

1.4 Stopping MapleSim Server

To stop the MapleSim Server:

1. At the prompt, to list your running containers, enter:

```
docker container ls
```

Find the running MapleSim Server container ID in the list.

2. Next, you must stop the MapleSim Server Docker container. To do this, enter:

```
docker container stop $CONTAINERID
```

Where $CONTAINERID is the container id obtained from step 1.

For more information on the docker stop command see https://docs.docker.com/engine/reference/commandline/stop/

1.5 Removing a Docker Image

At some point, you may want to remove some docker images from your machine.

To remove a Docker image, enter:

```
docker image rm $IMAGETAG
```

For more information on the `docker image` command, see:

https://docs.docker.com/engine/reference/commandline/image/

1.6 Adding Content to MapleSim Server

MapleSim Server is capable of rendering both classic and standard Maple worksheets, and Maple workbooks, as well as MapleSim models, for display in a web browser. This is the easiest way to create web content for use with MapleSim Server. Placing content in the correct location on MapleSim Server makes the content available to users. Without an installed copy of Maple, users can interact with a posted worksheet using their web browser, and even perform new computations.

For instructions and examples on how to configure MapleNet to host Maple documents, see the *Basic Document Hosting (page 23)*.

1.7 MapleNet Logging

MapleNet is a server process and as such it generates informative logs by default. It is important to understand how MapleNet logging working so its logs can be properly maintained and used.

docker log

MapleNet is deployed as a Docker container therefore its logs are captured by docker. You can access these logs by using the `docker logs` command. Docker has extensive logging configuration options for how it maintains its logs and for sending docker logs to other logging systems. You can also add command line arguments to the `docker run` command to configure how docker maintains MapleNet's logs. See *Logging Configuration (page 25)* for a basic log configuration example. For more information about docker's logging options, see

docker log: https://docs.docker.com/engine/reference/commandline/logs/

docker log driver configuration: https://docs.docker.com/config/containers/logging/configure/

MapleNet options

MapleNet has various options for configuring the generated logs. All these options are documented in the Configuration section. The most important option is the `MAPLENET_LOGGING_LEVEL` option. This option controls how verbose MapleNet's logging is. This options accepts the following values (from most verbose to quietest): `trace`, `debug`, `info`, `warning`, `error`, `fatal`. The default logging level is info. This level is chosen to provide a balance of informative logging without being excessive. Increasing the logging to debug or trace will provide additional logging, however these additional log are intended for developers more than users. Decreasing the logging levels will reduce the amount of information which may seem desirable, however should something go wrong, the reduced logging means less information for determining what happened. The default level (`info`) is the suggested level for a normal MapleNet deployment. If log storage is a concern, it is better to configure the docker log driver with log rotation than to decrease the logging level of MapleNet.

2 Environment Variable Configuration

As MapleNet is deployed as a Docker container, configuration is handled by setting environment variables within the Docker container. On the Docker command line (`docker run`) you can set an environment variable by using the `-e` command line argument. They can also be specified in a Docker stack YAML file. Any variables that are used to specify files or directories are for locations are **within** the container. See the *Adding Maple Documents to MapleNet* section of this guide for information on adding content to the Docker container.

The environment variables all start with the `MAPLENET_` prefix.

2.1 Licensing

Environment Variable	Parameter	Description
`MAPLENET_LICENSE`	file	This variable specifies which license file MapleNet uses. The license file must exist within the container at the time that MapleNet starts. It must be added to the container or mounted into the container.

2.2 Directory Setup

Environment Variable	Parameter	Description
`MAPLENET_WEBSERVER_DOCUMENTROOT`	directory	This variable specifies which directory MapleNet uses as its document root, the base directory of the content hosted by MapleNet. The default value of document root is `/webroot`. To make content available to users, mount a directory containing the content under the container's `/webroot` directory.
`MAPLENET_WEBSERVER_CACHEDIR`	directory	This variable specifies the directory where MapleNet stores cache files. The default value of this variable is `/webroot/maplenet/cache`. Cache directories contain temporary files required for rendering documents. As the remote clients need access to files in the cache directories, the cache directories must be located under document root.

2.3 Managing Connections

Environment Variable	Parameter	Description
`MAPLENET_WEBSERVER_REQUESTTIMEOUTMS`	timeout in milliseconds	This variable specifies how long, in milliseconds, MapleNet waits before timing out connections. The default value of this variable is `30000` (30 seconds). Documents that are opened by users will periodically connect to MapleNet to make sure those connections are kept open. This timeout is mostly for cases where clients disconnect without properly closing their connection.
`MAPLENET_WEBSERVER_NUMTHREADS`	integer	This variable specifies the maximum number of threads MapleNet can use for accepting connections. The default value is `1024`. These threads are used to handle user connections. If all of these threads are used, MapleNet will not be able to accept new connections.

MAPLENET_WEBSERVER_NOTFOUNDFILE	file	This variable specifies a file to be sent to the user when a requested file cannot be found. The default is the *empty string*, which causes MapleNet to reply with a very simple 404 message.
MAPLENET_WEBSERVER_PORT	port number	This variable specifies the port MapleNet listens on for new connections. The default value of this variable is 8080. This is the port within the Docker container. You will still need to map this port to an external port on the host machine, thus changing this is generally not required.

2.4 Directory Listings

Environment Variable	Parameter	Description
MAPLENET_WEBSERVER_ENABLEDIRECTORYLISTING	boolean	This variable specifies whether MapleNet permits directory listings. The default value of this variable is false. Directory listings allow the user to navigate document root like a file system.

2.5 Sendfile Usage

Environment Variable	Parameter	Description
MAPLENET_WEBSERVER_ENABLESENDFILE	boolean	This variable specifies whether MapleNet uses the sendfile command to optimize file transfers. *By default this option is enabled*. In some host configurations (certain networked or virtualized file systems) using sendfile can lead to data corruption in the transferred file.

2.6 Content Delivery Network

Environment Variable	Parameter	Description
MAPLENET_WEBSERVER_MAPLECLOUDCDN	URL	This variable specifies the base URL to use for fetching the MapleNet JavaScript library. The default value for this is variable is "/mapleonline", meaning the library will be loaded from the mapleonline subdirectory of MapleNet's document root. This can be used to place the library (mapleonline.nocache.js) on to a Content Delivery Network (CDN). mapleonline.nocache.js will be appended to the given URL.

2.7 Worksheet Template Location

Environment Variable	Parameter	Description
MAPLENET_WEBSERVER_MAPLEWORKSHEET	filename	This variable specifies the file to use as the Worksheet HTML template page. By default, this file is

		`/maple/data/MapleWorksheet.html`. Some users may want to use a custom version of this file.

2.8 Web Server Endpoints

Environment Variable	Parameter	Description
`MAPLENET_WEBSERVER_ENDPOINTS_COMPUTE`	boolean	This variable specifies whether MapleNet enables its compute endpoint. The default value of this variable is `true`. The compute endpoint allows for a user to submit a Maple computation request to the server and receive the result as a reply.
`MAPLENET_WEBSERVER_ENDPOINTS_DOCUMENT`	boolean	This variable specifies whether MapleNet enables its document endpoint. The default value of this variable is `true`. The document endpoint allows for users to open Maple worksheets hosted by MapleNet in a browser.
`MAPLENET_WEBSERVER_ENDPOINTS_DOWNLOAD`	boolean	This variable specifies whether MapleNet permits users to download the Maple documents hosted by MapleNet. The default value of this variable is `false`. If set to `true`, adding the `download` url parameter to the url of a Maple document causes it to be downloaded instead of displayed.
`MAPLENET_WEBSERVER_ENDPOINTS_HELP`	boolean	This variable specifies whether MapleNet enables its help endpoints. The default value of this variable is `true`. The help endpoints allow users to display worksheets taken from a Maple help database.
`MAPLENET_WEBSERVER_ENDPOINTS_UPLOAD`	boolean	This variable specifies whether MapleNet enables the upload endpoint. The default value is false. Enabling the upload endpoint allow users to upload content to MapleNet using the upload.html page.

2.9 CORS

Environment Variable	Parameter	Description
`MAPLENET_WEBSERVER_CORS_ALLOWORIGIN`	string	This variable specifies the value MapleNet sets for the cross-origin resource sharing (CORS) allow origin header. The default value for this value is the *empty string*. CORS allows sites hosted on different domains to access resources from MapleNet.
`MAPLENET_WEBSERVER_CORS_ALLOWMETHODS`	string	This variable specifies the value MapleNet sets for the cross-origin resource sharing (CORS) allow methods header. The default value for this value is the *empty string*. CORS allows sites hosted on different domains to access resources from MapleNet.
`MAPLENET_WEBSERVER_CORS_ALLOWHEADERS`	string	This variable specifies the value MapleNet sets for the cross-origin resource sharing (CORS) allow headers header. The default value for this value is the *empty string*. CORS allows sites hosted on different domains to access resources from MapleNet.

2.10 SSL

Environment Variable	Parameter	Description
MAPLENET_WEBSERVER_SSL_VERIFYPEER	boolean	This variable specifies that MapleNet will require that connecting clients have a valid certificate.The default value of this variable is `false`. This allows the server to verify that any connecting client has a certificate that is signed by certificate authority from the server's trusted certificate authorities.
MAPLENET_WEBSERVER_SSL_CAPATH	directory	This variable specifies a directory MapleNet will use as its certificate authority (CA) path. The default value of this variable is the *empty string*, meaning no CA path will be added. This directory will be searched for CA certificates in PEM format.
MAPLENET_WEBSERVER_SSL_CAFILE	file	This variable specifies a file MapleNet will use as its certificate authority (CA) file. The default value for this variable is the *empty string*, meaning no CA file will be added. A CA file is a file containing CA certificates in PEM format
MAPLENET_WEBSERVER_SSL_VERIFYDEPTH	integer	This variable specifies the maximum depth of a certificate authority chain that MapleNet will accept. The default value for this variable is `9`.
MAPLENET_WEBSERVER_SSL_DEFAULTVERIFYPATHS	boolean	This variable specifies whether MapleNet uses default values for `CAFILE` and `CAPATH`. The default is true. With this set MapleNet server will use default, OS supplied, certificates
MAPLENET_WEBSERVER_SSL_CIPHERLIST	comma separated list or ALL	This variable specifies which ciphers MapleNet should present to clients for use with SSL. The default value for this variable is `ALL`, meaning all available ciphers should be presented.
MAPLENET_WEBSERVER_SSL_PROTOCOLVERSION	integer	This variable specifies the minimal version of SSL/TLS MapleNet will accept for connections. The default value for this variable is `0`.
MAPLENET_WEBSERVER_SSL_SHORTTRUST	boolean	This variable specifies whether MapleNet checks for new certificates while it is running. The default value for this variable is `false`. When set to true MapleNet will check for new certificates added to the CAFILE or CAPATH.

2.11 Client Configuration

Environment Variable	Parameter	Description
MAPLENET_WEBCLIENT_CONFIGURATION	key=value	This variable is used to set client configuration values in MapleNet.The default value for this variable is the *empty string* (no values set). These key,value pairs are placed into a JavaScript map in the `MapleWorksheet.html` template. These values can then be accessed by JavaScript running in that page. The default MapleNet JavaScript currently recognizes the MathJaxCDN key. The corresponding value is the base URL to use for locating the MathJax library. When MathJaxCDN is not set, the MathJax library is loaded from the MathJax sub-directory of MapleNet's document root. This can be used to place the MathJax library on to a Content Delivery Network (CDN). `MathJax.js` will be appended to the given URL.
MAPLENET_WEBCLIENT_ADDITIONALJAVASCRIPTURL	string	This variable specifies a string that will be injected into the HTML page sent to the client when opening a document. The default value for this variable is the *empty string*, which mean that nothing will be added to the page. This can be used to add custom JavaScript to the page as viewed by the client.
MAPLENET_WEBCLIENT_HELPURL	URL	This variable sets a URL that that is used to map help links in worksheets to web pages. The default value for this variable is `/help/display` The help topic from the help link is appended to this value to form the URL for the link. The default value maps the help links to the help endpoint of the server hosting the worksheet. Assuming the help page exists in the help databases and the help endpoints are enabled, then the help page should display.

2.12 Managing Maple Engines

Environment Variable	Parameter	Description
MAPLENET_POOL_MAXENGINES	integer	This variable sets the maximum number of Maple engines that MapleNet will start. The default value for this variable is `0`, meaning no limit. This value is

		different than MAPLENET_POOL_MAXRUNNINGENGINES, as this limits the total number of engines that can be opened, not the number of running engines.
MAPLENET_POOL_MAXFALLBACKENGINES	integer	This variable sets the maximum number of Maple engines that MapleNet will start for image plot generation. The default value for this variable is 0, meaning no limit. The pool of engines for image plot generation is separate from the pool for normal computation/document engines.
MAPLENET_POOL_COMPUTATIONTIMELIMIT	seconds	This variable sets the timelimit for compute requests (as opposed to document computations). The default value is 360 seconds. Compute requests that run for longer than this will be stopped by MapleNet and an error will be returned.
MAPLENET_POOL_DOCUMENTCOMPUTATIONTIMELIMIT	seconds	This variable sets the timelimit for computations related to an open document (worksheet/workbook). The default value is 1200 seconds. Computations that last longer than this will be stopped by MapleNet and an error will be returned.
MAPLENET_POOL_QUEUETIMELIMIT	seconds	This variable sets the timelimit for requests (computation or document) that are not able to run because MapleNet is not allowed to start a running engine. The default value for this variable is 60 seconds. An engine may not be available to run because of limits on the number of running engines. For example license restrictions or MAPLENET_POOL_MAXRUNNINGENGINES. If a request waits longer than this limit, the request will be cancelled and an error will be returned.
MAPLENET_POOL_MAXRUNNINGENGINES	integer	This variable sets the maximum number of running engines that MapleNet will allow. It defaults to 0, which means the maximum allowed by the license. It is an error to set this value greater than the license allows.

2.13 Maple Configuration

Environment Variable	Parameter	Description
MAPLENET_MAPLE_LIBRARY	path	This variable specifies a value to set for the Maple libname variable. The default is the *empty string*, which uses the default value for Maple's libname. When specifying more that one path, use a comma (,) as a separator. When setting this parameter, only the directories listed will be used. If Maple's library (maple.mla) is not present in the list, MapleNet will not function properly.

MAPLENET_MAPLE_MSERVER	filename	This variable specifies the file to be executed when starting a Maple engine. The default value for this variable is the *empty string*. The default value uses the normal Maple engine binary.

2.14 Configuring Logging

Environment Variable	Parameter	Description
MAPLENET_LOGGING_DISABLE	boolean	This variable specifies if logging is disabled in MapleNet. The default value is `false`, meaning log messages will be generated.
MAPLENET_LOGGING_FILENAME	filename	This variable specifies a file that MapleNet's logs should be written to. The default value is the *empty string*. This default causes MapleNet to log to the console. Setting this value will capture the logs in a file **within** the Docker container. This is probably not want you want. Instead capture the output of Docker or use the `docker logs` command.
MAPLENET_LOGGING_FLUSH	boolean	This variable specifies if MapleNet should flush its logs whenever a logging message is produced. The default is `false`. Flushing causes log messages to not get buffered. This can reduce performance of MapleNet, but reduces the likelihood of a log message being lost if MapleNet should exit unexpectedly.
MAPLENET_LOGGING_LEVEL	log level	This variable specifies the logging level that MapleNet uses. There are 6 logging levels, from least to most output: `fatal`, `error`, `warning`, `info`, `debug` and `trace`. The default value is `info`, which generates sufficient logging for normal operations, without being excessive. Levels below `info` (`debug` and `trace`) are intended for debugging and generate too much output for normal use.
MAPLENET_LOGGING_SYNCHRONOUS	boolean	This variable whether MapleNet uses synchronous logging. The default is `false`. Synchronous logging forces the log messages to be generated directly by the caller, not send to another thread for output. This means the message is output more directly, reducing the likelihood the message will be lost if MapleNet exits unexpectedly.

2.15 Data Limit

Environment Variable	Parameter	Description
MAPLENET_ENGINE_JAVADATALIMIT	mebibytes	This variable specifies a data limit for Java operations used by MapleNet. The default is `2048 MiB`. The Maple engine can utilize a Java virtual machine (JVM) for certain operations. This variable limits the maximum amount of memory the JVM is allowed to use.

2.16 Compute Engine

Environment Variable	Parameter	Description
MAPLENET_COMPUTEENGINE_COMMANDLINE	string	This variable specifies extra command line arguments to use when starting a Maple engine for the compute endpoint. The default value for this variable is the *empty string*.
MAPLENET_COMPUTEENGINE_DISABLESECURITY	boolean	This variable specifies whether MapleNet disables the security setting when starting a Maple engine for the compute endpoint.

		The default value for this variable is false. The Maple engine has security settings that restrict access to the operating system. Disabling the security setting will disable these restrictions, allowing Maple access to the entire system.
MAPLENET_COMPUTEENGINE_CPULIMIT	integer	This variable specifies whether MapleNet starts the Maple engines for the compute endpoint with a CPU limit. The default value for this variable is 0, which means no limit is given. Passing a CPU limit to the Maple engine halts the Maple engine after a the given number of CPU seconds. When setting a CPU limit, it is important to remember that compute engines are re-used a limited number of times and the CPU limit applies to the lifetime of the compute engine.
MAPLENET_COMPUTEENGINE_DATALIMIT	integer	This variable specifies whether MapleNet starts the Maple engines for the compute endpoint with a data limit. The default value for this variable is 0, which means no limit is given. Passing a data limit to the Maple engine limits the maximum amount of memory a Maple engine can access. If this limit is exceeded the Maple engine will shutdown. Compute engines are restarted between each computation, so each computation should start with a minimal amount of memory.

2.17 Document Engine

Environment Variable	Parameter	Description
MAPLENET_DOCUMENTENGINE_COMMANDLINE	string	This variable specifies extra command line arguments to use when starting a Maple engine for a document. The default value for this variable is the *empty string*.
MAPLENET_DOCUMENTENGINE_DISABLESECURITY	boolean	This variable specifies whether the MapleNet security setting is disabled when starting a Maple engine for a document. The default value for this variable is false. The Maple engine has security settings that restrict access to the operating system. Disabling the security setting will disable these restrictions, allowing Maple access to the entire system.
MAPLENET_DOCUMENTENGINE_CPULIMIT	integer	This variable specifies whether MapleNet starts the Maple engines for documents with a CPU limit. The default value for this variable is 0, which means no limit is given. Passing a CPU limit to the Maple

		engine halts the Maple engine after a certain number of CPU seconds. Document engines persist for the lifetime of the document, are not re-used. Thus this variable limits the total amount of CPU time a document session can consume.
MAPLENET_DOCUMENTENGINE_DATALIMIT	integer	This variable specifies whether MapleNet starts the Maple engines for the compute endpoint with a data limit. The default value for this variable is 0, which means no limit is given. Passing a data limit to the Maple engine limits the maximum amount of memory a Maple engine can access. If this limit is exceeded the Maple engine will shutdown. Document engines persist for the lifetime of the document, are not re-used. Thus this variable limits the total amount of memory a document session can consume.

3 Security Issues

MapleNet permits remote users to execute Maple code on a server. Maple is a full featured programming language, including tools for accessing the file system, networking and external calling to other programming language, such as Java, Python and C. It is difficult to restrict what users can access. Deploying MapleNet securely requires understanding the environment in which it is intended to be used. Do you trust your users, or is there a risk of malicious access? Are there users whose content should be kept private from others? This section will describe the security risks of deploying MapleNet server and best practices for limited harm.

3.1 Untrusted Users

The risk of allowing untrusted users to access MapleNet is that someone malicious might attempt to cause harm or exploit the system for their own purposes. It is difficult to secure MapleNet against malicious users so we advise against allowing untrusted users to access a MapleNet installation. The biggest risk is allowing an untrusted user to execute their own code. If you intend to deploy MapleNet where it would be accessible to untrusted users, we suggest the following procedures.

1. Configure MapleNet behind a load balancer with SSL offload.
2. Disable the compute endpoint. The compute endpoint explicitly allows users to run arbitrary Maple code on the server.
3. Disable the help endpoints. The help pages may contain examples that could be exploited.
4. Disable uploading. Another route to executing malicious code would be to embed it in a worksheet and upload it.
5. Disable directory listing. This makes it harder for malicious users to find content on the site.
6. Double-check your content. Maple worksheets can contain embedded components. These components can accept user input and cause Maple code to be evaluated. It is possible to create worksheets that execute Maple code entered into a component (a text area or math container, for example). Do not allow such worksheets to be hosted.
7. Makes sure you have limited the CPU and data limits for your document engines. This makes denial of service attacks via Maple code more difficult.
8. Assume the content that users view is available to other users. With all the steps above implemented, it is very hard for one user to "snoop" on another user's content, however we suggest that you do not use MapleNet to display content that you would consider private when untrusted users have access to MapleNet.

3.2 Trusted Users

In an environment when you trust your users to not be malicious, MapleNet features can be enabled as you see fit. However there are still some issues to consider. Turning off unnecessary features is still a good idea. A curious user might experiment with the compute features of MapleNet without realizing it could negatively effect the performance of documents. With directory listings enabled, it is possible to locate temporary files created by on going computations and open documents (the contents of the cache directory). These locations can also be determined by viewing the HTTP requests made by a open document. These requests are encrypted when using SSL, but are sent in the clear when SSL is not enabled. This may be a concern as it allows one user to see some of the content generated by another user's document. If this is a concern, using SSL and disabling directory listings makes it significantly harder to discover those files. If you need to be certain that no data leakage can occur between groups of users, we suggest running multiple instances of MapleNet that are only accessible by users of the particular security levels.

4 MapleNet Metrics and Monitoring

4.1 Metrics and Monitoring Tools

MapleNet provides some secondary features and server monitoring tools. These are described below. The term endpoint refers to a URL that MapleNet provides that can be accessed using standard HTTP requests. When these endpoints are accessed MapleNet replies with an HTTP response containing the requested information. There is no file on the server corresponding to these replies, they are generated by MapleNet itself.

Health Check

The Health Check endpoint is `/healthcheck/`. When an `HTTP GET` accesses this endpoint MapleNet will reply with an HTTP response with a status code of 200 and with no content. This is intended to be used by monitoring services to verify that MapleNet is available. A successful reply from the health check endpoint verifies that MapleNet is able to accept new connections, but it does not verify that MapleNet is able to execute commands or open a new document.

The endpoint returns a json object of the form:

```
{
"check": "Foo",
"level": "WARNING",
"message": "Lorem ipsum dolor sit amet, consectetur adipiscing elit"
}
```

Where `check` is the name of the check that generated the message and `check` is one of:

- `PoolHeathCheck( $poolName )` , where `$poolName` is one of `Document`, `Compute`, or `Fallback`
- `LicenseCheck`.

The level field is one of `OK`, `WARNING`, or `ERROR`.

It's important to note that `messages` is supposed to be an array.

The message is an arbitrary string providing feedback for the MapleNet administrator.

A successful health check won't produce any messages. A health check that is not successful will produce either a `WARNING` or an `ERROR` message, which will appear as an entry in the messages.

The most severe level of all the messages is put in the status field. If there are no messages, the status field is set to OK.

Status is one of OK, `WARNING`, or `ERROR`.

The http return code for a `GET` to `/healthcheck/` will be 200 if the status is `OK` or `WARNING`. An http return code of 500 is returned if the status is `ERROR`.

When the healthcheck endpoint is requested, the health checks that are exercised are:

- a license check
- exercising each kernel pool
- When each kernel pool is exercised, `2+3` is executed on each kernel. An error is returned if a kernel could not be retrieved from the pool or if the returned value is incorrect (in other words, if the answer is not `5`). This could happen if the pools are already full and no kernels are released.

Command Line Parameter	Domain	Default	Purpose
`WebServer.Endpoints.HealthCheck.LicenseCheck`	boolean	true	Set to false to disable the license check, true to enable it
`WebServer.Endpoints.HealthCheck.Pool.Document`	boolean	true	Set to true to exercise the document kernel pool, false to disable it
`WebServer.Endpoints.HealthCheck.Pool.Compute`	boolean	true	Set to true to exercise the compute kernel pool, false to disable it
`WebServer.Endpoints.HealthCheck.Pool.Fallback`	boolean	true	Set to true to exercise the fallback kernel pool, false to disable it
`WebServer.Endpoints.HealthCheck.KernelTimeout`	positive integers	10	The amount of time (in seconds) the check will wait for a kernel to return the results of the test command
`WebServer.Endpoints.HealthCheck.QueueTimeout`	positive integers	10	The amount of time (in seconds) the check will wait for a kernel to be allocated from a pool

Monitoring

The monitoring endpoint is `/monitoring/`. When an `HTTP GET` accesses this endpoint, a snapshot of the internal state of MapleNet as a string of JSON is returned. The information displayed can be divided into two types, static values and dynamic values. The static values are values defined at MapleNet start up time, for example configuration values and version information. Dynamic values are values that change as clients connect to MapleNet, for example connected clients and open documents. If you want to view the monitoring data in a web browser, plugins are available for pretty printing JSON. This makes the monitoring output more human readable.

Value	**Definition**
Limiter	The limiter describes the number of running Maple engines. A running Maple engine corresponds to the restrictions imposed by the license. A waitingEngine is an engine that can't run because the maximum number of running engines has been reached.
engineManager	The engineManager provides a detailed breakdown of the Maple engines in use by MapleNet. Document engines are engines connections to open documents. Compute engines are used for the compute endpoint. As compute engines are pooled and reused, there is list of pooled compute engines.
documentManager	The documentManager section describes the documents currently opened by clients. Each open document lists the following fields: id a unique id assigned to that copy of the open document, the name of the document, the working directory of the document and the source of the document. The working directory is where the content created for displaying the document is kept.
clients	The clients section describes the document clients currently connected to MapleNet Server. Each client lists the IP address from which they are connected and the id of the document that they have opened.
helpDatabases	The helpDatabases section describes the help database found for use with the help endpoints.
Version	The Version section describes the versions of the various pieces used by MapleNet. This include the MapleNet and Maple build dates, release ids and build ids. These values are useful when reporting bugs or contacting Maplesoft Support.
license	The license section describes the license being used.
Start Up Configuration	The Start Up Configuration section describes the values applied by the MapleNet configuration. This combines the options set with configuration variables and default values.

Logging	The Logging section describes the current logging settings, the level and whether AutoFlush or Synchronous options are enabled.

Metrics over Prometheus

Metric Group: Web Endpoint Handling

Metric	Metric Type	Domain	Description
`request_latency_seconds`	Histogram	Non-negative double	A histogram of HTTP request handling latencies. Each datapoint is given two labels: the HTTP request method, and the handler. The HTTP methods are: • get • post • put • delete • head • options • patch

The handlers are:

Handler Name	Expected HTTP Method	Purpose
`worksheet`	get	The handler responds to requests to *.mw and *.maple
`html_file`	get	Responds to *.html. Performs substitutions in html files, namely `${MAPLE_CLOUD_CDN}` to the maple cloud cdn value provide in the docker configuration.
`soap`	get	Responds to SOAP requests at `/services/MapleService`
`mcs`	post	Responds to `/mnserver/mcs` protobuf requests.
`compute`	post	Responds to `/mnserver/compute`
`attachment`	get	Responds to `/attachment/`
`version`	get	Responds to `/maplenet/mnstatus/version.jsp`
`upload`	post	Responds to `/upload`
`monitoring`	get, post	Responds to `/monitoring/`
`healthcheck`	get	Responds to `/healthcheck/`

Metric Group: Webserver Monitoring

Metric	Metric Type	Domain	Description
`active_connections`	Gauge	Non-negative integer	The current number of connections

max_active_connections	Counter	Non-negative, monotonically increasing integer	High watermark for the maximum number of simultaneous connections.
connections_total	Counter	Non-negative, monotonically increasing integer	The total number of connections that the webserver has handled
requests_total	Counter	Non-negative, monotonically increasing integer	The total number of requests that the webserver has handled.
data_received_bytes_total	Counter	Non-negative, increasing integer	The total number of bytes the webserver has received.
data_sent_bytes_total	Counter	Non-negative, increasing integer	The total number of bytes the webserver has sent

Metric Group: Prometheus Webserver Monitoring

Metric	Metric Type	Domain	Description
exposer_transferred_bytes_total	Counter	Non-negative, increasing integer	The number of bytes the prometheus webserver has transmitted on the /metrics page
exposer_scrapes_total	Counter	Non-negative, monotonically increasing integer	The number of times the /metrics page has been generated
exposer_request_latencies	Summary	Non-negative float	The amount of time it takes to generate the response to the /metrics page

Metric Group: Kernel Pool Monitoring

Metric	Metric Type	Domain	Description
engines	Gauge	Non-negative integer	The number of engines running. Two labels on this statistic are "pool", which can be "document", "compute", or "fallback". And "state", which can be "idle", or "running". Note: MapleNet does not pool document kernels, therefore there will never be a metric with both pool=document and state=idle.
promised_engines	Gauge	Non-negative integer	Note: This does not distinguish between waiting document, compute, or fallback kernels.

Metric Group: Protobuf Messages Monitoring

Metric	Metric Type	Domain	Description
workbook_handler_latency_seconds	Summary	Non-negative float	Records the amount of time it takes to handle each protobuf message received on the websocket. There is a unique label for each type of protobuf message. The server does not have

			handlers for each message, thus some message types are currently unreported. Some message types are only meant to be sent from the server (for instance, ENGINE_STATUS).

The reported messages are:

Message Type	Description
WORKSHEET_RENDER_COMPLETE	Sent by the client when it has fully rendered the page.
UPDATE_IMAGE	Sets the content of an image from a specified file
UPDATE_CONTENTS	Updates the string contents of a model
SET_MODEL	Sets and saves the content for a model
SEND_MODEL_UPDATE	Sends a model update from the server to the client
QUERY_MODEL	Returns the value of a specific component (optionally including subcomponents) on a page
QUERY_CONTENTS	Returns a model's content for a specific model id
OPEN_WORKSHEET	Use to open a worksheet
MODEL_UPDATE	An event fired by the server when a change in the model has happened, or when a client wants to update the state of the model.
GET_ATTACHMENT_URL	Gets the URL for an attachment
GENERATE_PLOT_IMAGE	Generates an image for a plot. For instance, used to generate a thumbnail image of a plot.
EXECUTE_WORKBOOK_COMMAND	Executes a workbook command. A workbook command is a message internal to the MapleNetServer. Workbook handlers can be made of a sequence of workbook commands.
EC_SERVER_EVENT	Encodes plot events (play, pause, stop, etc)
EC_EVENT	Events for embedded components (button clicks, slider changes.
COMPUTE_PLOT	Used during testing
CLICK_BUTTON_GROUP	A button client event

Messages that the server doesn't explicitly handle (but accepts and no-ops):

Message Type	Description
OPEN_FILE	A message used to open a file within a workbook
PING	An application level ping, separate from the websocket-level ping message
CONFIG_OPTIONS	A message the server sends to the client to provide configuration values
ACTIVE_CLIENTS	Used to provide statistics about the open documents of each client
VERSION	A message the server sends to the client to provide version information
ERROR_MESSAGE	A message the server sends to the client so that the client can display an error message generated by the server
DOCUMENT_LOAD_COMPLETE	A message the client sends to the server when a document has finished loading
OPEN_WORKBOOK	The first message in a two step process to open worksheets
ENGINE_STATUS	A message the server sends to the client to indicate when a kernel has started (or stopped) running
WORKSHEET_SAVE_STATE	A message the server sends to the client to indicate information about the saved state of the worksheet

Metric Group: License

Metric	Metric Type	Domain	Description
license_expiry_remaining_seconds	Gauge	Non-negative, monotonically decreasing integer	Reports the amount of time until a license will expire. The label "feature" is used to differentiate different license. If a license in unexpiring, the entry for

			the license is "Nan". Note: We do not report the time remaining as an atomic operation. Each time we calculate the amount of time remaining on a license, we get the current time in milliseconds. Therefore, if two licenses have the same expiry, the output of monitoring will report a slight discrepancy between the amount of time remaining for each license.

Metric Group: Kernel

Metric	Metric Type	Domain	Description
`kernel_command_seconds`	Summary	Non-negative float	Reports the amount of time it takes for an engine to perform a command. All commands are aggregated into the same metric, kernel_command_seconds, unless the command is a bellwether command where it is uniquely identified with a "command" label. A bellwether command is a command that is run on every kernel. Bellwether commands include "_libraryversion();", "kernelopts(toolboxversion);", "kernelopts(version);", and "interface(version);". All of these commands are executed on a kernel every time a kernel is started. The results are used to initialize MapleNetServer values. Because these commands are always executed, variations in these values could indicate a change in the deployment's health or performance.

Bellwether commands:

Command	Description
`_libraryversion();`	Kernel values needed by MapleNetServer. Executed ever time a new kernel is started.
`kernelopts(toolboxversion);`	Kernel values needed by MapleNetServer. Executed ever time a new kernel is started.
`kernelopts(version);`	Kernel values needed by MapleNetServer. Executed ever time a new kernel is started.
`interface(version);`	Kernel values needed by MapleNetServer. Executed ever time a new kernel is started.
`License Check;`	The license check performed every time a kernel is started.
`2+3;`	The command sent to a kernel (in each of the compute, document, and fallback pools–if configured) when `/healthcheck/` is queried.

Note: bellwether commands are lazily added to the list of kernel_command_seconds and are not added to the list of kernel_command_seconds until the command is first executed. For instance `kernel_command_seconds{command="2+3"}` will not appear in the list until the first time the health check is queried.

5 Example Configurations

This section contains example configurations for typical MapleNet deployments

The following variables are used in this document, and should be replaced with the correct values:

`LICENSEFILE`: The location of the MapleNet license file (on the Docker host)

`HOSTPORT:` The port on the host machine on which MapleNet should accept connections

`IMAGETAG:` The tag of the Docker image created by the installer

`CONTENTDIR`: The directory containing Maple content for hosting by MapleNet (on the Docker host)

`MAPLEONLINECDNURL`: The URL of a Content Delivery Network hosting the MapleNet JavaScript libraries

`MATHJAXCDNURL`: The URL of a Content Delivery Network hosting the MathJax JavaScript package

Additional documentation for the configuration variables used in these examples is available in the Configuration section of the Administrators Guide. These examples are shown as separate commands, however arguments from one example can, in general. be combined with arguments from other examples.

Note: In the following examples long commands are broken across multiple lines. The \ character is used to indicate the continuation of the command on the next line. This is supported in many terminals so copying and pasting the entire command should work. If that does not work, duplicating the command as a single line by omitting these characters and joining the argument should also work.

5.1 Basic Document Hosting

These configurations are for customers who want to host Maple documents located within a directory on the Docker host machine.

Mounting as a subdirectory of /webroot

The easiest way to add user content to the container is to simply mount the directory containing the content as a sub-directory of `/webroot`.

```
docker run --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
   --mount type=bind,source=$CONTENTDIR,target=/webroot/content \
   --publish $HOSTPORT:8080 \
   --rm \
   maplesoft/maplenet:$IMAGETAG
```

With this configuration, the files in the `$CONTENTDIR` directory are available under

`http://localhost:$HOSTPORT/content`

If you want to be able to navigate the directory structure via the web browser you can enable directory listings using the `MAPLENET_WEBSERVER_ENABLEDIRECTORYLISTING` variable.

With this configuration the default locations of MapleNet's libraries are unaffected by the mount. However this does leave the MapleNet landing page and example document on the server. If you want to replace the entire `/webroot` directory, the following configuration will do that.

Mounting on top of /webroot

Replacing `/webroot` completely will hide the JavaScript libraries required for document rendering in MapleNet. Therefore you will need to either use a Content Delivery Network (see next configuration) or copy those libraries into your content directory so they continue to be available when `/webroot` is hidden. To copy the libraries from the Docker image, we first need to start the image. This is only to access the files, so a simple `docker run` command is sufficient.

```
docker create --name copy_container \
   --rm maplesoft/maplenet:$IMAGETAG
```

We use the `--name` option to give the container a easy to remember name. We can now copy the directory containing the MapleNet libraries to the directory of content we want to mount on top of `/webroot`.

```
docker cp -a copy_container:/webroot/mapleonline $CONTENTDIR
docker cp -a copy_container:/webroot/MathJax $CONTENTDIR
```

Now stop this container

```
docker stop copy_container
```

There should now be directories named `mapleonline` and `MathJax` within `$CONTENTDIR` containing the JavaScript libraries from the Docker container.

Now we can start the Docker container with `$CONTENTDIR` replacing `/webroot`

```
docker run --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
   --mount type=bind,source=$CONTENTDIR,target=/webroot \
   --publish $HOSTPORT:8080 \
   --rm \
   maplesoft/maplenet:$IMAGETAG
```

With this configuration, the `$CONTENTDIR` directory is the root of the files served by MapleNet.

Using a Content Delivery Network for JavaScript libraries

If you are able to use a Content Delivery Network (CDN) to host MapleNet's JavaScript libraries this can simplify the process of replacing `/webroot` as the MapleNet content is no longer require to exist within the Docker container. However to place the content on a CDN, it still needs to be extracted from the Docker image as described above. To use a CDN, the following command should be used

```
docker run --env MAPLENET_WEBSERVER_MAPLECLOUDCDN=$MAPLEONLINECDNURL \
   --env MAPLENET_WEBCLIENT_CONFIGURATION="MathJaxCDN=$MATHJAXCDNRURL" \
   --publish $HOSTPORT:8080 \
   --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
   --mount type=bind,source=$CONTENTDIR,target=/webroot \
```

```
   --rm \
   maplesoft/maplenet:$IMAGETAG
```

Logging Configuration

The following example configures the json-file logger (the docker default) to perform log rotation with three log files each with a maximum size of 10 Mb. Thus if the current log file reaches 10 Mb and there are already three log files, the oldest is deleted an a new log file is created.

```
docker run --log-opt max-size=10m \
   --log-opt max-file=3 \
   --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
   --mount type=bind,source=$CONTENTDIR,target=/webroot \
   --publish $HOSTPORT:8080 \
   --rm \
   maplesoft/maplenet:$IMAGETAG
```

The MapleNet container can also be configured to pass its logs to standard logging facilities, for example

```
docker run --log-driver syslog \
 --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
 --mount type=bind,source=$CONTENTDIR,target=/webroot \
 --publish $HOSTPORT:8080 \
 --rm \
 maplesoft/maplenet:$IMAGETAG
```

For a complete list of supported logging facilities, see the docker log driver documentation:

https://docs.docker.com/config/containers/logging/configure/

5.2 Basic Compute Hosting

This example configuration is for MapleNet's compute API. The primary concern for the compute API is usually resource limits. The following command starts MapleNet with restricted compute limits of 5 seconds of compute time and 500 MiB of memory.

```
docker run --env MAPLENET_POOL_COMPUTATIONTIMELIMIT=5 \
   --env MAPLENET_COMPUTEENGINE_DATALIMIT=500 \
   --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
   --publish $HOSTPORT:8080 \
   --rm \
   maplesoft/maplenet:$IMAGETAG
```

Cross-Origin Resource Sharing (CORS)

Cross-Origin Resource Sharing is a mechanism for allowing web applications running on one domain to access web services running on another. Normally web browsers do not allow applications to access services running on different domain. CORS allows the service to state if a domain is allowed to make requests to the server. This may be important for the compute service if users have written web applications hosted on other domains and want access the compute service. By default MapleNet is configured to not allow requests from different domains.

The following configuration allow requests from any domain

```
docker run --env MAPLENET_WEBSERVER_CORS_ALLOWORIGIN="*" \
   --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
   --mount type=bind,source=$CONTENTDIR,target=/webroot \
   --publish $HOSTPORT:8080 \
   --rm \
   maplesoft/maplenet:$IMAGETAG
```

If you have a list of domains you are willing to accept requests from you can use a comma separated list of domain names

```
docker run --env MAPLENET_WEBSERVER_CORS_ALLOWORIGIN="domain1.com,domain2.com,domain3.com" \
   --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
   --mount type=bind,source=$CONTENTDIR,target=/webroot \
   --publish $HOSTPORT:8080 \
   --rm \
   maplesoft/maplenet:$IMAGETAG
```

5.3 Adding Maple Libraries and Help Databases

Users can add Maple libraries and help databases to MapleNet. Adding Maple libraries allows hosted documents and compute requests to access the Maple functionality in those libraries. Adding help databases allows MapleNet to host Maple help pages for display in browsers. In this example we will simply add the user libraries and help databases to the Maple library directory. For this example, we'll use `$MAPLELIBRARYDIR` to represent the path to a Maple library (.mla) `$MAPLELIBRARY` and `$MAPLEHELPDIR` to represent a the path to a Maple help database (.help) `$MAPLEHELP`.

```
docker run --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
   --mount type=bind,source=$CONTENTDIR,target=/webroot \
   --mount type=bind,source=$MAPLELIBRARYDIR/$MAPLELIBRARY,target=/maple/lib/$MAPLELIBRARY \
   --mount type=bind,source=$MAPLEHELPDIR/$MAPLEHELP,target=/maple/lib/$MAPLEHELP \
   --publish $HOSTPORT:8080 \
   --rm \
   maplesoft/maplenet:$IMAGETAG
```

Multiple libraries and help database can be added by having multiple mount commands.

Care must be taken to not override the default Maple libraries (maple.mla, update.mla,MathematicalFunctions.mla or MTM.mla) as this would remove Maple (and MapleNet) functionality. If the name of your library conflicts with an existing Maple library, you can simply mount it with a different name.

```
docker run --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
   --mount type=bind,source=$CONTENTDIR,target=/webroot \
   --mount type=bind,source=$MAPLELIBRARYDIR/maple.mla,target=/maple/lib/mymaple.mla \
   --publish $HOSTPORT:8080 \
   --rm \
   maplesoft/maplenet:$IMAGETAG
```

Changing the URL for the Help Database

If you are hosting a help database, you can change the value of URL that MapleNet uses for help by using the WebClient.HelpUrl command parameter.

For example, to instruct MapleNet to use "http://exampledatabase.com/help" as the help database URL:

```
docker run --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly
--publish $HOSTPORT:8080 maplesoft/maplenet:$IMAGETAG
--WebClient.HelpUrl "http://exampledatabase.com/help"
```

(5.1)

5.4 Enabling the Upload Page

MapleNet includes an upload page that allows users to upload Maple documents to MapleNet from their web browsers. To enable this feature the `MAPLENET_WEBSERVER_ENDPOINTS_UPLOAD` variable must be set. In addition, the upload page displays the contents of the upload directory if `MAPLENET_WEBSERVER_ENABLEDIRECTORYLISTING` is set.

```
docker run --env MAPLENET_WEBSERVER_ENDPOINTS_UPLOAD=true \
   --env MAPLENET_WEBSERVER_ENABLEDIRECTORYLISTING=true \
   --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
   --mount type=bind,source=$CONTENTDIR,target=/webroot/content \
   --publish $HOSTPORT:8080 \
   --rm \
   maplesoft/maplenet:$IMAGETAG
```

With these variables set, the upload page

```
http://$HOSTNAME/mapleonline/upload/upload.html
```

will be fully functional.

By default the upload directory lives within the docker container, thus when the container is restarted any uploads are lost. To have the uploaded content persist between MapleNet restarts, mount a host directory on top of the upload directory. With this, the uploads are saved to the host directory. If /webroot is replaced with a host directory (as described above), uploads will be stored into the host directory. If that is not the case, the following command mounts the `$UPLOADDIR` from the host machine on top of the MapleNet upload directory.

```
docker run --env MAPLENET_WEBSERVER_ENDPOINTS_UPLOAD=true \
   --env MAPLENET_WEBSERVER_ENABLEDIRECTORYLISTING=true \
   --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
   --mount type=bind,source=$CONTENTDIR,target=/webroot/content \
   --mount type=bind,source=$UPLOADDIR,target=/webroot/worksheet/upload \
   --publish $HOSTPORT:8080 \
   --rm \
   maplesoft/maplenet:$IMAGETAG
```

5.5 Security Options

The following options implement the suggested configuration in the Security section of the Administrators Guide. It also mounts `$CONTENTDIR` on top of `/webroot` as described above.

```
docker run --env MAPLENET_ENDPOINTS_COMPUTE=false \
   --env MAPLENET_ENDPOINTS_HELP=false \
   --env MAPLENET_DOCUMENTENGINE_CPULIMIT=120 \
   --env MAPLENET_DOCUMENTENGINE_DATALIMIT=2048 \
   --mount type=bind,source=$LICENSEFILE,target=/maple/license/license.dat,readonly \
   --mount type=bind,source=$CONTENTDIR,target=/webroot \
   --publish $HOSTPORT:8080 \
```

```
  --rm \
  maplesoft/maplenet:$IMAGETAG
```

5.6 Troubleshooting

Docker not starting

Error: Bind for $HOSTPORT failed: port is already allocated

The port you specified for MapleNet to listen on is already in use. This could be caused by an existing MapleNet instance using the same port. Running

```
docker ps
```

will show all the running Docker containers as well as the port they are using. You can use `docker stop` to stop a running container or select a different port for MapleNet.

MapleNet is not starting

Error: The license file, /maple/license/license.dat, does not exist

This indicates that MapleNet was unable to locate a valid license. Make sure you completed the installation step to obtain a valid license and that it was correctly mounted into the Docker container.

Error: Unable to create compute cache directory

If you are mounting on top of `/webroot`, MapleNet needs to be able to create directories in the mounted directory. The permissions on the `$CONTENTDIR` may be preventing MapleNet from doing so.

Performances Issues

Error: Users seeing "Time out" errors when accessing MapleNet

When users see time out errors when connecting to MapleNet, this usually indicates that MapleNet is overloaded. There are a few configuration options that may be able to solve these issues.

`MAPLENET_WEBSERVER_NUMTHREADS`: The MapleNet web server has a limited number of threads to handle incoming connections. If you are handling a large number of incoming connections you may need to increase this value. Be aware that increasing the number of web server threads also increases the amount of memory MapleNet will use.

`MAPLENET_POOL_MAXENGINES`: MapleNet maintains a pool of Maple engines. If there are a large number of open documents, it is possible to reach this limit. Increasing this limit will allow more users to have open documents on MapleNet. Each running Maple engine requires memory, so this will also lead to higher memory usage. This variable does not effect the maximum number of **running** engines, simply the maximum number of open engines.

`MAPLENET_POOL_QUEUETIMELIMIT`: MapleNet has a limit on the number of engines that can run at the same time (limited by the MapleNet license). When MapleNet runs a command it may need to wait if the maximum number of engines are already running. This variable determines how long MapleNet should wait for an available engine before aborting.

`MAPLENET_WEBSERVER_REQUESTTIMEOUTMS`: This variable limits how long MapleNet keeps a connection open when it stops receiving messages from a client. The MapleNet client sends regular messages to keep the connection alive and these are normally sufficient. However if users have low speed or unreliable connections, this timeout may be exceeded, and the connection closed.

MapleNet memory usage

MapleNet allows multiple users to run commands in Maple on a single server. This can use a lot of memory, potentially making the host machine unstable. If you have problems with excessive memory usage, you can try adjusting the following variables.

MAPLENET_POOL_MAXENGINES: Reduce the maximum number of open Maple engines, with the trade off of allowing fewer users to access MapleNet.

MAPLENET_COMPUTEENGINE_DATALIMIT and MAPLENET_DOCUMENTENGINE_DATALIMIT: These variables limit the amount of memory a single compute or document engine can use. Setting these limits will stop individual connections from using a large amount of memory, with the trade off that large computations may not be able to finish.

MAPLENET_ENGINE_JAVADATALIMIT: If you see mjava processes consuming large amounts of memory, adjusting this variable may help. In some circumstances (machines with a large amount of memory) the java virtual machine may use a large amount of memory instead of collection more quickly. This variable forces java to work within a smaller memory footprint.

Increase the number of allowed running engines

If the none of the suggestions above help, and you are seeing high load on the machine, then you many need to increase the number of licensed running engines. Before doing this, verify that during peak load times, you are seeing one running engine for each allowed running engine in your license. The easiest way to do this is to look at the MapleNet monitoring page. In the limiter section you should see three values, `maxRunningEngines`, `runningEngines` and

`waitingEngines`. If `waitingEngines` is greater than 0, then MapleNet is running at or beyond it optimal its capacity. You may need to increase your number of licensed engines to allow more engines to run in parallel. This only makes sense if you also have available CPU resources. MapleNet is designed to run with one core per running engine. Running MapleNet with more allowed running engines than CPU cores is not suggested, and will not increase performance.

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Bell, Ian H.; Wronski, Jorrit; Quoilin, Sylvain; and Lemort, Vincent. **Pure and Pseudo-pure Fluid Thermophysical Property Evaluation and the Open-Source Thermophysical Property Library CoolProp**. Industrial & Engineering Chemistry Research, Vol. **53** No. *6* (2014), pp. 2498--2508; http://www.coolprop.org/.

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