ModSecurity Guide

For use with Red Hat JBoss middleware products.
Abstract

Configure and use the Red Hat JBoss Core Services ModSecurity module as a web application firewall.
## Table of Contents

**PROVIDING FEEDBACK ON RED HAT DOCUMENTATION** ........................................... 3

**CHAPTER 1. MODSECURITY MODULE** .............................................................. 4

**CHAPTER 2. CONFIGURING MODSECURITY ON RHEL** .................................... 5
  2.1. MODSECURITY DEPENDENCIES ON RHEL ............................................. 5
  2.2. MODSECURITY INSTALLATION ON RHEL ............................................. 5
  2.3. LOADING MODSECURITY ................................................................. 5
  2.4. CONFIGURING THE RULES DIRECTORY ON RHEL ................................. 6
  2.5. KEY MODSECURITY CONFIGURATION OPTIONS .................................. 6

**CHAPTER 3. CONFIGURING MODSECURITY ON WINDOWS SERVER** .................... 7
  3.1. MODSECURITY DEPENDENCIES ON WINDOWS SERVER ............................ 7
  3.2. INSTALLING MODSECURITY ON WINDOWS SERVER ................................ 7
  3.3. CONFIGURING THE RULES FOLDER ON WINDOWS SERVER ....................... 8
  3.4. KEY MODSECURITY CONFIGURATION OPTIONS .................................. 8

**CHAPTER 4. CREATING MODSECURITY RULES** ............................................. 10
  4.1. MODSECURITY RULES IN THE APACHE REQUEST CYCLE ....................... 10
  4.2. STRUCTURE OF MODSECURITY RULES ............................................. 10
  4.3. MODSECURITY CONFIGURATION DIRECTIVES .................................... 10
  4.4. EXAMPLE OF A SIMPLE MODSECURITY RULE .................................... 11
  4.5. EXAMPLE OF A COMPLEX MODSECURITY RULE .................................... 11
  4.6. ADDITIONAL RESOURCES (OR NEXT STEPS) ....................................... 12
PROVIDING FEEDBACK ON RED HAT DOCUMENTATION

We appreciate your feedback on our technical content and encourage you to tell us what you think. If you’d like to add comments, provide insights, correct a typo, or even ask a question, you can do so directly in the documentation.

**NOTE**

You must have a Red Hat account and be logged in to the customer portal.

To submit documentation feedback from the customer portal, do the following:

1. Select the **Multi-page HTML** format.
2. Click the **Feedback** button at the top-right of the document.
3. Highlight the section of text where you want to provide feedback.
4. Click the **Add Feedback** dialog next to your highlighted text.
5. Enter your feedback in the text box on the right of the page and then click **Submit**.

We automatically create a tracking issue each time you submit feedback. Open the link that is displayed after you click **Submit** and start watching the issue or add more comments.

Thank you for the valuable feedback.
CHAPTER 1. MODSECURITY MODULE

The ModSecurity module is a web application firewall (WAF) that you can use to filter, monitor, and block HTTP traffic that web clients send to a web server application. Unlike a regular firewall, a WAF uses filters to determine which applications and users can interact with your Apache HTTP Server application. The effectiveness of ModSecurity relies on user-defined rules that enable ModSecurity to perform configurable and real-time monitoring of HTTP traffic to detect attacks instantly.

NOTE

The Red Hat JBoss Core Services ModSecurity Guide provides information and examples for the ModSecurity version 2.9 module that is available with the Red Hat JBoss Core Services 2.4.57 release. The effectiveness of ModSecurity depends on user-generated rules. This document describes how to create and implement rules. This document does not provide a set of rules to use.
CHAPTER 2. CONFIGURING MODSECURITY ON RHEL

When you install Red Hat JBoss Core Services on Red Hat Enterprise Linux (RHEL), you can configure the ModSecurity module to function as a web application firewall (WAF) for the Apache HTTP Server.

NOTE

JBCS 2.4.57 does not currently provide an archive file distribution of the Apache HTTP Server for RHEL 9.

2.1. MODSECURITY DEPENDENCIES ON RHEL

ModSecurity has several dependencies to function successfully. Some of these dependencies are already included as a part of Red Hat JBoss Core Services.

The following table provides a list of ModSecurity dependencies:

<table>
<thead>
<tr>
<th>Dependency</th>
<th>Part of JBCS on RHEL?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apache Portable Runtimes (APR)</td>
<td>Yes</td>
</tr>
<tr>
<td>APR-Util</td>
<td>Yes</td>
</tr>
<tr>
<td>mod_unique_id</td>
<td>Yes</td>
</tr>
<tr>
<td>libcurl</td>
<td>Yes</td>
</tr>
<tr>
<td>Perl-Compatible Regular Expressions (PCRE)</td>
<td>Yes</td>
</tr>
<tr>
<td>libxml2</td>
<td>No</td>
</tr>
</tbody>
</table>

NOTE

On RHEL, Red Hat JBoss Core Services includes all of these dependencies except the libxml2 library.

2.2. MODSECURITY INSTALLATION ON RHEL

The ModSecurity module is included as part of a Red Hat JBoss Core Services installation.

You can follow the procedures in the Red Hat JBoss Core Services Apache HTTP Server Installation Guide to download and install the Apache HTTP Server for your operating system.

Additional resources

- Red Hat JBoss Core Services Apache HTTP Server Installation Guide

2.3. LOADING MODSECURITY

You can load the ModSecurity module by using the LoadModule command.
Procedure

- To load the ModSecurity module, enter the following command:

  LoadModule security2_module modules/mod_security2.so

2.4. CONFIGURING THE RULES DIRECTORY ON RHEL

ModSecurity functionality requires that you create rules that the system uses. Apache HTTP Server provides a preconfigured `mod_security.conf.sample` file in the `HTTPD_HOME/modsecurity.d` directory. To use ModSecurity rules, you must modify the `mod_security.conf.sample` file with settings that are appropriate for your environment. You can store the ModSecurity rules in the `modsecurity.d` directory or the `modsecurity.d/activated_rules` subdirectory.

Procedure

1. Go to the `HTTPD_HOME/modsecurity.d` directory.
2. Rename the `mod_security.conf.sample` file to `mod_security.conf`:

   `mv mod_security.conf.sample ./mod_security.conf`
3. Open the `mod_security.conf` file and specify parameters for all the configuration directives that you want to use with the ModSecurity rules.

2.5. KEY MODSECURITY CONFIGURATION OPTIONS

You can use key ModSecurity configuration options to improve the performance of regular expressions, investigate ModSecurity 2.6 phase one moving to phase two hook, and allow use of certain directives in `.htaccess` files.

- **enable-pcre-jit**
  Enables Just-In-Time (JIT) compiler support in the Perl-Compatible Regular Expressions (PCRE) library 8.20 or later to improve the performance of regular expressions.

- **enable-request-early**
  Enables testing of the ModSecurity 2.6 move from phase one to phase two hook

- **enable-htaccess-config**
  Enables use of directives in `.htaccess` files when `AllowOverride Options` is set
CHAPTER 3. CONFIGURING MODSECURITY ON WINDOWS SERVER

When you install Red Hat JBoss Core Services on Windows Server, you can configure the ModSecurity module to function as a web application firewall (WAF) for the Apache HTTP Server.

3.1. MODSECURITY DEPENDENCIES ON WINDOWS SERVER

ModSecurity has several dependencies to function successfully. Some of these dependencies are already included as a part of Red Hat JBoss Core Services.

The following table provides a list of ModSecurity dependencies:

<table>
<thead>
<tr>
<th>Dependency</th>
<th>Part of JBCS on Windows Server?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apache Portable Runtimes</td>
<td>Yes</td>
</tr>
<tr>
<td>APR-Util</td>
<td>Yes</td>
</tr>
<tr>
<td>mod_unique_id</td>
<td>Yes</td>
</tr>
<tr>
<td>libcurl</td>
<td>Yes</td>
</tr>
<tr>
<td>Perl-Compatible Regular Expressions (PCRE)</td>
<td>Yes</td>
</tr>
<tr>
<td>libxml2</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**NOTE**

On Windows Server, Red Hat JBoss Core Services includes all of these dependencies.

3.2. INSTALLING MODSECURITY ON WINDOWS SERVER

The ModSecurity module is included as part of a Red Hat JBoss Core Services installation. Apache HTTP Server provides many of the items that are required to run ModSecurity on Windows Server. However, you must ensure that your system complies with certain criteria to allow ModSecurity to function correctly.

**Prerequisites**

- The folder where you build software from source contains both the Apache source, which you use to build the Apache HTTP Server, and the ModSecurity source. For example:
  - Apache source is in `C:\sourceFolder\httpd-2.4.57`
  - Apache has been installed to `C:\Apache2457`
  - ModSecurity source is in `C:\sourceFolder\mod_security`
In this case, `sourceFolder` is a generic folder that you use in conjunction with the project.

- Your build environment is set up correctly. For example:
  - Ensure that the `PATH` environment variable includes the Visual Studio variables set by `vsvars32.bat`.
  - Ensure that the `PATH` environment variable includes the `bin` folder for `CMAKE`.
  - Set an environment variable for the Apache source code directory, which is located at `C:\sourceDirectory\httpd-2.4.57`.

Procedure

- Follow the procedures in the Red Hat JBoss Core Services Apache HTTP Server Installation Guide to download and install the Apache HTTP Server to the appropriate location on your `C:` drive.

Additional resources

- Red Hat JBoss Core Services Apache HTTP Server Installation Guide

### 3.3. Configuring the Rules Folder on Windows Server

ModSecurity functionality requires that you create rules that the system uses. Apache HTTP Server provides a preconfigured `mod_security.conf.sample` file in the `HTTPD_HOME\modsecurity.d` folder. To use ModSecurity rules, you must modify the `mod_security.conf.sample` file with settings that are appropriate for your environment. You can store the ModSecurity rules in the `modsecurity.d` folder or the `modsecurity.d\activated_rules` subfolder.

Procedure

1. Go to the `HTTPD_HOME\modsecurity.d` folder.
2. Rename the `mod_security.conf.sample` file to `mod_security.conf`.
3. Open the `mod_security.conf` file and specify parameters for all the configuration directives that you want to use with the ModSecurity rules.

### 3.4. Key ModSecurity Configuration Options

You can use key ModSecurity configuration options to improve the performance of regular expressions, investigate ModSecurity 2.6 phase one moving to phase two hook, and allow use of certain directives in `.htaccess` files.

- **enable-pcre-jit**
  Enables Just-In-Time (JIT) compiler support in the Perl-Compatible Regular Expressions (PCRE) library 8.20 or later to improve the performance of regular expressions.

- **enable-request-early**
Enables testing of the ModSecurity 2.6 move from phase one to phase two hook enable-htaccess-config

Enables use of directives in \texttt{.htaccess} files when \texttt{AllowOverride Options} is set
CHAPTER 4. CREATING MODSECURITY RULES

ModSecurity primarily functions based on custom user-defined rules. These rules determine the types of security checks that ModSecurity performs.

4.1. MODSECURITY RULES IN THE APACHE REQUEST CYCLE

You can apply rules to any of the five ModSecurity processing phases of the Apache request cycle:

**Request headers**

Apply a ModSecurity rule to this phase by specifying a `REQUEST_HEADERS` variable in the rule syntax.

**Request body**

Apply a ModSecurity rule to this phase by specifying a `REQUEST_BODY` variable in the rule syntax.

**Response headers**

Apply a ModSecurity rule to this phase by specifying a `RESPONSE_HEADERS` variable in the rule syntax.

**Response body**

Apply a ModSecurity rule to this phase by specifying a `RESPONSE_BODY` variable in the rule syntax.

**Logging**

Apply a ModSecurity rule to this phase by specifying a `LOGGING` variable in the rule syntax.

Additional resources


4.2. STRUCTURE OF MODSECURITY RULES

A ModSecurity rule typically consists of four main parts:

- A configuration directive
- One or more variables
- One or more operators
- One or more actions

4.3. MODSECURITY CONFIGURATION DIRECTIVES

A ModSecurity rule starts with a configuration directive. The configuration directives for ModSecurity are similar to the Apache HTTP Server directives. You can use most ModSecurity directives within the various Apache scope directives. However, you may only use some ModSecurity directives once in the main configuration file.

You must store these rules and the core rule files outside of the `httpd.conf` file. You can use Apache `Include` directives to call these rules. This facilitates the upgrade and migration of the rules.

Additional resources

4.4. EXAMPLE OF A SIMPLE MODSECURITY RULE

You can define the following simple ModSecurity rule, for example, to check if the URI portion of a request equals a specific lowercase value:

```plaintext
SecRule REQUEST_URI "@streq /index.php" "id:1,phase:1,t:lowercase,deny"
```

The preceding ModSecurity rule consists of the following components:

- **SecRule**: A configuration directive that creates a rule to analyze the specified variables by using the specified operator
- **REQUEST_URI**: A variable that holds the full request URL including the query string data
- **"@streq /index.php"**: An operator where `@streq` checks for string values that are equal to `/index.php`
- **"id:1,phase:1,t:lowercase,deny"**: Actions or transformations that the rule performs

**NOTE**
Most ModSecurity rules use this configuration directive.

Based on the preceding example, during phase 1 of the Apache request cycle, the rule obtains the URI portion of the HTTP request and transforms the value to lowercase. The rule then checks if the transformed value equals `/index.php`. If the value does equal `/index.php`, ModSecurity denies the request and does not process any further rules.

4.5. EXAMPLE OF A COMPLEX MODSECURITY RULE

You can define the following complex ModSecurity rule, for example, to check if a request has changed history:

```plaintext
SecRule REQUEST_URI\|REQUEST_BODY\|REQUEST_HEADERS_NAMES\|REQUEST_HEADERS "history.pushstate\|history.replacestate" "phase:4,deny,log,msg:'history-based attacks detected'"
```

The preceding ModSecurity rule consists of the following components:

- **SecRule**: A configuration directive that creates a rule to analyze the specified variables by using the specified operator
- **REQUEST_URI\|REQUEST_BODY\|REQUEST_HEADERS_NAMES\|REQUEST_HEADERS "history.pushstate\|history.replacestate"**: A configuration that specifies the variables to analyze
- **"phase:4,deny,log,msg:'history-based attacks detected'"**: Actions or transformations that the rule performs

**NOTE**
The rule performs the `lowercase` action first before the rule implements the preceding operator instruction.
NOTE

Most ModSecurity rules use this configuration directive.

`REQUEST_URI|REQUEST_BODY|REQUEST_HEADERS_NAMES|REQUEST_HEADERS`

A pipe-separated list of variables that define different parts of the request that the rule checks

"history.pushstate|history.replacestate"

A pipe-separated pair of operators that check for the JavaScript `history.pushstate()` and `history.replacestate()` methods

"phase:4,deny,log,msg:'history-based attacks detected'"

Actions or transformations that the rule performs if the specified operator values are found

Based on the preceding example, during phase 4 of the Apache request cycle, the rule checks different parts of the request cycle for `history.pushstate()` and `history.replacestate()` methods. If the rule finds these methods in the request URL string, request body, request header names, or request headers, the rule performs the following actions:

- **deny**
  Stops the rule processing and intercepts the transaction

- **log**
  Logs a successful match of the rule to the Apache error log file and the ModSecurity audit log

- **msg**
  Outputs a message defined as `history-based attacks detected` with the log

### 4.6. ADDITIONAL RESOURCES (OR NEXT STEPS)

- [ModSecurity Reference Manual: Actions](#)
- [ModSecurity Reference Manual: Configuration Directives](#)
- [ModSecurity Reference Manual: Variables](#)