

BigMemory Max Installation Guide

Version 4.3.6

October 2018

This document applies to BigMemory Max Version 4.3.6 and to all subsequent releases.

Specifications contained herein are subject to change and these changes will be reported in subsequent release notes or new editions.

Copyright © 2010-2018 Software AG, Darmstadt, Germany and/or Software AG USA Inc., Reston, VA, USA, and/or its subsidiaries and/or its affiliates and/or their licensors.

The name Software AG and all Software AG product names are either trademarks or registered trademarks of Software AG and/or Software AG USA Inc. and/or its subsidiaries and/or its affiliates and/or their licensors. Other company and product names mentioned herein may be trademarks of their respective owners.

Detailed information on trademarks and patents owned by Software AG and/or its subsidiaries is located at <http://softwareag.com/licenses>.

Use of this software is subject to adherence to Software AG's licensing conditions and terms. These terms are part of the product documentation, located at <http://softwareag.com/licenses> and/or in the root installation directory of the licensed product(s).

This software may include portions of third-party products. For third-party copyright notices, license terms, additional rights or restrictions, please refer to "License Texts, Copyright Notices and Disclaimers of Third Party Products". For certain specific third-party license restrictions, please refer to section E of the Legal Notices available under "License Terms and Conditions for Use of Software AG Products / Copyright and Trademark Notices of Software AG Products". These documents are part of the product documentation, located at <http://softwareag.com/licenses> and/or in the root installation directory of the licensed product(s).

Use, reproduction, transfer, publication or disclosure is prohibited except as specifically provided for in your License Agreement with Software AG.

Table of Contents

About This Documentation.....	5
Online Information and Support.....	5
Data Protection.....	6
Installation Overview.....	7
Installation using the Software AG Installer.....	9
Performing the Standalone Installation of BigMemory Max.....	13
Configuring BigMemory Max.....	15
Working with Terracotta License Files.....	17
Starting the Terracotta Server and Management Console.....	19
Using Terracotta Products in Docker Containers.....	23

About This Documentation

Online Information and Support

Software AG Documentation Website

You can find documentation on the Software AG Documentation website at "<http://documentation.softwareag.com>". The site requires credentials for Software AG's Product Support site Empower. If you do not have Empower credentials, you must use the TECHcommunity website.

Software AG Empower Product Support Website

If you do not yet have an account for Empower, send an email to "empower@softwareag.com" with your name, company, and company email address and request an account.

Once you have an account, you can open Support Incidents online via the eService section of Empower at "<https://empower.softwareag.com/>".

You can find product information on the Software AG Empower Product Support website at "<https://empower.softwareag.com/>".

To submit feature/enhancement requests, get information about product availability, and download products, go to "[Products](#)".

To get information about fixes and to read early warnings, technical papers, and knowledge base articles, go to the "[Knowledge Center](#)".

If you have any questions, you can find a local or toll-free number for your country in our Global Support Contact Directory at "https://empower.softwareag.com/public_directory.asp" and give us a call.

Software AG TECHcommunity

You can find documentation and other technical information on the Software AG TECHcommunity website at "<http://techcommunity.softwareag.com>". You can:

- Access product documentation, if you have TECHcommunity credentials. If you do not, you will need to register and specify "Documentation" as an area of interest.
- Access articles, code samples, demos, and tutorials.
- Use the online discussion forums, moderated by Software AG professionals, to ask questions, discuss best practices, and learn how other customers are using Software AG technology.
- Link to external websites that discuss open standards and web technology.

Data Protection

Software AG products provide functionality with respect to processing of personal data according to the EU General Data Protection Regulation (GDPR). Where applicable, appropriate steps are documented in the respective administration documentation.

1 Installation Overview

The system requirements for Terracotta and other Software AG products are available on the Software AG documentation web site at "<http://documentation.softwareag.com/>", using the Empower login ID and password that you have received by email when you licensed the product.

Select the link for the *Software AG System Requirements* that can be found with the documentation of the product's respective version.

You can install BigMemory Max in two different ways:

- Using the Software AG Installer, thus simplifying the integration with other Software AG products, such as the components of the webMethods product suite. Refer to the section "[Installation using the Software AG Installer](#)" on page 9 for details.
- As a self-contained, standalone installation. Refer to the section "[Performing the Standalone Installation of BigMemory Max](#)" on page 13 for details.

2 Installation using the Software AG Installer

You can install your licensed Terracotta BigMemory software using the Software AG Installer. The Software AG Installer is a generic tool for installing Software AG products. The availability of this alternative may depend on your product licensing options.

Terracotta is typically distributed as part of a product bundle, so when you run the Software AG Installer, you will be able to select the appropriate bundle. From the bundle you can select individual products, including Terracotta.

Refer to the separate documentation for the Software AG Installer for details of the installation. The documentation for the Software AG Installer is summarized in the following section.

Overview of the Documentation for using the Software AG Installer

For the installation using the Software AG Installer, refer to the following documents:

■ Using the Software AG Installer

This document describes how to use the Software AG Installer tool. The usage of the Software AG Installer is the same for all products, so the documentation of the Software AG Installer does not refer explicitly to Terracotta.

To access the document *Using the Software AG Installer*, do the following:

1. Log in to the Software AG documentation web site at "<http://documentation.softwareag.com/>", using the Empower login ID and password that you have received by email when you licensed the product.
2. Select the link for the Software AG Installer.
3. The selected page lists several versions of the installer documentation, each shown with a release date. Select the version of the installer documentation that corresponds to the release date of the Software AG Installer you are using. The release date of the Software AG Installer is generally included in the file name of the downloaded executable file. You can also find the release date of the Software AG Installer by clicking the "About" link when you run the Software AG Installer.

■ Installing Software AG Products

This document contains specific installation information about many Software AG products, including Terracotta.

The most recent version of the document *Installing Software AG Products* is available in the documentation web site using the following URL:

["http://documentation.softwareag.com/webmethods/Installing_Software_AG_Products.htm"](http://documentation.softwareag.com/webmethods/Installing_Software_AG_Products.htm)

■ Upgrading Software AG Products

If you are upgrading from a previous product version, refer also to this document. This document contains information about how to upgrade an existing Software AG product version to a new version.

The most recent version of the document *Upgrading Software AG Products* is available in the documentation web site using the following URL:

["http://documentation.softwareag.com/webmethods/Upgrading_Software_AG_Products.htm"](http://documentation.softwareag.com/webmethods/Upgrading_Software_AG_Products.htm)

If you need to access versions of the documents *Installing Software AG Products* and *Upgrading Software AG Products* for previous product releases, proceed as follows:

1. From the starting page at ["http://documentation.softwareag.com/"](http://documentation.softwareag.com/), follow the "webMethods" link.
2. Navigate to the webMethods Product Suite, then select the Suite version number that matches the Terracotta version number.
3. Select the link that deals with installation topics.

System Requirements

For a list of supported operating systems and web browsers, as well as information about the JDK delivered with your licensed product, refer to the document *Software AG System Requirements* that is available in the Software AG documentation web site.

To access this document, do the following:

1. Log in to the Software AG documentation web site, as described above.
2. Navigate to the Terracotta overview page, then select the link for your licensed Terracotta version.

The document is available in the list of documentation titles.

Specifying a different JDK/JRE Location

The installation of BigMemory Max, when performed using the Software AG Installer, includes the installation of a version of the JDK.

If you already have a JDK installed, you can change the BigMemory Max configuration to use your own installed JDK/JRE.

The JDK/JRE used by BigMemory Max is configured in the setup configuration file (namely `setenv.bat` or `setenv.sh`, depending on your operating system) in the location `<SAGInstallerDirectory>/Terracotta/server/bin`, where `<SAGInstallerDirectory>` is the root directory of the Software AG products that you selected when running the Software AG Installer.

By default, the BigMemory Max configuration file looks for the existence of the suite-wide `setenv.bat` or `setenv.sh` configuration file, which is located in `<SAGInstallerDirectory>/install/bin`, and if it finds the suite-wide configuration file,

executes it. The suite-wide configuration file sets up the environment variables `JAVA_HOME` and `JRE_HOME` to point to the JVM that is installed with the Software AG Installer.

If you wish to use your own settings for `JAVA_HOME` and `JRE_HOME`, proceed as follows:

1. Open the BigMemory Max configuration file in a text editor.
2. Comment out the lines that find and execute the suite-wide configuration file.
3. Replace the commented-out lines with your own local definitions for `JAVA_HOME` and `JRE_HOME`.
4. Save and close the file.
5. Stop and restart BigMemory Max.

Note: Even if you use your own JDK/JRE, you should NOT remove the JDK that is installed with BigMemory Max; this JDK is required to run the Software AG Uninstaller, regardless of any other JDK/JRE you use.

3 Performing the Standalone Installation of BigMemory Max

This section describes how to perform the installation of BigMemory Max if you intend to use BigMemory Max as a standalone product. If you plan to install BigMemory Max as part of a software bundle from Software AG rather than as a standalone product, use instead the Software AG Installer, as described in the section [“Installation using the Software AG Installer” on page 9](#).

Performing the standalone installation of BigMemory Max is as easy as downloading the kit and ensuring that the correct files are on your application's classpath. The only platform requirement is using JDK 1.6 or higher.

To install BigMemory Max

1. If you do not have a standalone BigMemory Max kit, download it from [“http://terracotta.org/downloads/bigmemorymax”](http://terracotta.org/downloads/bigmemorymax).

The kit is packaged as a tar.gz file. Unpack it on the command line or with the appropriate decompression application.

2. Add the following JARs from in the kit to your application's classpath:

- apis/ehcache/lib/ehcache-ee-*<version>*.jar

This file contains the API to BigMemory Max.

- apis/ehcache/lib/slf4j-api-*<version>*.jar

This file is the bridge, or logging facade, to the BigMemory Max logging framework.

- apis/toolkit/lib/terracotta-toolkit-runtime-ee-*<version>*.jar

This file contains the libraries for the Terracotta Server Array.

3. Save the BigMemory Max license key file to the BigMemory Max home directory. This file, called terracotta-license.key, was attached to an email you received after registering for the BigMemory Max download.

Alternatively, you can add the license key file to your application's classpath, or explicitly specify the location of the license key file as described in [“Working with Terracotta License Files” on page 17](#).

4. BigMemory Max uses Ehcache as its user-facing interface. To configure BigMemory Max, create an ehcache.xml configuration file, or update the one that is provided in the config-samples/ directory of the BigMemory Max kit. For example:

```
<ehcache xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="http://ehcache.org/ehcache.xsd"
  name="myBigMemoryMaxConfig">
  <!-- Tell BigMemory where to write its data to disk. -->
```

```

<diskStore path="/path/to/my/disk/store/directory"/>
<!-- Set 'maxBytesLocalOffHeap' to the amount of off-heap in-memory
storage you want to use. This memory is invisible to the Java garbage
collector, providing for gigabytes to terabytes of in-memory data without
garbage collection pauses. -->
<cache name="myBigMemoryMaxStore"
    maxBytesLocalHeap="512M"
    maxBytesLocalOffHeap="8G">
    <!-- Tell BigMemory to use the "localRestartable" persistence
strategy for fast restart (optional). -->
    <persistence strategy="localRestartable"/>
    <!-- Include the terracotta element so that the data set will be
managed as a client of the Terracotta server array. -->
    <terracotta/>
</cache>
<!-- Specify where to find the server array configuration. In this
case, the configuration is retrieved from the local server. -->
<terracottaConfig url="localhost:9510" />
</ehcache>

```

Place your ehcache.xml file in the top-level of your classpath.

For more information on configuration options, see "Configuring Storage Tiers" in the *BigMemory Max Configuration Guide* and the reference ehcache.xml configuration file in the config-samples directory of the BigMemory Max kit.

5. Use the `-XX:MaxDirectMemorySize` Java option to allocate enough direct memory in the JVM to accommodate the off-heap storage specified in your configuration, plus at least 250MB to allow for other direct memory usage that might occur in your application. For example:

```
-XX:MaxDirectMemorySize=9G
```

Set `MaxDirectMemorySize` to the amount of BigMemory you have. For more information about this step, see "Allocating Direct Memory in the JVM" in the *BigMemory Max Configuration Guide*.

Also, allocate at least enough heap using the `-Xmx` Java option to accommodate the on-heap storage specified in your configuration, plus enough extra heap to run the rest of your application. For example:

```
-Xmx1g
```

Finally, if necessary, define the `JAVA_HOME` environment variable.

6. Learn BigMemory basics from the "Tutorials" or look through the "Code Samples" for examples of how to employ the various features and capabilities of BigMemory Max. You will find both of these resources in the online documentation for BigMemory Max.

4 Configuring BigMemory Max

For a general overview to configuring BigMemory Max, see "Configuring BigMemory Max" in the *BigMemory Max Configuration Guide*. Specific configuration topics are introduced below.

Automatic Resource Control

Automatic Resource Control (ARC) gives you fine-grained controls for tuning performance and enabling trade-offs between throughput, latency and data access. Independently adjustable configuration parameters include differentiated tier-based sizing and pinning hot or eternal data in the most effective tier. For details, see "Automatic Resource Management" in the *BigMemory Max Administrator Guide*.

Dynamically Sizing Stores

Tuning often involves sizing stores appropriately. There are a number of ways to size the different BigMemory Max data tiers using simple configuration sizing attributes. For information about sizing tiers by configuring dynamic allocation of memory and automatic balancing see "Sizing Storage Tiers" in the *BigMemory Max Configuration Guide*.

Pinning Data

One of the most important aspects of running an in-memory data store involves managing the life of the data in each BigMemory Max tier. For information about pinning, expiration, and eviction of data, see "Managing Data Life" in the *BigMemory Max Configuration Guide*.

Fast Restartability

BigMemory Max has full fault tolerance, allowing for continuous access to in-memory data after a planned or unplanned shutdown, with the option to store a fully consistent record of the in-memory data on the local disk at all times. For information about data persistence, fast restartability, and using the local disk as a storage tier for in-memory data (both heap and off-heap stores), see "Configuring Fast Restart" in the *BigMemory Max Configuration Guide*.

Hybrid Data Storage

BigMemory Hybrid extends BigMemory distributed in a Terracotta Server Array so that data can be stored across a hybrid mixture of RAM and SSD/Flash. For additional information, see "Using BigMemory Hybrid" in the *BigMemory Max Administrator Guide*.

Search

Search billions of entries-gigabytes, even terabytes of data-with results returned in less than a second. Data is indexed without significant overhead, and features like "GroupBy", direct support for handling null values, and optimization around handling

huge results sets are included. BigMemory Search provides the ability for data to be looked up based on multiple criteria instead of just keys. You can query BigMemory data using either simple SQL statements or the Search API. For more information, see "Searching a Cache" and "Searching with BigMemory SQL" in the *BigMemory Max Developer Guide*.

Transactional Caching

Transactional modes are a powerful extension for performing atomic operations on data stores, keeping your data in sync with your database. For information about configuring BigMemory Max transactional modes, see Transactional Support and Explicit Locking topics in the *BigMemory Max Developer Guide*. You can use Explicit Locking as a custom alternative to XA Transactions or Local transactions.

Administration and Monitoring

The Terracotta Management Console (TMC) is a web-based monitoring and administration application for tuning cache usage, detecting errors, and providing an easy-to-use access point to integrate with production management systems. For information about using the TMC, see the *Terracotta Management Console User's Guide*.

For logging, BigMemory Max uses the flexible SLF4J logging framework. For information about SLF4J, see "Logging" in the *BigMemory Max Administrator Guide*.

Scale Up and Scale Out

- See "Defining a Distributed Configuration" in the *BigMemory Max Configuration Guide* to learn more about configuration for large amounts of in-memory data.
- See the *BigMemory Max Administrator Guide* to learn how to use the potential of BigMemory Max.

5 Working with Terracotta License Files

A Terracotta license file is required to run enterprise versions of Terracotta products. The name of the file is `terracotta-license.key` and must not be changed. Trial versions of Terracotta enterprise products expire after a trial period. Expiration warnings are issued both to logs and standard output to allow enough time to contact Terracotta for an extension.

Each node using an enterprise version of Terracotta software requires a copy of the license file or configuration that specifies the file's location. By default, the file is provided in the root directory of the Terracotta software kit. To avoid having to explicitly specify the file's location, you can leave it in the kit's root directory.

Or, more generally (if you are using BigMemory Max), ensure that the resource `/terracotta-license.key` is on the same classpath as the standard Terracotta runtime JARs. For example, the license file could be placed in `WEB-INF/classes` when using a web application.

Explicitly Specifying the Location of the License File

If the file is in the Terracotta installation directory, you can specify it with:

```
-Dtc.install-root=/path/to/terracotta-install-dir
```

If the file is in a different location, you can specify it with:

```
-Dcom.tc.productkey.path=/path/to/terracotta-license.key
```

Alternatively, the path to the license file can be specified by adding the following to the beginning of the Terracotta configuration file (`tc-config.xml` by default):

```
<tc-properties>
  <property name="productkey.path" value="path/to/terracotta-license.key" />
  <!-- Other tc.properties here. -->
</tc-properties>
```

To refer to a license file that is in a WAR or JAR file, substitute `productkey.resource.path` for `productkey.path`.

Verifying Products and Features

There are a number of ways to verify what products and features are allowed and what limitations are imposed by your product key. The first is by looking at the readable file (`terracotta-license.key`) containing the product key.

Second, at startup Terracotta software logs a message detailing the product key. The message is printed to the log and to standard output. The message should appear similar to the following:

```
2010-11-03 15:56:53,701 INFO - Terracotta license loaded from
/Downloads/terracotta-ee-3.4.0/terracotta-license.key
Capabilities: DCV2, authentication, ehcache, ehcache monitor, ehcache offheap,
operator console, quartz, roots, server array offheap, server striping, sessions
Date of Issue: 2010-10-16
```

```
Edition: FX  
Expiration Date: 2011-01-03  
License Number: 0000  
License Type: Trial  
Licensee: Terracotta QA  
Max Client Count: 100  
Product: Enterprise Suite  
ehcache.maxOffHeap: 200G  
terracotta.serverArray.maxOffHeap: 200G
```

6 Starting the Terracotta Server and Management Console

Large data sets in BigMemory Max can be distributed across the Terracotta Server Array (TSA) and managed with the Terracotta Management Console (TMC).

Terracotta Server can also be started, stopped and monitored using Software AG Command Central.

When using Command Central, these are the scripts to start and to stop the Servers:

```
<installDir>\Terracotta\server\wrapper\bin\startup.bat
<installDir>\Terracotta\server\wrapper\bin\shutdown.bat
```

For more information see section *BigMemory Max Administrator Guide > Using Command Central to Manage Terracotta > Monitoring Terracotta from Command Central*

To start the Terracotta server and the TMC

1. To configure the Terracotta Server, create a tc-config.xml configuration file, or update the one that is provided in the config-samples/ directory of the BigMemory Max kit. For example:

```
<?xml version="1.0" encoding="UTF-8" ?>
<tc:tc-config xmlns:tc="http://www.terracotta.org/config"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.terracotta.org/schema/terracotta-9.xsd">
  <servers>
    <server host="localhost" name="My Server Name">
      <!-- Specify the path where the server should store its data. -->
      <data>/local/disk/path/to/terracotta/server1-data</data>
      <!-- Specify the port where the server should listen for client
      traffic. -->
      <tsa-port>9510</tsa-port>
      <jmx-port>9520</jmx-port>
      <tsa-group-port>9530</tsa-group-port>
      <management-port>9540</management-port>
      <!-- Enable BigMemory on the server. -->
      <dataStorage size="8g">
        <offheap size="4g"/>
        <hybrid/>
      </dataStorage>
    </server>
    <!-- Add the restartable element for Fast Restartability (optional). -->
    <restartable enabled="true"/>
  </servers>
  <clients>
    <logs>logs-%i</logs>
  </clients>
</tc:tc-config>
```

Place your tc-config.xml file in the Terracotta server/ directory.

For more information about configuration options, refer to the *BigMemory Max Administrator Guide*.

2. In a terminal, change to your Terracotta server/ directory. Then execute the start-tc-server command:

```
%> cd /path/to/bigmemory-max-<version>/server
%> ./bin/start-tc-server.sh
```

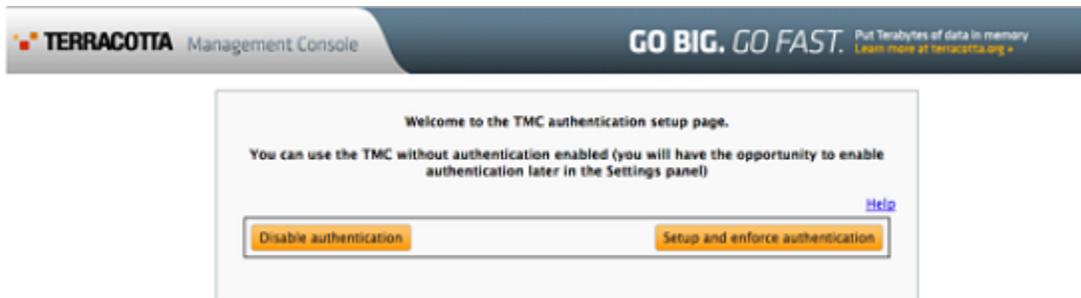
You should see confirmation in the terminal that the server started.

Note: Note: For Microsoft Windows installations, use the BAT scripts, and where forward slashes ("/") are given in directory paths, substitute back slashes ("\").

3. In a terminal, change to your Terracotta tools/management-console/ directory. Then execute the start-tmc command:

```
%> cd /path/to/bigmemory-max-<version>/tools/management-console
%> ./bin/start-tmc.sh
```

4. In a browser, enter the URL <http://localhost:9889/tmc>. When you first connect to the TMC, the authentication setup page appears, where you can choose to run the TMC with authentication or without.



5. Use the TMC to manage all of the clients and servers in your deployment. For more information about the TMC, see the *Terracotta Management Console User's Guide*.

The screenshot displays the Terracotta Management Console interface. At the top, the logo and tagline "GO BIG. GO FAST. Put Terabytes of data in memory. Learn more at terracotta.org" are visible. Below the header, there are navigation links for "New Connection", "Preferences", "About", and "Help". The main area shows connection status for "MyLocalCluster (1 client)" with "1 Active" and "0 Mirrors" clients, and "MyLocalEnvironment (1 member)" with "1 Connected" member. A dropdown menu indicates the connection information is for "MyLocalCluster".

The interface includes tabs for "Application Data", "Monitoring", "Administration", and "Troubleshooting". Under "Monitoring", there are sub-tabs for "Overview", "Charts", "Sizing", and "Management". The "Overview" tab is active, showing a table of cache performance metrics. The table has columns for "Cache", "Hit Ratio", "Hit Rate", "Miss Rate", "Size", "Local Heap Size", "Local Heap MB", "Avg. Get Millis.", and "Search".

Cache	Hit Ratio	Hit Rate	Miss Rate	Size	Local Heap Size	Local Heap MB	Avg. Get Millis.	Search
Cache1	0%	0	77	6,145	6,145	9.8	1.70	
Cache2	0%	0	78	4,413	4,195	6.7	1.92	

The status bar at the bottom of the console shows the URL "localhost:9009/tmc/#".

7 Using Terracotta Products in Docker Containers

If you want to run Terracotta products (Ehcache-based client, Terracotta Server, Terracotta Management Console - TMC) in Docker containers, we have provided some instructions and Dockerfiles to get you started.

When you install your Terracotta product using the Software AG Installer, instructions on using Docker are created at the following locations under the installation root location:

■ The "images" folder

This contains the Docker image definition, using Dockerfiles, as well as some instructions and information on how to run containers built from those images.

We suggest you build images in this order:

1. server (the Terracotta Server)
2. client (some Java code running Ehcache, configured to connect to the Terracotta Server)
3. management (the TMC, used to monitor and manage your Terracotta servers and clients)

■ The "orchestration" folder

This contains Docker Compose orchestration files, to help you set up more complex scenarios (several Terracotta Servers, several clients, one TMC).

Note: The orchestration instructions assume you already built the Docker images.