Cisco Workload Automation Performance and Tuning Guide

Version 6.3.2

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Contents

Preface

The purpose of this document is to help you troubleshoot performance issues with Cisco Workload Automation.

Audience

This guide is for administrators who install, configure, monitor, and tune the Cisco Workload Automation for better performance.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly What's New in Cisco Product Documentation, which also lists all new and revised Cisco technical documentation, at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

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Related Documentation

You can access the following additional Cisco Workload Automation guides on the Cisco *Workload Automation* page on Cisco.com:

- *Cisco Workload Automation Documentation Overview.*
- *Cisco Workload Automation Release Notes*.
- *Cisco Workload Automation Installation and Configuration Guide.*
- *Cisco Workload Automation User Guide*.
- *Cisco Workload Automation Performance and Tuning Guide*. (this document)

Cisco Workload Automation data sheets and other CWA documents can be found at:

http://www.cisco.com/c/en/us/products/cloud-systems-management/tidal-enterprise-scheduler/literature.html.

Document Change History

The table below provides the revision history for the CIS Release Notes.

Version Number	Issue Date	Reason for Change
6.2.1 (SP2)	May 2015	■ Added Monitoring CWA Java Application section. Enlarged screenshots to make them readable. General editing.
6.2.1 (SP3)	March 2016	■ Restructured document into functional chapters. ■ Corrected the JVMARGS hyphens that incorrectly showed as en-dashes.
6.3	August 2016	■ Rebranded Cisco Tidal Enterprise Scheduler (TES) to Cisco Workload Automation (CWA).
6.3.1	May 2017	■ Added new configuration parameters for Large, Medium, and Small environments.
6.3.2	Oct 2017	■ Enhanced web scrolling performance.

1

Optimizing CWA Performance

Optimization and tuning is an exact science which is why it is critical to be able to recognize which parts of the system are being stressed (monitoring) and then knowing what parameters should be adjusted to reduce that stress (tuning). This chapter describes:

- CWA 6.3.2 Hardware Requirements
- Performance Matrix

Monitoring tasks are described in the Monitoring CWA, page 11 chapter.

Tuning tasks are described in the Tuning CWA, page 35 chapter.

See Transporter Performance, page 45 for the best practices and configuration options for the Transporter.

CWA 6.3.2 Hardware Requirements

Hardware requirements are provided below for small, medium, and large systems as defined in Configuration Definition for these CWA components:

- Master Configuration, page 8
- Client Manager Configuration, page 8
- Master and Client Manager DB Configuration, page 8
- Java Client Configuration, page 8
- Adapter Configuration, page 8
- Transporter Configuration, page 9

Note: All memory, CPU, and disk requirements in this section are for CWA-related components only, and do not take into account any additional OS/application requirements.

Configuration Definition

When referring to configuration sizes in the following sections, we use these definitions:

Configuration Size	Jobs Definition	DB Size
Small Configuration	1 – 3000	< 4 GB
Medium Configuration	3,000 – 20,000	< 16 GB
Large Configuration	20,000 and less than 100 K	> 32GB

Also see Size-Based Guidelines for Tuning Parameters, page 39.

Master Configuration

Required for the CWA Master only (see Note in CWA 6.3.2 Hardware Requirements, page 7):

Master Configuration	Memory	CPU Cores
Small	8GB	4
Medium	16GB	8
Large	24GB	16

Client Manager Configuration

Required for the CWA Client Manager only (see Note in CWA 6.3.2 Hardware Requirements, page 7):

Client Manager Configuration	Memory	CPU Cores
Small	12 GB	8
Medium	24 GB	16
Large	32 GB	24

Master and Client Manager DB Configuration

Minimum sizes required by the CWA Master and Client Manager databases:

- MS SQL Server: 128 MB Data, 32 MB Log
- Oracle: 400 MB Data, 300 MB Index, 200 MB Temp

As the number of jobs or logs increases, DBA should tune the DB accordingly.

Java Client Configuration

Required for the CWA Java Client only (see Note in CWA 6.3.2 Hardware Requirements, page 7):

Java Client	Memory	CPU Cores
Small	4 GB	4
Medium	8 GB	4
Large	16 GB	8

Adapter Configuration

For each CWA adapter instance, allocate the following extra RAM:

Adapter	Memory*
Small	1 GB
Medium	1 GB
Large	2 GB

Transporter Configuration

Required for the CWA Transporter only (see Note in CWA 6.3.2 Hardware Requirements, page 7):

Transporter	Memory*	CPU Cores*
Small	4 GB	2
Medium	8 GB	4
Large	16 GB	4

Performance Matrix

The tables below help you link common catalysts that impact performance with the areas that need to be monitored/tuned to get better performance

Catalyst	CPU	Memory	JMS	Cache Read	Cache Write	Cache Tuning	Cache Sync
Users	X	X	X	X		X	
Schedule Activity	X	X	X		X		
Schedule Compile	X	X	X		X		
Cache Sync	X	X	X		X		X

For example, in the table above, if you are experiencing performance problems with large schedules, the items you should tune or monitor would be the CPU, the memory, your JMS, and the Cache Write

Catalyst	CPU	Memory	JMS	DB Connections	Message Threads
Client Managers	X	X	X	X	X
Adapter Connections	X	X			X
Agents	X	X			X
Schedule Activity	X	X	X	X	X
Schedule Compile	X	X	X	X	
Definitions		X		X	
Logs and History				X	
Cache Sync	X	X	X	X	X

Performance Matrix

2

Monitoring CWA

Overview

This chapter covers the tasks you can use to monitor CWA performance:

Monitoring with JConsole

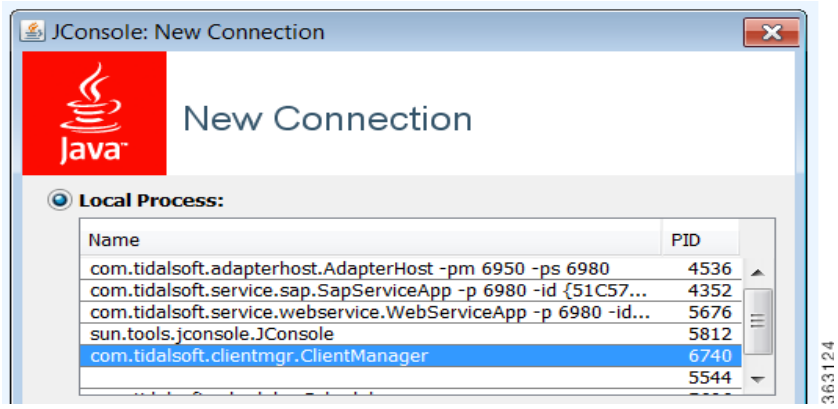
JConsole is a diagnostic tool that comes with the standard JDK. It allows you to connect directly to a running JVM and monitor many performance metrics, including memory/CPU usage. JConsole can also be used to access diagnostic modules exposed by each individual application called MBeans. Both the Master and Client Manager expose MBeans.

Connecting JConsole

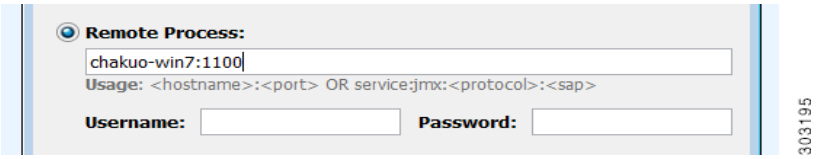
Before connecting JConsole to either the Client Manager or Master, make sure the following property is set in clientmgr.props or master.props.

JmxOn=Y

If you are running JConsole on the same machine as the JVM you are connecting to, the JVM will be listed in JConsole.



If you are connecting JConsole to a JVM running on a remote machine, type in the remote JVM's machine host name and port (the default Client Manager port is 1100).



Note: You can change the default port for the JVM by setting the following property in clientmgr.props or master.props.
JmxRmiPort=1200

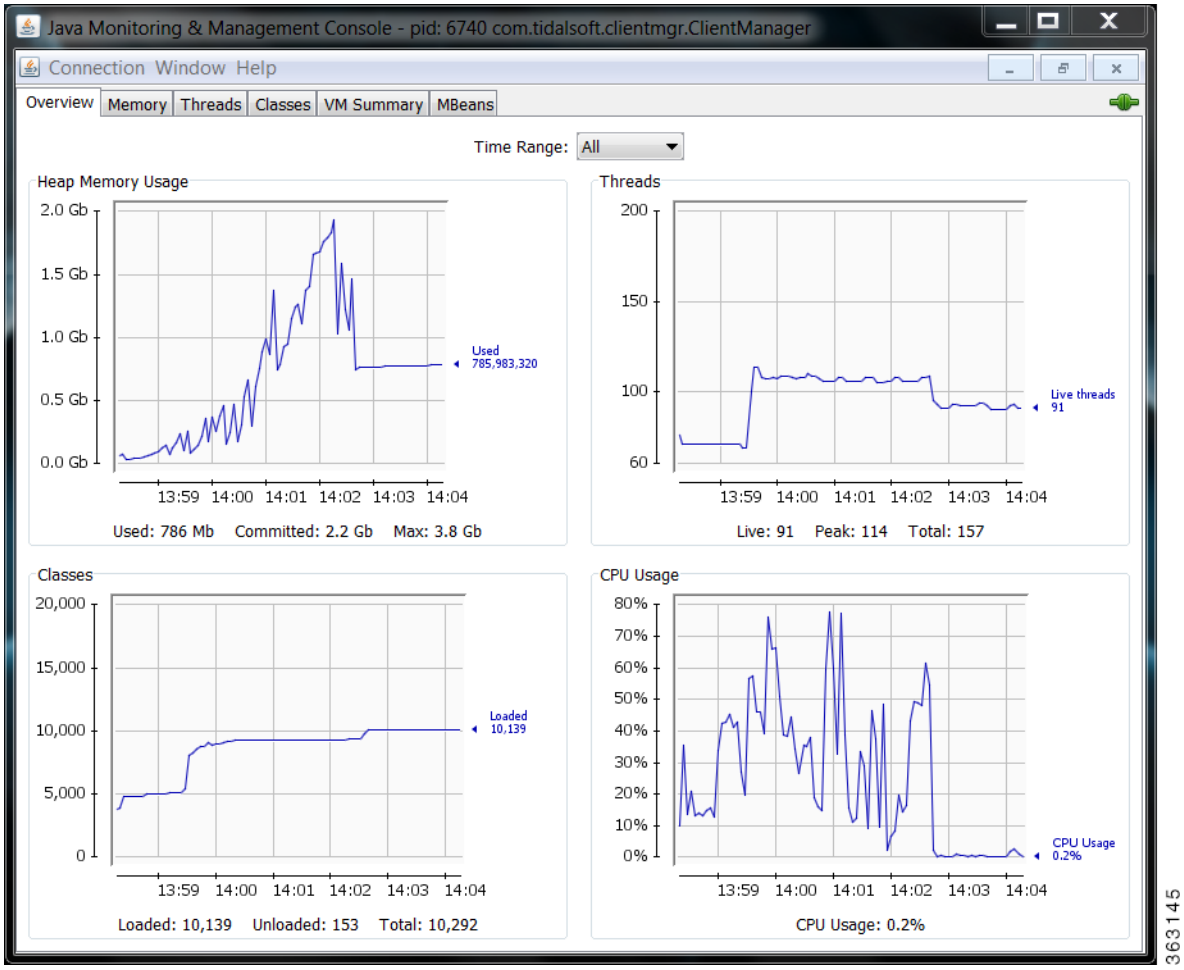
Note: To avoid random port generation, add **JmxRemotePort=1098** along with existing **JmxRmiPort** in master.props or clientmgr.props. For JConsole, ensure that you use the **JmxRmiPort**.

Viewing a System Overview

The Overview tab of JConsole provides an overview of JVM's memory, threads, and CPU usage.

To view a system overview of the vital stats for the JVM, select the **Overview** tab of the console.

Figure 1 Viewing Vital Stats for JVM



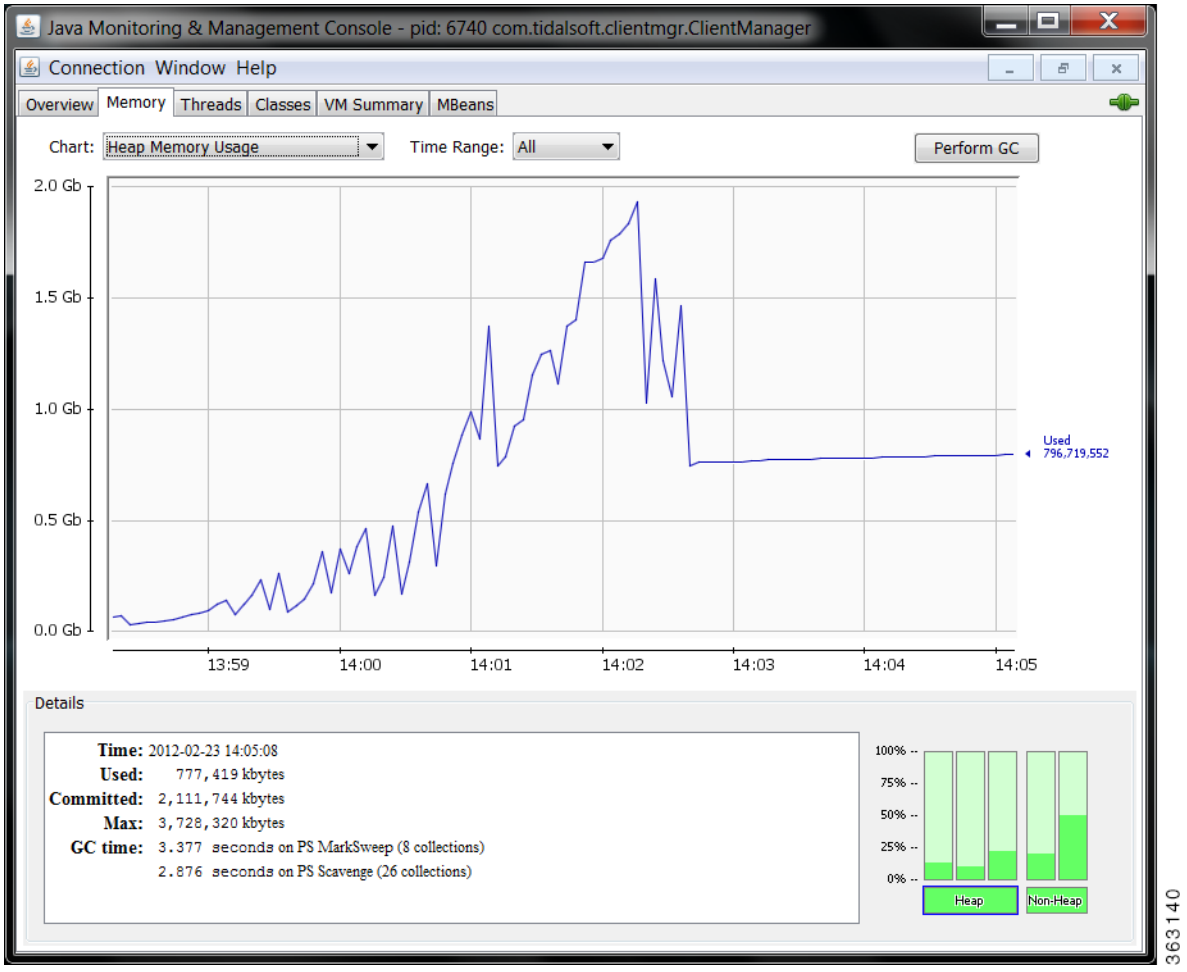
Viewing Memory Usage

To view memory usage, select the **Memory** tab of the console.

The memory tab provides more detailed information about JVM's memory use, allowing you to determine if the JVM has sufficient memory for the application that is running.

Note: For a normal running JVM, you should see memory use increase and decrease in the short term. However, if you see that memory use is increasing in the long term, it may indicate a memory that will eventually result in an out-of-memory termination.

Figure 2 Viewing Memory Usage

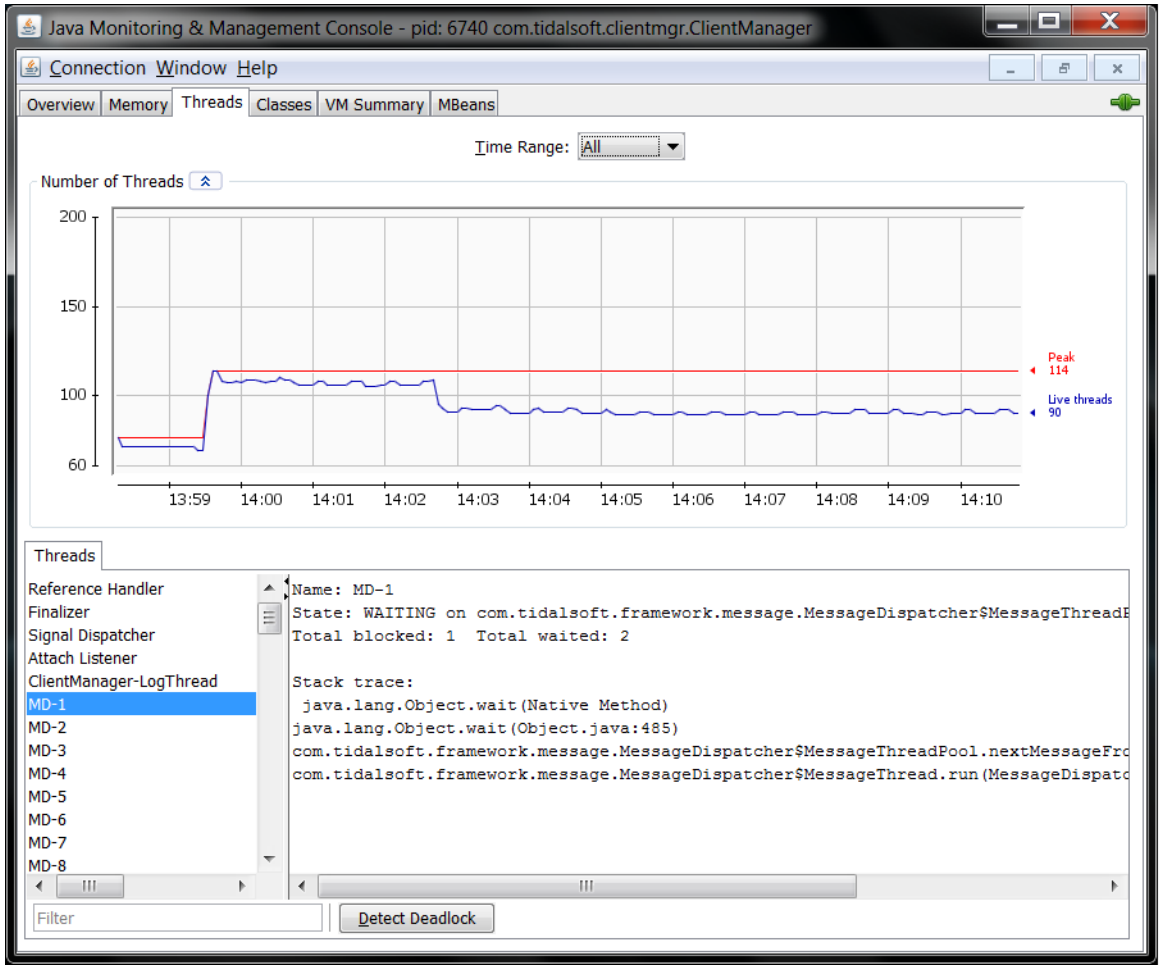


Viewing Active Threads

To view active threads and potential deadlocks, select the **Threads** tab of the console.

This screen provides stack traces for every thread in the JVM. A stack trace shows exactly what a thread is doing at the time of the trace. This screen allows you to automatically detect thread deadlocks.

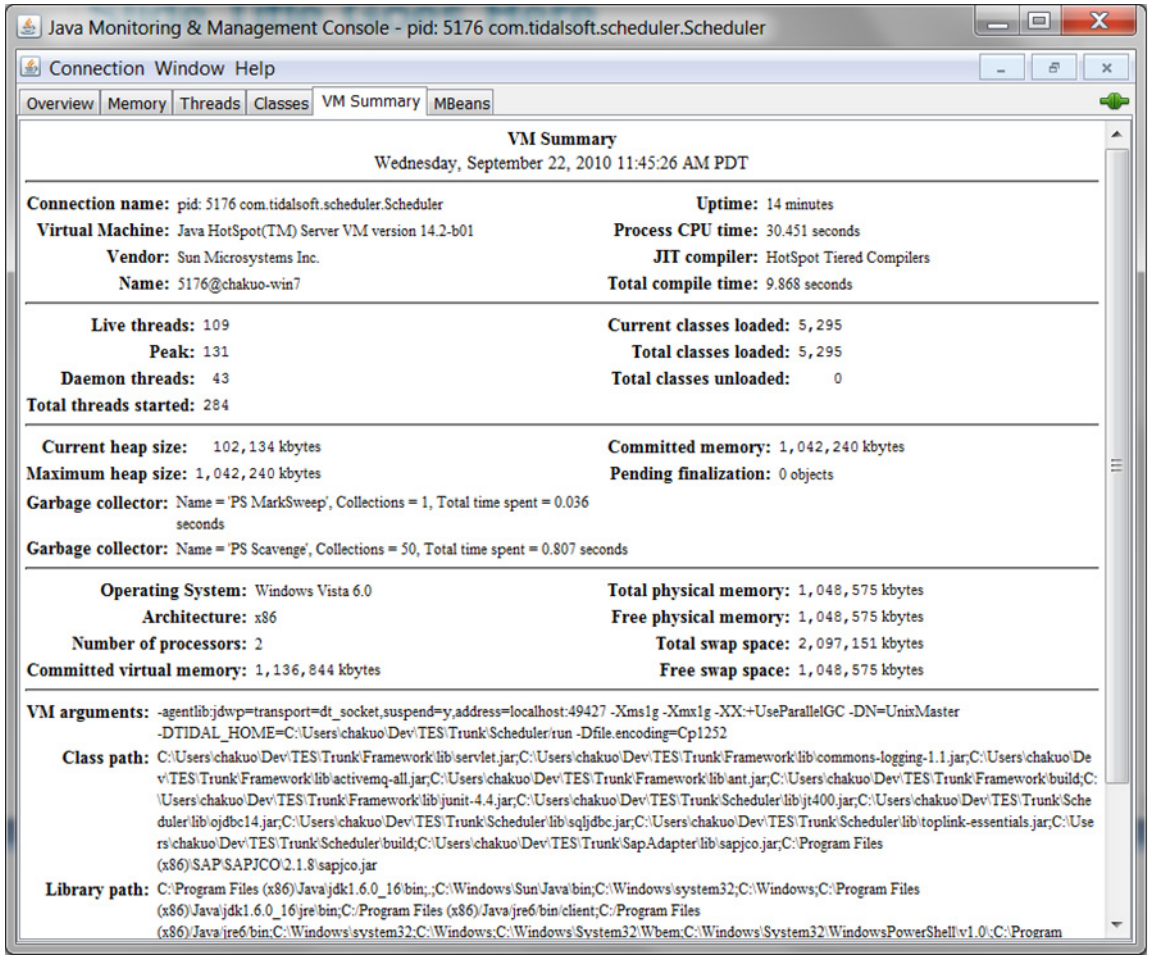
Figure 3 Viewing active threads



Viewing a VM Summary

For viewing a virtual machine summary and for basic technical support information, select the VM Summary tab of the console.

Figure 4 Viewing a VM summary

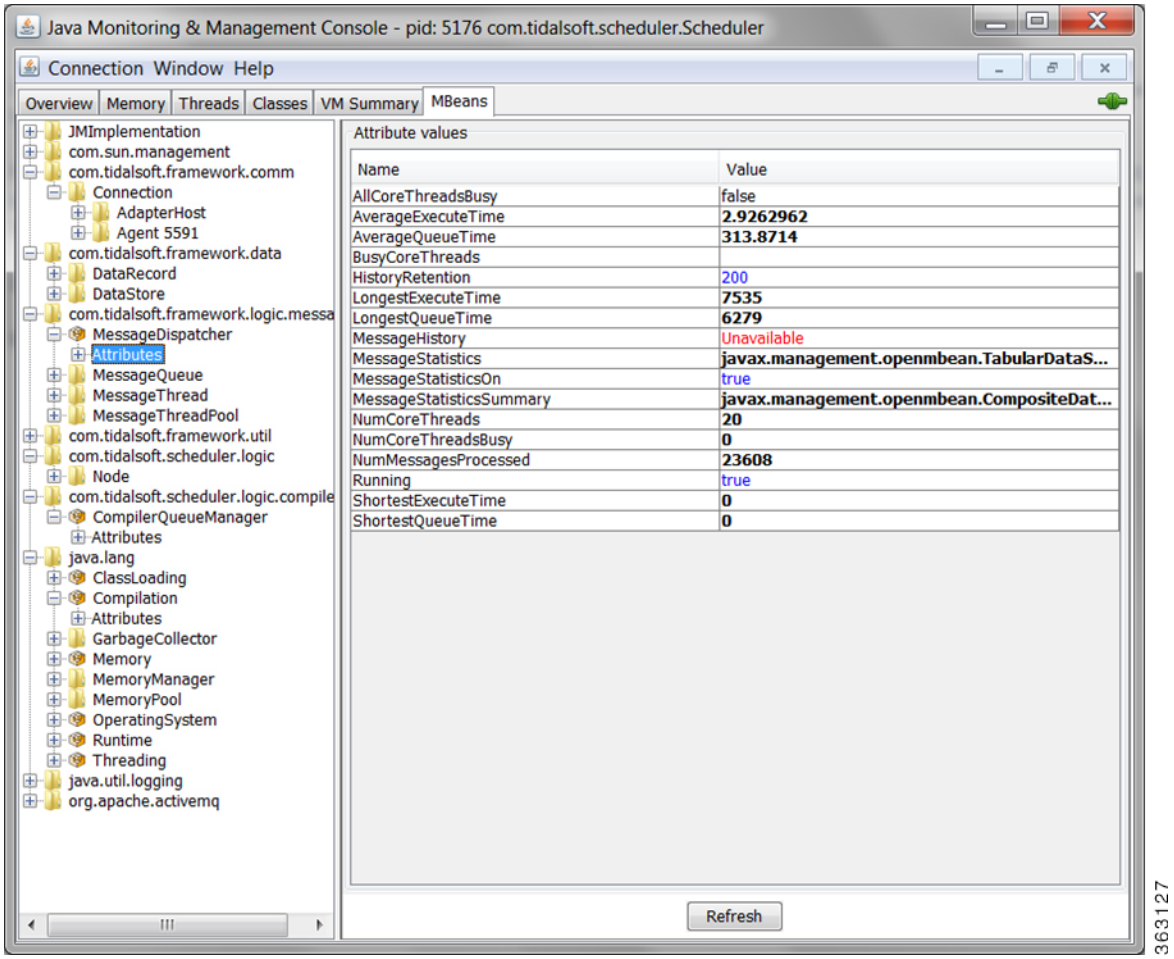


Monitoring Scheduling Activity

Viewing MBeans

For viewing custom monitoring modules (MBeans), select the MBeans tab of the console.

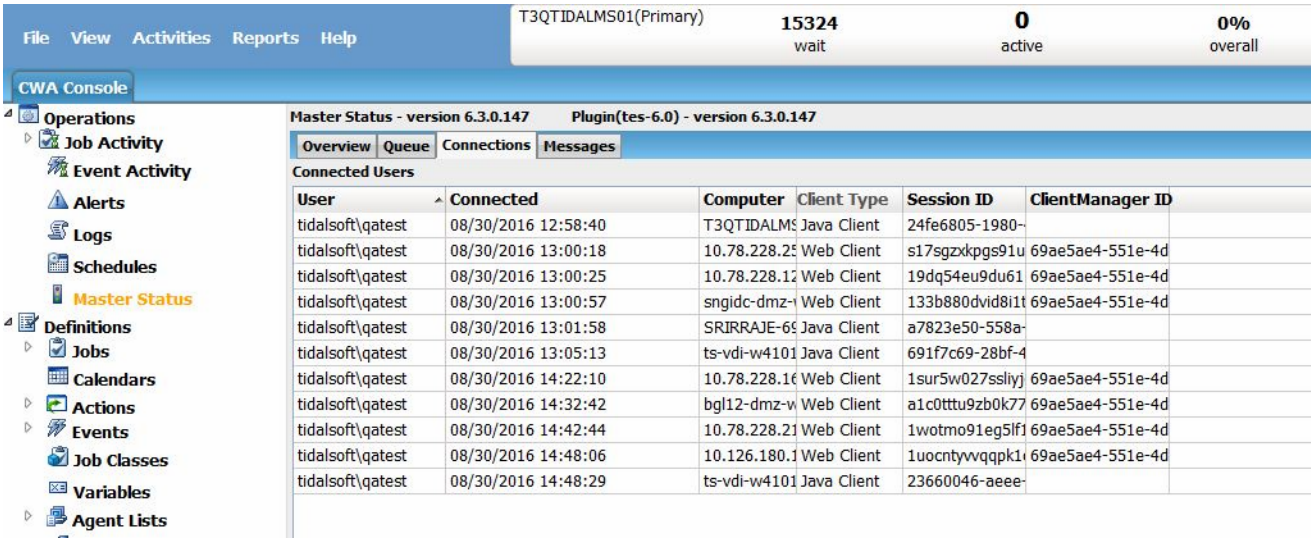
Figure 5 Viewing MBeans



Viewing Connected Users

For viewing connected users, click the **Connections** tab on the Master Status pane.

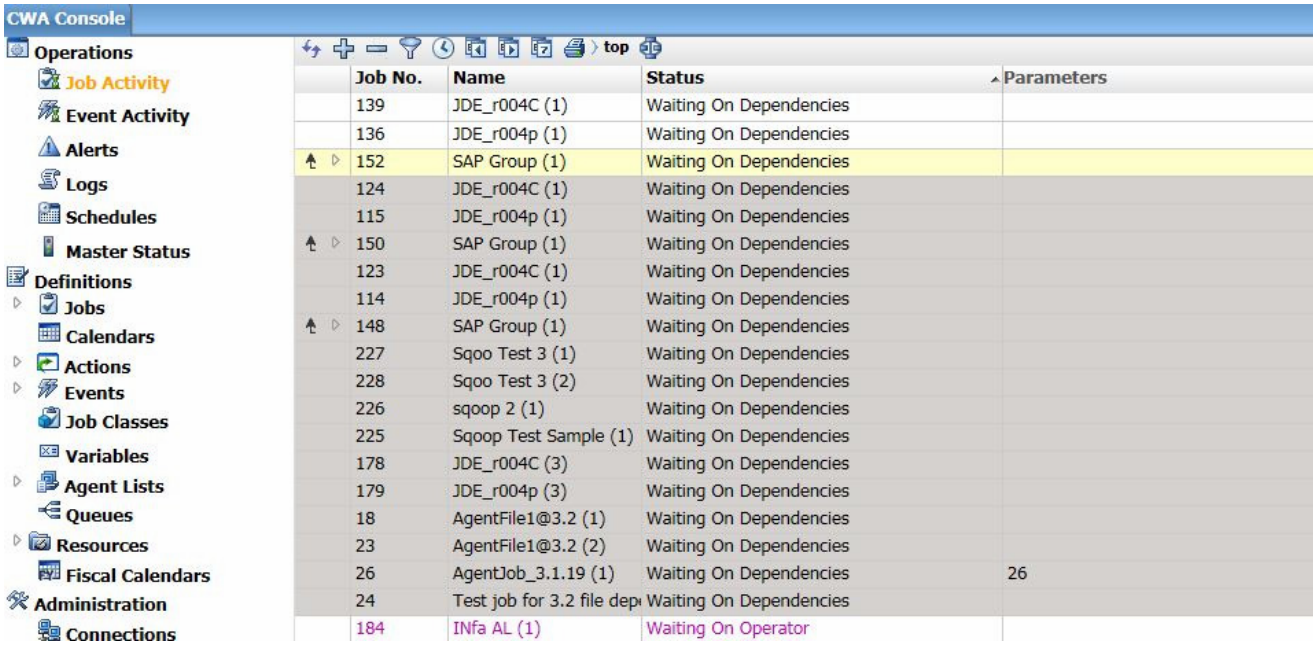
Figure 6 Viewing connected users



Viewing Job Activity

For viewing current job activity, select **Operations > Job Activity** from the Navigation tree to view the Job Activity pane.

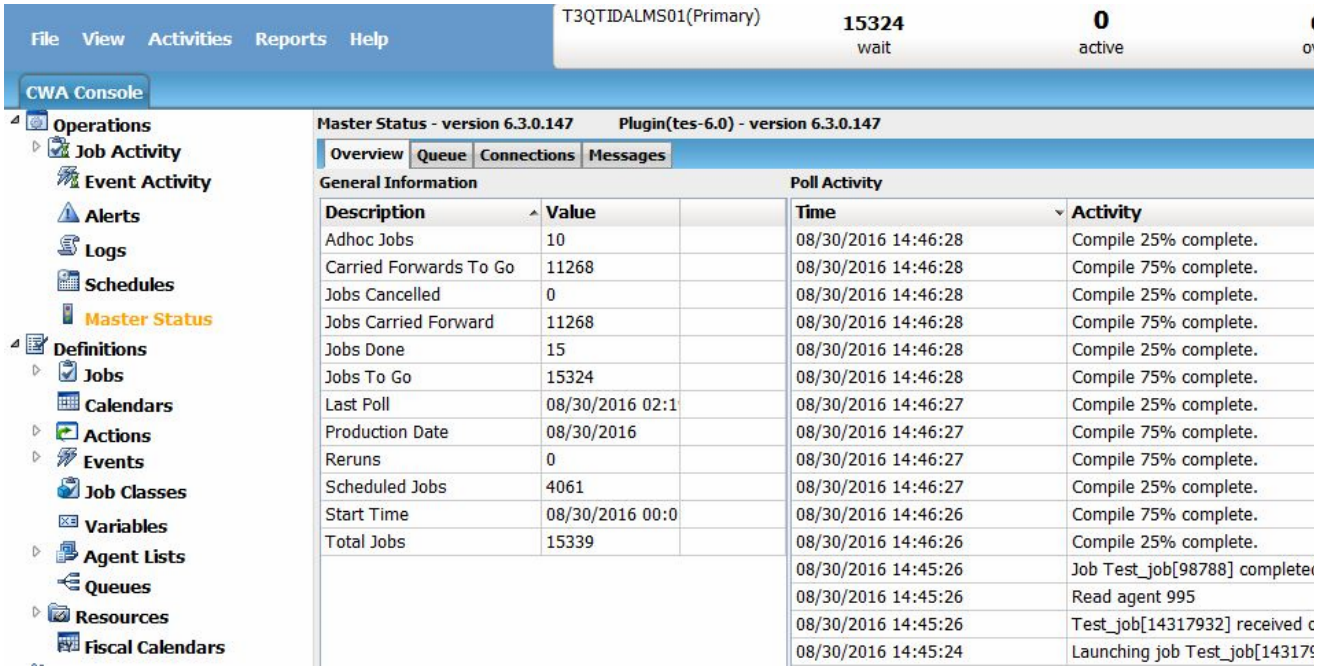
Figure 7 Viewing Job Activity



Viewing Master Status

For viewing an overview of the Master status, select **Operations > Master Status** from the Navigation tree to view the Master Status pane, and then click **Overview**.

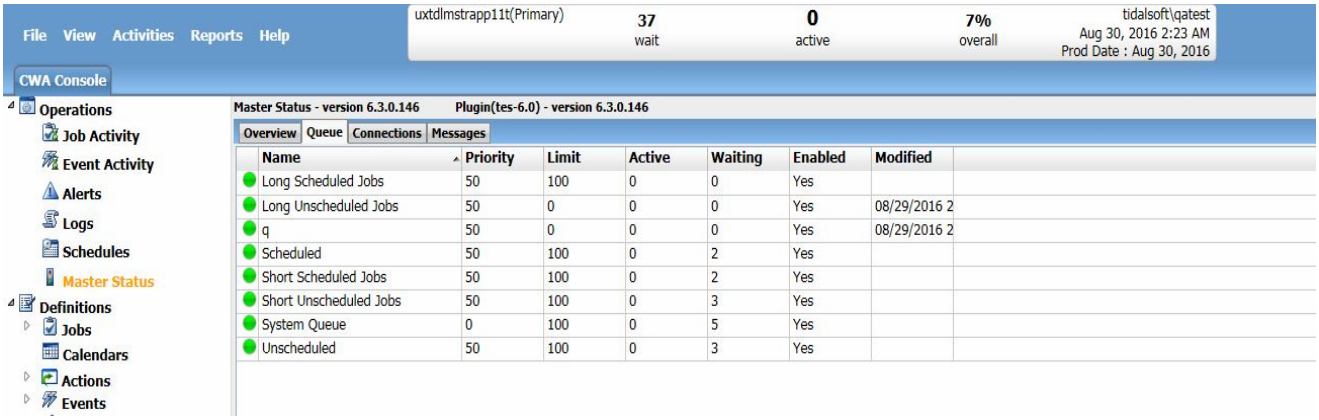
Figure 8 Viewing the Master Status



Viewing Queue Activity

For viewing queue activity, choose **Operations > Master Status** from the Navigation tree to view the Master Status pane, and then click **Queue**.

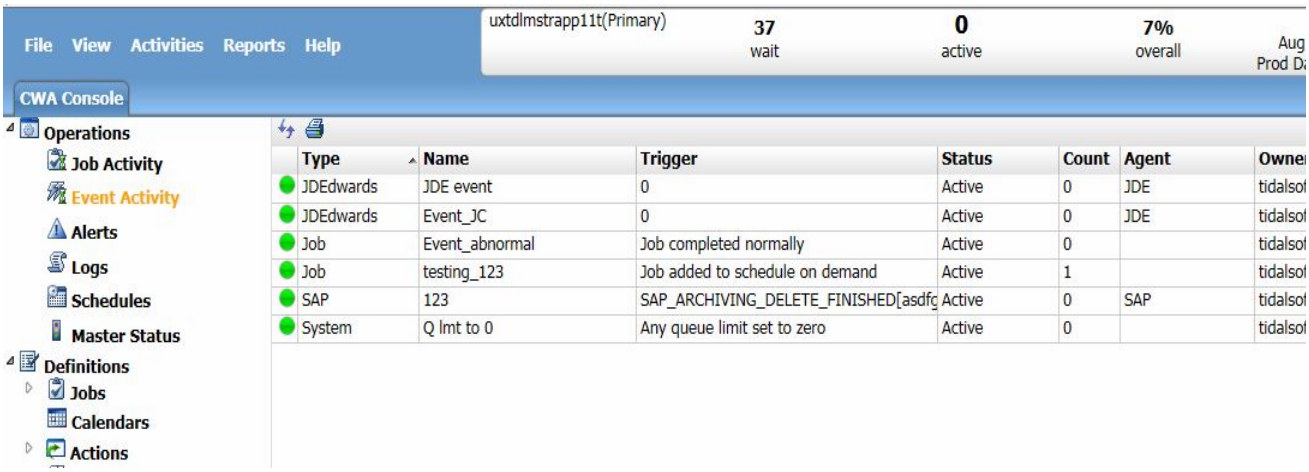
Figure 9 Viewing Queue Activity



Viewing Event Activity

To view event activity, choose **Operations > Event Activity** from the Navigation tree to view the Event Activity pane.

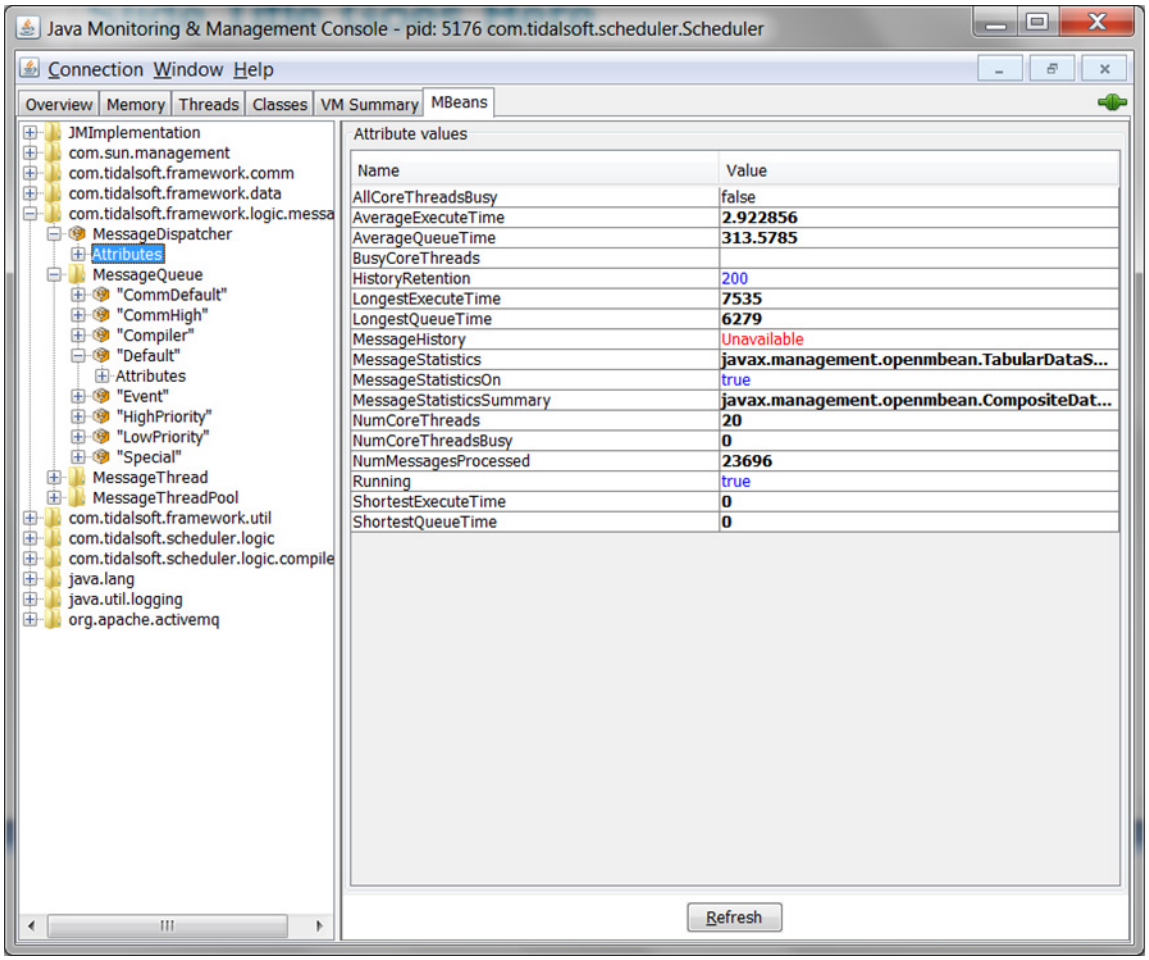
Figure 10 Viewing Event Activity



Monitoring the Overall Message System

For monitoring the overall message system, click the MBeans tab on the Java console, and then select Attributes from the tree to view the attribute values.

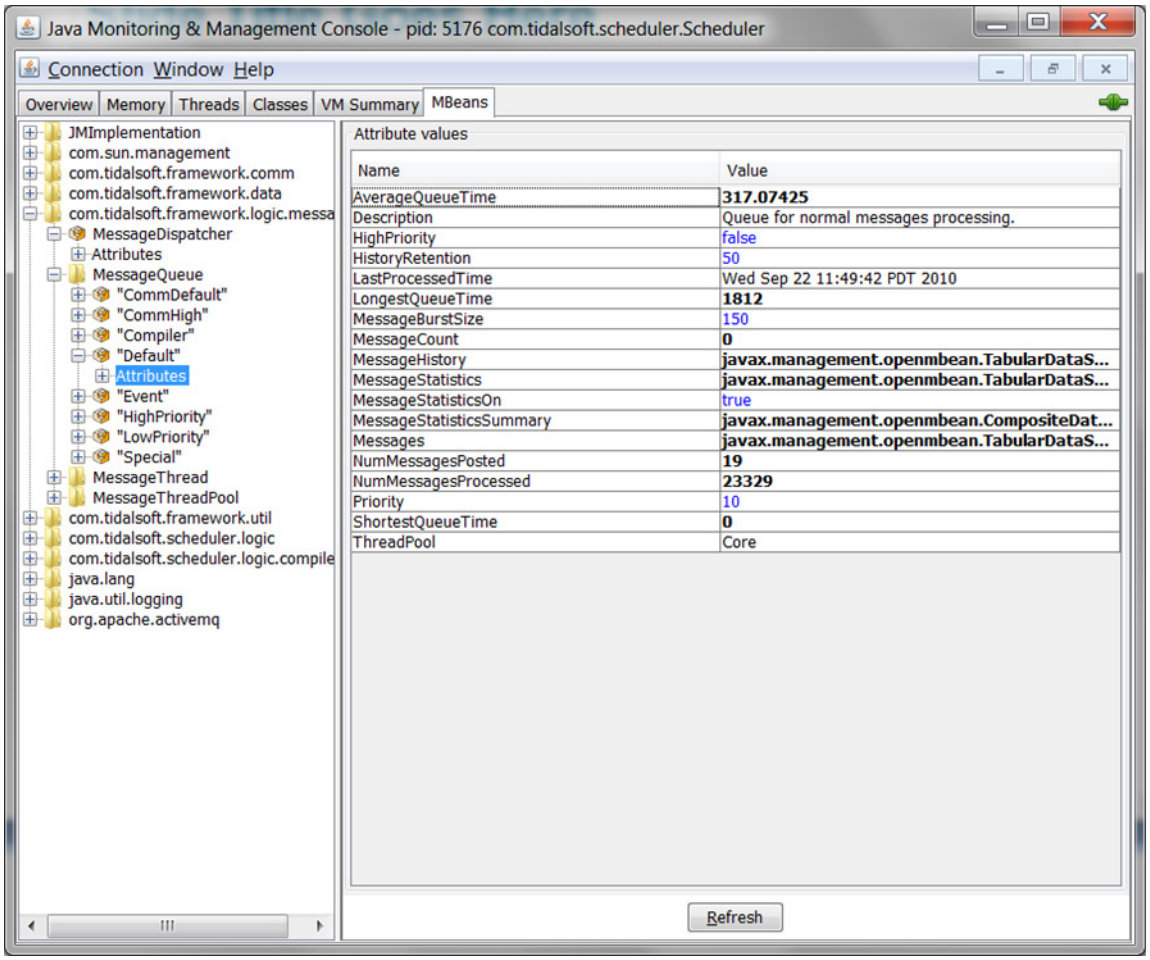
Figure 11 Monitoring the overall message system



Monitoring a Message Queue

For monitoring a message queue, click the MBeans tab on the Java console, and then choose **MessageQueue > Attributes** from the tree to view the attribute values associated with the message queues.

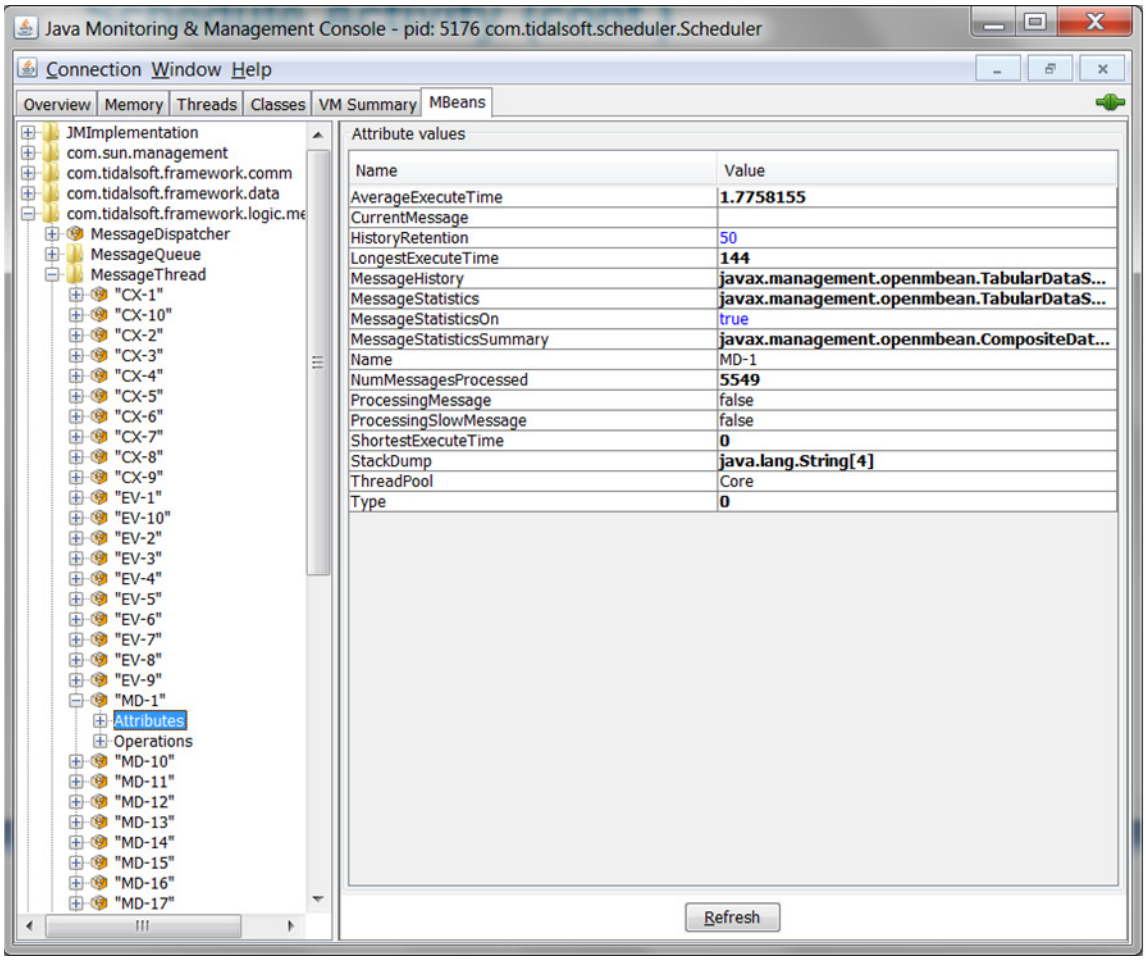
Figure 12 Monitoring a message queue



Monitoring a Message Thread

For monitoring a message thread, click the MBeans tab on the Java console, and then choose **MessageThread > threadname > Attributes** from the tree to view the attribute values associated with the message thread.

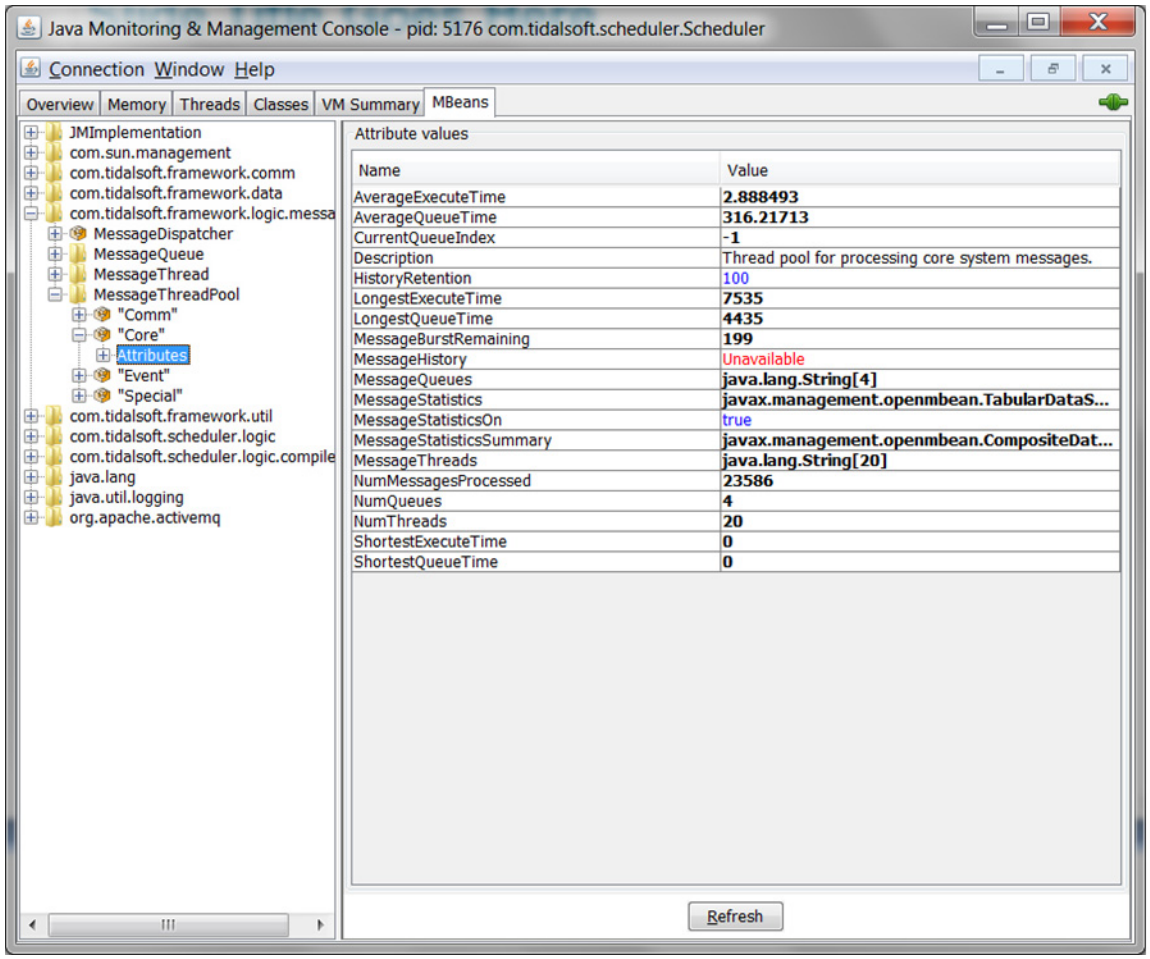
Figure 13 Monitoring a Message Thread



Monitoring a Message Thread Pool

For monitoring a message thread pool, click the MBeans tab on the Java console, and then choose **MessageThreadPool > poolname > Attributes** from the tree to view the attribute values associated with the message thread pool.

Figure 14 Monitoring a Message Thread Pool

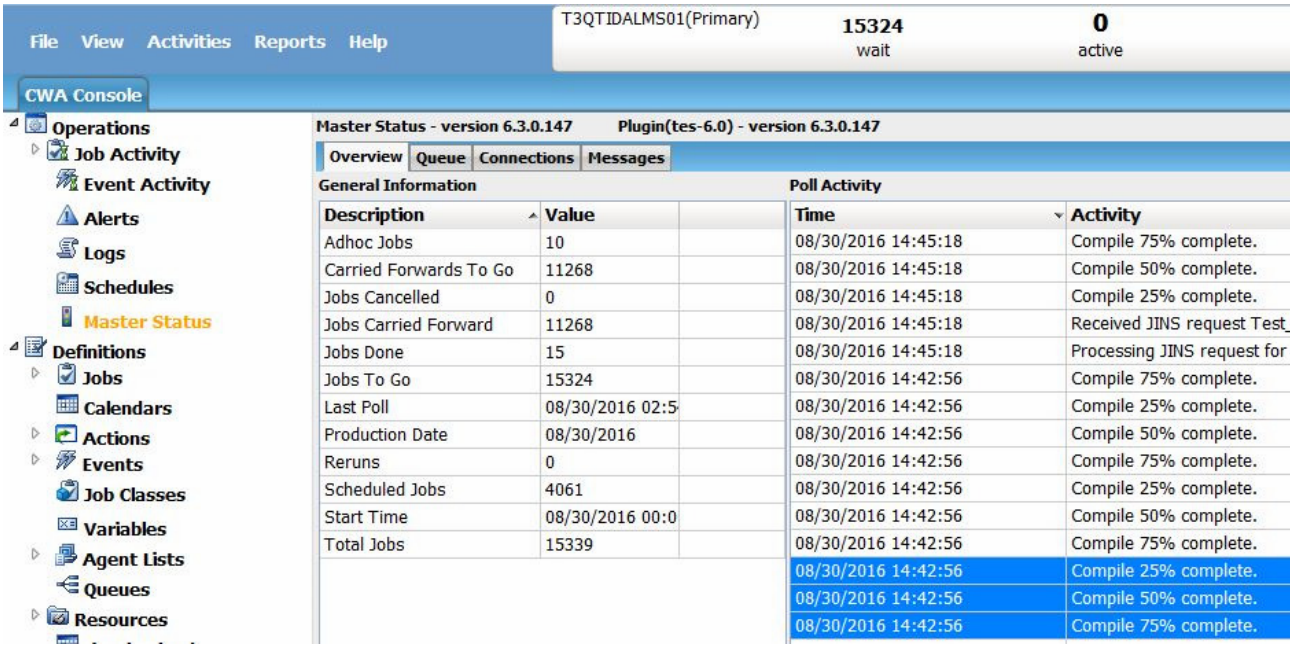


Monitoring Schedule Compiling

Master Status-Compile Status

For monitoring the Master compile status, choose **Operations > Master Status** from the Navigation tree to view the Master Status pane, and then click **Overview**. You can view the compile percentage in the Poll Activity pane as displayed below.

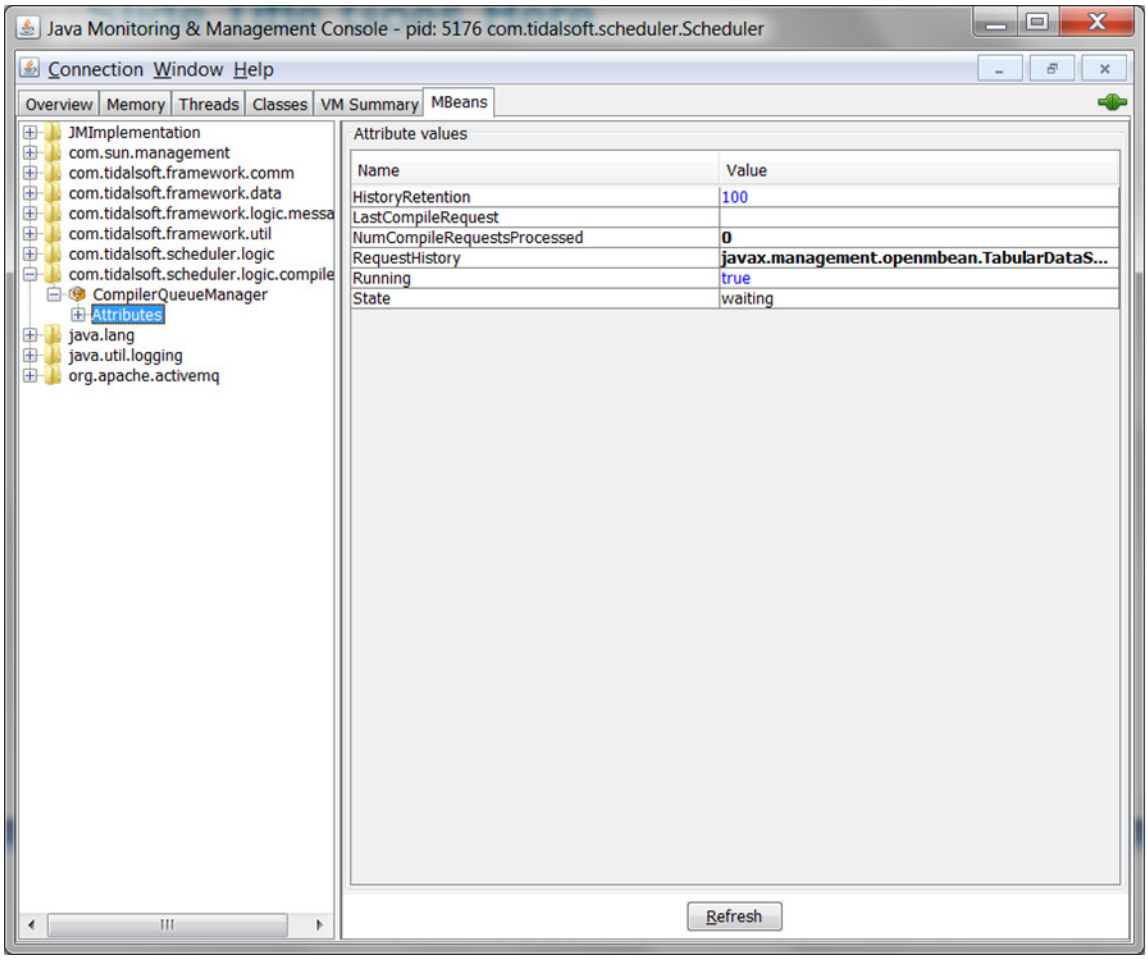
Figure 15 Viewing the Master compile status



Monitoring the Queue Manager Compiler

For monitoring the queue manager compiler, select the MBeans tab on the Java console, and then select **CompilerQueueManager > Attributes** from the tree to view the attribute values associated with the queue manager compiler.

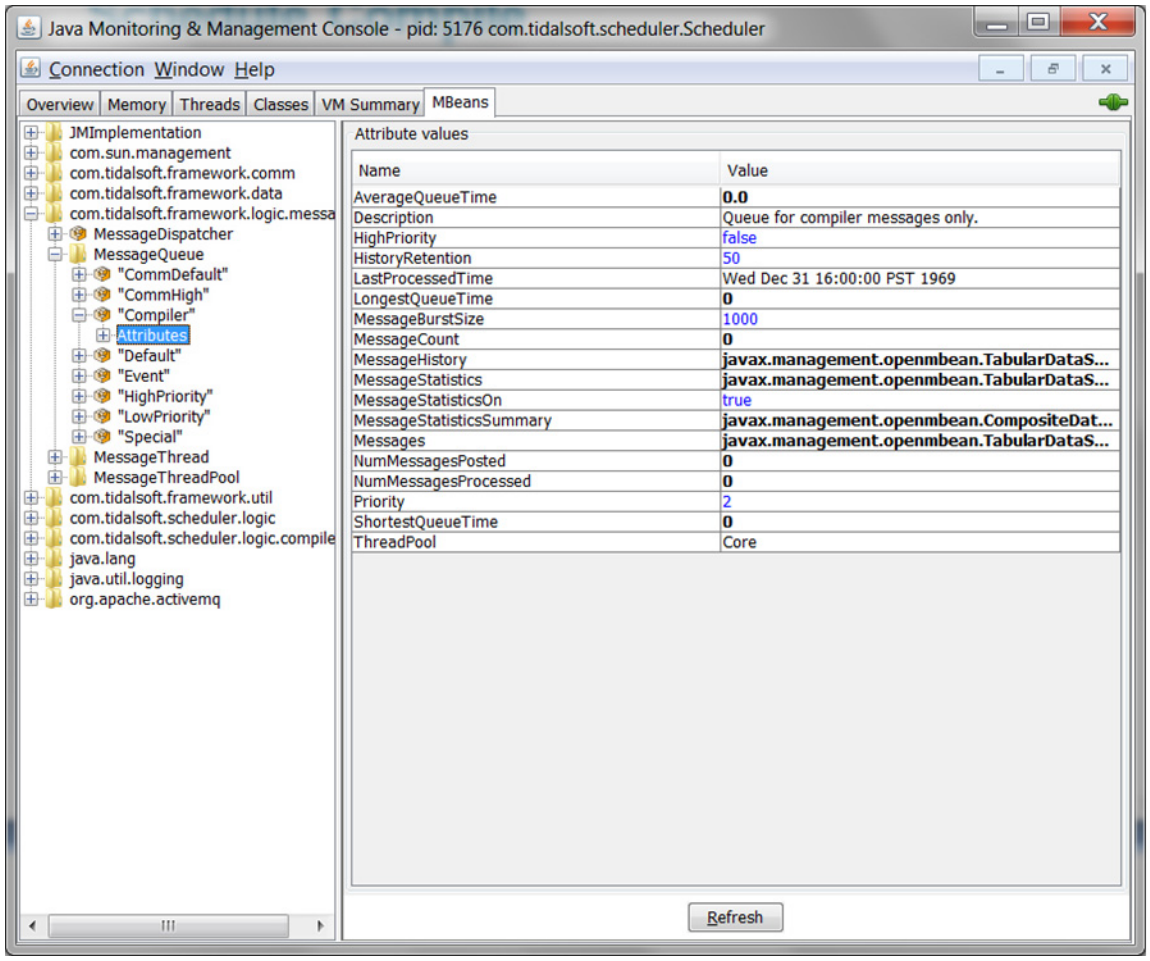
Figure 16 Monitoring the queue manager compiler



Monitoring the Message Queue Compiler

For monitoring the queue message compiler, select the MBeans tab on the Java console, and then choose **MessageQueue > Attributes** from the tree to view the attribute values associated with the queue message compiler.

Figure 17 Monitoring the message queue compiler

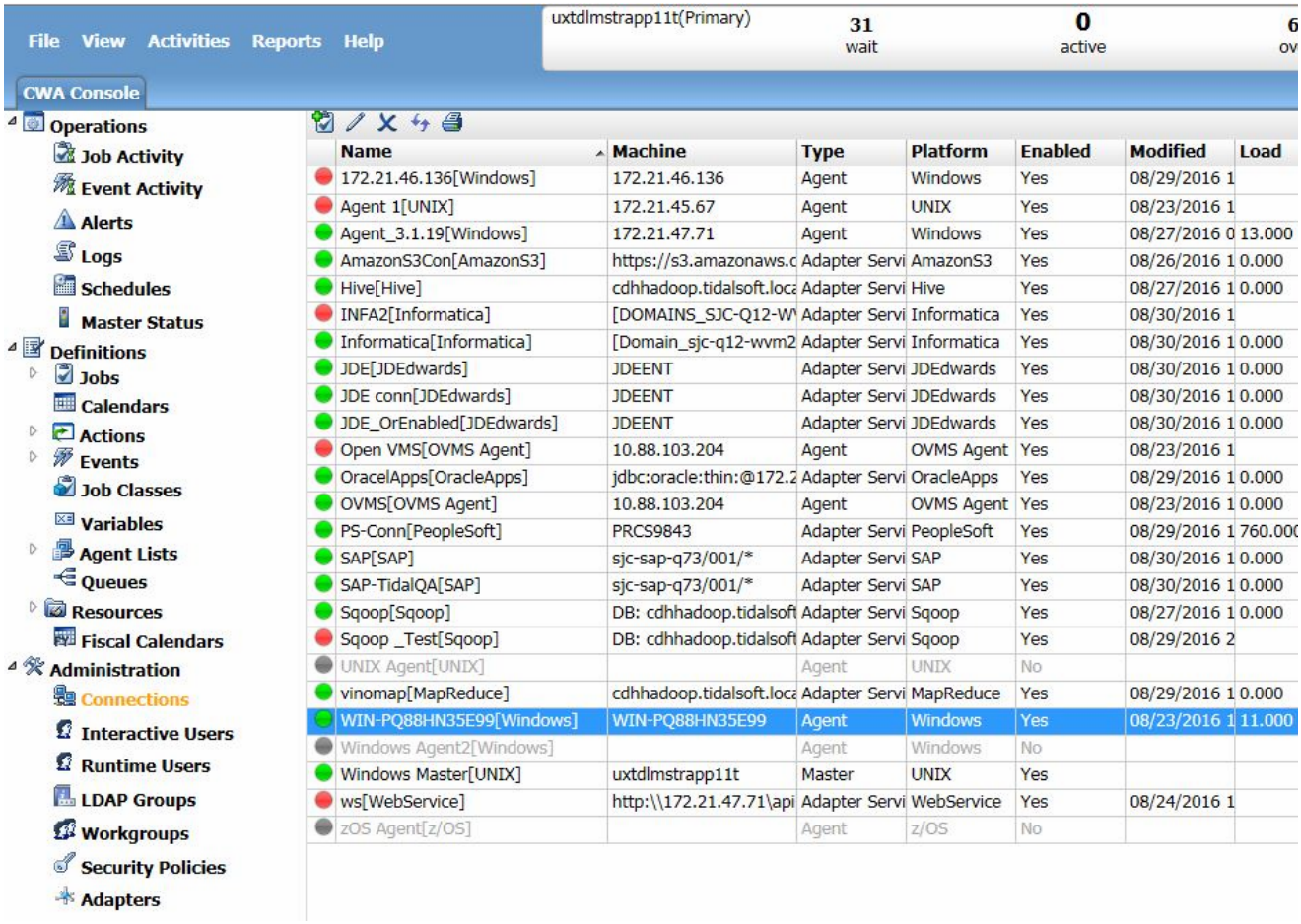


Monitoring Adapter/Agent Connections

Viewing All Connections and Statuses

To view all connections and their statuses, choose Administration > Connections from the Navigation tree to view the Connections pane.

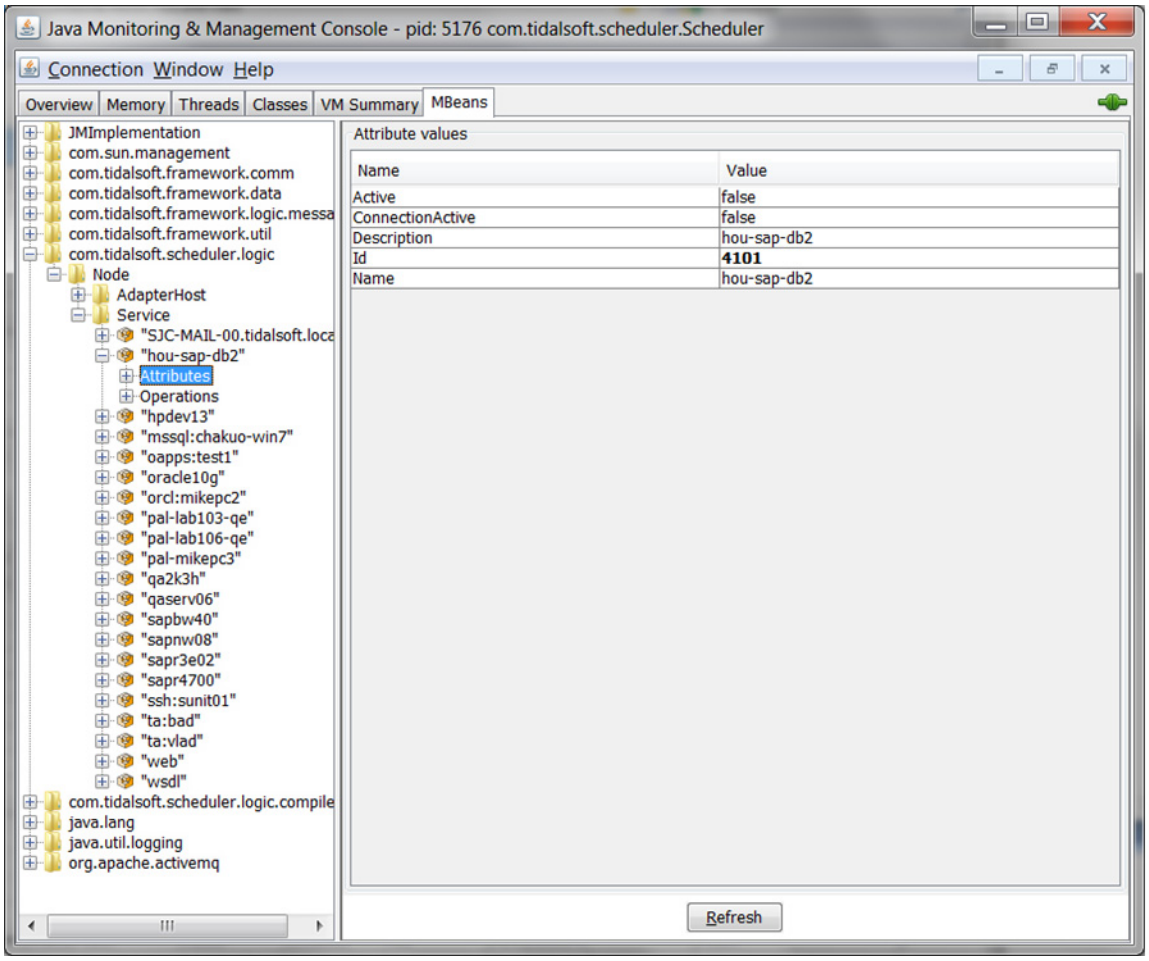
Figure 18 Viewing All Connections and their statuses



Monitoring Adapter Connections via JConsole

For monitoring the adapter connections, select the **MBeans** tab on the Java console, and then choose **Node > Service > Attributes** from the tree to view the attribute values associated with the adapter connection.

Figure 19 Viewing adapter connections via JConsole



Monitoring the CWA Java Application Performance

JConsole is recommended for capturing/monitoring any performance related issue with the Java Client application. JConsole, a GUI-based software, does not provided a way to capture performance data in a non-interactive way. To capture JMX MBean Attribute values as displayed below, for the purposes of generating alarms when the software exceeds thresholds, use the following command-line alternatives to the JConsole.

- **Jmxterm** (http://wiki.cyclopsgroup.org/jmxterm)
- **cmdline-jmxclient** (http://crawler.archive.org/cmdline-jmxclient)

jmxterm retrieves MBean Attribute values in an interactive shell, whereas **cmdline-jmxclient** retrieves it non-iteractiavely. The syntax of cmdline-jmxclient is as follows:

```
Z:\>java -jar cmdline-jmxclient-0.10.3.jar
Usage: java -jar cmdline-jmxclient.jar USER:PASS HOST:PORT [BEAN] [COMMAND]
Options:
USER:PASS Username and password. Required. If none, pass '-'.
E.g. 'controlRole:secret'
HOST:PORT Hostname and port to connect to. Required. E.g. localhost:8081.
```

List registered beans if only USER:PASS and this argument.

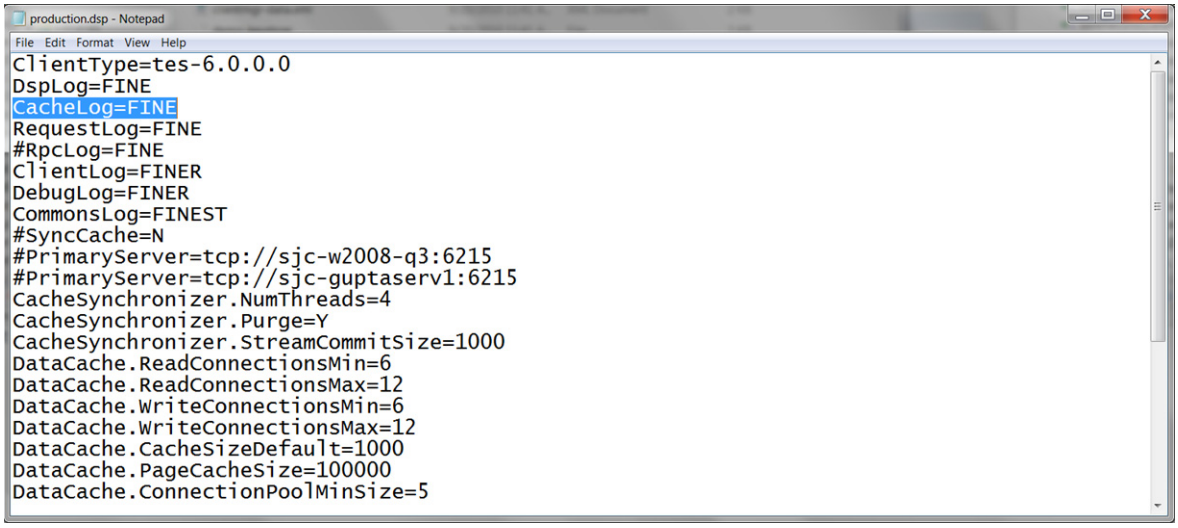
BEANNAME Optional target bean name. If present we list available operations and attributes.

COMMAND Optional operation to run or attribute to fetch. If none supplied, all operations and attributes are listed. Attributes begin with a capital letter: e.g. 'Status' or 'Started'. Operations do not. Operations can take arguments by adding an '=' followed by comma-delimited params. Pass multiple attributes/operations to run more than one per invocation.

Monitoring the Cache Sync

To monitor the Cache sync, open *DSP.props* and set the cache logging level to FINE as displayed below.

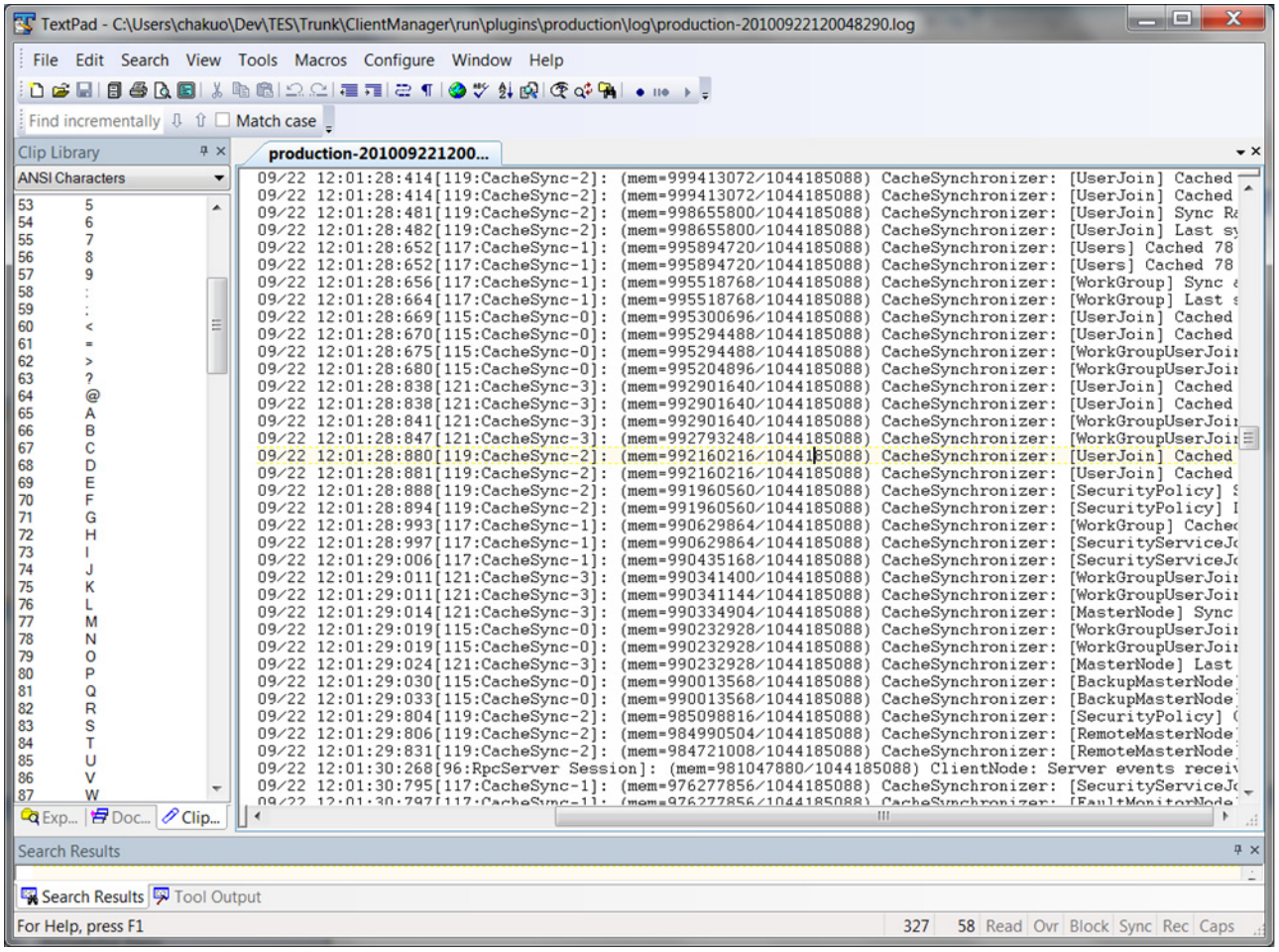
Figure 20 Monitoring the Cache sync



Viewing the Cache Sync Logging

To view the Cache sync logging, open the log file located in the *Log* folder.

Figure 21 Viewing the Cache sync logging



Viewing the Client Manager Output Log

To view the Client Manager output, open the *clientmgr.out* log file located in the *Log* folder.

Figure 22 Viewing the Client Manager Output

```
[08/27 01:26:43:401]:Client Manager: version 6.3.0.146
[08/27 01:26:43:403]:Java version: 1.8.0_91
[08/27 01:26:43:403]:Java Virtual Machine version: 25.91-b15
[08/27 01:26:43:403]:Start Time : 08/27/16 01:26:43:403
[08/27 01:26:43:403]:--------------------------------------------------------------------------------
[08/27 01:26:43:405]:Maximum number of log files = 50
[08/27 01:26:43:406]:Added a LogFile called 'RegularFile'
[08/27 01:26:43:539]:08/27 01:26:43[08/27 01:26:43:539]:: [08/27 01:26:43:539]:(mem=4051760528/4116185088) [08/27 01:26
[08/27 01:26:43:574]:Retrieved a LogFile called 'RegularFile'
[08/27 01:26:45:461]:2016-08-27 01:26:45.460:INFO::JMX connector: Logging initialized @5061ms
[08/27 01:26:52:916]:-- Loading DSP: plugins\tes-6.0\tes-6.0.0.0.jar
[08/27 01:26:55:784]:Maximum number of log files = 50
[08/27 01:26:55:785]:Added a LogFile called 'tes-6.0'
[08/27 01:27:04:458]:ClientNode: Primary Server = [tcp://localhost:6215]
[08/27 01:27:04:467]:ClientNode: Backup Server  = [tcp://]
[08/27 01:29:23:713]:Primary objects synchronized in 134 seconds.
[08/27 01:29:37:199]:2016-08-27 01:29:37.199:INFO:oejs.Server:Thread-45: jetty-9.1.5.v20140505
[08/27 01:29:37:262]:2016-08-27 01:29:37.261:INFO:oejsh.ContextHandler:Thread-45: Started o.e.j.s.h.ContextHandler@7dc
[08/27 01:29:37:298]:2016-08-27 01:29:37.298:INFO:oejsh.ContextHandler:Thread-45: Started o.e.j.s.ServletContextHandle
[08/27 01:29:37:300]:2016-08-27 01:29:37.300:INFO:oejsh.ContextHandler:Thread-45: Started o.e.j.s.ServletContextHandle
[08/27 01:29:37:301]:2016-08-27 01:29:37.301:INFO:oejsh.ContextHandler:Thread-45: Started o.e.j.s.ServletContextHandle
[08/27 01:29:37:303]:2016-08-27 01:29:37.303:INFO:oejsh.ContextHandler:Thread-45: Started o.e.j.s.ServletContextHandle
[08/27 01:29:37:304]:2016-08-27 01:29:37.304:INFO:oejsh.ContextHandler:Thread-45: Started o.e.j.s.ServletContextHandle
[08/27 01:29:37:616]:2016-08-27 01:29:37.616:INFO:oejw.StandardDescriptorProcessor:Thread-45: NO JSP Support for /clie
[08/27 01:29:37:625]:2016-08-27 01:29:37.625:WARN:oejs.SecurityHandler:Thread-45: Path with uncovered http methods: /
[08/27 01:29:38:225]:2016-08-27 01:29:38.225:INFO:oejsh.ContextHandler:Thread-45: Started o.e.j.w.WebAppContext@22a730
%20Files/TIDAL/ClientManager/webapps/client/,AVAILABLE}{webapps\client}
[08/27 01:29:40:668]:2016-08-27 01:29:40.666:INFO:oejs.ServerConnector:Thread-45: Started ServerConnector@703fed54{HTTP
[08/27 01:29:40:668]:2016-08-27 01:29:40.668:INFO:oejs.Server:Thread-45: Started @180280ms
[08/27 01:29:40:668]:Retrieved a LogFile called 'RegularFile'
[08/27 01:30:54:624]:Adapters initialized: 91 seconds.
[08/27 01:30:54:624]:Client initialized.
[08/27 01:31:23:311]:Secondary objects synchronized in 28 seconds.
[08/27 03:22:29:751]:Retrieved a LogFile called 'RegularFile'
[08/27 03:24:25:619]:Retrieved a LogFile called 'tes-6.0'
[08/27 03:24:26:957]:Retrieved a LogFile called 'tes-6.0'
[08/27 03:25:03:871]:Retrieved a LogFile called 'tes-6.0'
[08/27 03:26:02:569]:Primary objects synchronized in 63 seconds.
[08/27 03:26:08:229]:Secondary objects synchronized in 5 seconds.
```

3

Tuning CWA

Overview

This chapter covers the tasks you can use to tune CWA performance:

- Configuration and Tuning, page 35
- Size-Based Guidelines for Tuning Parameters, page 39

Configuration and Tuning

This section will walk you through how to tune the application (either Master or Client Manager) to get better performance.

Memory

These parameters tune the amount of memory the application has to use to get work done. If an application does not have enough memory to work with, it could have very poor performance or in the worst case get out of memory errors and fail.

The following parameters apply to all Java applications:

- -Xmn = size of young generation (1/4 size of heap)
- -Xmx = max heap size
- -Xms = initial heap size (guarantees JVM has that much memory)
- -Xss = thread stack size (increase if getting stack overflow exceptions)
- JVMARGS= -Xmn1024m -Xms28672m -Xmx28672m

CPU

The system CPU is not readily tunable from our application or the JVM itself, however, know that the CPU is an important resource that directly impacts performance. If a system does not have enough CPUs or CPU power, applications can run very slowly across the board. Upgrade your system to more CPUs or faster CPUs if the system monitor consistently shows the CPU meter very high.

JMS

Both the Master and Client Manager rely on the Java Message Service (JMS) for internal and cross communication with each other. You can think of JMS as the communication link between the Master and Client Manager. That is why JMS can greatly impact performance, especially if there is a lot of data moving back and forth between the Master and Client Manager., such as the primary and secondary cache synchronization.

JMS sessions process all messages such as during the use of one worker thread per session. The following threads are affected:

- MinSessionPoolSize – minimum number of ActiveMQ sessions kept pooled. Having sessions available to handle requests reduces the cost of allocating sessions on demand.
- MaxSessionPoolSize – maximum number of ActiveMQ sessions kept pooled.

  Note: If more sessions are needed to process messages, the system will still allocate them. This setting only limits the number of sessions allowed to be pooled.
- MaxConcurrentMessage – maximum number of ActiveMQ messages allowed to be processed concurrently. This setting is important for increasing throughput and utilizing all the cores on a system when there are many messages waiting in the ActiveMQ queues.

The following Message Brokers handle all JMS traffic:

- MessageBroker.MemoryLimit – how much memory (in MB) to allocate to ActiveMQ for storing in-flight messages. If queues become full, ActiveMQ will page messages to disk, which is more expensive than keeping them in memory.
- MessageBroker.TempLimit – how much memory (in MB) to allocate to ActiveMQ for storing temporary messages. If queues become full, ActiveMQ will page messages to disk, which is more expensive than keeping them in memory.
- MessageBroker.StoreLimit – how much disk space (in MB) to allocate to ActiveMQ for storing in-flight messages when memory is full.

The following *master.props* properties are what you would tune for DSP to Master message traffic for ***all*** DSP connections:

- MinSessionPoolSize (5)
- MaxSessionPoolSize (10)
- MaxConcurrentMessages (10)

The following *master.props* properties are what you would tune for DSP to Master message traffic ***per*** DSP connections:

- ClientConnection.MinSessionPoolSize (2)
- ClientConnection.MaxSessionPoolSize (5)
- ClientConnection.MaxConcurrentMessages (5)

The following *master.props* properties are what you would tune for Remote Master to Master message traffic per Remote Master:

- RemoteMasterClient.MinSessionPoolSize (2)
- RemoteMasterClient.MaxSessionPoolSize (5)
- RemoteMasterClient.MaxConcurrentMessages (5)

The following *master.props* properties are what you would tune for Master to Remote Master message traffic per Remote Master:

- RemoteMasterServer.MinSessionPoolSize (2)

- RemoteMasterServer.MaxSessionPoolSize (5)
- RemoteMasterServer.MaxConcurrentMessages (5)

The following *tes-6.0.dsp* properties are what you would tune for Master to DSP message traffic:

- ClientNode.MinSessionPoolSize (5)
- ClientNode.MaxSessionPoolSize (10)
- ClientNode.MaxConcurrentMessages (10)

The following *tes-6.2.dsp* properties are what you would tune for Fault Monitor to DSP message traffic:

- FTNode.MinSessionPoolSize (2)
- FTNode.MaxSessionPoolSize (5)
- FTNode.MaxConcurrentMessages (5)The following *tes-6.2.dsp* properties are what you would tune for Cache Read connections shared among all threads:
- DataCache.ReadConnectionsMin (2) – minimum number of JDBC connections kept pooled to read from the data cache. Having connections always available to handle read requests reduces the cost of allocating connections on demand.
- DataCache.ReadConnectionsMax (4) – maximum number of JDBC connections allowed to be allocated concurrently to read from the data cache. If this number is exceeded, read requests will be queued and blocked. Recommend increasing to handle more concurrent users.

The following *tes-6.2.dsp* properties are what you would tune for Cache Write connections shared among all threads:

- DataCache.WriteConnectionsMin (4) – minimum number of JDBC connections kept pooled to write to the data cache. Having connections always available to handle write requests reduces the cost of allocating connections on demand.
- DataCache.WriteConnectionsMax (8) – maximum number of JDBC connections allowed to be allocated concurrently to write to the data cache. If this number is exceeded, write request will be queued and blocked. Recommend increasing to handle more data update activity between the Master and DSP.

The following *tes-6.2.dsp* properties are what you would tune for Cache Tuning tradeoff between performance and memory/disk usage:

- DataCache.PageCacheSize (50000) – number of pages (of size DataCache.PageSize) in memory allocated to the data cache. The in-memory data cache allows for the fastest possible read/write access. Thus, for very large data caches, it is recommended that the data cache be given as much memory as possible.
- DataCache.PageSize (4096) – size (in bytes) of each page in the data cache. The data cache stores records in page-size chunks. Larger pages may improve read/write access when the data cache needs to fetch records from disk, with the added cost of a larger data cache in-memory and on disk. Another factor to keep in mind is the OS disk block size. Usually, it is recommended to keep the data cache page size the same as the OS disk block size.
- DataCache.CacheSizeDefault (1000) – number of objects each table in the data cache is allowed to keep in memory. More objects equals faster read/write access from and to the data cache.

The following *tes-6.2.dsp* properties are what you would tune for Cache Syncing, which affects the data sync between the Master database and Client Manager (DSP) cache.

- CacheSynchronizer.Purge (N) – Y to purge leftover deleted records during sync. Leftover records may exist in the cache if the Master deletes the records from its database when the Client Manager is not connected.

- CacheSynchronizer.NumThreads (4) – number of concurrent threads spawned to sync the cache. More threads increase throughput, but use more CPU and memory. Recommend to set at or below number of physical cores on machine.
- CacheSynchronizer.StreamCommitSize (1000) – number of records committed to the cache in a batch. Larger batches improve throughput, but use more memory.

The following *master.props* properties are what you would tune for the connections used to read/write to the Master database:

- Shared between normal Master operation PLUS cache sync (both can be high I/O).
- Each Client Manager can configure X number of sync threads = Master needs X number of DB connections.
- DatabaseConnections (20)

Master Messaging

Master messaging impacts only the Master, but it has a big impact on the performance of the Master and thus indirectly the Client Manager as well. The Master is designed to be a heavily multi-threaded application. By tuning the messaging parameters, the Master is bettter able to utilize the threading capabilities of the system.

All work in the Master is performed by the following message threads:

- Message Queues

  Before a message is sent to an object, it is first posted to one of the application's message queues. Each queue or set of queues is allocated for a specific type of message. For example, the default queues are for general messages, the compiler queue is for compile messages, and the communication queues are for communication messages. Each queue has a priority that determines how often its messages get processed. Higher priority queues have their messages processed more frequently than lower priority ones.

- Message Threads

  Message threads are the workhorse of the application. They are responsible for pulling messages out of queues and then executing them. Depending on the application configuration, there may be anywhere from a dozen to a hundred threads running inside the application. Generally speaking, more threads equal better performance, since each CPU can execute a thread at the same time as another CPU. So, technically, a dual core system can process twice as many messages as a single core system. However, in reality, because each thread eats up a bit of memory and CPU, performance is expected to degrade when there are too many threads for the system to handle.

- Message Thread Pools

  A message thread pool groups together a set of messages threads with a set of message queues. The intent is to force threads from a pool to only process messages for queues from the same pool. This guarantees if threads in one pool are busy, messages in another pool will still get processed by free threads in that pool.

To configure the Master messaging:

- MessageThreads = general workhorse threads
- SpecialMessageThreads = adapter-related threads
- EventMessageThreads = event-related threads
- CommThreads = communication threads

Note: As a best practice, retain no more than 20 M message log records for better performance.

WebClient Performance Parameters

The following *tes-6.0.0.0.dsp* properties are what you would tune for the WebClient performance:

- JdbcFetchSize – Allows you to specify the number of rows fetched with each database round trip for a query. Setting the fetch size overrides the row-prefetch setting and affects the subsequent queries executed through that statement object. The default value is 100.
- JdbcBatchSize – The client manager maintains a temporary table to track the filtered records in the job and job activity screen. This parameter controls the size of batch insertion into the temporary table. The default value is 100.
- JobThreadSliceSize – When the user in the Webclient or REST API, requests the job or job run data, the Client manager API uses parallel threads to fetch the child information of the top level job group. For a flat hierarchy with lot of top level groups, this tends to take over most of the thread resources that interact with database for one user request.

  This parameter allows the user to configure the number of top level groups child information to fetch in single thread. The higher number reduces the number of threads required to satisfy one user request and allows the system to be more responsive for many concurrent users. Higher number though might increase the response time for one user, as the child information fetch for top level job group is less concurrent per user.

  The JobThreadSliceSize with a value of 8 was tested across different environments (small, medium, and large). An optimal result was obtained based on the collected metrics.
- GridScrollingDataFetchDelay – Defines the time delay to load the page when scrolling in data grids and drop-downs. By default, the delay value is 1000. The allowed values are >= 400 and <=1000 milliseconds. The recommended value is 400 milliseconds.

  If the delay is reduced, the user interface will be more responsive. But, more page request for a given amount of scroll is sent to the client manager with increased load on the client manager or database.
- GridRecordFetchPageSize – Defines the number of pages to load as per request for every data grid and drop-downs. By default, the page size value is 1. The allowed values are >= 1 and <=3. The recommended value is 2.

  If the browser height dictates 100 rows per page having a page value of 2, the rows fetched per request will be increased to 200.

  If the page size is increased, the user interface will have more records and the view will be loaded seamlessly, which may increase the load on the client manager or database to fetch more records.

  Note: In a large environment, values lower than the default values of GridScrollingDataFetchDelay and GridRecordFetchPageSize parameters, are not recommended.

Size-Based Guidelines for Tuning Parameters

Small, medium, and large configurations require parameters to be tuned differently. Set the parameters as indicated in this section.

Small Configuration

tes-6.0.0.0.dsp

CacheSynchronizer.NumThreads=2

DataCache.ReadConnectionsMin=5

DataCache.ReadConnectionsMax=10

DataCache.WriteConnectionsMin=5

DataCache.WriteConnectionsMax=10

DataCache.PageCacheSize=16384

DataCache.ConnectionPoolMinSize=5

DataCache.ConnectionPoolMaxSize=10

DataCache.StatementCacheSize=750

ClientNode.MinSessionPoolSize=5

ClientNode.MaxSessionPoolSize=10

ClientNode.MaxConcurrentMessages=10

JdbcFetchSize=200

JdbcBatchSize=300

JobThreadSliceSize=8

GridScrollingDataFetchDelay=400

GridRecordFetchPageSize=2

clientmgr.props

JVMARGS= -Xms2048m -Xmx8192m -XX:PermSize=1024m -XX:MaxPermSize=1024m

ClientSession.MinSessionPoolSize=5

ClientSession.MaxSessionPoolSize=10

ClientSession.MaxConcurrentMessages=10

DataSource.MinSessionPoolSize=5

DataSource.MaxSessionPoolSize=10

DataSource.MaxConcurrentMessages=10

master.props

MessageBroker.MemoryLimit=2048

MessageBroker.StoreLimit=32768

MinSessionPoolSize=250

MaxSessionPoolSize=2500

MaxConcurrentMessages=5

ClientConnection.MinSessionPoolSize=10

ClientConnection.MaxSessionPoolSize=50

ClientConnection.MaxConcurrentMessages=10

DatabaseConnections=35

MessageThreads=25

EventMessageThreads=25

CommThreads=25

SpecialMessageThreads=25

JVMARGS= -Xms2048m -Xmx8192m -XX:PermSize=256m -XX:MaxPermSize=256m

transporter.cmd

JVMARGS= -Xms1024m -Xmx4096m

transporter.props

READJOBS_PAGINATED=true

READJOBS_BATCHES=false

READJOBS_ALL=false

READ_BATCHES=10000

XPORTER_DEBUG=YES

Medium Configuration

tes-6.0.0.0.dsp

CacheSynchronizer.NumThreads=4

DataCache.ReadConnectionsMin=10

DataCache.ReadConnectionsMax=20

DataCache.WriteConnectionsMin=10

DataCache.WriteConnectionsMax=20

DataCache.PageCacheSize=131072

DataCache.ConnectionPoolMinSize=10

DataCache.ConnectionPoolMaxSize=20

DataCache.StatementCacheSize=1500

ClientNode.MinSessionPoolSize=10

ClientNode.MaxSessionPoolSize=20

ClientNode.MaxConcurrentMessages=10

JdbcFetchSize=200

JdbcBatchSize=300

JobThreadSliceSize=8

GridScrollingDataFetchDelay=400

GridRecordFetchPageSize=2

clientmgr.props

JVMARGS= -Xms4096m -Xmx20480m -XX:PermSize=2048m -XX:MaxPermSize=2048m

ClientSession.MinSessionPoolSize=10

ClientSession.MaxSessionPoolSize=20

ClientSession.MaxConcurrentMessages=10

DataSource.MinSessionPoolSize=10

DataSource.MaxSessionPoolSize=20

DataSource.MaxConcurrentMessages=10

master.props

MessageBroker.MemoryLimit=4096

MessageBroker.StoreLimit=65536

MinSessionPoolSize=500

MaxSessionPoolSize=5000

MaxConcurrentMessages=10

ClientConnection.MinSessionPoolSize=10

ClientConnection.MaxSessionPoolSize=100

ClientConnection.MaxConcurrentMessages=10

DatabaseConnections=75

MessageThreads=50

EventMessageThreads=50

CommThreads=50

SpecialMessageThreads=50

JVMARGS= -Xms4096m -Xmx16384m -XX:PermSize=256m -XX:MaxPermSize=256m

transporter.cmd

JVMARGS= -Xms3072m -Xmx10240m

transporter.props

READJOBS_PAGINATED=true

READJOBS_BATCHES=false

READJOBS_ALL=false

READ_BATCHES=10000

XPORTER_DEBUG=YES

Large Configuration

tes-6.0.0.0.dsp

CacheSynchronizer.NumThreads=8

DataCache.ReadConnectionsMin=50

DataCache.ReadConnectionsMax=100

DataCache.WriteConnectionsMin=50

DataCache.WriteConnectionsMax=100

DataCache.PageCacheSize=1048576

DataCache.ConnectionPoolMinSize=20

DataCache.ConnectionPoolMaxSize=40

DataCache.StatementCacheSize=7500

ClientNode.MinSessionPoolSize=50

ClientNode.MaxSessionPoolSize=100

ClientNode.MaxConcurrentMessages=10

JdbcFetchSize=200

JdbcBatchSize=300

JobThreadSliceSize=8

GridScrollingDataFetchDelay=400

GridRecordFetchPageSize=2

clientmgr.props

JVMARGS= -Xms6144m -Xmx24576m -XX:PermSize=3072m -XX:MaxPermSize=3072m

ClientSession.MinSessionPoolSize=50

ClientSession.MaxSessionPoolSize=100

ClientSession.MaxConcurrentMessages=10

DataSource.MinSessionPoolSize=50

DataSource.MaxSessionPoolSize=100

DataSource.MaxConcurrentMessages=10

master.props

MessageBroker.MemoryLimit=8192

MessageBroker.StoreLimit=65536

MinSessionPoolSize=1000

MaxSessionPoolSize=10000

MaxConcurrentMessages=25

ClientConnection.MinSessionPoolSize=25

ClientConnection.MaxSessionPoolSize=100

ClientConnection.MaxConcurrentMessages=25

DatabaseConnections=75

MessageThreads=75

EventMessageThreads=75

CommThreads=75

SpecialMessageThreads=75

JVMARGS= -Xms4096m -Xmx24576m -XX:PermSize=256m -XX:MaxPermSize=256m

transporter.cmd

JVMARGS= -Xms4096m -Xmx16384m

transporter.props

READJOBS_PAGINATED=true

READJOBS_BATCHES=false

READJOBS_ALL=false

READ_BATCHES=10000

XPORTER_DEBUG=YES

4

Transporter Performance

General Best Practices

Consider the following best practices while using the CWA Transporter:

- Use server-side filter to read specific jobs.
- Run only one instance of transporter at a time in a machine.
- Have small number of top level groups.
- Transport during off peak hours or when Client Manager usage is significantly less.

Transporter Job Read Options

Configurations have been made available to provide improved performance for unfiltered job reads. Multiple options are available for flexibility. Configuring these options may require tuning based on the customer environment. For tuning purpose, it would best to run the Transporter in debug mode with an open console so that you can view how the reads are performing.

To run the Transporter in debug mode, include **XPORTER_DEBUG=YES** in the Transporter.props file and run the **transporter.cmd** script located in bin.

The REST call job.getList has been replaced with the following options:

Parameters Configured via Transporter.props

Only one of the following parameters should be set to true at a time:

- READJOBS_PAGINATED
- READJOBS_ALL
- READJOBS_BATCHES

The READ_BATCHES parameter applies to READJOBS_PAGINATED or READJOBS_BATCHES.

If none of these parameters is set, the default configuration for read is (READ_BATCHES=500, READJOBS_BATCHES=true)

The READ_BATCHES parameter is used when reading paginated or batched reads.

The READJOBS_PAGINATED parameter determines whether to read jobs in pages.

The READJOBS_BATCHES parameter determines whether to read jobs in batches.

The READJOBS_ALL parameter determines whether to read all, given the min and max job ID.

READJOBS_PAGINATED

READJOBS_PAGINATED configures the Client Manager to return job data in pages, with the batches based on the READ_BATCHES value.

For example, READ_BATCHES=1000 and READJOBS_PAGINATED=true, tells the Client Manager to return job data in batches of 1000. This approach reduces the overhead on the Client Manager as data is sent in smaller batches. Increasing the READ_BATCHES value will reduce the number of requests sent to the Client Manager since the jobs are returned in larger batches.

Note: This approach may have less benefit given many jobs (i.e. 50K or more). The batching is done at the Client Manager level.

READJOBS_BATCHES

READJOBS_BATCHES reads jobs based on a given range of job IDs, where the range is specified via READ_BATCHES.

For example, if you have 50,000 job records whose job IDs start at 1 and ends at 50000, and you have set READ_BATCHES=1000 and READJOBS_BATCHES=true, requests will be sent to the Client Manager to query job records in ranges, until no more records are returned, as follows.

```
jobid >=1        and jobid <=1001
jobid >=1002 and jobid <= 2002
jobid >=2003 and jobid <= 3003
…
```

If all the job IDs are sequential and start at 1, then each batch request will result in roughly 1000 records. However, if there are large gaps in the job IDs, due to mass job deletes for example, the request may return fewer results depending on where the job record ID falls in that range. While executing the read and running Transporter in the debug mode, if you find that very few or 0 records are returned given a READ_BATCHES configuration, then increasing this value will be necessary to reduce the number of requests that return 0 or few results.

Note: This approach appears to be more beneficial when there are many job records (50K or more).

READJOBS_ALL

READJOBS_ALL reads all jobs based on the first and last job ID. The result is that all jobs will be read in a single request. This approach is different from the job.getList call in that while both return all jobs, this request adds a query condition to the request, which seems to produce better performance. However, because all records are returned in a single request, the Client Manager will need to process all the records to send to Transporter.

Note: If there are many job records, the overhead on the Client Manager may be too high.