NonStop Java Platform mBean to ASAPX Agent

Overview

The Java virtual machine exposes a number of metrics through platform mBeans. An mBean is java class that holds metric information. Platform mBeans hold metric information about the operation of the JVM. Application developers can create additional mBeans for exposing application metrics.

There are a number of tools in the market place that can attach to a JVM using JMX and display metric information based on these mBeans. Most of these tools are not really geared to 24x7x365 monitoring and recording of history nor are they aimed at monitoring a large number of JVM instances running on a single platform.

ASAPX is NonStop product used with ASAP to report application based metrics. It was designed for the NonStop platform. ASAP, and ASAPX, provides an on platform collection framework having a low overhead.

An agent is the java term for a piece of code that runs in, or with, the JVM but separate from the application code.

Thus having an agent pick up the platform mBeans for a JVM process and send them to ASAP provides a way to monitor the JVM internal workings on a NonStop system where there might be numerous JVMs running, do so with low overhead, and for extended run times. Further, the ASAP alerting strategies can be used to inform operators should preset thresholds be exceeded.

Requirements to monitor mBeans with this tool

All of the following requirements must be met to successfully use this tool.

1. Have ASAP and ASAPX installed and licensed on the NonStop Server.
2. Have NonStop JVM 1.6 or later installed on the NonStop Server, and if running JVM 1.7 have it enabled to use the 32 bit mode. Please contact if using 64 bit mode is needed.
3. Have NonStop Jtoolkit version for the JVM being used installed.
4. Obtain the asapAgent.jar file by reviewing the license agreement at the end of this document and sending an email indicating acceptance of the license requesting the jar to: alan.charley@hp.com

Platform mBeans to be monitored

 MemoryPoolMXBean

The management interface for a memory pool. A memory pool represents the memory resource managed by the Java virtual machine and is managed by one or more [memory managers](http://docs.oracle.com/javase/7/docs/api/java/lang/management/MemoryManagerMXBean.html).

GarbageCollectorMXBean

The management interface for the garbage collection of the Java virtual machine. Garbage collection is the process that the Java virtual machine uses to find and reclaim unreachable objects to free up memory space. A garbage collector is one type of [memory manager](http://docs.oracle.com/javase/7/docs/api/java/lang/management/MemoryManagerMXBean.html).

MemoryMXBean

The management interface for the memory system of the Java virtual machine.

ClassLoadingMXBean

The management interface for the class loading system of the Java virtual machine.

CompilationMXBean

The management interface for the compilation system of the Java virtual machine.

ThreadMXBean

The management interface for the thread system of the Java virtual machine.

NOTE: Some counters may not be supported on NonStop, but have been included so that if at some point the JVM does support them they will be ready to use. Or if the agent is adapted to run in the ASAP Hybrid environment the counters might be supported by JVMs running on Linux.

Memory Usage reporting contains four values:

|  |  |
| --- | --- |
| init  | represents the initial amount of memory (in bytes) that the Java virtual machine requests from the operating system for memory management during startup. The Java virtual machine may request additional memory from the operating system and may also release memory to the system over time. The value of init may be undefined.  |
| used  | represents the amount of memory currently used (in bytes).  |
| committed  | represents the amount of memory (in bytes) that is guaranteed to be available for use by the Java virtual machine. The amount of committed memory may change over time (increase or decrease). The Java virtual machine may release memory to the system and committed could be less than init. committed will always be greater than or equal to used.  |
| max  | represents the maximum amount of memory (in bytes) that can be used for memory management. Its value may be undefined. The maximum amount of memory may change over time if defined. The amount of used and committed memory will always be less than or equal to max if max is defined. A memory allocation may fail if it attempts to increase the used memory such that used > committed even if used <= max would still be true (for example, when the system is low on virtual memory).  |

Below is a picture showing an example of a memory pool:

 +----------------------------------------------+

 +//////////////// | +

 +//////////////// | +

 +----------------------------------------------+

 |--------|

 init

 |---------------|

 used

 |---------------------------|

 committed

 |----------------------------------------------|

 max

Platform mBean mapping to ASAPX entities

JMEM (Jvm Memory)

Domain naming… JMEM\$Jvm

|  |  |  |
| --- | --- | --- |
| ASAP Attribute | mBean | Method |
| HeapInit | MemoryMXBean | getHeapMemoryUsage() |
| HeapUsed | MemoryMXBean | getHeapMemoryUsage() |
| HeapCommitted | MemoryMXBean | getHeapMemoryUsage() |
| HeapMax | MemoryMXBean | getHeapMemoryUsage() |
| NonHeapInit | MemoryMXBean | getNonHeapMemoryUsage() |
| NonHeapUsed | MemoryMXBean | getNonHeapMemoryUsage() |
| NonHeapCommitted | MemoryMXBean | getNonHeapMemoryUsage() |
| NonHeapMax | MemoryMXBean | getNonHeapMemoryUsage() |
| PendingFinalization  | MemoryMXBean | getObjectPendingFinalizationCount() |

JMPOOL (Jvm Memory Pool)

Domain naming… JMPOOL\$jvm\<pool name>

|  |  |  |
| --- | --- | --- |
| ASAP Attribute | mBean | Method |
| PeakInit | MemoryPoolMXBean | getPeakUsage() |
| PeakUsed | MemoryPoolMXBean | getPeakUsage() |
| PeakCommitted | MemoryPoolMXBean | getPeakUsage() |
| PeakMax | MemoryPoolMXBean | getPeakUsage() |
| CollectionInit | MemoryPoolMXBean | getCollectionUsage() |
| CollectionUsed | MemoryPoolMXBean | getCollectionUsage() |
| CollectionCommitted | MemoryPoolMXBean | getCollectionUsage() |
| CollectionMax | MemoryPoolMXBean | getCollectionUsage() |

JGC (Jvm garbage collection)

Domain naming… JGC\$jvm\<collector name>

|  |  |  |
| --- | --- | --- |
| ASAP Attribute | mBean | Method |
| MinorCount | GarbageCollectorMXBean | getCollectionCount() |
| MinorTime | GarbageCollectorMXBean | getCollectionTime() |
| MajorCount | GarbageCollectorMXBean | getCollectionCount() |
| MajorTime | GarbageCollectorMXBean | getCollectionTime() |

JCLS (Jvm class loader)

Domain naming… JCLS\$jvm

|  |  |  |
| --- | --- | --- |
| ASAP Attribute | mBean | Method |
| TotalLoaded | ClassLoadingMXBean | [getTotalLoadedClassCount](http://docs.oracle.com/javase/7/docs/api/java/lang/management/ClassLoadingMXBean.html#getTotalLoadedClassCount())() |
| LoadedCount | ClassLoadingMXBean | * + - getLoadedClassCount()
 |
| UnloadedCount | ClassLoadingMXBean | * + - getUnloadedClassCount()
 |
| CompTime | CompilationMXBean | [getTotalCompilationTime](http://docs.oracle.com/javase/1.5.0/docs/api/java/lang/management/CompilationMXBean.html#getTotalCompilationTime())() |

JTHRD (Jvm Threads)

Domain naming… JTHD\$jvm\<thread name>

|  |  |  |
| --- | --- | --- |
| ASAP Attribute | mBean | Method |
| CpuTime | ThreadMXBean | getThreadCpuTime(id) |
| UserTime | ThreadMXBean | getThreadUserTime(id) |
| Waits | ThreadMXBean\ThreadInfo | getWaitedCount() |
| WaitTime | ThreadMXBean\ThreadInfo | getWaitedTime() |

JCTHRD (Jvm Current Thread)

Domain naming… JCTHD\$jvm

|  |  |  |
| --- | --- | --- |
| ASAP Attribute | mBean | Method |
| CpuTime | ThreadMXBean | getCurrentThreadCpuTime() |
| UserTime | ThreadMXBean | getCurrentThreadUserTime() |
| ThreadCount | ThreadMXBean | getThreadCount() |
| DaemonCount | ThreadMXBean | getDaemonThreadCount() |
| PeakCount | ThreadMXBean | getPeakThreadCount() |

Description of ASAP Attributes

JMEM (Jvm Memory)

|  |  |
| --- | --- |
| ASAP Attribute | Description |
| HeapInit | current memory usage of the heap that is used for object allocation, initial amount of memory |
| HeapUsed | current memory usage of the heap that is used for object allocation, memory currently used |
| HeapCommitted | current memory usage of the heap that is used for object allocation, guaranteed to be available |
| HeapMax | current memory usage of the heap that is used for object allocation, maximum that can be used |
| NonHeapInit | current memory usage of non-heap memory that is used, initial amount of memory |
| NonHeapUsed | current memory usage of non-heap memory that is used, memory currently used |
| NonHeapCommitted | current memory usage of non-heap memory that is used, guaranteed to be available |
| NonHeapMax | current memory usage of non-heap memory that is used, maximum that can be used |
| PendingFinalization  | approximate number of objects for which finalization is pending |

JMPOOL

Current domains listed for NonStop JVMS:

Code\_cache

Eden\_space

Perm\_gen

Survivor\_space

Tenured\_gen

|  |  |
| --- | --- |
| ASAP Attribute | Description |
| PeakInit | peak memory usage of this memory pool since the Java virtual machine was started or since the peak was reset, initial amount of memory |
| PeakUsed | peak memory usage of this memory pool since the Java virtual machine was started or since the peak was reset, memory currently used |
| PeakCommitted | peak memory usage of this memory pool since the Java virtual machine was started or since the peak was reset, guaranteed to be available |
| PeakMax | peak memory usage of this memory pool since the Java virtual machine was started or since the peak was reset, maximum that can be used |
| CollectionInit | memory usage after the Java virtual machine most recently expended effort in recycling unused objects in this memory pool, initial amount of memory  |
| CollectionUsed | memory usage after the Java virtual machine most recently expended effort in recycling unused objects in this memory pool, memory currently used |
| CollectionCommitted | memory usage after the Java virtual machine most recently expended effort in recycling unused objects in this memory pool, guaranteed to be available |
| CollectionMax | memory usage after the Java virtual machine most recently expended effort in recycling unused objects in this memory pool, maximum that can be used |

JGC

Default domains listed for NonStop JVMS:

Copy

Marksweepcompact

|  |  |
| --- | --- |
| ASAP Attribute | Description |
| MinorCount | total number of collections that have occurred |
| MinorTime | approximate accumulated collection elapsed time in milliseconds |
| MajorCount | total number of collections that have occurred |
| MajorTime | approximate accumulated collection elapsed time in milliseconds |

Note: If a collector manages more than 2 memory pools it is considered a major collection, else it is considered a minor collection.

JCLS

|  |  |
| --- | --- |
| ASAP Attribute | Description |
| TotalLoaded | total number of classes that have been loaded since the Java virtual machine has started execution |
| LoadedCount | number of classes that are currently loaded in the Java virtual machine |
| UnloadedCount | total number of classes unloaded since the Java virtual machine has started execution. |
| CompTime | approximate accumulated elapsed time (in milliseconds) spent in compilation. |

JTHRD

Domain names are dependent upon application thread use.

|  |  |
| --- | --- |
| ASAP Attribute | Description |
| CpuTime | total CPU time for the thread in nanoseconds |
| UserTime | CPU time that the thread has executed in user mode in nanoseconds |
| Waits | total number of times that the thread waited for notification. |
| WaitTime | approximate accumulated elapsed time (in milliseconds) that the thread has waited for notification |

Note: CpuTime, UserTime, WaitTime not currently supported

JCTHRD

|  |  |
| --- | --- |
| ASAP Attribute | Description |
| CpuTime | total CPU time for the current thread in nanoseconds |
| UserTime | CPU time that the current thread has executed in user mode in nanoseconds |
| ThreadCount | current number of live threads including both daemon and non-daemon threads |
| DaemonCount | current number of live daemon threads |
| PeakCount | peak live thread count since the Java virtual machine started or peak was reset |

ASAP/X configuration changes

The following ASAP EDL file should be added to the ASAPUSER file for the ASAP instance to be used for monitoring enabled JVMs

 JVMEDL

The following lines should be added to the ASAPXCNF file for the ASAP instance to be used for monitoring enabled JVMs

Set aggregate JMEM 1

Set aggregate JMPOOL 1 2

Set aggregate JGC 1 2

Set aggregate JCLS 1

Set aggregate JTHD 1 2

Set aggregate JCTHD 1

Once that changes have been completed the ASAP instance must be (re)started.

Enabling monitoring for a JVM

The asapAgent.jar is supplied to the JVM on the command line with standard JVM option.

 -javaagent:jarpath[=options]

Where;

 jarpath is the location of the asapAgent.jar

 options are;

 ID=\$XXX to supply the ASAP ID of the instance to use, $ZOO is the default

 RATE=nnn , rate to report data in minutes, should match ASAP RATE

 MPOOL, report the MPOOL metrics

 GC, report the GC metrics

 THRD, report the thread metrics.

 By default only JMEM, JCLS, JCTHRD metrics are reported, since they are a single domain per JVM.

The asapAgent jar depends on a small piece of JNI code for communication with ASAP. The JNI code is provided as DLL named libAsapAgent.so. This file must have execution privileges and be located on path the JVM uses for locating libraries. This can be set with -Djava.library.path= and/or on NonStop with export \_RLD\_LIB\_PATH=.

Testing the agent for proper configuration

Once ASAP has been configured and restarted, the asapAgent jar contains a test program that can be used to validate the agents operation.

The following command starts a JVM, attaches the agent, prints the platform mBeans discovered, then loops forever printing “Application sleeping” while providing information to ASAP.

run -name=/G/agt \

java -Djava.library.path=/usr/tandem/javaexth11/lib:/path/to/agent/dll \

-javaagent:./asapAgent.jar="ID=\$ZOO,RATE=60,GC,MPOOL,THRD" \

-cp ./asapAgent.jar:/usr/tandem/javaexth11/lib/tdmext.jar \

com.hp.asap.agent.test

/G/agt The jvm must have a process name,here $AGT will be used for testing

/path/to/agent/dll This is path to where libAsapAgent.so was installed.

$ZOO This is the ASAP ID to be used, change to the ASAP ID the EDL was installed in

Then in ASAP after 1 minute execute this command

App

Domains similar to this list should be displayed.

Jcls\$Agt Up 9/24 6:10 5 0

Jcthrd\$Agt Up 9/24 6:10 6 0

Jgc\Copy\$Agt Up 9/24 6:10 5 0

Jgc\Marksweepcompact\$Agt Up 9/24 6:10 5 0

Jmem\$Agt Up 9/24 6:10 10 0

Jmpool\Code\_cache\$Agt Up 9/24 6:10 9 0

Jmpool\Eden\_space\$Agt Up 9/24 6:10 9 0

Jmpool\Perm\_gen\$Agt Up 9/24 6:10 9 0

Jmpool\Survivor\_space\$Agt Up 9/24 6:10 9 0

Jmpool\Tenured\_gen\$Agt Up 9/24 6:10 9 0

Jthrd\Finalizer\$Agt Up 9/24 6:10 5 0

Jthrd\Main\$Agt Up 9/24 6:10 5 0

Jthrd\Reference\_handler\$Agt Up 9/24 6:10 5 0

Jthrd\Signal\_dispatcher\$Agt Up 9/24 6:10 5 0

Jthrd\Timer-0\$Agt Up 9/24 6:10 5 0

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