IBM® WebSphere® Application Server V7

Garbage Collection and Memory Visualizer overview

@business on demand.

This presentation provides an overview of and shows you how to install the Garbage Collection and Memory Visualizer.

Agenda

- Garbage Collection (GC) and Memory Visualizer overview

- Installing the GC and Memory Visualizer

The first section of this presentation provides an overview of the GC and Memory Visualizer, including how to gather the garbage collection data that it processes, its basic functionality, and some typical usage scenarios. The second section will describe how to install the visualizer.

Section

Garbage Collection and Memory Visualizer overview

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This section provides an overview of the GC and Memory Visualizer.

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Garbage collection data

- The GC and Memory Visualizer processes garbage collection data
- Verbose garbage collection logs
  - ▸ Tool works with `optthruput`, `optavgpause`, and `gencon` GC policies
  - ▸ Preferred method for enabling verbose GC is with `-Xverbosegclog`
    - `-Xverbosegclog:file_name`
    - `-Xverbosegclog:%pid.txt`
    - `-Xverbosegclog`
  - ▸ Can also use `-verbose:gc` flag
    - File produced might contain additional application output
- Garbage collection traces
  - ▸ GC and Memory Visualizer supports `-Xtgc:freelist` output
- Works with all IBM SDKs version 1.4.2 or higher

The GC and Memory Visualizer processes garbage collection data, including verbose GC logs and traces. It is compatible with three garbage collection policies: optimized for throughput, optimized for average pause time, and generational concurrent garbage collection. There are multiple ways to enable verbose garbage collection logging, and the recommended command-line option for doing so is –Xverbosegclog. You can use the –Xverbosegclog parameter to name your log files, either with a static file name, or with a tokenized file name string. Multiple tokens are supported, including the process ID, user name, several time-related tokens, and others; these are fully documented in the Java™ Diagnostics Guide. While the –verbose:gc flag is more commonly used to turn on verbose GC logging, the file produced might not be in valid XML format. If this is the case, the GC and Memory Visualizer might not be able to parse it. Most verbose GC log files produced by IBM software products, like the GC data written to the native_stderr.log file in WebSphere Application Server, while not valid XML, can still be processed by the tool. In addition to verbose log files, the GC and Memory Visualizer can also parse freelist traces. The tool can process garbage collection data from any IBM SDK for Java, version 1.4.2 or higher.
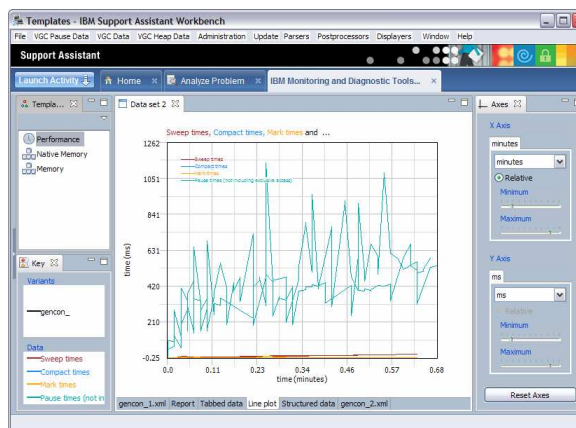
GC and Memory Visualizer overview

- The GC and Memory Visualizer is a tool for visualizing verbose garbage collection output
  - The tool parses and plots verbose GC output and garbage collection traces (`-Xtgc` output)
- The GC and Memory Visualizer provides
  - Raw view of data
  - Line plots to visualize a variety of GC data characteristics
  - Tabulated reports with heap occupancy recommendations
  - View of multiple datasets on a single set of axes
  - Ability to save data as an image (jpeg) or comma separated file (csv)

The GC and Memory Visualizer allows you to visualize your garbage collection data, as raw datasets, line plots, reports, and images. The "Line plot" portion of the tool displays graphs of over forty different garbage collection data characteristics – including used heap, pause times, and the reason for garbage collection being triggered. You can read in multiple sets of garbage collection logs and display them together on a single set of axes, which allows you to easily compare garbage collection behavior across multiple test runs of an application. The "Report" section of the tool contains a summary of the line plot data, along with information on general garbage collection behavior and heap sizing recommendations based on overall heap occupancy.

Usage scenarios

- Investigate performance problems
  - ‣ Long periods of pausing or unresponsiveness
- Evaluate your heap size
  - ‣ Check heap occupancy and adjust heap size if needed
- Garbage collection policy tuning
  - ‣ Examine GC characteristics, compare different policies
- Look for memory growth
  - ‣ Heap consumption slowly increasing over time
  - ‣ Evaluate the general health of an application

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When experiencing poor Java application performance, people sometimes have a tendency to jump to the conclusion that the garbage collector is to blame, but that is often not the case. One way to check whether garbage collection might be bogging your application down is by examining the logs. Is your application having to spend a large percentage of its time collecting garbage? Are you noticing period of unresponsiveness in your application that correspond to long garbage collection pause times in your logs? If so, you can probably tune your garbage collection policies to get better behavior. If you have concerns about your overall heap size, check out the Report tab portion of the GC and Memory Visualizer. It contains information on your heap utilization and offers recommendations for adjusting your heap size. To see how using different garbage collection policies will affect your application, gather logs for test runs using the different policies, and then load those logs into a GC and Memory Visualizer workspace. View and compare their characteristics on a single plot. To check the overall health of your application, use the GC and Memory Visualizer to examine your application's heap consumption over a long period of time. If your heap usage is slowly creeping up over time, you might have a memory leak in your application. If you suspect a memory leak, IBM provides another tool called the Memory Dump Diagnostic for Java that can help you isolate the source of the leak. The Memory Dump Diagnostic for Java tool is also available as a plug-in for IBM Support Assistant.

Section

Installing the visualizer

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The Garbage Collection and Memory Visualizer is available as an IBM Support Assistant add-on. This section explains where to download IBM Support Assistant and how to install the GC and Memory Visualizer add-on in your support assistant workbench.

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IBM Support Assistant

- The Garbage Collection and Memory Visualizer is available as an add-on to IBM Support Assistant V4
  - ▶ Available on Windows® and Linux®

- The support assistant is an integrated serviceability workbench that offers many product documentation add-ons and tools
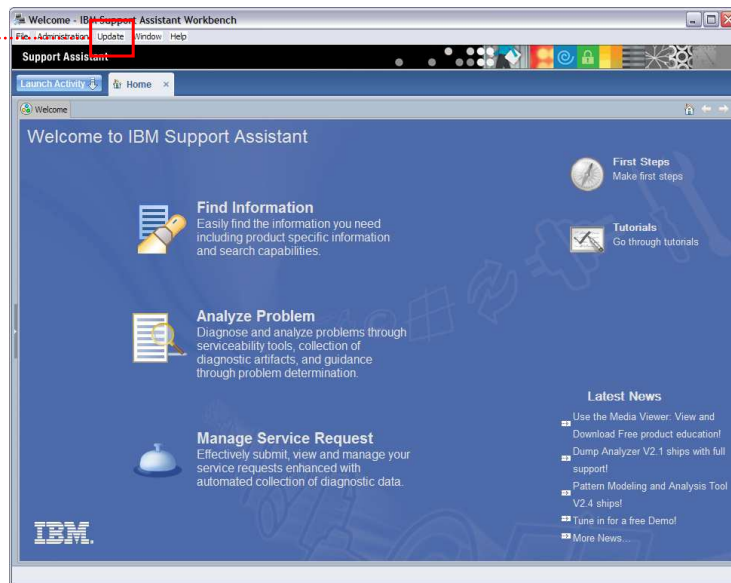 - ▶ Available as a free download from http://www.ibm.com/software/support/isa/

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Initially, the IBM Support Assistant Workbench will not have any product or tool add-ons installed. You can customize your workbench by installing add-ons. You can browse through the available product and tool add-ons under the Update > Find new menu. The Garbage Collection and Memory Visualizer is a tool add-on, so look for it under the "Tool add-ons" menu.

Installing IBM Support Assistant add-ons
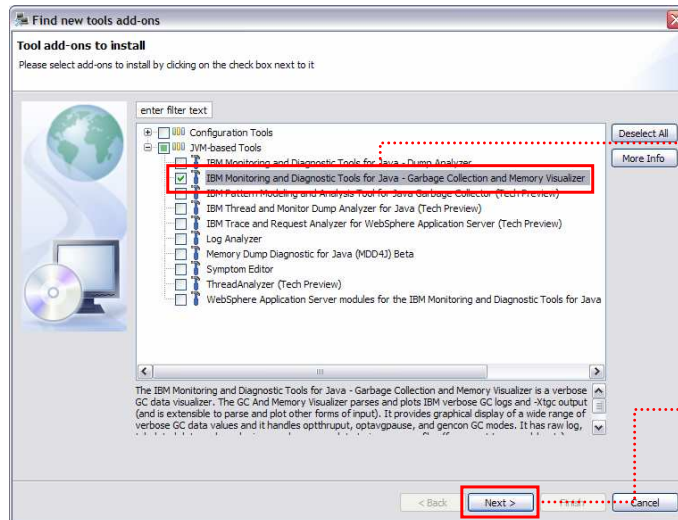
Expand **JVM-based Tools** and select the box next to the **Garbage Collection and Memory Visualizer**

Click the **Next** button to continue downloading the add-on

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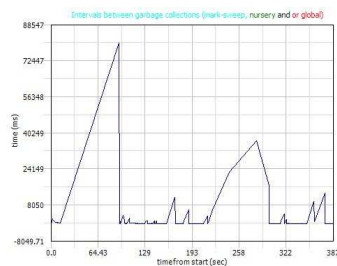
The IBM Support Assistant Workbench will go out to an online repository and determine which tools are available for you to download. There are two types of tools in the list – Configuration Tools and JVM-based Tools. Expand the section for JVM-based tools and look through the list to find the Garbage Collection and Memory Visualizer. Note that the tool is listed under its full expanded name of IBM Monitoring and Diagnostic Tools for Java – Garbage Collection and Memory Visualizer. Choose the box next to the visualizer and click Next to continue with the add-on download. You are prompted to select a license agreement, and then the add-on is downloaded and installed. After installation is complete, you are prompted to restart the support assistant workbench.

Starting the GC and Memory Visualizer
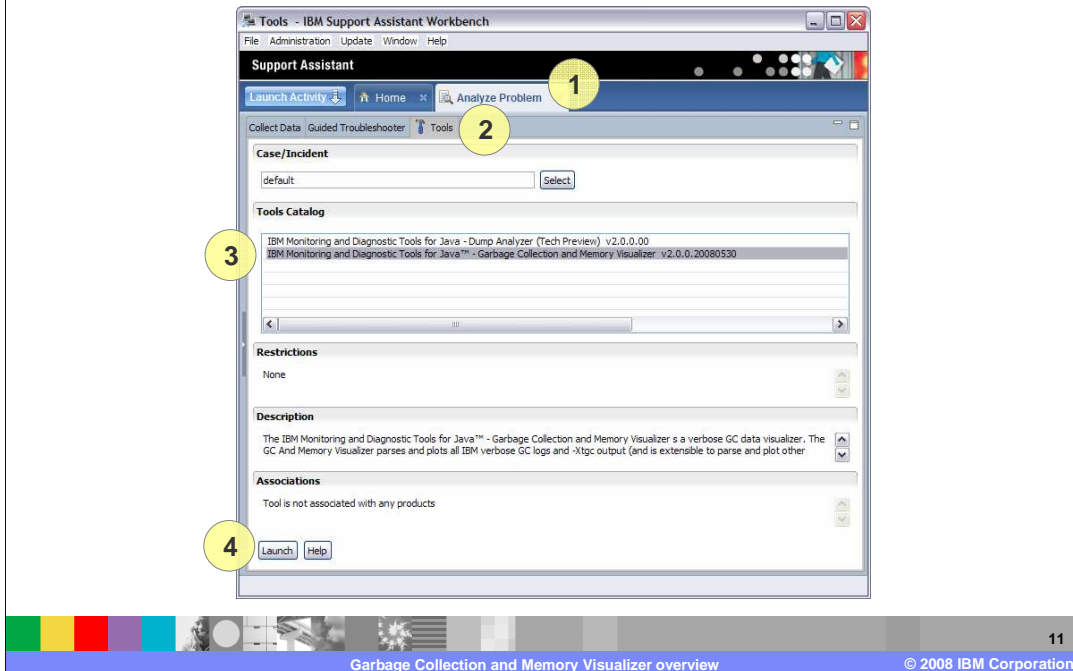
Back in the IBM Support Assistant Workbench, start the Analyze Problem activity by either selecting Analyze Problem from the home page or choosing it from the Launch Activity dropdown menu. Once in the Analyze Problem activity, go into the Tools tab and highlight the Garbage Collection and Memory Visualizer in the list of available tools. Finally, click the Launch button to start the GC and Memory Visualizer. You are prompted to supply the location of a log file for analysis. The visualizer is started in a new tab inside your support assistant workbench.
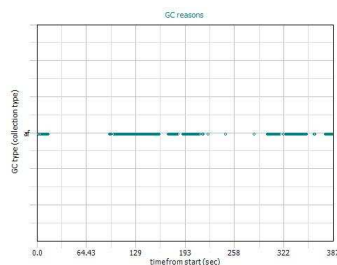
Once you have started the GC and Memory Visualizer, you are able to view line plots for your default log file, read in additional logs, and explore their data characteristics. You can use the VGC Data and VGC Heap Data menus to choose which data options you want to display and analyze. For example, you can see pause times and intervals between garbage collection cycles, your total used heap space, and over forty other measures. The visualizer also provides summary reports with overall garbage collection statistics and heap size recommendations.

Section

Summary and references

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The next section contains a summary and links to references.

Summary

- The Garbage Collection and Memory Visualizer is a graphical tool for visualizing garbage collection data
  - ▸ Provides line plots, reports, and configuration recommendations
  - ▸ Useful for performance analysis and GC tuning
  - ▸ Available as a add-on to IBM Support Assistant

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The Garbage Collection and Memory Visualizer processes garbage collection data, including verbose GC logs and traces. You can create line plots of your data, view summary reports, and get heap size configuration recommendations. The visualizer allows you to do performance analysis, garbage collection tuning, and to inspect the general health of your Java applications. It is available for free download as an add-on for the IBM Support Assistant workbench.

References

- IBM Support Assistant
  - http://www-306.ibm.com/software/support/isa/
- Diagnostics Guide
  - http://publib.boulder.ibm.com/infocenter/javasdk/v6r0/index.jsp
- developerWorks® articles about garbage collection
  - http://www-128.ibm.com/developerworks/java/library/j-ibmjava2/
  - http://www-128.ibm.com/developerworks/java/library/j-ibmjava3/

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