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Java Virtual Machine (JVM)

Every process run on a computer must be run in the primary memory (RAM) of the computer. Apart from the program code itself, data that is used by the process must be placed in the memory. Programs written in Java must be run in a so-called Java Virtual Machine (JVM). The JVM is a program that emulates a virtual computer on top of the physical computer. The memory that is available for programs run in the JVM, for example Rational Focal Point, is also handled by the JVM. However, the JVM must in turn allocate that memory from the operating system (OS) on which it runs.

Handling Memory in Java

The JVM has a limit for the amount of memory (maximum memory) that can be used by programs running inside it. We call this `max_mem`. This limit can be set when the JVM is started. In Rational Focal Point, it is set by a parameter set at installation. The JVM does not allocate all memory instantly, but increases the amount of allocated memory little by little, when needed. `alloc_mem` is the amount of memory allocated for programs in the JVM .

Memory allocated by the JVM that is no longer used (i.e. it has been released by the JVM through a so-called garbage collection, briefly described below) does not have to be returned to the operating system. Depending on which implementation of the JVM that is used, such memory can be returned every now and then or not be returned at all. Consequently, there can be memory allocated by the JVM that is currently not used by programs in it. We call the part of the memory that is used by code running in the JVM `used_mem`.

Whenever a Java program needs more memory, it will first use the memory that has been allocated but that is not used at the moment. If that is not sufficient, the amount of allocated memory will be increased until it covers the need of the program. A Java program does not have to request memory from the JVM actively and then return it, but creates structures, so-called objects, in the memory as needed. When an object no longer is used by the program, the JVM is responsible for releasing the associated memory associated. This process is called garbage collection.

Garbage collection

When a Java program is running, memory is used for different types of objects. The object can be used by the programs during long periods of time. Some objects do not last very long, while others can live as long as the program is running. When an object no longer is used, it must be garbage collected so that the memory used by the object can be reused.

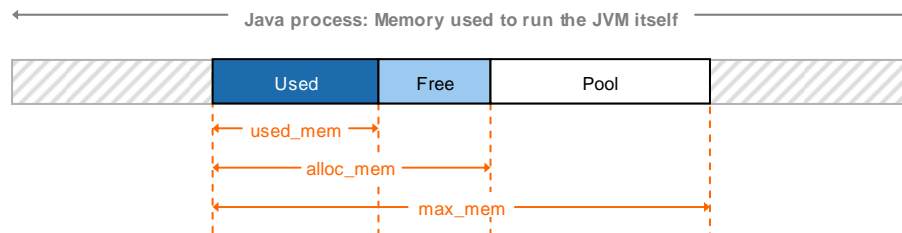
Garbage collection is completely controlled by the JVM and can be executed in many different ways depending on the JVM implementation, the amount of allocated memory, the object turnover etc. This means that objects no longer used can be garbage collected directly or at a much later occasion.

The Rational Focal Point Memory Bar

Components

The memory bar in Rational Focal Point consists of three parts; used, free and pool.

- **Used** – is the equivalent to `used_mem` in the memory handling discussion above, i.e. the amount of memory used at the moment. This also includes objects that are no longer used, but not yet garbage collected.
- **Free** – displays the difference between `alloc_mem` and `used_mem`. “Free” represents the amount of memory the program can use without having to allocate more memory from the operating system to the JVM.
- **Pool** – displays the difference between `max_mem` and `alloc_mem`. “Pool” represents the amount of further memory the JVM can allocate from the operating system, should need arise.



Note that the memory bar displays information about the current node.

Why does the memory bar change?

Every time Rational Focal Point is started large amounts of data is read into the cache. This causes the `alloc_mem` and `used_mem` bars to increase significantly. One reason is that objects held by the cache cannot be garbage collected, and is thus kept in the memory permanently. Another reason is that many temporary objects are used during the start itself.

During continuous useage, many operations that require a lot of memory can be performed during a short period of time. If the garbage collector does not have the time to do its job, or if it does not find any memory to release, the alloc_mem bar will most likely increase. Depending on which JVM implementation that is used, the alloc_mem bar can shorten again, when memory has been released by the garbage collector. However, it is possible that the JVM never returns memory to the operating system, but please note that this does not affect how memory is reused in the JVM itself.

How do I interpret the bar?

The memory bar in Rational Focal Point is a useful tool for troubleshooting the application, but should not be over-interpreted. It is an on-the-spot account of the memory situation in the JVM. If used_mem is close to 100% at one occasion, it might just be 50% at the next. To get a true picture of the memory usage situation, one must supervise the bar during a longer period of time to find peaks and valleys, and how closely together these peaks and valleys are.

More information

Contacting IBM Rational Software Support

If the self-help resources have not provided a resolution to your problem, you can contact IBM® Rational® Software Support for assistance in resolving product issues.

Note If you are a heritage Telelogic customer, a single reference site for all support resources is located at <http://www.ibm.com/software/rational/support/telelogic/>

Prerequisites

To submit your problem to IBM Rational Software Support, you must have an active Passport Advantage® software maintenance agreement. Passport Advantage is the IBM comprehensive software licensing and software maintenance (product upgrades and technical support) offering. You can enroll online in Passport Advantage from <http://www.ibm.com/software/lotus/passportadvantage/howtoenroll.html>

•To learn more about Passport Advantage, visit the Passport Advantage FAQs at http://www.ibm.com/software/lotus/passportadvantage/brochures_faqs_quickguides.html.

•For further assistance, contact your IBM representative.

To submit your problem online (from the IBM Web site) to IBM Rational Software Support, you must additionally:

•Be a registered user on the IBM Rational Software Support Web site. For details about registering, go to <http://www.ibm.com/software/support/>.

•Be listed as an authorized caller in the service request tool.

Submitting problems

To submit your problem to IBM Rational Software Support:

1. Determine the business impact of your problem. When you report a problem to IBM, you are asked to supply a severity level. Therefore, you need to understand and assess the business impact of the problem that you are reporting.

Use the following table to determine the severity level:

Severity	Description
1	The problem has a <i>critical</i> business impact: You are unable to use the program, resulting in a critical impact on operations. This condition requires an immediate solution.
2	This problem has a <i>significant</i> business impact: The program is usable, but it is severely limited.
3	The problem has <i>some</i> business impact: The program is usable, but less significant features (not critical to operations) are unavailable.
4	The problem has <i>minimal</i> business impact: The problem causes little impact on operations or a reasonable circumvention to the problem was

implemented.

2. Describe your problem and gather background information. When describing a problem to IBM, be as specific as possible. Include all relevant background information so that IBM Rational Software Support specialists can help you solve the problem efficiently. To save time, know the answers to these questions:

- What software versions were you running when the problem occurred?

To determine the exact product name and version, use the option applicable to you:

- Start the IBM Installation Manager and select **File > View Installed Packages**.

Expand a package group and select a package to see the package name and version number.

- Start your product, and click **Help > About** to see the offering name and version number.

- What is your operating system and version number (including any service packs or patches)?

- Do you have logs, traces, and messages that are related to the problem symptoms?

- Can you recreate the problem? If so, what steps do you perform to recreate the problem?

- Did you make any changes to the system? For example, did you make changes to the hardware, operating system, networking software, or other system components?

- Are you currently using a workaround for the problem? If so, be prepared to describe the workaround when you report the problem.

3. Submit your problem to IBM Rational Software Support. You can submit your problem to IBM Rational Software Support in the following ways:

- Online:** Go to the IBM Rational Software Support Web site at <https://www.ibm.com/software/rational/support/> and in the Rational support task navigator, click Open Service Request. Select the electronic problem reporting tool, and open a Problem Management Record (PMR), describing the problem accurately in your own words.

For more information about opening a service request, go to

<http://www.ibm.com/software/support/help.html>

You can also open an online service request using the IBM Support Assistant. For more information, go to <http://www.ibm.com/software/support/isa/faq.html>.

- By phone:** For the phone number to call in your country or region, go to the IBM directory of worldwide contacts at <http://www.ibm.com/planetwide/> and click the name of your country or geographic region.

Through your IBM Representative: If you cannot access IBM Rational Software Support online or by phone, contact your IBM Representative. If necessary, your IBM Representative can open a service request for you. You can find complete contact information for each country at <http://www.ibm.com/planetwide/>.

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