Java Debugging with Eclipse - Tutorial

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Eclipse Debugging. This article describes how to debug a Java application in Eclipse. This article is based on Eclipse 4.6 (Eclipse Neon).

1. Overview

1.1. What is debugging?

during the execution.

A *breakpoint* in the source code specifies where the execution of the program should stop during debugging. Once the program is stopped you can investigate variables, change their content, etc.

To stop the execution, if a field is read or modified, you can specify *watchpoints*.

> *Breakpoints* and *watchpoints* are sometimes called *stop points*.

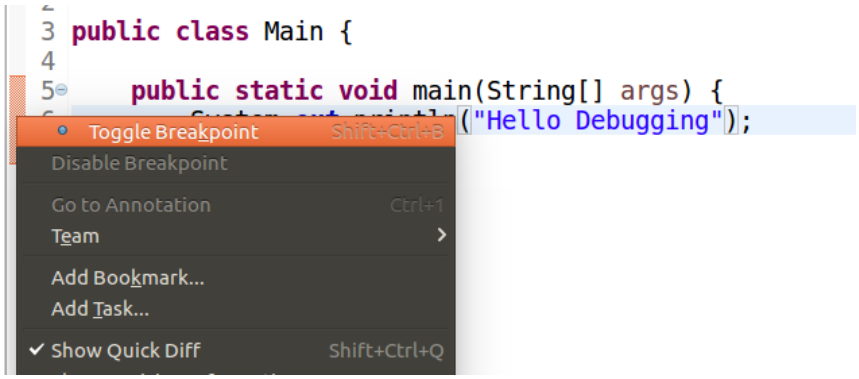
1.2. Debugging support in Eclipse

Eclipse allows you to start a Java program in *Debug mode*.

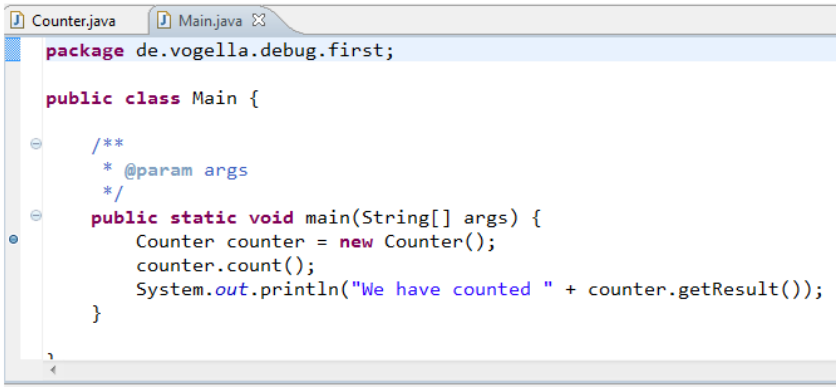
Eclipse provides a *Debug perspective* which gives you a pre-configured set of *views*. Eclipse allows you to control the execution flow via debug commands.

1.3. Setting Breakpoints

To define a breakpoint in your source code, right-click in the left margin in the Java editor and select *Toggle Breakpoint*. Alternatively you can double-click on this position.

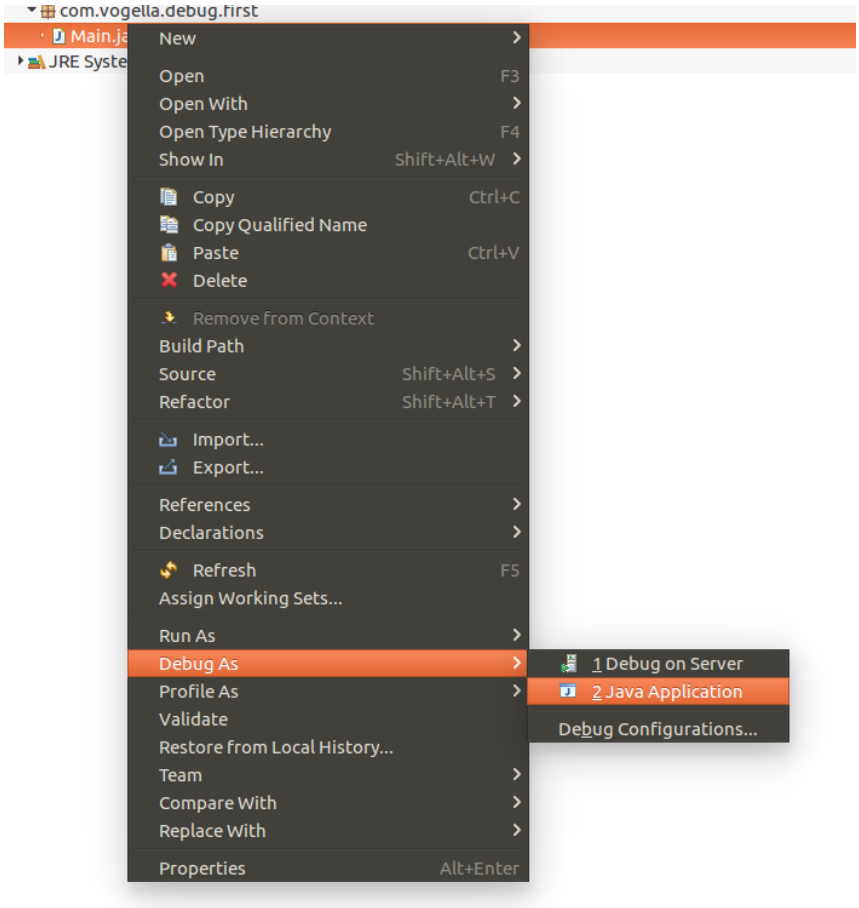


For example in the following screenshot we set a breakpoint on the line `Counter counter = new Counter();`.

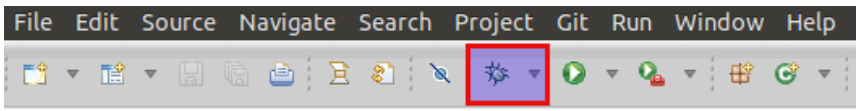


1.4. Starting the Debugger

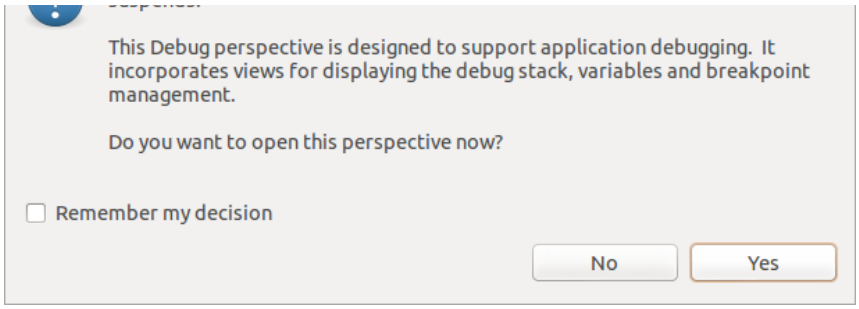
To debug your application, select a Java file with a main method. Right-click on it and select Debug As ▸ Java Application.



> If you started an application once via the context menu, you can use the created launch configuration again via the `Debug` button in the Eclipse toolbar.



If you have not defined any breakpoints, program as normally. To debug the program you need to define breakpoints. Eclipse asks you if you want to switch to the *Debug perspective* once a stop point is reached. Answer *Yes* in the corresponding dialog. Afterwards Eclipse opens this *perspective*.



1.5. Controlling the program execution

Eclipse provides buttons in the toolbar for controlling the execution of the program you are debugging. Typically, it is easier to use the corresponding keys to control this execution.

You can use allow use shortcut key to step through your coding. The meaning of these keys is explained in the following table.

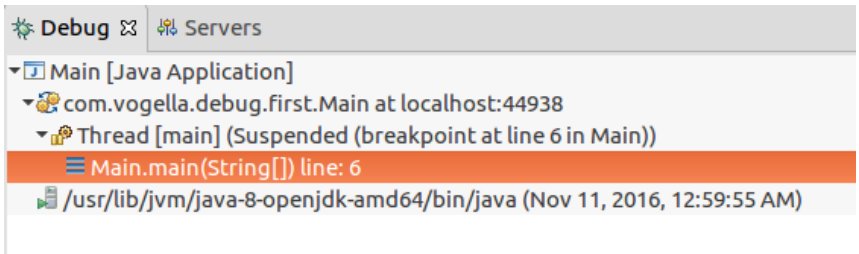
Table 1. Debugging key bindings / shortcuts

Key	Description
F5	Executes the currently selected line and goes to the next line in your program. If the selected line is a method call the debugger steps into the associated code.
F6	F6 steps over the call, i.e. it executes a method without stepping into it in the debugger.
F7	F7 steps out to the caller of the currently executed method. This finishes the execution of the current method and returns to the caller of this method.

F8	F8 tells the Eclipse debugger to resume the execution of the program code until is reaches the next breakpoint or watchpoint.

The following picture displays the buttons and their related keyboard shortcuts.

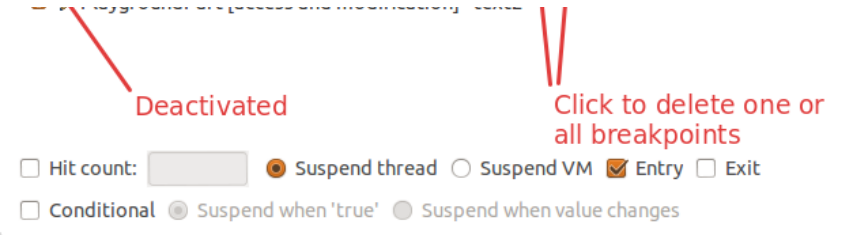
The call stack shows the parts of the program which are currently executed and how they relate to each other. The current stack is displayed in the *Debug* view.



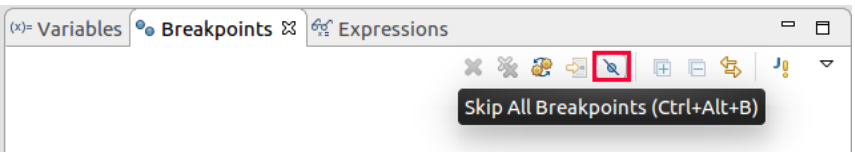
1.6. Breakpoints view and deactivating breakpoints

The *Breakpoints* view allows you to delete and deactivate *breakpoints* and *watchpoints*. You can also modify their properties.

To deactivate a breakpoint, remove the corresponding checkbox in the *Breakpoints* view. To delete it you can use the corresponding buttons in the view toolbar. These options are depicted in the following screenshot.



If you want to disable all breakpoints at the same time, you can press the `Skip all breakpoints` button. If you press it again, your breakpoints are reactivated. This button is highlighted in the following screenshot.

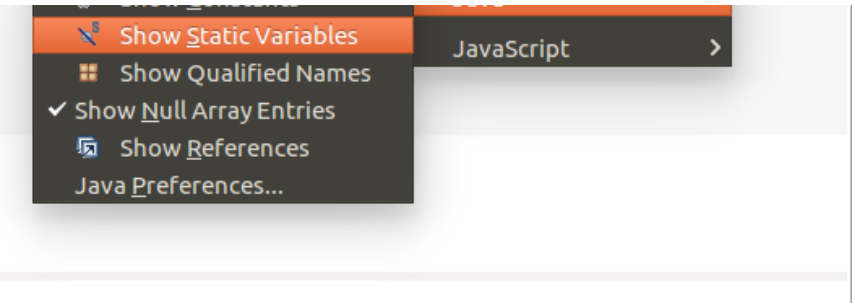


1.7. Evaluating variables in the debugger

The *Variables* view displays fields and local variables from the current executing stack. Please note you need to run the debugger to see the variables in this view.

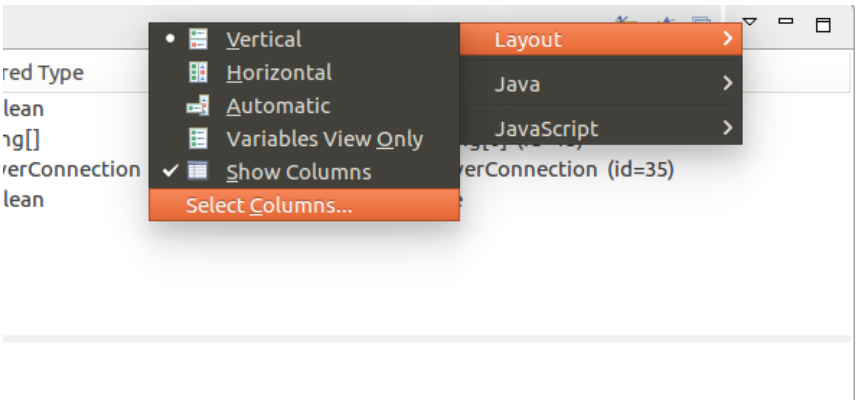
> As of Eclipse 4.7 you also see the return statement of the last method call in the debugger.

Use the drop-down menu to display static variables.



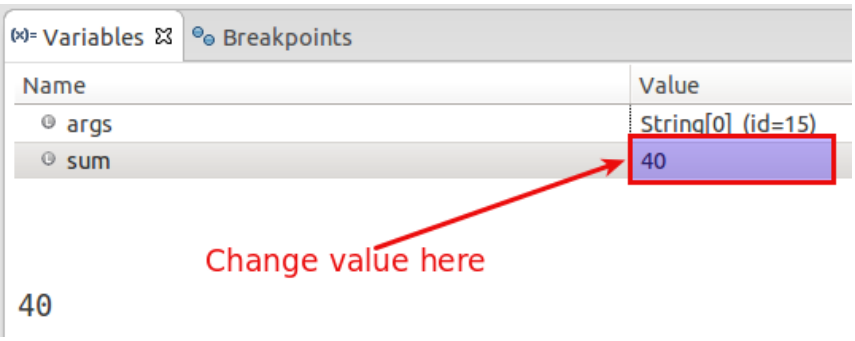
Via the drop-down menu of the *Variables* view you can customize the displayed columns.

For example, you can show the actual type of each variable declaration. For this select Layout ▸ Select Columns... ▸ Type.



1.8. Changing variable assignments in the debugger

The *Variables* view allows you to change the values assigned to your variable at runtime. This is depicted in the following screenshot.

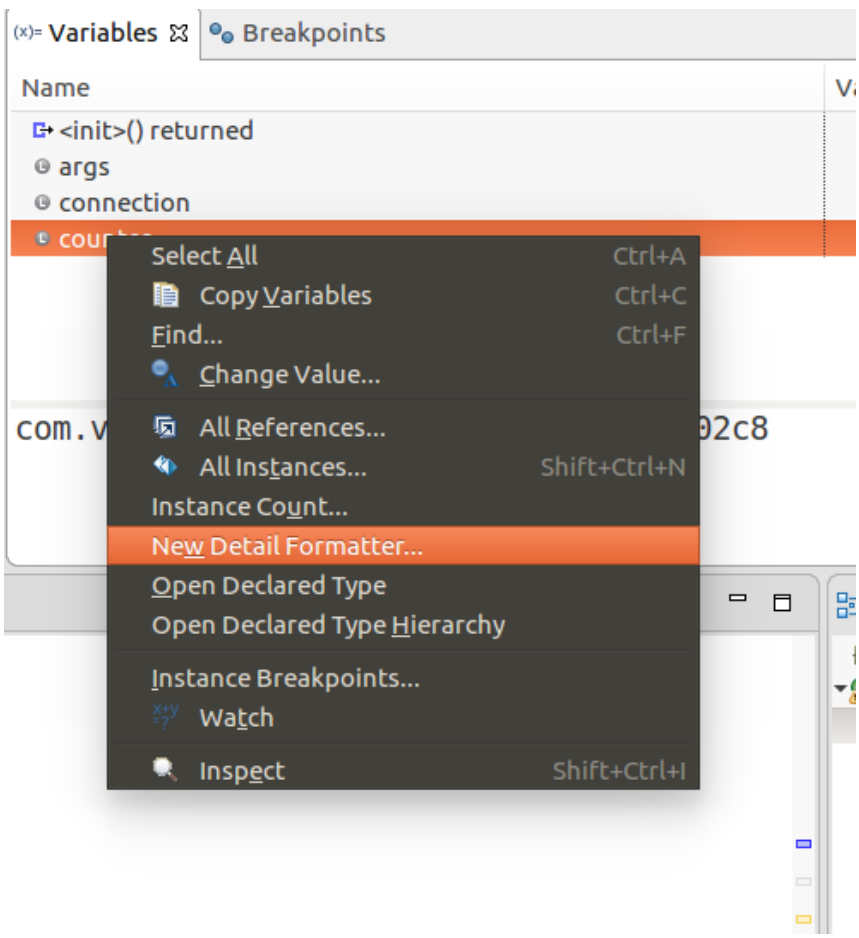


1.9. Controlling the display of the variables with Detail Formatter

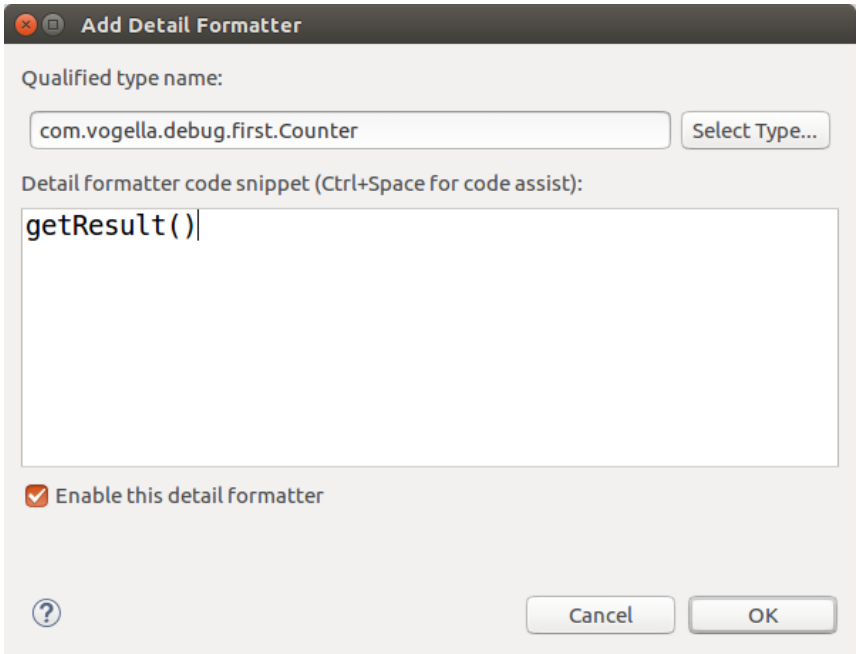
By default the *Variables* view uses the `toString()` method to determine how to display the variable.

You can define a *Detail Formatter* in which you can use Java code to define how a variable is displayed.

For example, the `toString()` method in the `Counter` class may show meaningless information, e.g. `com.vogella.combug.first.Counter@587c94`. To make this output more readable you can right-click on the corresponding variable and select the New Detail Formater... entry from the context menu.



`getResult()` method of this class is used. This setup is depicted in the following screenshot.



2. Advanced Debugging

The following section shows more options you have for debugging.

2.1. Breakpoint properties

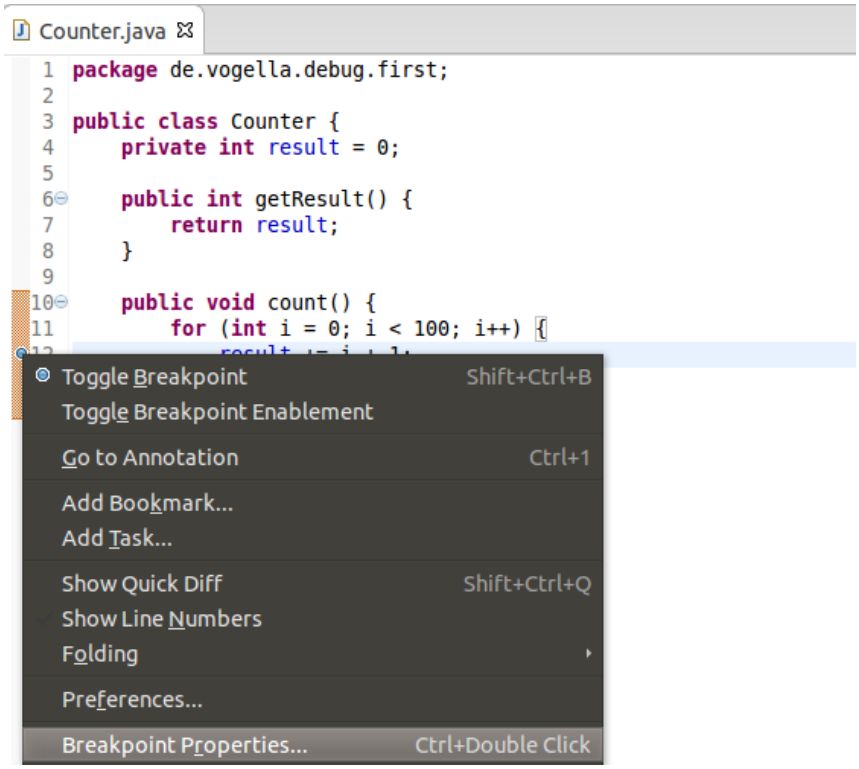
After setting a breakpoint you can select the properties of the breakpoint, via right-click ▸ Breakpoint Properties. Via the breakpoint properties you can define a condition that restricts the activation of this breakpoint.

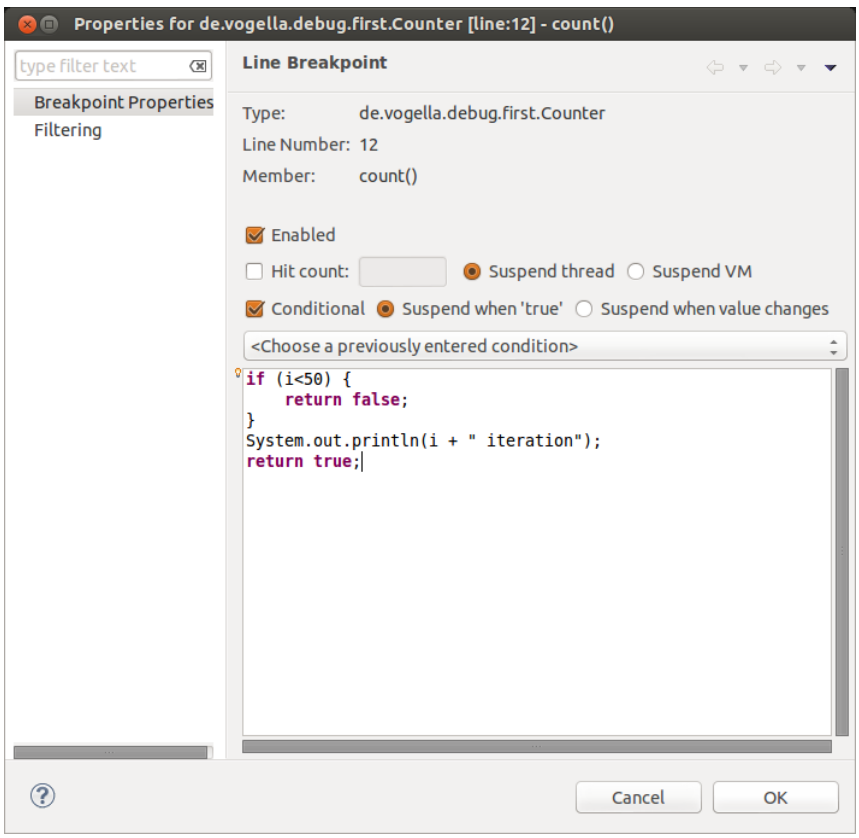
You can for example specify that a breakpoint should only become active after it has reached 12 or more times via the *Hit Count* property.

You can also create a conditional expression. The execution of the program only stops at the breakpoint, if the condition evaluates to true. This mechanism can

program execution reaches that point.

The following screenshot depicts this setting.

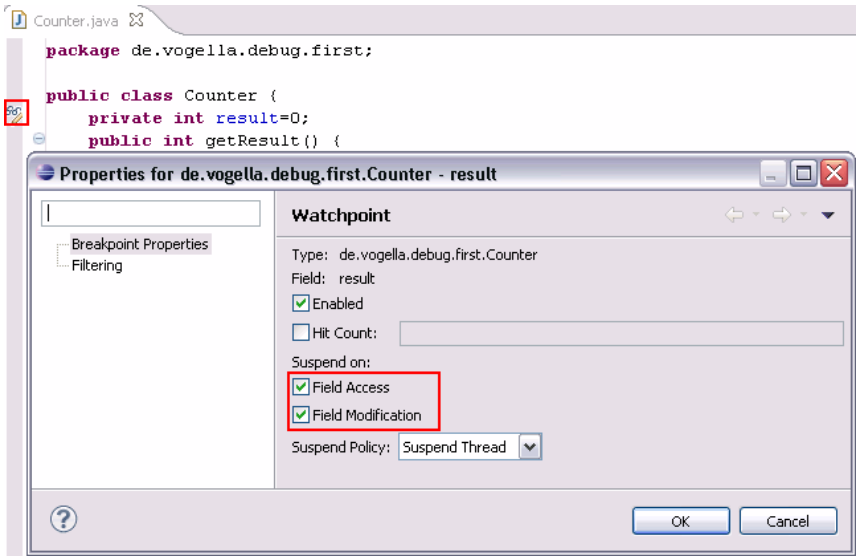




2.2. Watchpoint

A *watchpoint* is a breakpoint set on a field. The debugger will stop whenever that field is read or changed.

You can set a *watchpoint* by double-clicking on the left margin, next to the field declaration. In the properties of a *watchpoint* you can configure if the execution should stop during read access (Field Access) or during write access (Field Modification) or both.



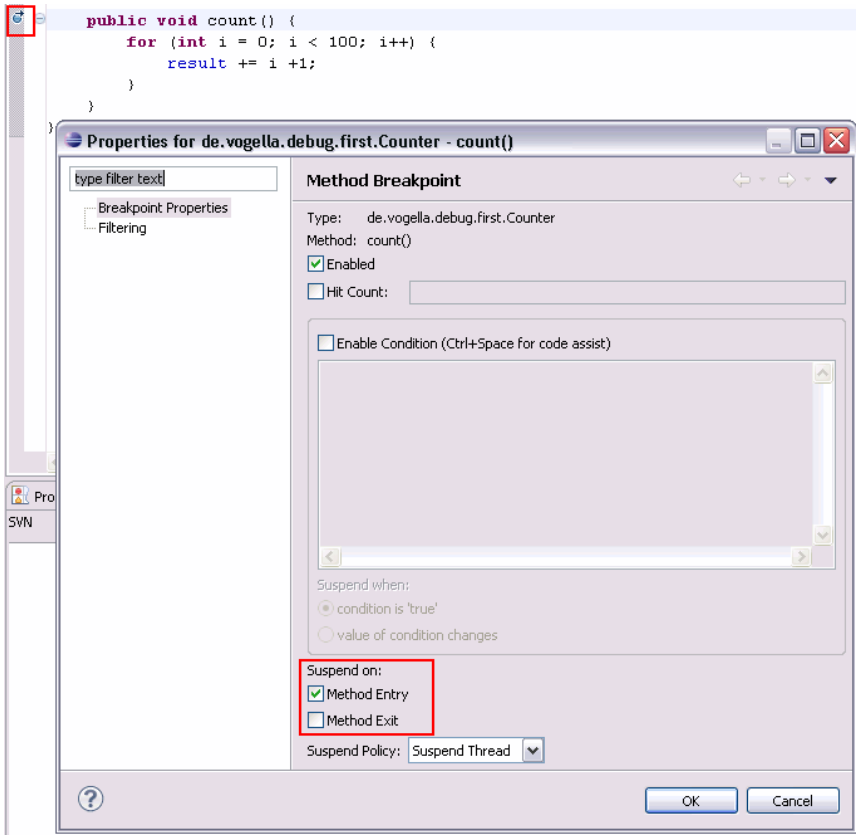
2.3. Exception breakpoints

You can set breakpoints for thrown exceptions. To define an exception breakpoint click on the `Add Java Exception Breakpoint` button icon in the *Breakpoints* view toolbar.

You can configure, if the debugger should stop at caught or uncaught exceptions.

2.4. Method breakpoint

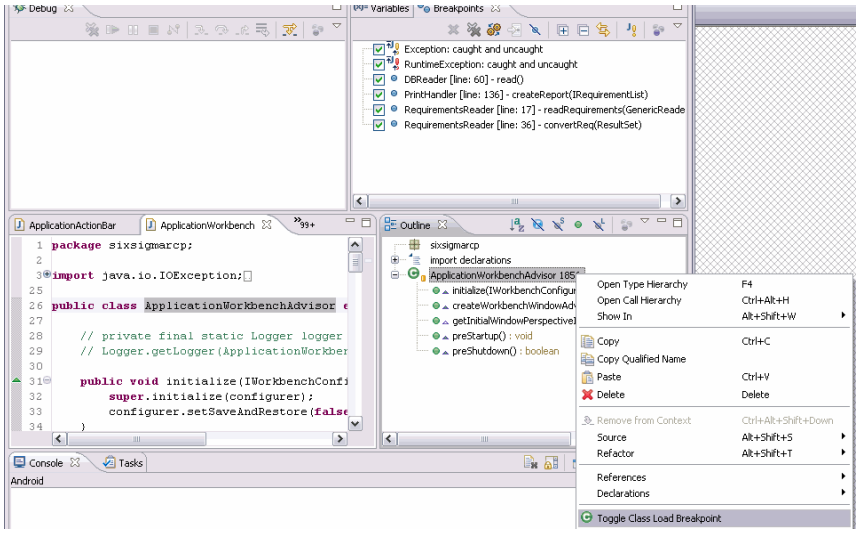
You can configure if you want to stop the program before entering or after leaving the method.



2.5. Breakpoints for loading classes

A class load breakpoint stops when the class is loaded.

To set a class load breakpoint, right-click on a class in the *Outline* view and choose the *Toggle Class Load Breakpoint* option.



Alternative you can double-click in the left border of the Java editor beside the class definition.

2.6. Step Filter

You can define that certain packages should be skipped in debugging. This is for example useful if you use a framework for testing but don't want to step into the test framework classes. These packages can be configured via the Window ▸ Preferences ▸ Java ▸ Debug ▸ Step Filtering menu path.

2.7. Hit Count

For every breakpoint you can specify a hit count in its properties. The application is stopped once the breakpoint has been reached the number of times defined in the hit count.

2.8. Remote debugging

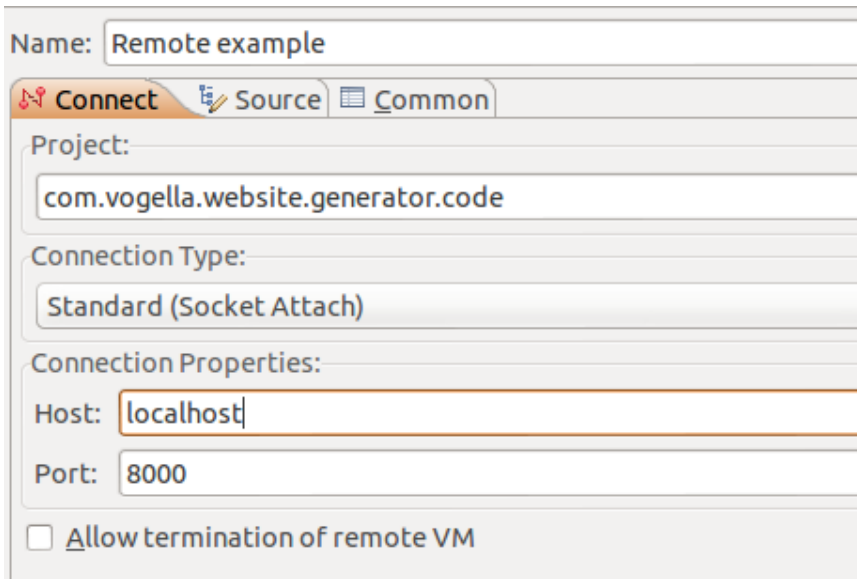
Eclipse allows you to debug applications which runs on another Java virtual machine or even on another machine.

following code example.

```
java -Xdebug -Xnoagent \
-Djava.compiler=NONE \
-Xrunjdwp:transport=dt_socket,server=y,suspend=y,address=5005
```

In you Eclipse IDE you can enter the hostname and port to connect for debugging via the Run ▸ Debug Configuration... menu.

Here you can create a new debug configuration of the *Remote Java Application* type. This configuration allows you to enter the hostname and port for the connection as depicted in the following screenshot.



NOTE:Remote debugging requires that you have the source code of the application which is debugged available in your Eclipse IDE.

2.9. Drop to frame

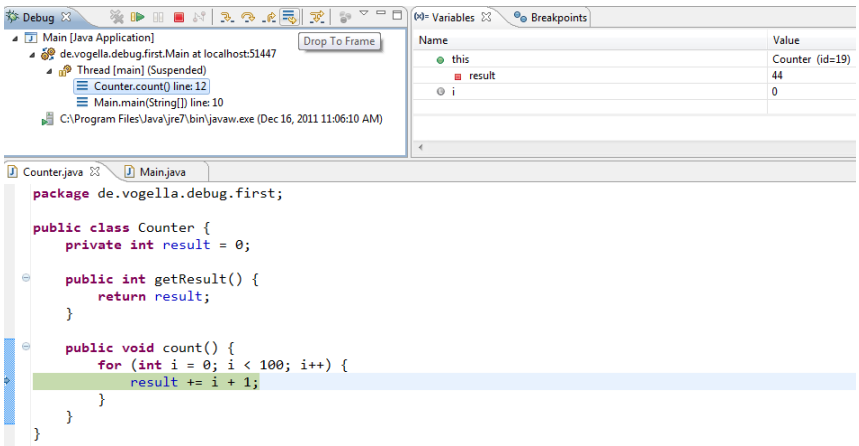
Eclipse allows you to select any level (frame) in the call stack during debugging and set the JVM to restart from that point.

that already run will remain modified.

To use this feature, select a level in your stack and press the *Drop to Frame* button in the toolbar of the *Debug* view.

> Fields and external data may not be affected by the reset. For example if you write a entry to the database and afterward drop to a previous frame, this entry is still in the database.

The following screenshot depicts such a reset. If you restart your `for` loop, the field `result` is not set to its initial value and therefore the loop is not executed as without resetting the execution to a previous point.



3. Exercise: Create Project for debugging

3.1. Create Project

To practice debugging create a new Java project called `de.vogella.combug.first`. Also create the package `de.vogella.combug.first` and create the following classes.

```java
public class Counter {
  private int result = 0;

  public int getResult() {
    return result;
  }

  public void count() {
    for (int i = 0; i < 100; i++) {
      result += i + 1;
    }
  }
}
```

JAVA

```java
package de.vogella.combug.first;

public class Main {
  /**
   * @param args
   */
  public static void main(String[] args) {
    Counter counter = new Counter();
    counter.count();
    System.out.println("We have counted "
        + counter.getResult());
  }
}
```

3.2. Debugging

Set a breakpoint in the `Counter` class. Debug your program and follow the execution of the `count` method.

Define a *Detailed Formatter* for your `Counter` which uses the `getResult` method. Debug your program again and verify that your new formatter is used.

Delete your breakpoint and add a breakpoint for class loading. Debug your program again and verify that the debugger stops when your class is loaded.

4. About this website

5. Links and Literature

5.1. Debugging Links

Eclipse IDE book from Lars Vogel

(http://www.amazon.com/dp/3943747042)

How to develop your own debugger

(http://www.eclipse.org/articles/Article-Debugger/how-to.html)

5.2. vogella GmbH training and consulting support

TRAINING (http://www.vogella.com/training/)	SERVICE & SUPPORT (http://www.vogella.com/consulting/)

raining/)	onsulting/)
The vogella company provides comprehensive training and education services (http://www.vogella.com/training/) from experts in the areas of Eclipse RCP, Android, Git, Java, Gradle and Spring. We offer both public and inhouse training. Whichever course you decide to take, you are guaranteed to experience what many before you refer to as "The best IT class I have ever attended" (http://www.vogella.com/training/) .	The vogella company offers expert consulting (http://www.vogella.com/consulting/) services, development support and coaching. Our customers range from Fortune 100 corporations to individual developers.

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