Software Development
Lecture 7

COMP220/COMP285

Sebastian Coope

Eclipse and Java

These slides are mainly based on "*Java Development with Eclipse*" – D.Gallardo et al., Manning Publications., 2003

Eclipse

- **Eclipse** is a quite complicated ***Software Development Kit*** (**SDK**),
- We will cover only
  1. The ***general description*** of **Eclipse**
     - including the **Java** quick tour in **Eclipse**
  2. Using **JUnit** from inside of **Eclipse**
  3. Using **Ant** from inside of **Eclipse** (at the very end of our lectures after learning **Ant**)

General description of Eclipse

- Eclipse is a Software Development Kit (**SDK**)
- It, may be compared to a *blacksmith's shop*, where you can
  - not only *make products*,
  - but also make the *tools for making the products*.

General description of Eclipse

- *At the most fundamental level*, Eclipse is actually the ***Eclipse platform*** which
  - ***integrates*** *software development tools* as Eclipse ***plug-ins***.
- Except of a small *runtime kernel*,
  - everything is a *plug-in* or a *set of related plug-ins*.

General description of Eclipse

- Most important plug-in is **JDT** (Java Development Toolkit)
  - for *writing and debugging Java programs*.
- In this form **Eclipse** is just **Java IDE** (**I**ntegrated **D**evelopment **E**nvironment).
  - This is what most people use **Eclipse** for.
  - We too, because *we will not create in these lectures* ***our own plug-ins***.
  - However, we will use ***already existing plug-ins*** for **JDT**, **Junit** and **Ant**.

General description of Eclipse

- Anyway, you should know that **Eclipse** contains **PDE:**
  - **Plug-in Development Environment**
  - it makes Eclipse *easily extensible by other plug-ins*.

General description of Eclipse

- Although **Eclipse** is written in **Java** and mostly for creating **Java** projects, it is ***language neutral*** :
  - *additional plug-ins* are available for *other languages*, such as C/C++, Cobol, and C#

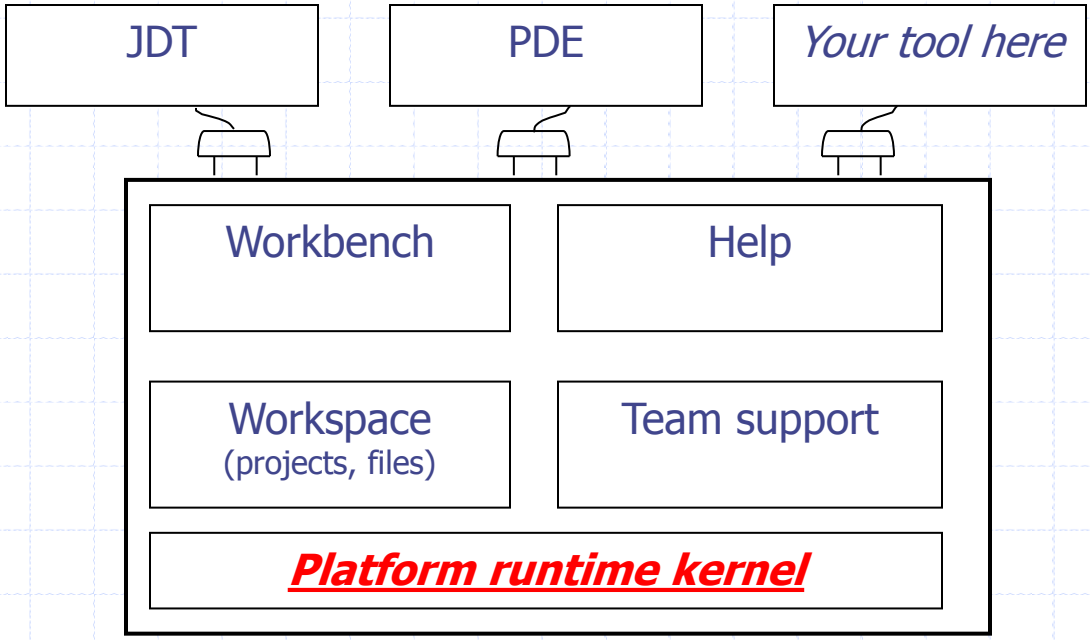
- But it is ***not*** strongly ***platform neutral*** :
  - it uses the *operating system's* ***native graphics***.

General description of Eclipse

- The ***Eclipse platform*** consists of
  - a small *platform runtime kernel*,
  - *workbench* (**GUI**: menus, toolbars, perspectives, views and editors),
  - *workspace* (to contain and manage *projects*),
  - *team support components*,
  - *help*

General description of Eclipse

The Eclipse Architecture



Except for small ***runtime kernel***,
everything in Eclipse is a plug-in
or a set of related plug-ins

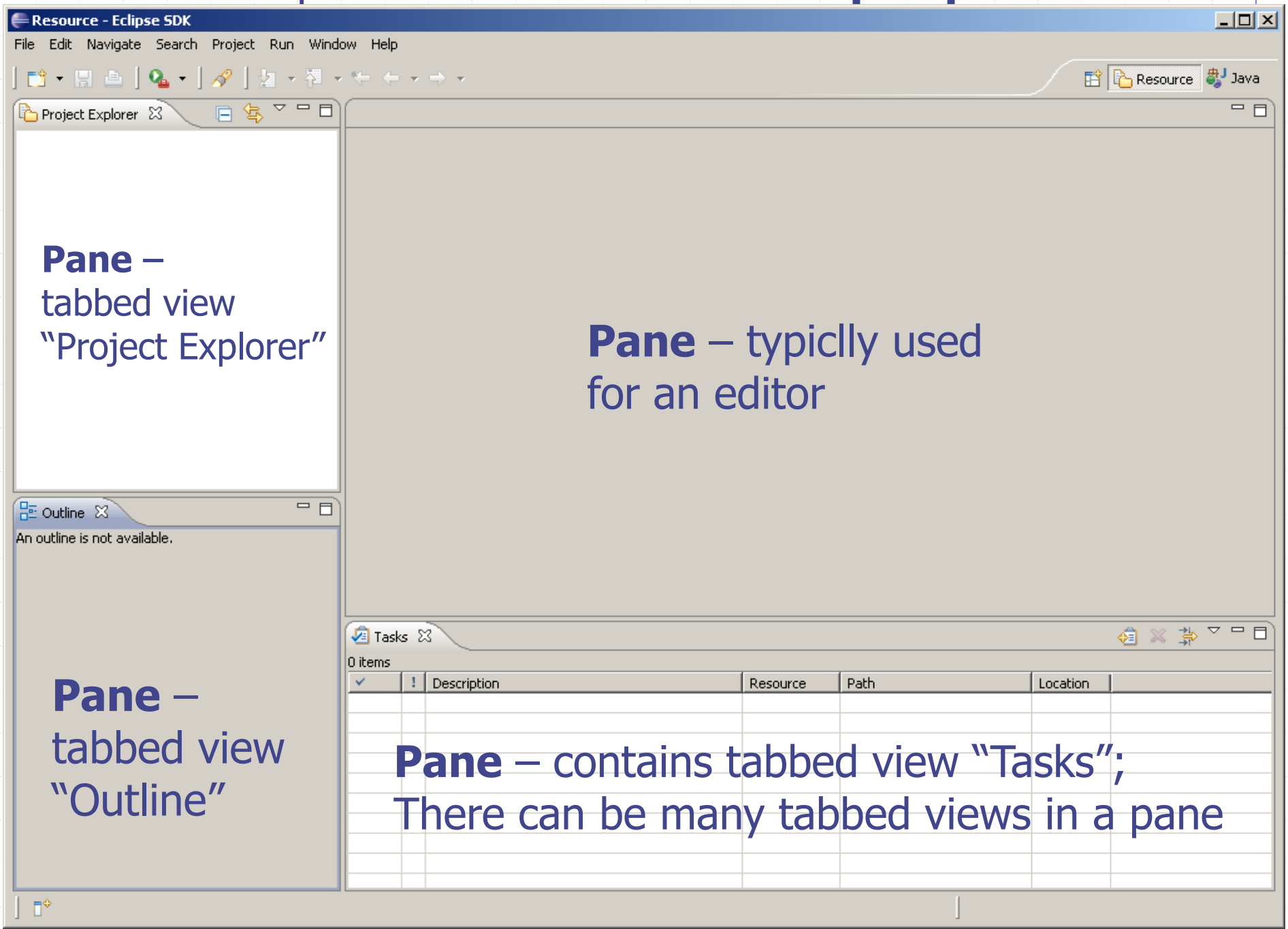
General description of Eclipse

- **Team support** (plug-in):
  - Facilitates the use of a *version control* or *configuration management* system.
  - The **Eclipse** platform includes a client for *Concurrent Versions System* (**CVS**):
    - a *source control tool*
    - invaluable if two or more people work together on a single set of files – *to coordinate changes*.

Eclipse Workbench

- ***Workbench***
  - main window which shows a *perspective*
- ***Perspective:***
  - set of ***panes***
- ***Pane*** contains
  - ***view(s***) which can be tabbed
- One pane serves as an ***editor***

Eclipse Workbench - **Resource perspective**



Eclipse Workbench

- ***Resource Perspective*** is sometimes considered as *home perspective:*
  - a general purpose perspective for
    - *creating, viewing, and managing all types of resources*
  - contains, in particular, ***Project Explorer (Navigator) view*** showing
    - a ***hierarchical*** *representation of the* ***workspace*** and *all the* ***projects*** *in it*

Eclipse Workbench

- *Other perspectives* are available
  - either by clicking on ***perspective switcher*** icon  (choose **Other…**) or
  - on a perspective icons on ***shortcut toolbar*** in the right up corner

  - or via

Window > Open Perspective > Other…

  - ***perspective switcher*** can be put, e.g., *along the left side* (as in the **Eclipse book**) by right clicking on  .

Eclipse Workbench

- **Changing how a perspective looks like:**
  - Temporary *supersizing* a **view** by double-clicking on the title bar of the **view**
  - *moving **views** around* by dragging their title bars
  - *adding a new **view**:* **Window > Show View**
  - *closing a **view***
  - ***restoring the perspective*** to its **default** appearance:
    - **Window > Reset Perspective**
  - *saving your customized perspective:*
    - **Window > Save Perspective As**

Toolbar buttons (see the Help in Eclipse)

The following buttons may appear in the Workbench toolbar, toolbars for views, and the shortcut bar:

Button	Description	Button	Description
	Open a new perspective		Save the active editor contents
	Save the contents of all editors		Save editor contents under a new name or location
	Opens the search dialog		Print editor contents
	Open a resource creation wizard		Open a file creation wizard
	Open a folder creation wizard		Open a project creation wizard
	Open the import wizard		Open the export wizard
	Run incremental build		Run a program
	Debug a program		Run an external tool or Ant
	Cut selection to clipboard		Copy selection to clipboard
	Paste selection from clipboard		Undo most recent edit
	Redo most recent undone edit		Navigate to next item in a list
	Navigate to previous item in a list		Navigate forwards
	Navigate backwards		Navigate up one level
	Add bookmark or task		Open a view's drop down menu
	Close view or editor		Pin editor to prevent automatic reuse
	Filter tasks or properties		Go to a task, problem, or bookmark in the editor
	Restore default properties		Show items as a tree
	Refresh view contents		Sort list in alphabetical order
	Cancel a long running operation		Delete selected item or content
	Last edit location		Toggle Mark Occurrences
	Toggle Block Selection Mode		Show Whitespace Characters
	Show source of selected element only		

Eclipse Workbench

- There are several standard **types of projects** in **Eclipse:**
  - ***Java*** – the choice for *developing a **Java** program*
  - ***Plug-in Development***
    - *for creating your own plug-ins* for **Eclipse** (will ***not*** be considered)
  - **etc.**

The **Java** quick tour in **Eclipse**
Creating a **Java** ***project***

- ***Right-click*** in the **Project Explorer view** in **Resource** perspective (or in the **Package Explorer view** in **Java** perspective) and select

  New > Project > Java Project > Next

  to start **New Java Project** Wizard.

- Enter the **Project name**, say **`Hello.`**

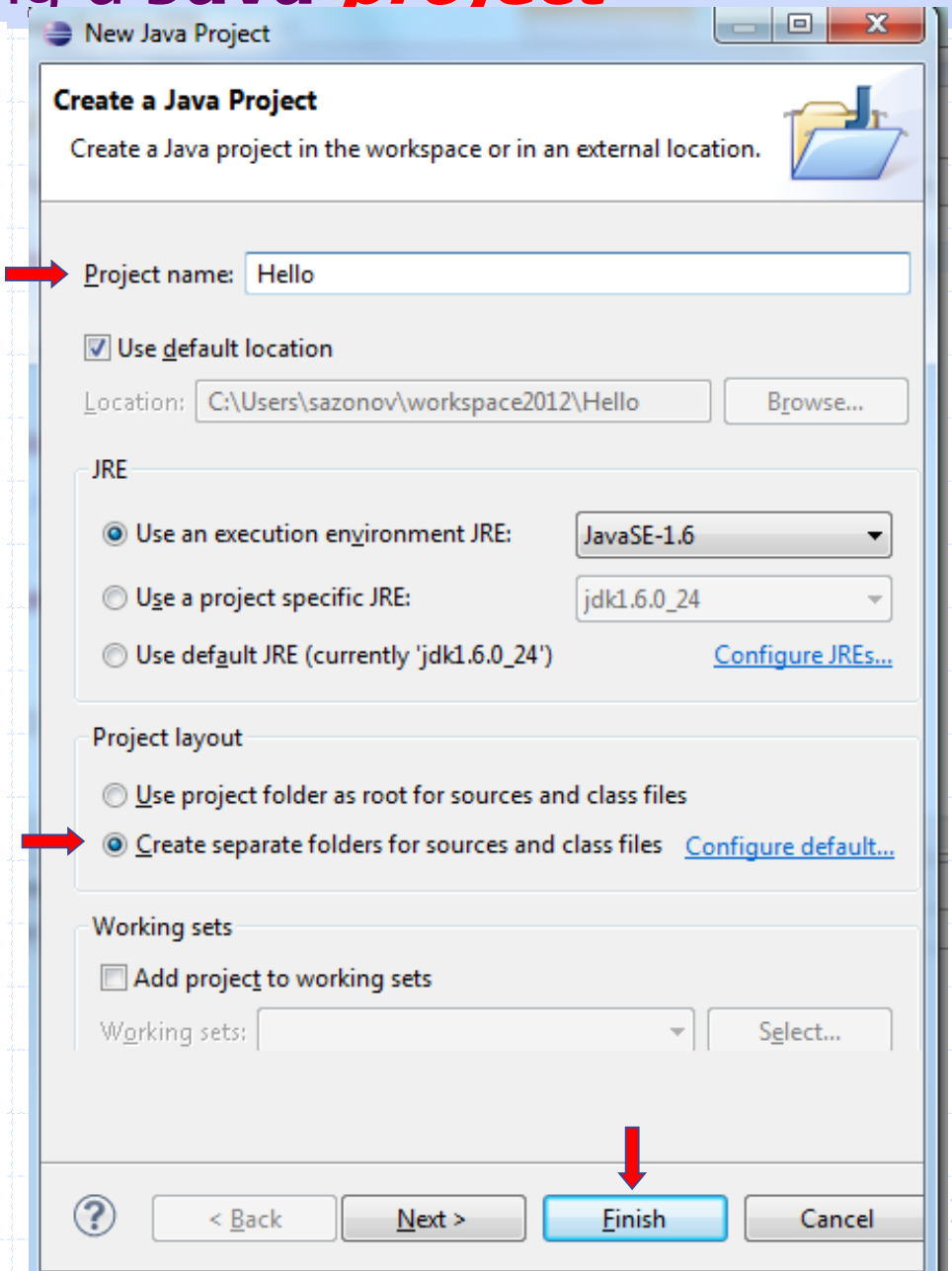
- Choose "**Create separate folders for sources and class files".**
  - Otherwise your ***sources*** and (compiled) ***class files*** will be ***in the same root directory*** **`Hello.`**

- (Note that clicking **Next** would take you to a dialog box that *lets you* ***change*** *a number of* ***Java build settings***. **For this example we don't need to change anything**.)

- Click **Finish.**

- Confirm switching to **Java Perspective.**

The **Java** quick tour in **Eclipse**
Creating a **Java** ***project***



The **Java** quick tour in **Eclipse**
Creating a **Java** ***project***

- **Create another** similar project

  `Proj-Joint-Source-Classes`

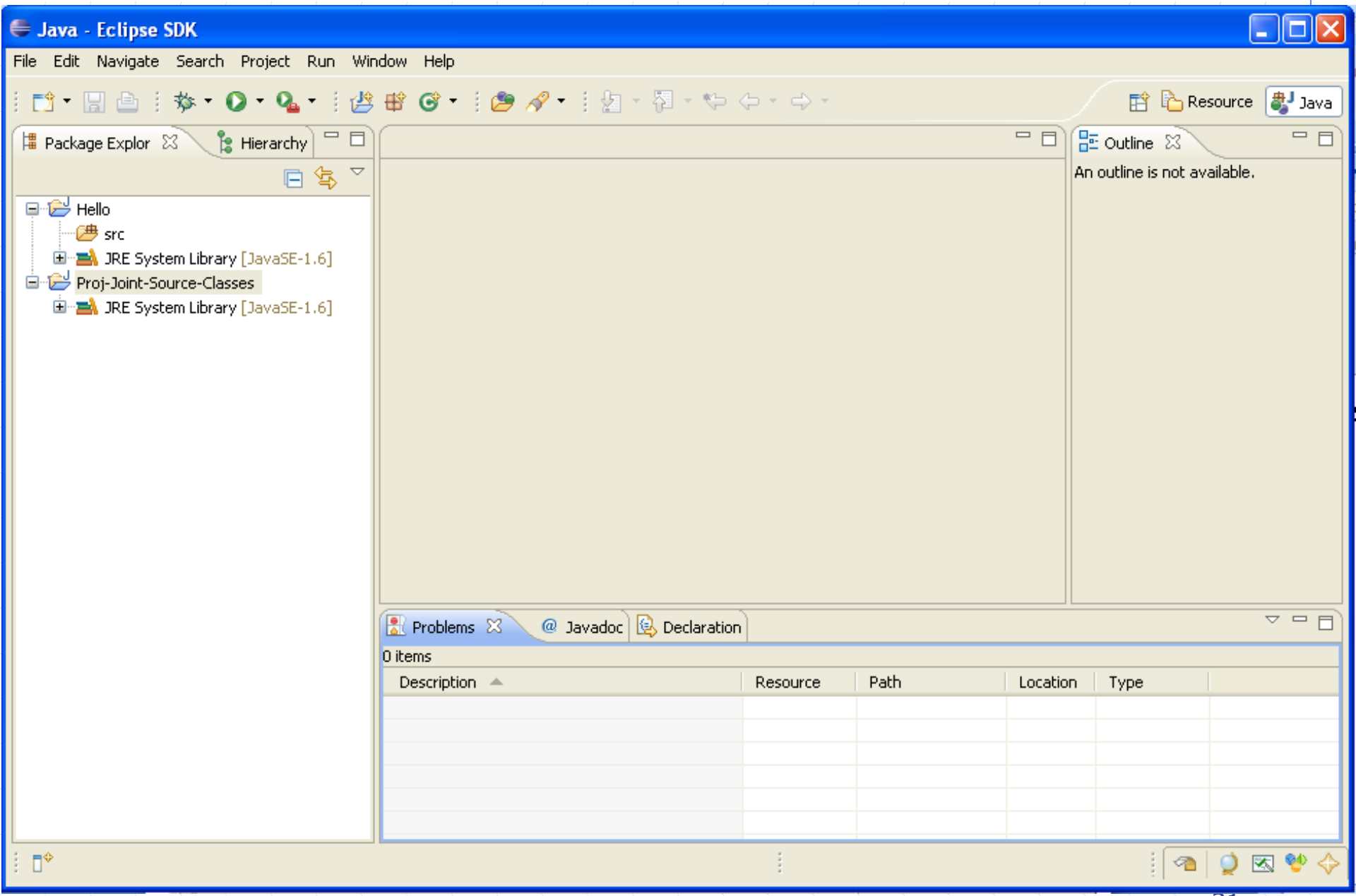
  now with **choosing**

  "Use project folder as root for sources and class files"

  We will see the difference and *use this version in a later exercise*.

- See the result of your actions in the next slide

Java perspective



The **Java** quick tour in **Eclipse:** Creating a **Java** ***project***

- New **Java Perspective** appears
  - containing **Package Explorer** view (instead of the similar **Project Explorer view**) with two new **rojects**
    - **`Hello`** and
    - **`Proj-Joint-Source-Classes;`**
  - **Package Explorer**
    - understands *Java packages* and
    - displays them *as a single entry* rather than as a *nested set of directories* (as we will see soon).

The **Java** quick tour in **Eclipse:** Creating a **Java *class***

- It is a good practice to organize Java classes into ***packages***. (We will see this later also in **Ant.**)
- E.g., the ***package*** for **Java** classes in our project `Hello` may be named

  `org.eclipseguide.hello`

- **In your Labs (for the future Lab Test) you should choose, instead, your own package consisting of combinations of your**

  `surname.first_name.ID123456.hello`

  (use your personal ID)

possibly in a different order; **not all your packages should coincide**.

THIS IS COMPULSORY REQUIREMENT
FOR YOUR FUTURE WORK
WHICH WILL BE NEEDED FOR YOUR CLAS TEST

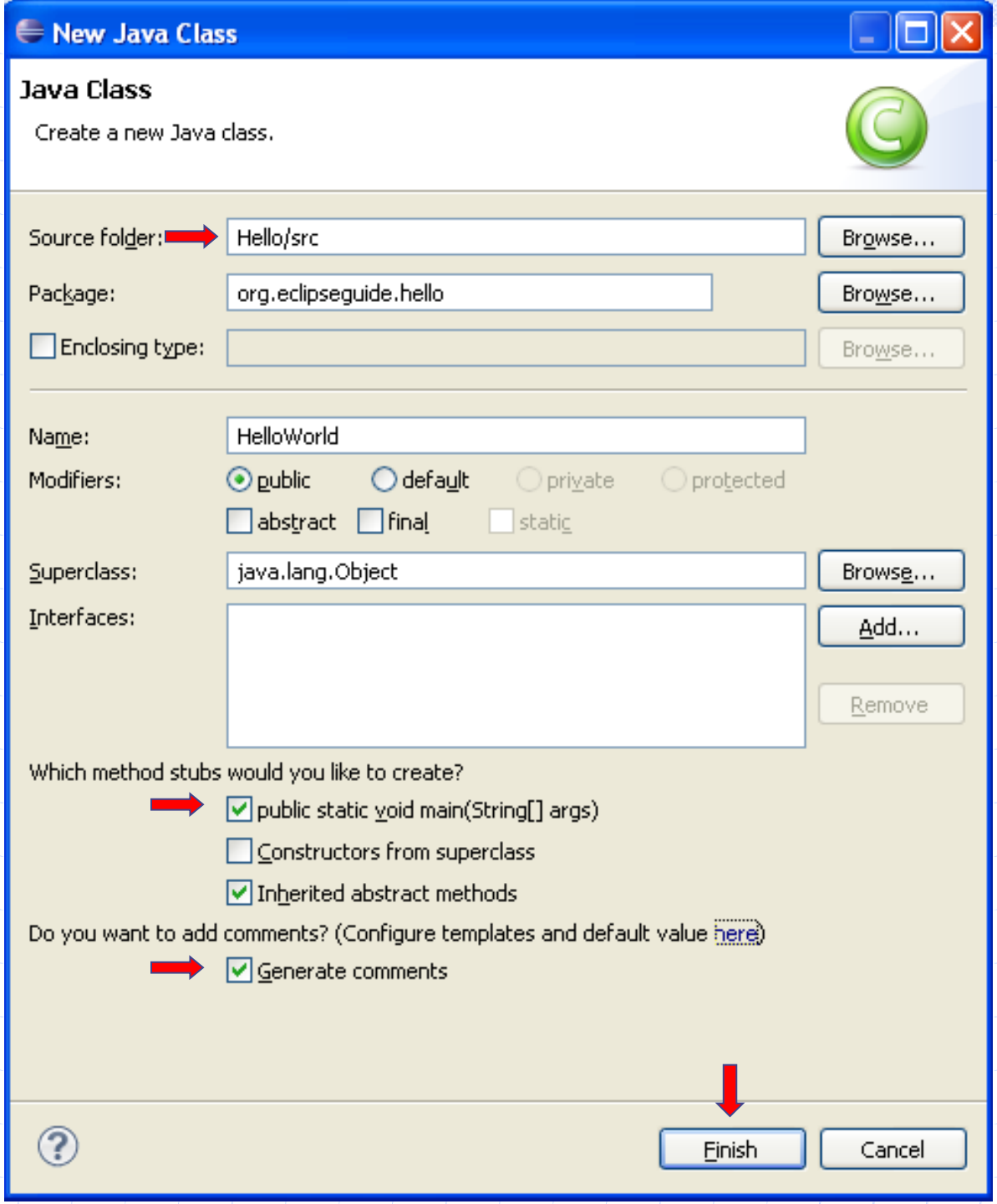
Note that pure sequence of digits (`123456`) is not allowed as a package component (between dots).

The **Java** quick tour in **Eclipse:** Creating a **Java *class***

- In ***Java** perspective* , follow these steps to create new **Java *program (class):***
  - *Right-click* on the project name **`Hello`** and select

    New > Class
  - Enter the ***package** name* **like** **`org.eclipseguide.hello`** **(**actually, use **your personal package** as described above**!!)**
  - Enter the ***class** name* **`HelloWorld`**
  - Check ***stub method*** :

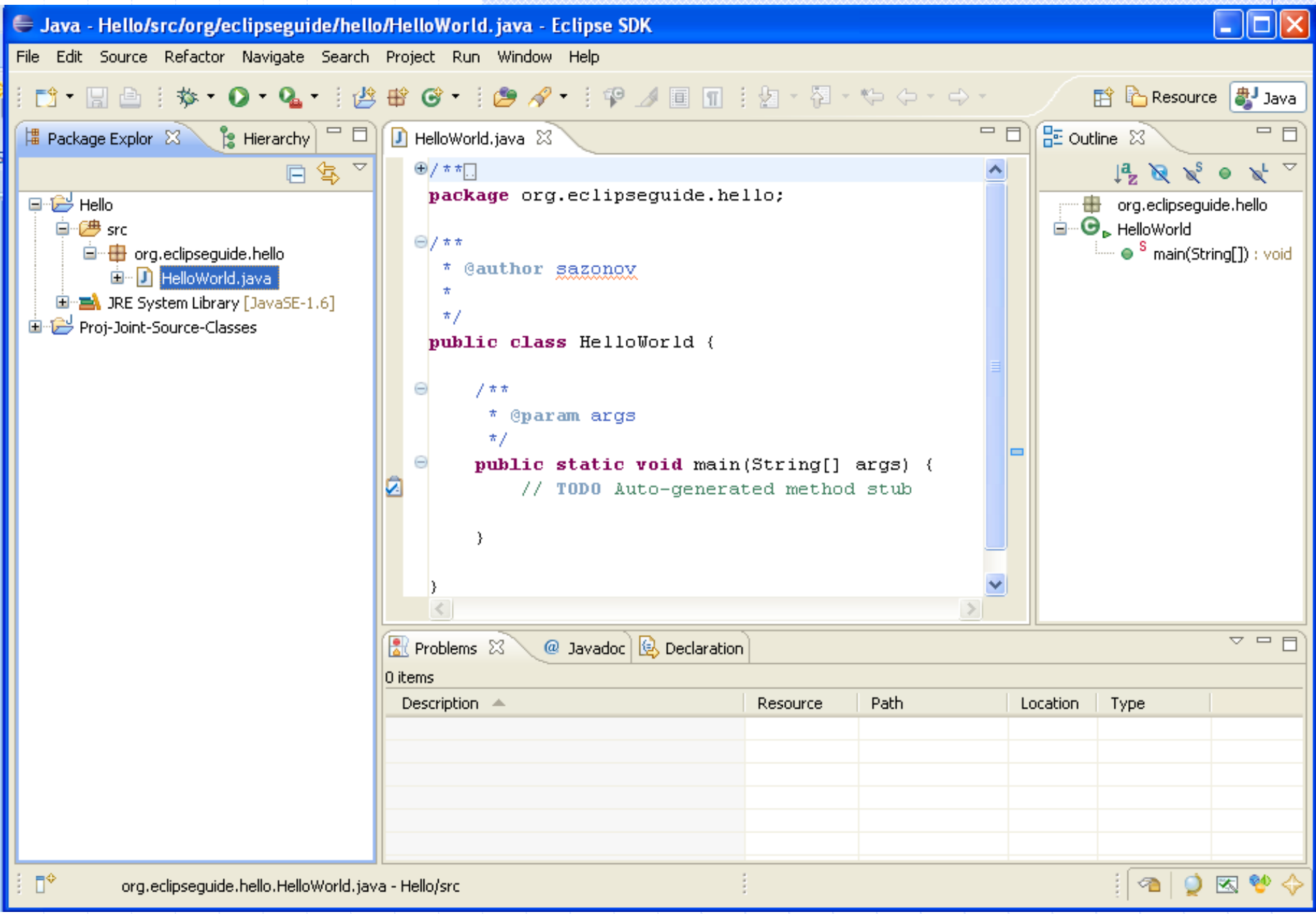
    ```
    public static void main(String[] args)
    ```
  - Check "***Generate comments***" (see next slide)



- Pay attention to the automatically chosen ***source folder***

`Hello/src`

- Click **Finish**, and look at the *automatically generated* result in the next slide.


Java - Hello/src/org/eclipseguide/hello/HelloWorld.java - Eclipse SDK
File Edit Source Refactor Navigate Search Project Run Window Help
Resource
Java
Package Explor
Hierarchy
Hello
src
org.eclipseguide.hello
HelloWorld.java
JRE System Library [JavaSE-1.6]
Proj-Joint-Source-Classes
HelloWorld.java
/**..
package org.eclipseguide.hello;
/**
* @author sazonov
*
*/
public class HelloWorld {
/**
* @param args
*/
public static void main(String[] args) {
// TODO Auto-generated method stub
}
}
Outline
org.eclipseguide.hello
HelloWorld
main(String[]) : void
Problems
Javadoc
Declaration
0 items
Description
Resource
Path
Location
Type
org.eclipseguide.hello.HelloWorld.java - Hello/src

The **Java** quick tour in **Eclipse: Creating** a Java **class**

- **Examine:**
  - Contents of the *workspace* directory
    - in your lab machines it should be

      `H:\eclipse`
  - *Package Explorer view* in **Java Perspective**,
  - *Project Explorer view* in **Resource Perspective**.

The **Java** quick tour in **Eclipse:** Creating a Java **class**

- Pay attention how the *package* and *files* **`HelloWorld.java`** and **`HelloWorld.class`** are posed in directories/views.
- Note that neither **Resource Perspective** nor **Java Perspective** show default **`bin`** directory for compiled classes.
- In the editor area we see the ***stub Java code*** **`HelloWorld.java`** (with an empty **`main()`** method) *generated by the wizard*.

The **Java** quick tour in **Eclipse:** Creating a Java **class**

- **Code-completion/code-generation features:**
  - **Add** a line to `main()` method
    `System.out.println("Hello, World!");`
  - **Eclipse** helpfully inserts closing *parentheses* and double *quotation marks*;
  - Code-completion feature, ***code assist***, presents a list of proposals – the *methods* and *attributes* for the class;
  - ***Code assist*** may also be invoked by **Ctrl-Space;**
  - For example, **type** `sysout` followed by **Ctrl-Space** to get `System.out.println();`
  - These features are ***easy to customize*** via **Eclipse's *settings and preferences*** as we will see later.

The **Java** quick tour in **Eclipse:** Creating a Java **class**

- **Repeat the same** in the project

  `Proj-Joint-Source-Classes`

  - This ***project directory*** (unlike **`Hello`** ***project***) serves as ***joint directory*** for ***source code*** and for ***compiled classes***.
  - **USE** the same package name as above and similar class name **`Hello`** to **`HelloWorld.`**

We *will use this project and new* **`Hello`** *class later.*

The **Java** quick tour in **Eclipse: Running** a Java program

- *Select* **`HelloWorld`** source in the editor – **click.**
- To **run** this program,
  - *select* **Run > Run As > Java Application**.
- **Eclipse** can prompt you to *save changes* before it runs the program.
  - Click **OK.**
- **Console view** appears and *displays the program output:*

```
Hello, World!
```

The **Java** quick tour in **Eclipse: Running** the Java program

- To ***re-run*** the ***chosen file***, click **Run** button 
- or select

  Run > 

  or hit

  Ctrl+F11,

- **No separate step is required to compile!**
- ***Compiling*** **goes** ***while editing!***

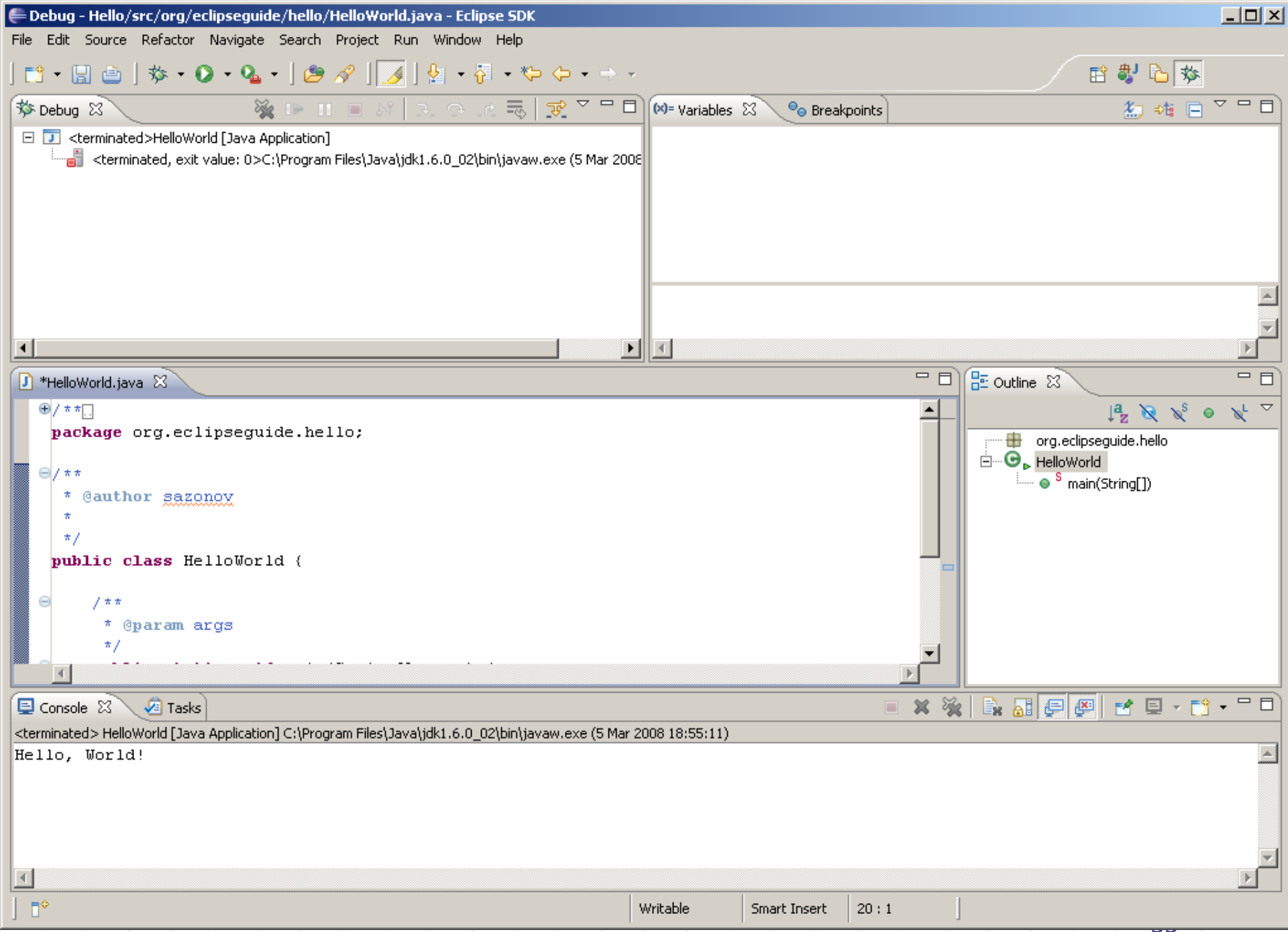
The **Java** quick tour in **Eclipse: Syntax Errors**

- Eclipse **JDT** includes a special *incremental compiler* and *evaluates your code as you type it*,
  - by creating `.class` file *automatically*.
- It can ***highlight*** things such as *syntax errors* and *unresolved references* as you type.
- **TRY it**:
  - by deliberately creating some syntactical errors,
  - and experimenting with **red signs** in the left and right border of the editor.

The **Java** quick tour in **Eclipse: Debugging** the Java program

- **Eclipse** *interprets the code in a more comprehensive way* than a simple editor can.
- **Eclipse's** ability to *run the code* ***interactively*** is one of major benefits.
- By using the **JDT** ***debugger***, you can
  - execute your **Java** program *line by line* and
  - examine the *value of variables* at different points in the program.
- This process can be ***invaluable in locating problems in your code***.
- **We will not go into further details**. Just look at **Debug perspective** in the next slide

  (Window > Open Perspective > Other… > Debug).



Debug perspective

The **Java** quick tour in **Eclipse: Preferences** and other settings

- **Eclipse's** *default settings* can be *changed* or *restored* by selecting

  Window > Preferences...

- These are, for example,
  - *Code Style:* **Java>Code Style**
    - ***formatter***,
    - ***code templates*** for generating ***code*** or ***comments***,
  - Adding ***classpath entries*** and ***User Libraries*** via

    Java>Build Path

- We will *consider only some of these settings*.

The **Java** quick tour in **Eclipse: Preferences** and other settings

- ***Exporting*** **and** ***importing preferences*** can be done via
  File > *Import* > General > Preferences
  File > *Export* > General > Preferences
- **Javadoc comments** may be changed as follows:
  - Select
    Window > Preferences > Java > Code Style > Code Templates
  - Select **Code > New Java Files**, and click **Edit**
  - Change the text to the following (by using **Insert Variable** buttons):

```
/* ${file_name}                                  ← Added
 * Created on ${date}
 */
${filecomment}
${package_declaration}

                                                 ← Original
${typecomment}
${type_declaration}
```

  - Click **OK** in the **Edit Template** dialog box
    (**continued** on the next slide)

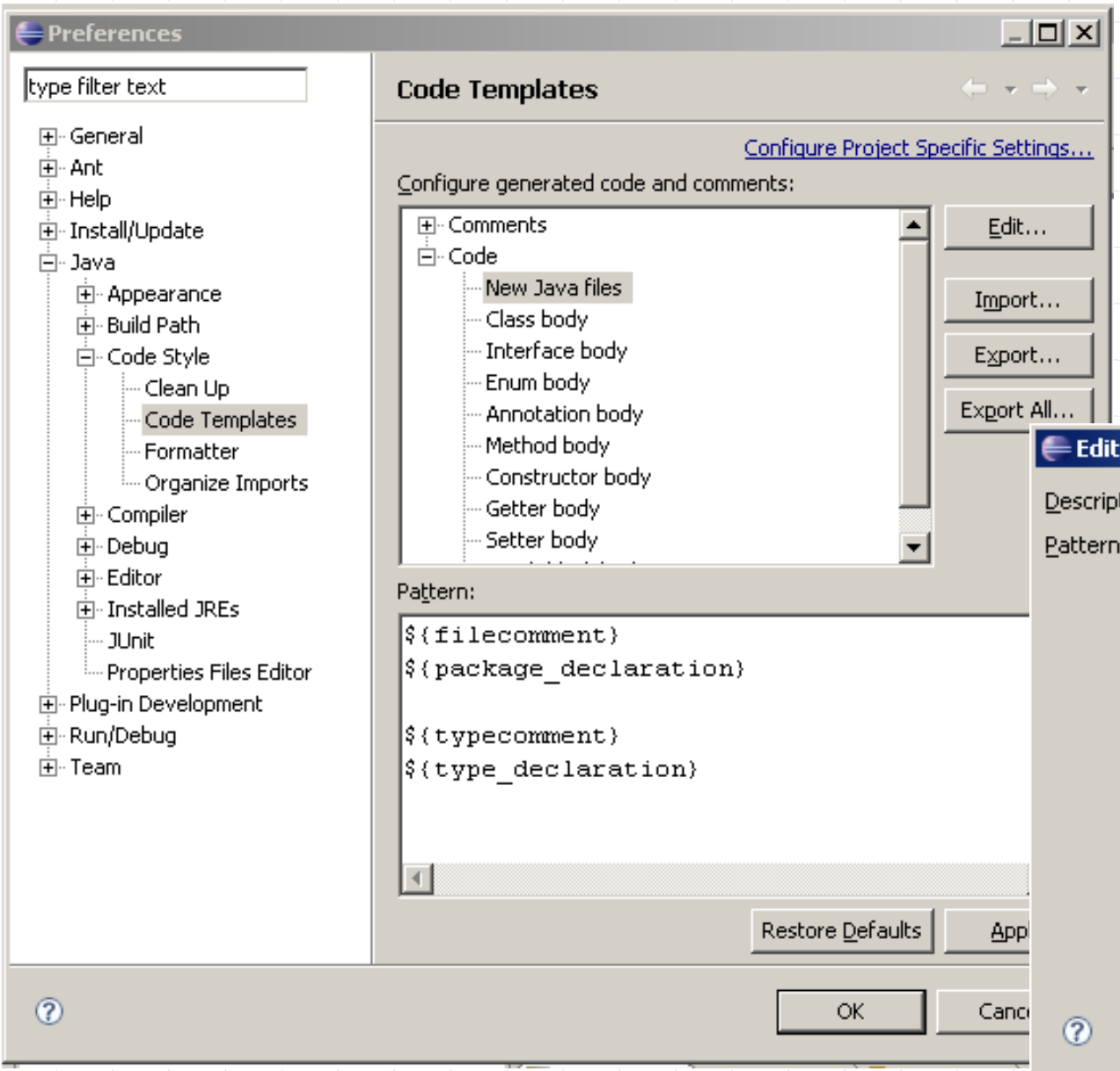
The **Java** quick tour in **Eclipse: Preferences** and other settings

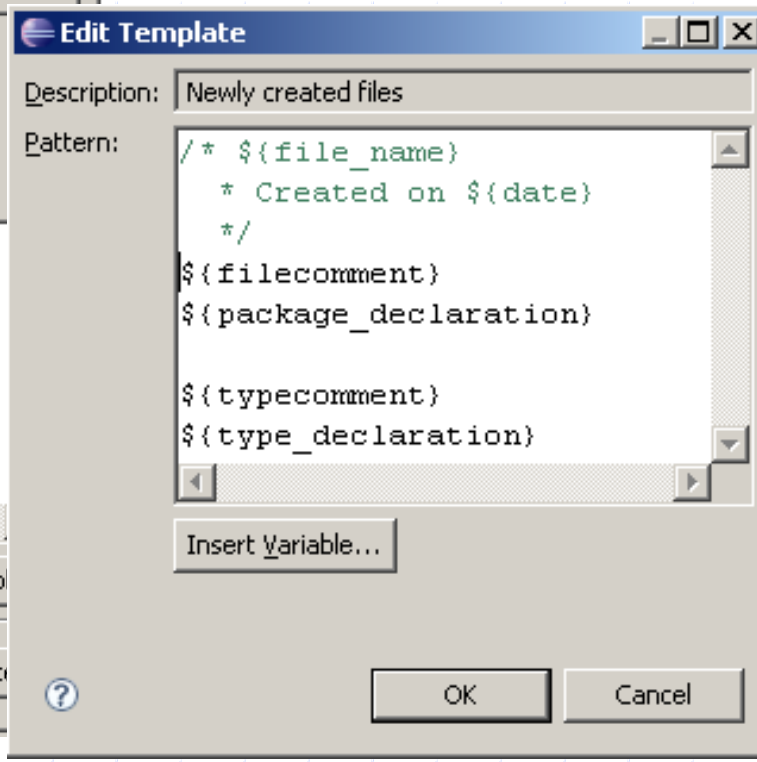
- **Javadoc comments** changes (continued):
  - Select **Comments > Types** (in the same box), and click **Edit**
  - Change the text to the following:

```
/**
 * Add one sentence class summary here.
 * Add class description here.
 *
 * @author ${user}
 * @version 1.0, ${date}
 *
 * ${tags}
 */
```

  - Click **OK** in the **Edit Template** dialog box
  - Note, that you can always use **Restore Defaults** button.
  - Click **OK** again.
- *To see all your changes*, **create a new class** `Test` in `org.eclipseguide.hello` package with checking **Generate Comments**.
- **TRY it. (See the next slide for illustration of the above steps.)**

Changing **Javadoc comments and code style**





The **Java** quick tour in **Eclipse: Preferences** and other settings

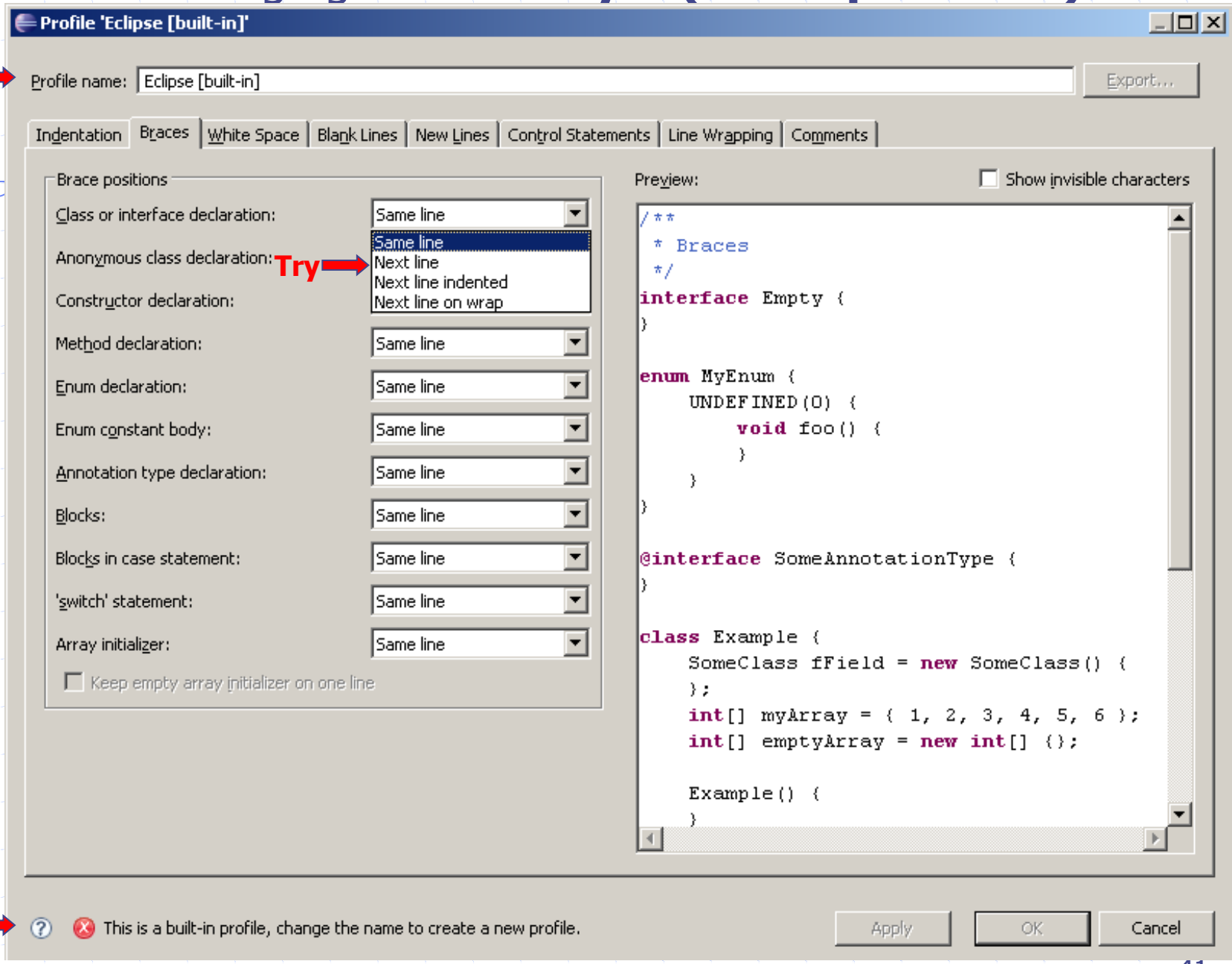
Format style

- Select **Window > Preferences > Java > Code Style > Formatter**
- Click **Edit** button,
- then choose, *for example*, **Braces** tab
- **Choose** one of the options:

  Same line, Next line, Next line indented, Next line on wrap
- and see how format style changes.

  (see the next slide)

Changing **Format style (brace positions)**



You will be prompted to ***change profile*** to, e.g., ***MyProfile***

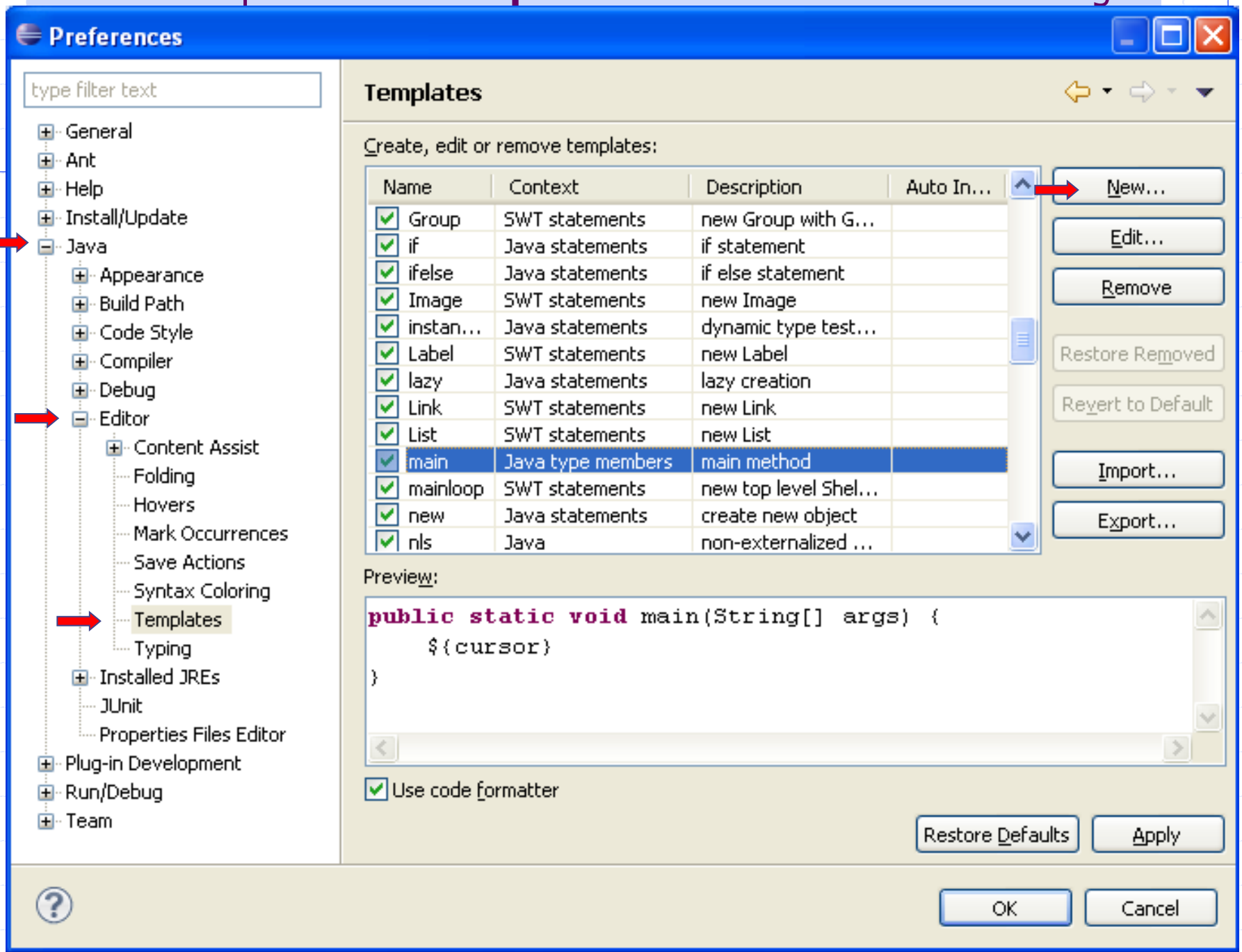
The **Java** quick tour in **Eclipse: Preferences** and other settings

- **Code generation templates** (to be invoked by **Ctrl-Space**).
  - **Templates** for flow control constructs (like `do while` statement) are found in

    Window > Preferences > Java > Editor > Templates

(see the next slide)

The **Java** quick tour in **Eclipse: Preferences** and other settings



The **Java** quick tour in **Eclipse: Preferences** and other settings

- **Create** template to produce

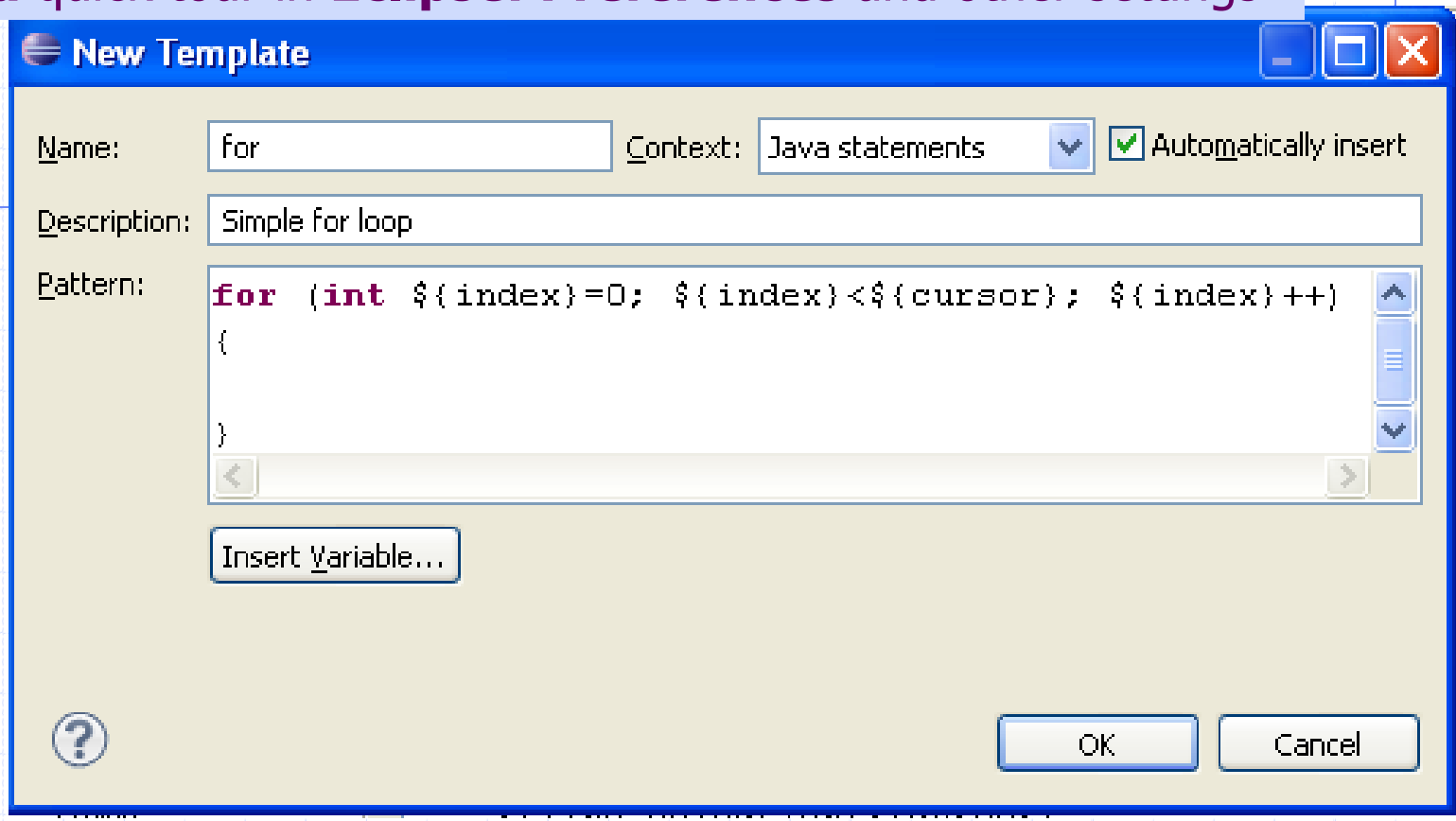
  simple **`for`** *loop:*

  - Select (as above)

Window > Preferences > Java > Editor > Templates

  - Click the **New** button.
  - Choose Context **Java statements.**
  - **Enter**
    - **`for`** as the **name** of new template,
    - **`Simple for loop`** as the description, and
    - the ***pattern*** on the next slide (by using **Insert Variable**):

The **Java** quick tour in **Eclipse: Preferences** and other settings



Finally,

- Click **OK** in this **New Template** dialog box,
- Click **OK** in the **Preference** dialog to return to the **Workbench**.
- **TRY** new version of **`for`** of **`Simple for loop`** just created with using **Ctrl-Space**.

The **Java** quick tour in **Eclipse: Preferences** and other settings

- Setting **Classpaths** and **classpath variables:**
  - Select **Window > Preferences > Java > Build Path > Classpath Variables**
  - Click the **New** button.
  - Enter the *classpath variable name*, (**just for example**), **`MYSQL_JDBC`.**
  - Either *browse* or *enter manually*, (**just for example,** even if it does not exist in your computer) the path **`C:\mysql\jdbc\lib\mm.mysql-2.0.14-bin.jar`**
  - Click **OK** twice to save and return to **Workbench.**

The **Java** quick tour in **Eclipse: Preferences** and other settings

- ***Adding*** **JAR classpath** or **classpath variable** (such as `MYSQL_JDBC`) ***to a project***:
  - right-click on the **project name (Hello)**,
  - select **Properties**, then **Java Build Path,** and **Libraries** tab, then
    - ***either*** add the **JAR** *explicitly* by selecting **Add External JARs…** from your file system**,**
    - ***or*** select **Add Variable**, click `MYSQL_JDBC`, and **OK**
- In our case, `MYSQL_JDBC` ***points to non-existing location***, so Eclipse **does not allow to add** this variable.

- Similarly, we could add **classpath variable** `JUNIT4_EXTERNAL` (- external to Eclipse, which has its own **JUnit3 and JUnit4**) for our independent of **Eclipse JUnit4**

  `C:/JAVA/junit4.8.2/junit-4.8.2.jar`

- Alternatively, if we want to use **Eclipse's** internal plugin for **JUnit**, we could click **Add Library…** and chose **JUnit3** or **JUnit4.**

The **Java** quick tour in **Eclipse:** **Importing** pre-existing **Eclipse** **projects** into **workspace**

- Some **Eclipse** ***project (s)*** can be
  - created by another developer or
  - deleted from the workspace by yourself (without complete deleting the project contents on disk; e.g. you can **temporary delete** your `Hello` project and then **import it back**).
- To ***import*** such a pre-existing **Eclipse** projects from some other workspace ***into your current workspace***, select

  File > **Import** > **General** >

  > **Existing Projects into Workspace** > **Next**

  - Choose **Select Root Directory** (i.e., a pre-existing - another or the current - **workspace**) containing existing projects and click **Browse** to find it.
  - **Choose** project/subdirectory to import.

The **Java** quick tour in **Eclipse:** **Importing** pre-existing **Eclipse projects** into **workspace**

- You can additionally **decide** whether to **Copy Projects into Workspace** by ticking the appropriate box (if it is not in the current workspace) or **not copy**

That is, a content of a directory on disk can be dealt with as a part of our ***abstract*** **Workspace** but ***non necessarily physically contained*** in the **Workspace** directory on disk.

- Click **Finish.**

The **Java** quick tour in **Eclipse: Conclusion** notes

- **Thus, we know how to**
  - start a project in **Eclipse,**
  - create a stub **Java** class by using a wizard,
  - use the simplest **Code-completion/code-generation** features of the editor (**Ctrl-Space**),
  - **run** and **re-run** a **Java** program in **Eclipse,**
  - that **Eclipse** editor ***highlights*** and helps to correct *syntax errors* and *unresolved references* (discussed later),
  - that **Eclipse** has a special **Debug perspective** to facilitate debugging a **Java** program (*details omitted*),
  - use **Preferences** for
    - code ***formatting*** style (positions of braces was considered)),
    - ***templates*** for generating code (or comments – *details omitted for self-study*),
    - adding ***classpath*** entries (*details omitted for self-study*),
    - etc.
  - **import** some pre-existing **Eclipse projects** into **workspace**

The **Java** quick tour in **Eclipse:** Conclusion notes

- **Eclipse** is available from

  `http://www.eclipse.org`