

JAVA

Tools in JDK

Tools

- javac
- javadoc
- jdb
- javah
- jconsole
- jshell
- ...

JAVA

javac

javac

- arguments
 - cp
 - encoding

 - g debugging info
 - g:none

 - target version of bytecode (6, 7, 8, 9,...)
 - release

 - source version of language

 - d directory for generated bytecode

 - ...

JAVA

jshell

jshell

- interactive shell
- since Java 9

JAVA

javadoc

Overview

- a tool for automated generation of documentation from source codes
- class declarations etc. plus documentation comments
 - documentation directly in the code
 - easily kept up-to-date
- output – (implicitly) HTML pages
- documentation comments

```
/** comment */
```

 - written next to a documented element
 - contains – text + special tags + html code
- the `javadoc` program
 - included in JDK
 - generates documentaion

Comments

- written next a documented element (without any empty new lines)

```
/** Commenting class */  
public class MyClass {  
    /** Commenting field */  
    public int a;  
    /** Commenting method */  
    public void foo() {  
        ...  
    }  
}
```

Comments

- ignored otherwise (considered as normal comments)

```
/** ignored */  
import java.util.*;  
  
public class MyClass {  
    void foo() {  
        /** ignored */  
    }  
}
```

Multi-line comments

- comments typically over several lines
- initial spaces and stars on second and subsequent lines are ignored
- without stars, the space are not ignored (since 1.3)

```
/** This is a multi-line comment.  
 * Initial spaces and stars  
 * are ignored and removed.  
 */
```

```
/** Initial spaces are not ignored as  
 there is no star.  
 */
```

Parts of comments

- two parts in documentations comments
 - main description
 - part with tags
- first the main description, then the part with tags
 - cannot be swapped
 - the part with tags starts with a first tag (`@something`)

```
/** This is the main description. This is  
 * still the main description.  
 * @see java.lang.Object  
 */
```

- comment can have only a single section

Types of tags

- "block tags"
 - @tag
 - standalone tags
 - can be placed only at the beginning of a line (initial spaces and stars ignored)
 - character @ is considered as normal character elsewhere
- "in-line tags"
 - {@tag}
 - can be anywhere in the text
 - also in the main description

@deprecated As of JDK 1.1,
replaced by {@link #setBounds(int,int,int,int)}

Comments

- first sentence = overview
 - a sentence ends with first dot followed by a white space (or by first tag)
 - shown
 - in a overview of class elements (methods, fields)
 - in the short description of a class
- one comment for several fields

```
/** A comment for both fields */  
public int x, y;
```

HTML

- text of comments ~ HTML
- HTML tags can be used

```
/** This is a <b>documentation</b>  
 * comment.  
 */
```
- characters `<` `>` `&` should be written in a HTML form
 - `<` ... `<`;
 - `>` ... `>`;
 - `&` ... `&`;
- usage of some tags is not recommended
 - e.g. headers `<h1>` `<h2>`
 - can break the structure of generated documentation

Inheriting comments

- if the comment is not present it is inherited from parents
 - overridden methods
 - implemented methods
- inherited only the part that is not defined
 - since 1.4
 - till 1.3 – presence of documentation comment prevents inheriting of anything
- explicit inheriting `{@inheritDoc}`

Package documentation

- documentation comments for a package
- the package.html file
- in the same directory as the package
- contains a HTML page
- to the documentation, everything between the tags `<body>` a `</body>` is included
- it is written without `/** ... */`
- first sentence – short description of the package

- description of a group of classes
- the overview.html file
- the same structure as package.html

Tags

Tag	since	Tag	since
@author	1.0	@return	1.0
@{code}	1.5	@see	1.0
@{docRoot}	1.3	@serial	1.2
@deprecated	1.0	@serialData	1.2
@exception	1.0	@serialField	1.2
{@inheritDoc}	1.4	@since	1.1
{@link}	1.2	@throws	1.2
{@linkplain}	1.4	{@value}	1.4
{@literal}	1.5	@version	1.0
@param	1.0		

Tags for methods

```
/** Main description.  
 * @param p1 description of p1  
 * @param p2 description of p2  
 * @throws IOException when the  
 *             exception is thrown  
 * @throws MyException when the  
 *             exception is thrown  
 * @returns what is returned  
 */  
int foo(int p1, long p2) throws  
    IOException, MyException;
```

Other tags

- `@since text`
 - can be used everywhere
 - meaning: since which version of a sw the particular element exists
 - `@since 1.4`
- `@exception`
 - the same as `@throws`
- `@author name`
 - name of the author
 - can be used with classes, packages and overview

Other tags

- @see reference
 - "See also" header in the generated docs.
 - three possible formats
 - @see "string"
 - @see "The Java language specification"
 - @see label
 - @see package.class#member label
 - @see String#equals(Object) equals
 - @see java.io.File#exists() exists
- {@link package.class#member label}
 - a reference in a text (e.g. in the main description)
 - similar to @see

Other tags

- `{@linkplain package.class#member label}`
 - the same as `{@link ...}`
 - printed using the same font as for plain text
 - for `{@link ...}` another font is used (typically monospaced)
- `@deprecated` text
 - denotes API, which should not be used (intended for removal in future)
 - text – explanation why deprecated
 - the compiler checks for this tag
 - prints out a warning if deprecated API is used
 - since 5.0 – annotation `@deprecated`
- `{@docRoot}`
 - relative path to the root directory of the generated documentation

Other tags

- `{@literal text}`
 - a text that will not be interpreted
 - `{@literal ac}`
 - the generated documentation will contain `ac`
 - `` will not be interpreted as a tag
- `{@code text}`
 - the same as `<code>{@literal text}</code>`

javadoc

- generating documentation – javadoc
 - a part of the JDK
 - execution:

```
javadoc [arguments] [packages]
        [source_files]
        [-subpackages pkg1:pkg2:...]
```


Arguments for javadoc

- `-overview path/file`
 - a path to the file `overview.html`
- `-public`
 - include only public elements to the documentation
- `-protected`
 - include only public and protected elements
 - default behavior
- `-package`
 - include public, protected and package-private elements
- `-private`
 - include all elements

Arguments for javadoc

- `-doclet class`
 - doclet generates the documentation
 - default doclet generates HTML
- `-source 1.4`
 - version of source codes accepted
- `-sourcepath list_of_paths`
 - path for source files
- `-verbose -quiet`
 - level of verbosity
- `-locale language_country_variant`
 - if present it must be as first argument
- `-encoding encoding`
 - encoding of source files

Arguments for javadoc

- `-d path`
 - **directory** for generated documentation
- `-version`
 - **include tag** `@version`
- `-author`
 - **include tag** `@author`
- `-windowtitle text`
- `-doctitle text`
- `-header text`
 - **placed to the beginning** of each page
- `-footer text`
 - **placed to the end** of each page
- `-nodeprecated`
- `-nosince`

JAVA

ANT

Overview

- <http://ant.apache.org/>
- a tool for (not only) building of Java programs
- close to **make**
- written in Java
- extensible
 - by adding classes
- input file (buildfile)
 - (as makefile in **make**)
 - XML
- NetBeans internally uses Ant for compilation, execution, ... of projects

Buildfile

- default name `build.xml`
- contains a **single** `project`
- and at least one `target`

```
<?xml version="1.0" encoding="us-ascii" ?>
<project ...>
  <target ...>
    ...
  </target>
  <target ...>
    ...
  </target>
</project>
```

Project

- attributes
 - name
 - name of the project
 - default
 - default target that will be executed if no target is explicitly given
 - mandatory attribute
 - basedir
 - a base directory for all paths in the file
- optional element <description>
 - description of the project

```
<project name="Project" default="compile"  
  basedir=".">  
  <description>A long description of the  
  project</description>
```

Target

- a sequence of tasks that have to be executed
- can depend on other targets
 - is executed after them
- attributes
 - name
 - mandatory
 - depends
 - a list of targets on which the targets depend
 - description
 - short description
 - if
 - the name of a property that must be set
 - unless
 - the name of a property that must not be set

Target

```
<target name="compile" depends="init"  
        description="Compile the app">
```

```
    ....
```

```
</target>
```

Task

- executable code
- different number of arguments
 - depends on the particular task
- core
- optional
- own

```
<name attr1="value" attr2="value" .../>
```

```
<javac srcdir="..." destdir="..."/>
```

Property

- name and value
- name – case sensitive
- obtaining the value - `${property}`
- built-in properties
 - `basedir`
 - `ant.file`
 - `ant.version`
 - `ant.project.name`
 - `ant.java.version`
 - **system properties of Java**
- own properties
 - `<property name="name" />`

Example

```
<?xml version='1.0' encoding='us-ascii'?>
<project basedir="." default="compile" name="Project">
  <description>Project description</description>

  <property name="src" location="src"/>
  <property name="classes" location="classes"/>

  <target name="init">
    <mkdir dir="${classes}"/>
  </target>

  <target name="compile" depends="init"
description="Compile">
    <javac debug="true" destdir="${classes}"
      srcdir="${src}" includes="**/*.java"
      classpath="${src}" />
  </target>

  <!-- continuation -->
```

Example

```
<!-- continuation -->
```

```
<target name="run" depends="init,compile"  
  description="Execute">  
  <java fork="true" classname="Main"  
    classpath="${classes}" />  
</target>
```

```
</project>
```

Execution

- `ant [arguments] [target [target2 ...]]`
- **arguments**
 - projecthelp, -p
 - project help
 - description of the project + description of tasks
 - propertyfile <file>
 - defines properties from the file
 - D<property>=<name>
 - definition of properties
 - buildfile <file>
 - file <file>
 - f <file>
 - buildfile

Task javac

- executes the Java compiler
- compiles only those file that have to be compiled
 - no .class file or .class file is older than .java
 - warning!
 - only by names of files
 - i.e. does not know about inner classes, etc.
- **attributes**
 - `srcdir`
 - directory with .java files
 - mandatory
 - `destdir`
 - directory for .class files
 - `classpath`
 - **CLASSPATH**

Task javac

- **attributes**
 - `encoding`
 - `encoding`
 - `source`
 - `-source` attribute for javac
 - `compiler`
 - which compiler should be used
 - `fork`
 - true or false (default is false)
 - whether to execute the compiler in the same JVM as ANT or in a new one
- `srcdir`, `classpath` (and others) can be substituted by nested elements `<src>`, `<classpath>` (and others)

Task java

- executes a Java program
- attributes
 - `classname`
 - a class to be run
 - `jar`
 - jar-file to be run
 - mandatory either `classname` or `jar`
 - `classpath`
 - `fork`
 - run in a new JVM
- nested elements
 - `<arg>`
 - command-line arguments

Task property

- sets property(-ies) to a given value(s)
- value cannot be changed
- attributes
 - name
 - name of the property
 - value
 - value of the property
 - location
 - absolute path of the given files
 - file
 - file from which the properties should be read
 - url
 - url from which the properties should be read

Task property

- example

```
<property name="src" location="src"/>  
<property name="foo.dist" value="dist"/>  
<property file="foo.properties"/>  
<property url="http://..." />
```

Task javadoc

- runs javadoc
- attributes
 - `sourcepath` – directories with sources
 - `sourcefiles` – source files to be processed
 - `packagenames` – for which packages docs should be **generated**
 - `destdir` – directory for generated docs
 - `public, protected, package, private` – for **which elements docs should be generated**
 - `author` – include `@author`
 - `version` – include `@version`
 - ... many others

Others

- many other tasks
 - `delete`
 - deletes files/directories
 - `move`
 - move/rename
 - `mkdir`
 - creating a directory
 - `copy`
 - copying
 - `echo`
 - prints out a text to the std output

JAVA

Maven

Overview

- <http://maven.apache.org/>
- a tool for managing projects
 - roughly, Maven can be seen as an Ant extension
 - but it is not an Ant extension
- provides
 - dependency management
 - project building
 - usage of “best practices”
 - extensibility by new modules
 - ...

Usage

- a project generation
mvn archetype:generate
 - DarchetypeGroupId=org.apache.maven.archetypes
 - DgroupId=com.mycompany.app
 - DartifactId=my-app
- archetype ~ a project template
- generates the following structure

Project structure

```
my-app
|-- pom.xml
`-- src
    |-- main
    |   |-- java
    |   |   |-- com
    |   |   |   |-- mycompany
    |   |   |   |   |-- app
    |   |   |   |   |   |-- App.java
    |-- test
    |   |-- java
    |   |   |-- com
    |   |   |   |-- mycompany
    |   |   |   |   |-- app
    |   |   |   |   |   |-- AppTest.java
```

POM – Project Object Model

- a project definition

```
<project xmlns="http://maven.apache.org/POM/4.0.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
    http://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>
  <groupId>com.mycompany.app</groupId>
  <artifactId>my-app</artifactId>
  <packaging>jar</packaging>
  <version>1.0-SNAPSHOT</version>
  <name>Maven Quick Start Archetype</name>
  <url>http://maven.apache.org</url>
  <dependencies>
    <dependency>
      <groupId>junit</groupId>
      <artifactId>junit</artifactId>
      <version>3.8.1</version>
      <scope>test</scope>
    </dependency>
  </dependencies>
</project>
```

Build lifecycle

- mvn “phase”
 - previous phases are also executed
1. process-resources
 2. compile
 3. process-test-resources
 4. test-compile
 5. test
 6. package
 7. install
 8. deploy

Others

- generating different project types
mvn archetype:generate \
-DarchetypeGroupId=org.apache.maven.archetypes
-DarchetypeArtifactId=maven-archetype-webapp
-DgroupId=com.mycompany.app
-DartifactId=my-webapp
- generating documentation
mvn archetype:generate
-DarchetypeGroupId=org.apache.maven.archetypes
-DarchetypeArtifactId=maven-archetype-site
-DgroupId=com.mycompany.app
-DartifactId=my-app-site

JAVA

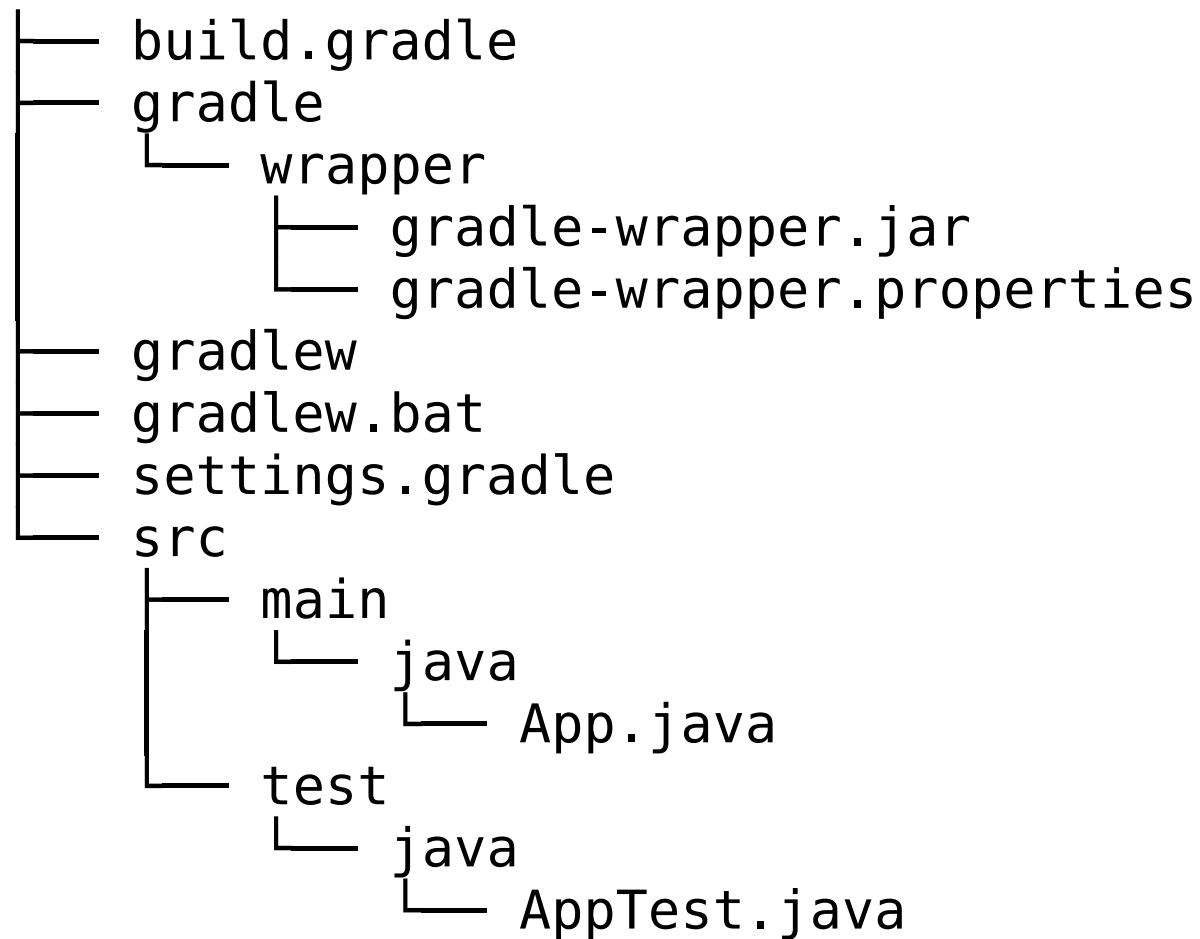
Gradle

Gradle

- <https://gradle.org/>
- similar to Maven
 - the same repositories for dependencies
 - but own language for project specification
 - DSL in Groovy
 - DSL in Kotlin
- support for multiple languages/environments
 - Java, Android, Groovy, Scala, Kotlin, C++

Project structure

- `gradle init --type java-application`



Gradle

- gradle build
- gradle run
- ...

- gradle tasks
 - a list of possible tasks



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