Object Oriented Programing 1

Lecture 3: Setting Java Environment, Introduction to JVM, Overview and installation java IDE

By

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Agenda

1. Setting Java Environment, Introduction to JVM, JRE and JDK.
2. Overview and Installation of java IDE

Setting Java Environment

An environment is the surroundings or conditions in which a person, animal or plant lives or a program operates.

Terms such as:- habitat, territory, domain, home or abode may help as bring Java environment close to the understanding of java environment.

Java Environment is a dynamic "object" on a computer that stores a value(like a key-value pair), which can be referenced by one or more software programs that runs on Java in Windows.

Setting Java Environment+

We will set an environment variable with name "**java**" and its value will be the path of the **/bin** directory present in Java directory or the address of where java is installed. So whenever a program will require Java environment, it will look for the **java** environment variable which will give it the path to the execution directory.

Setting the path/address where java can be found by all objects/software that runs based on it is what we are up to at this point.

Java Development Kit-JDK

For us to be able to setup java environment, we need to have JDK setup file. Which if we do not have, we must download it.

Without setting up java environment, Integrated development environment-IDE will not be able to install on our computers.

Note! The JDK version should match the IDE version we need to install because if the IDE version is of a lower version and yet the JDK version is higher or too low, then the IDE will not install.

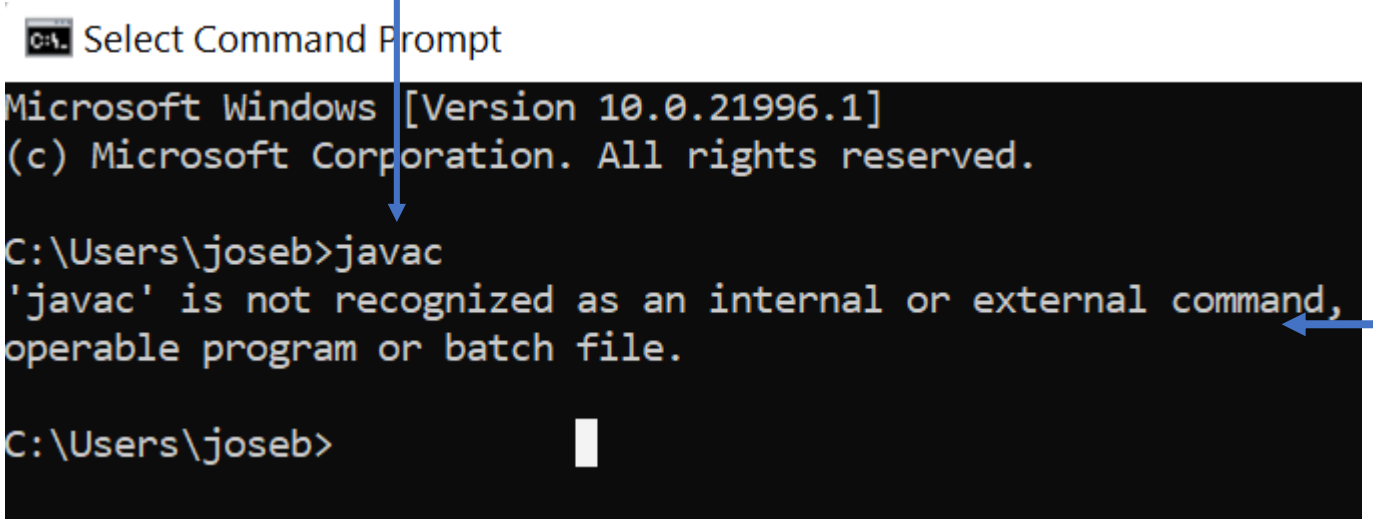
E.g. NetBeans 8.2 can not install on JDK 16, it needs JDK 8.

How do I know whether I have java environment setup on my computer or not?

Java Development Kit-JDK

Follow the steps below to check java status on your pc.

1. Open command prompt/cmd application on your windows computer
2. Type “javac” and press Enter Key

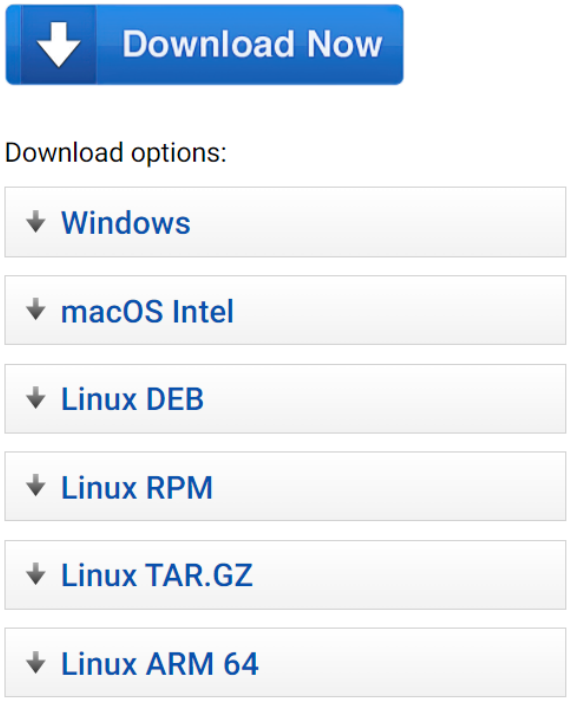


“Javac is not recognized” message shows you that java environment is not yet set.

Where/How to get JDK

Now that we have realized that the computer has not been informed bout the need to use java, we need to inform it by installing the jdk.

Now we need to download the JDK for windows or Linux or Solaris or Mac etc. depending on your OS.

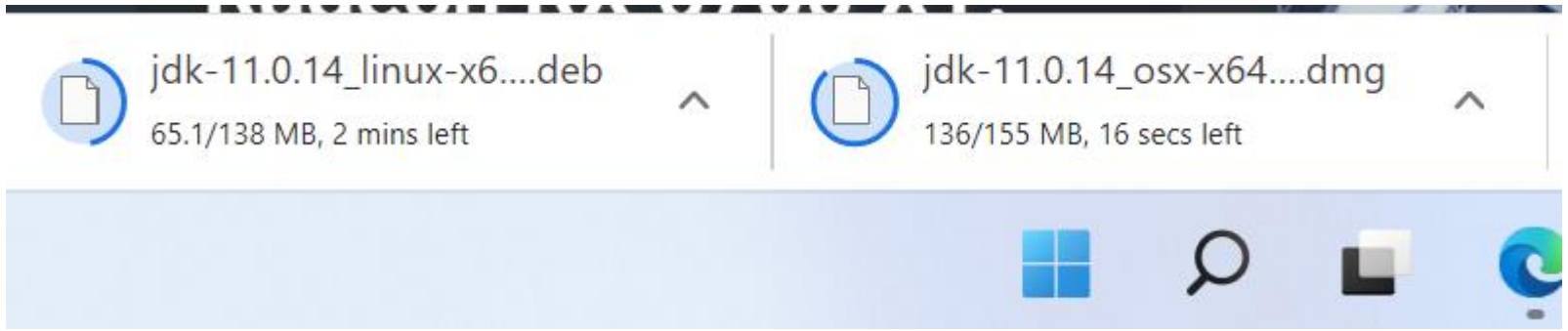


Download for Windows or

Linux or macOS or Solaris

Where/How to get JDK ++

On opening any of the links above, you should be able to see download like: -

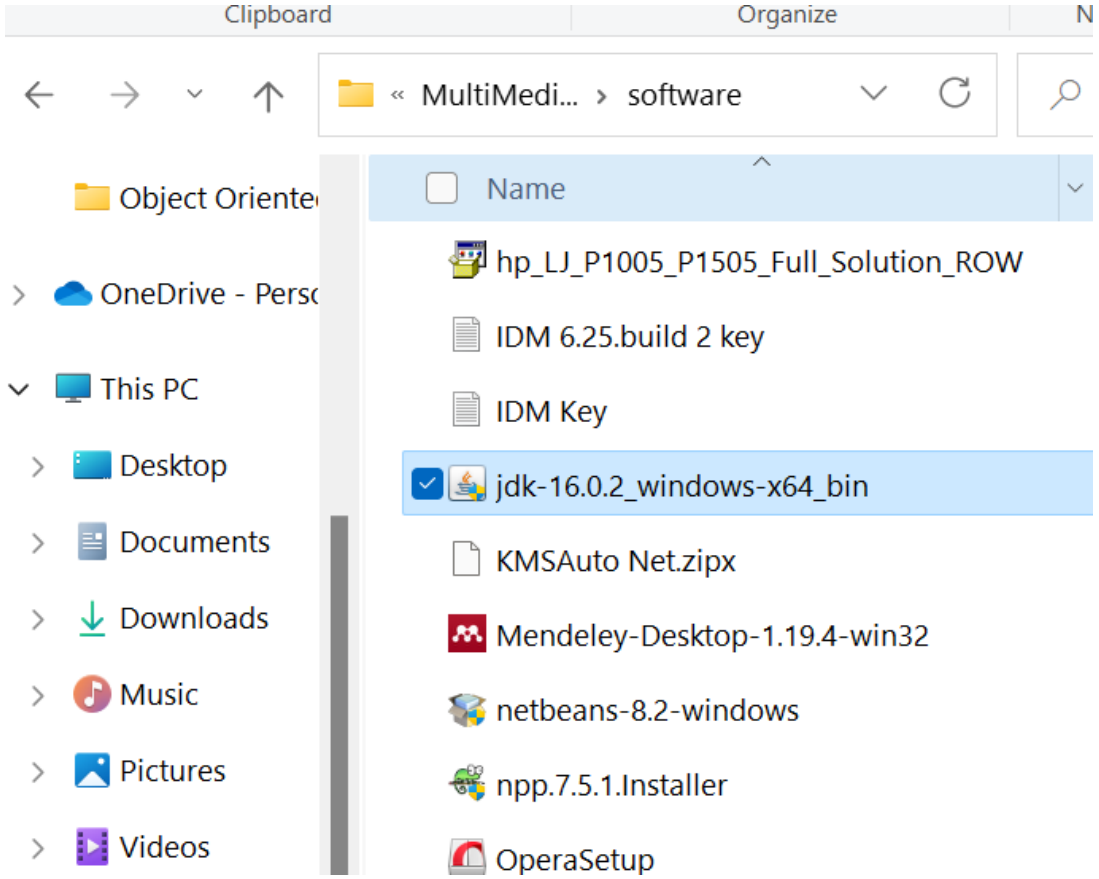


Wait until the download is complete then you start the process of installation

Step by Step guide to JDK 16.0.2 installation on windows OS

Once you have downloaded the **jdk-16.0.2_windows-x64_bin.exe file** follow the following steps:

1. Open the **jdk-16.0.2_windows-x64_bin.exe file** from the folder it is located



Step by Step guide to JDK 16.0.2 installation on windows OS+

Step 2

2. Click **Next**

Step by Step guide to JDK 16.0.2 installation on windows OS++

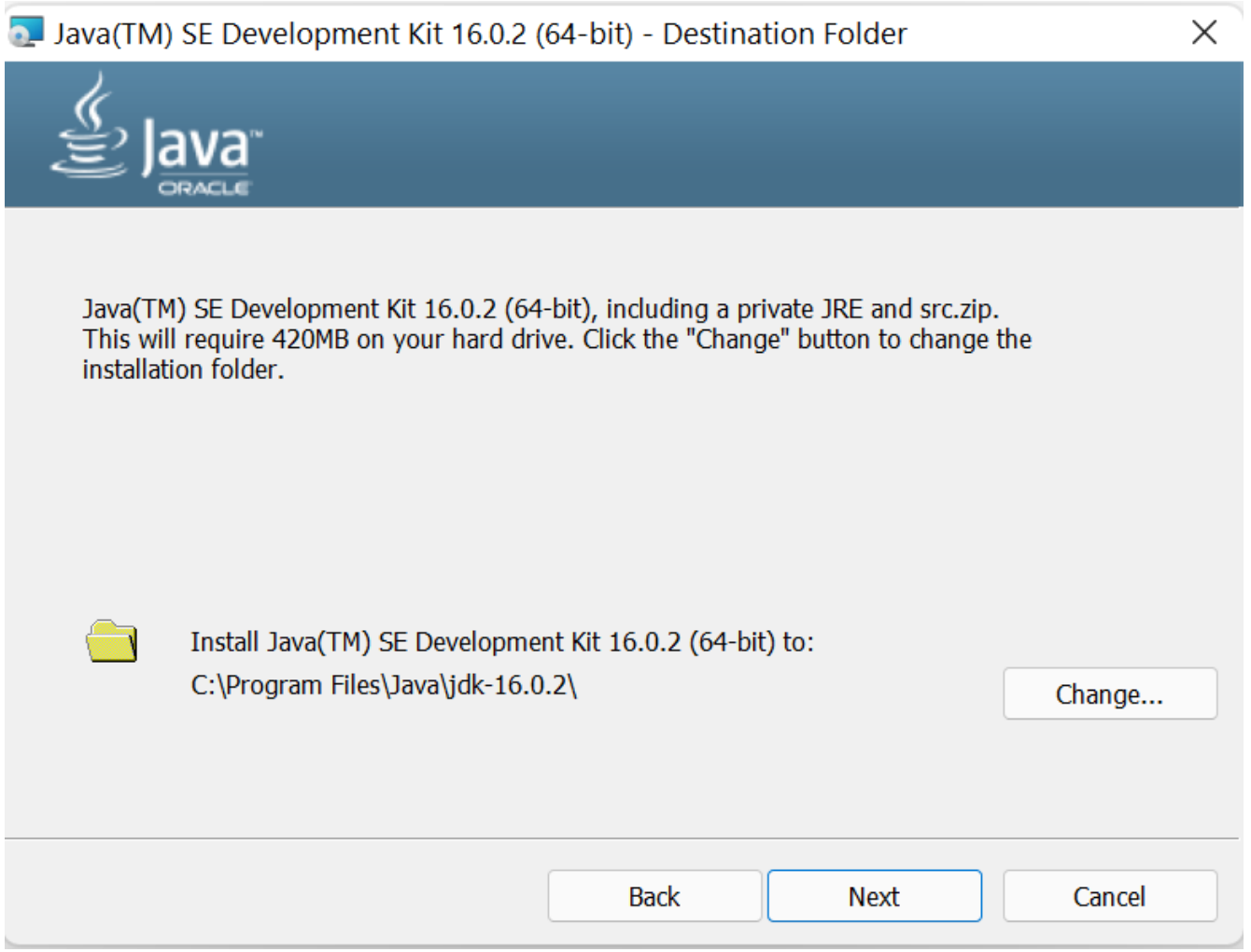
Step 3

3. Click **Next**

Step by Step guide to JDK 16.0.2 installation on windows OS+++

Step 4

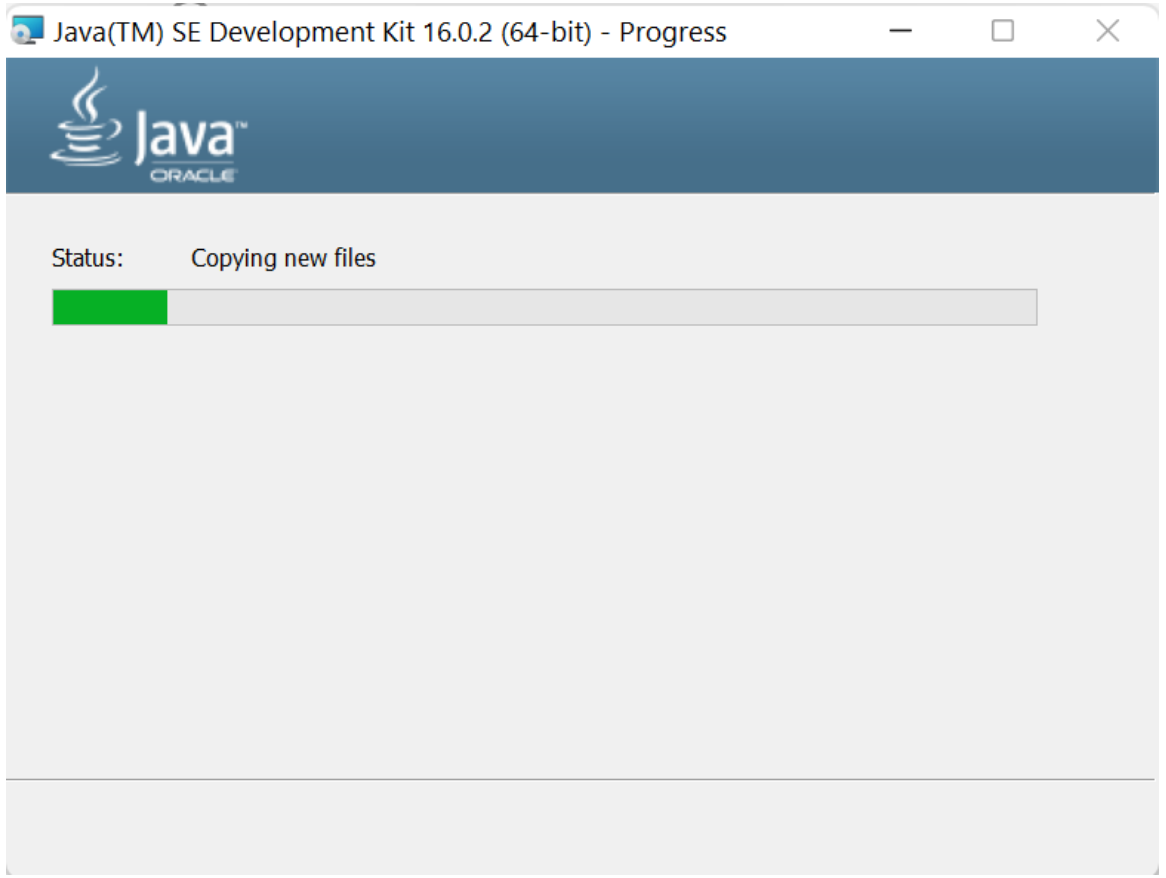
4. Click **Next**



Step by Step guide to JDK 16.0.2 installation on windows OS++++

Step 5

5. Wait until the installation progress bar is complete

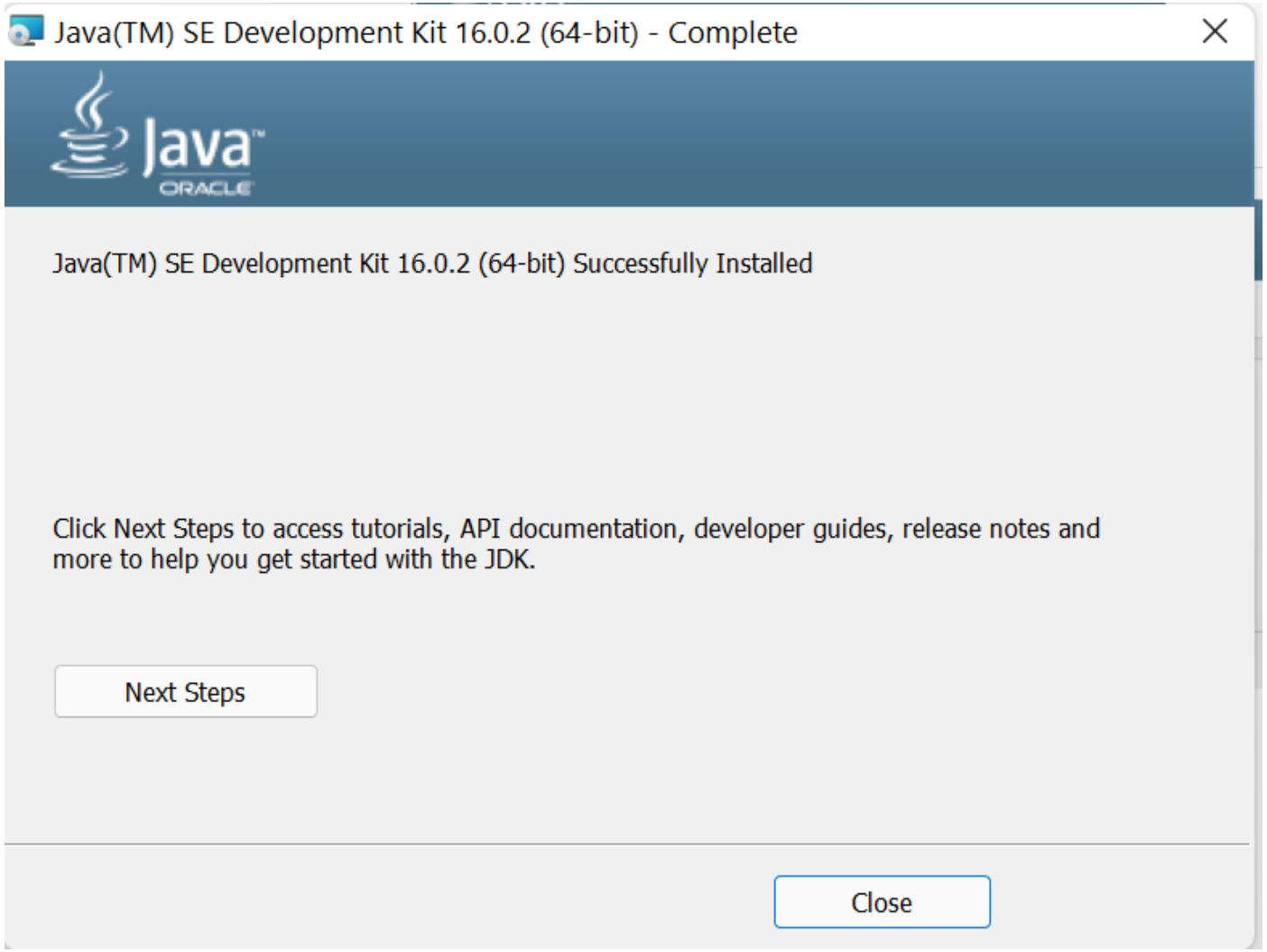


Step by Step guide to JDK 16.0.2 installation on windows OS+++++

Step 6

6. Click **Close**

Congs, you have successful installed JDK onto you computer



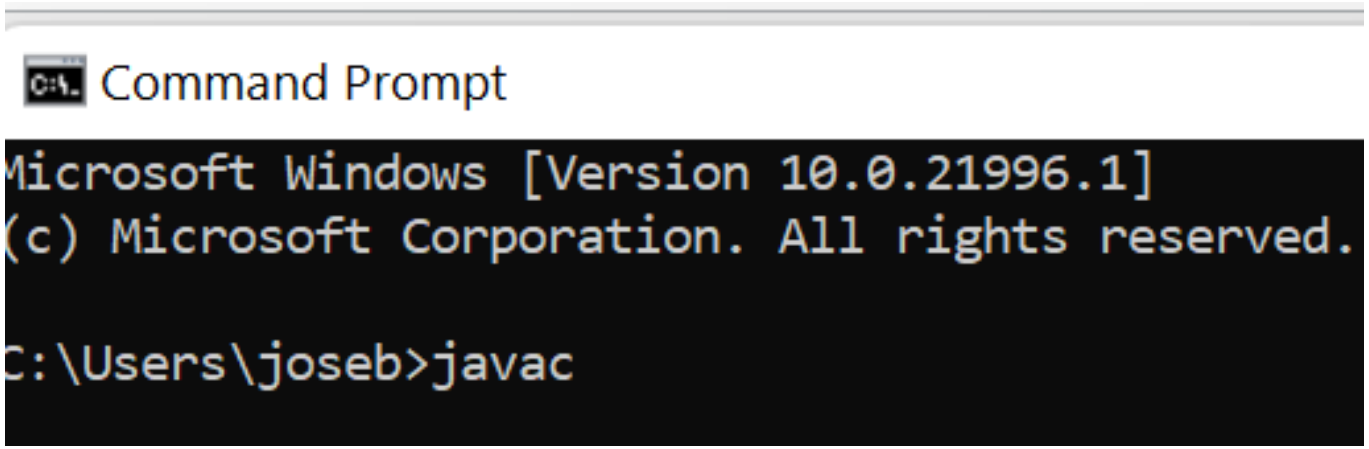
Setting up Java Environment

In most cases, JDK environment is not automatically setup with the installation of the JDK. We will therefore have to check if our machine now detect the presence of Java environment in out computer.

Lets check again.

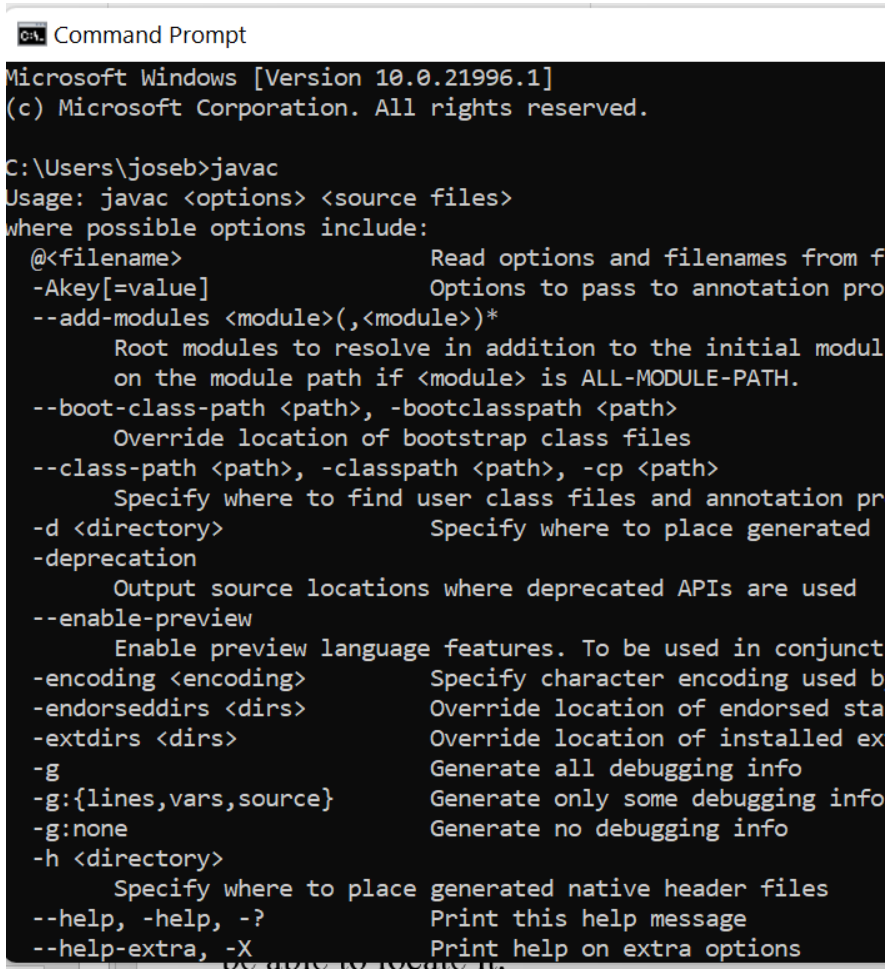
Open **cmd**

Type **javac** and press Enter Key



Java Environment is Set

If you can see the feedback on the following screen after pressing Enter Key then JDK is detected.



At this point you can even go ahead and install IDE. However, we still need to register the jdk path to the computer variable environment to be sure all software that will need java will be able to locate it.

Setting up java Environment

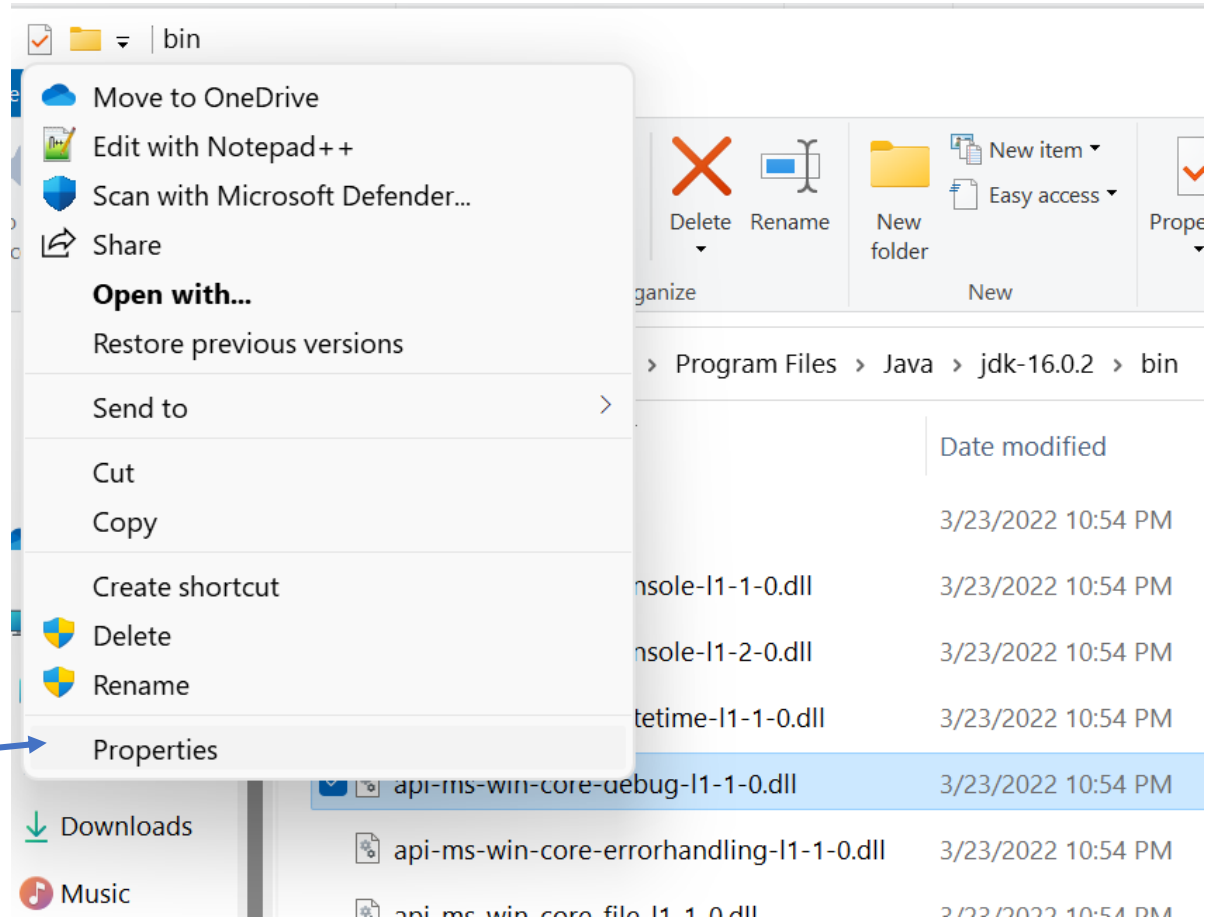
a) Now we need to copy the address of the java bin folder:

1. Getting the address of the bin folder of the Java installation

   i. Get the Location of the bin folder of you Java version installed, by (Opening e.g. C:\Program files\Java\jdk-16.0.2\bin)

   ii. Then right click on any file,

   iii. Click **Properties**

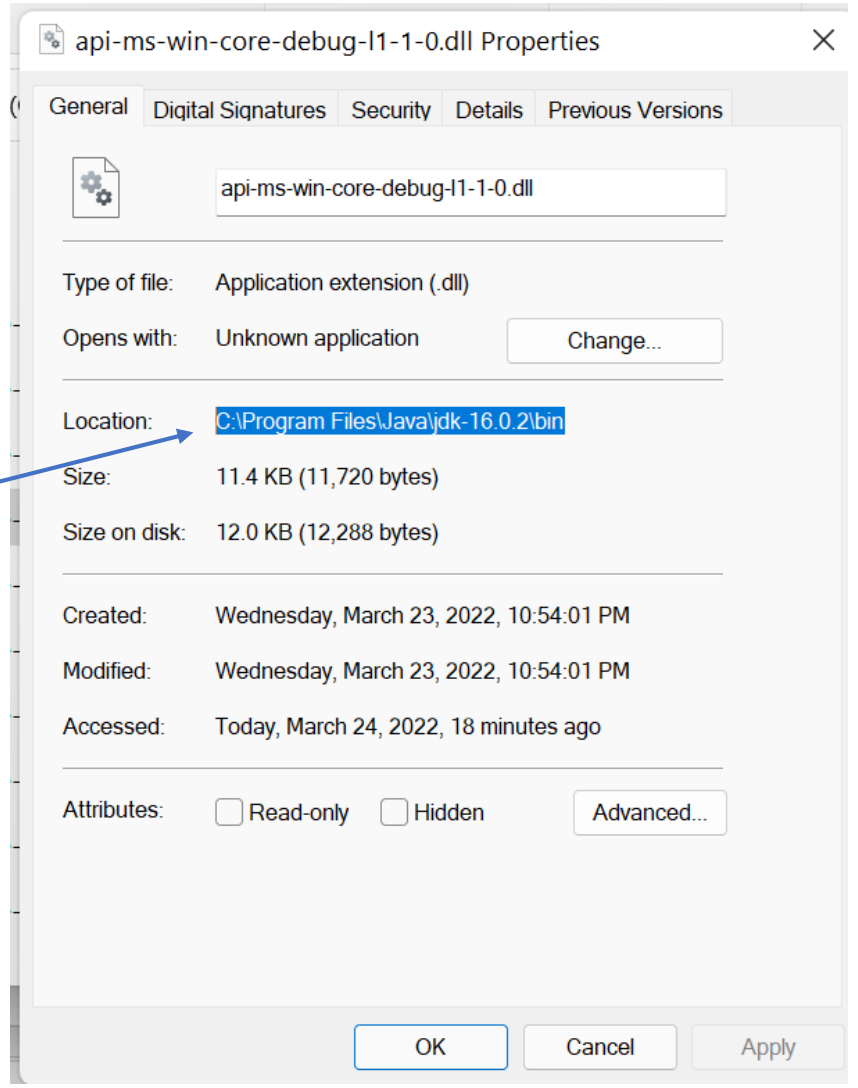


Setting up java Environment

a) Now we need to copy the address of the java bin folder:

1. Getting the address of the bin folder of the Java installation

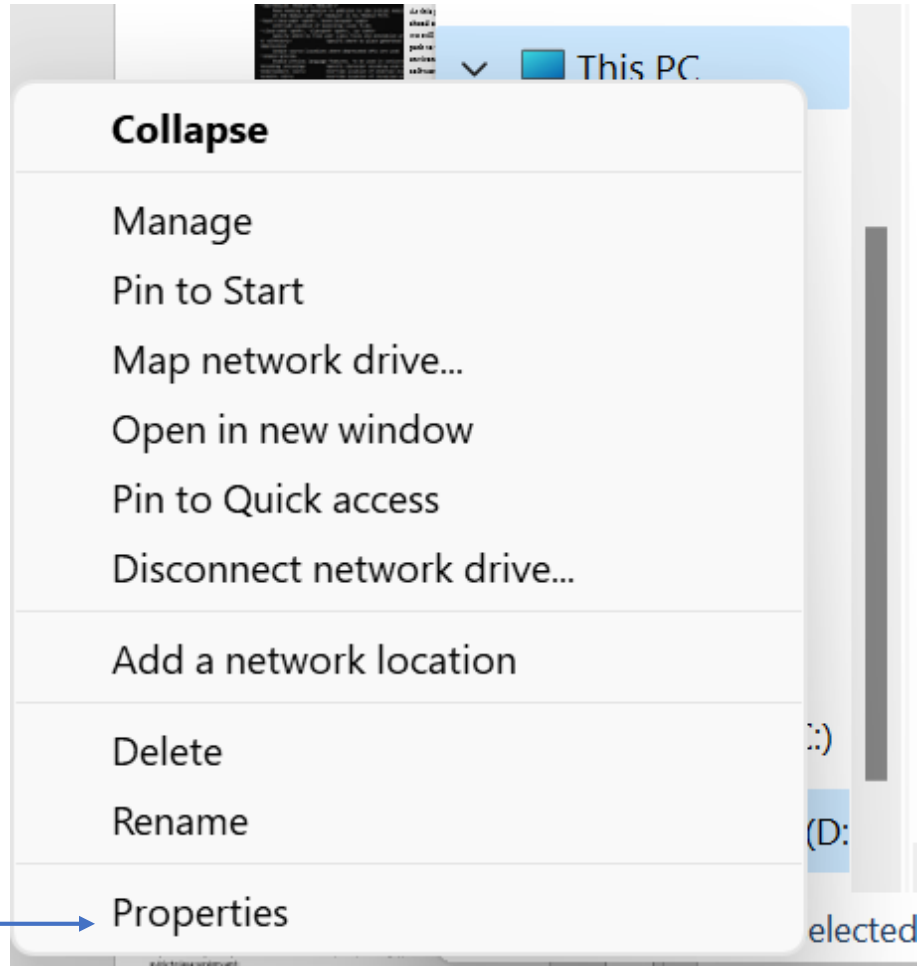
   vi. Highlight the **Location** address of the file and copy



Setting up java Environment

b) Now we need to paste the bin folder location to the computer environment Variable:

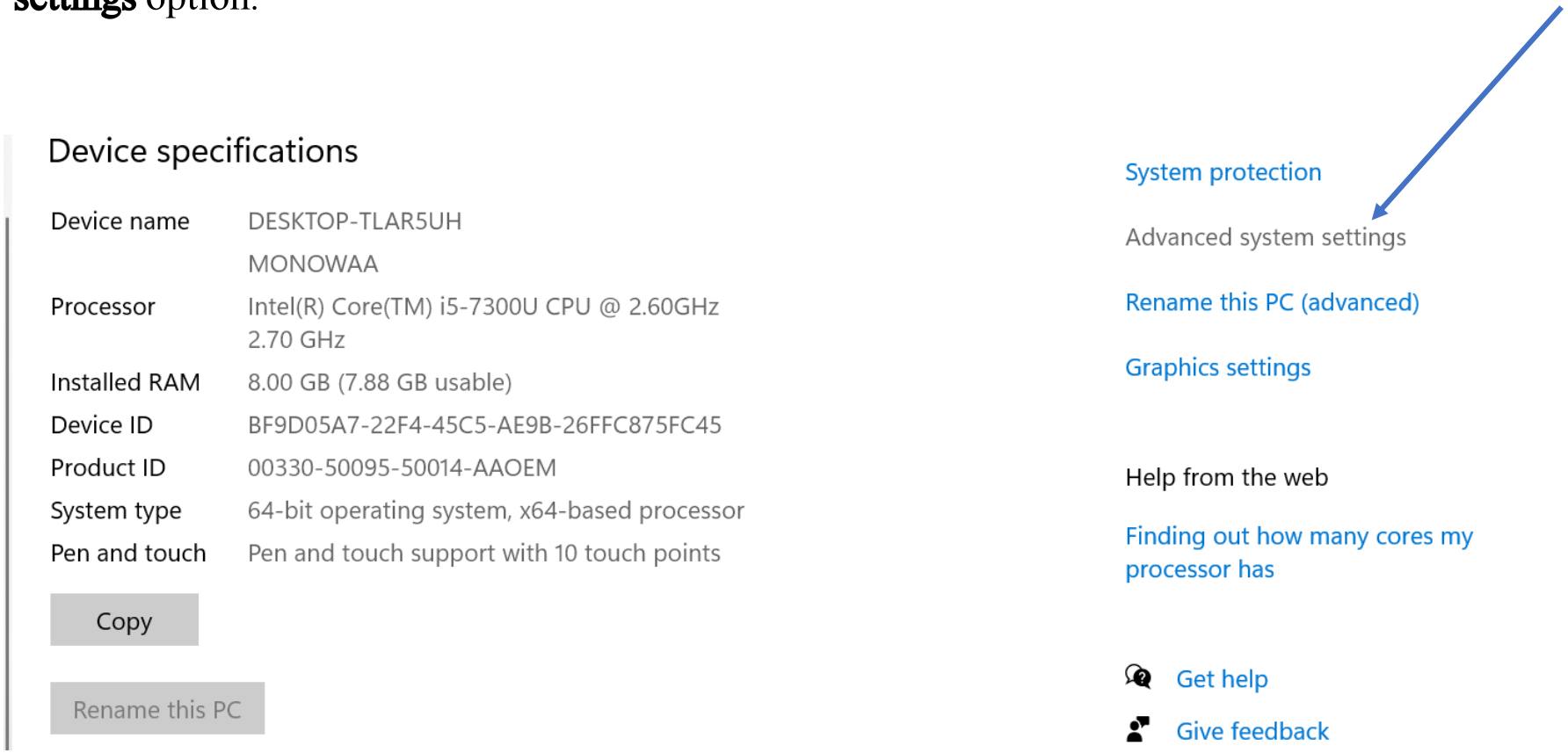
i. Right click on **My Computer** or **This PC**(in Windows 10+) and select the option **Properties**.



Setting up java Environment

b) Now we need to paste the bin folder location to the computer environment Variable:

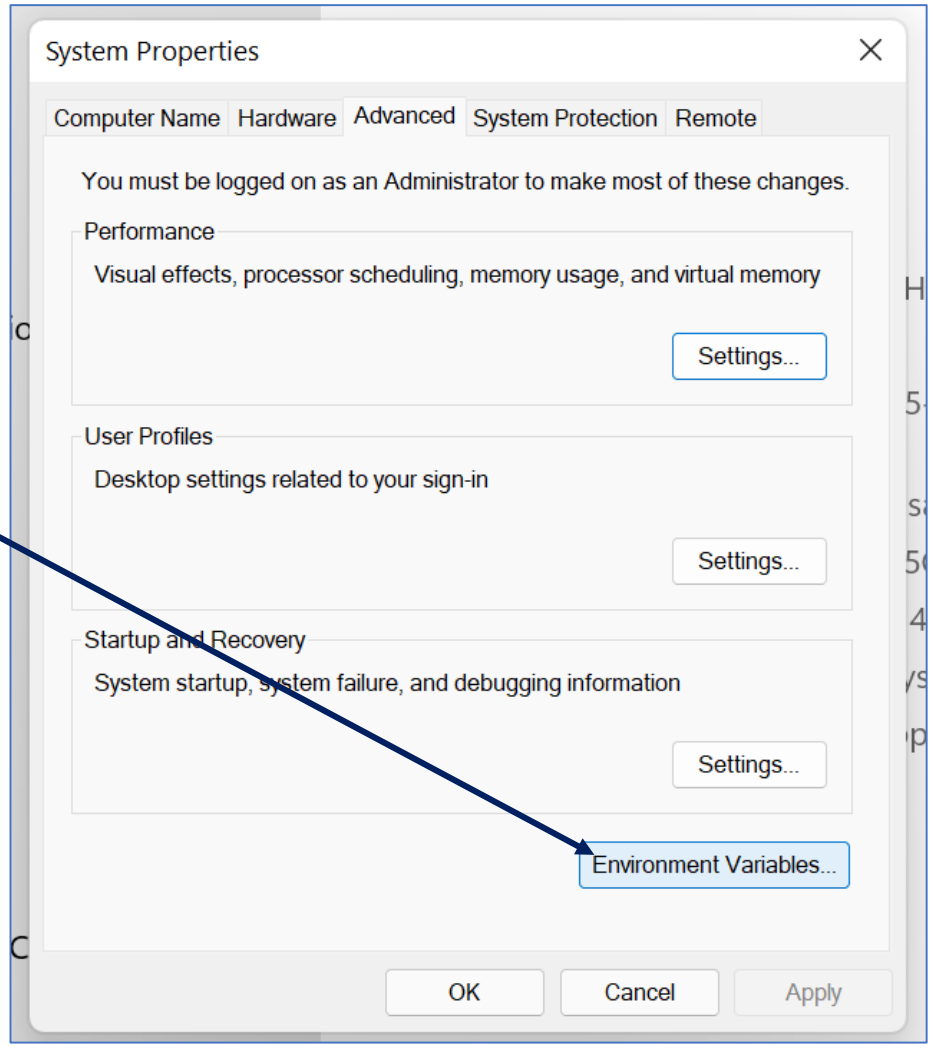
ii. A new window with System properties will open. From the right sidebar, click on the **Advanced system settings** option.



Setting up java Environment

b) Now we need to paste the bin folder location to the computer environment Variable:

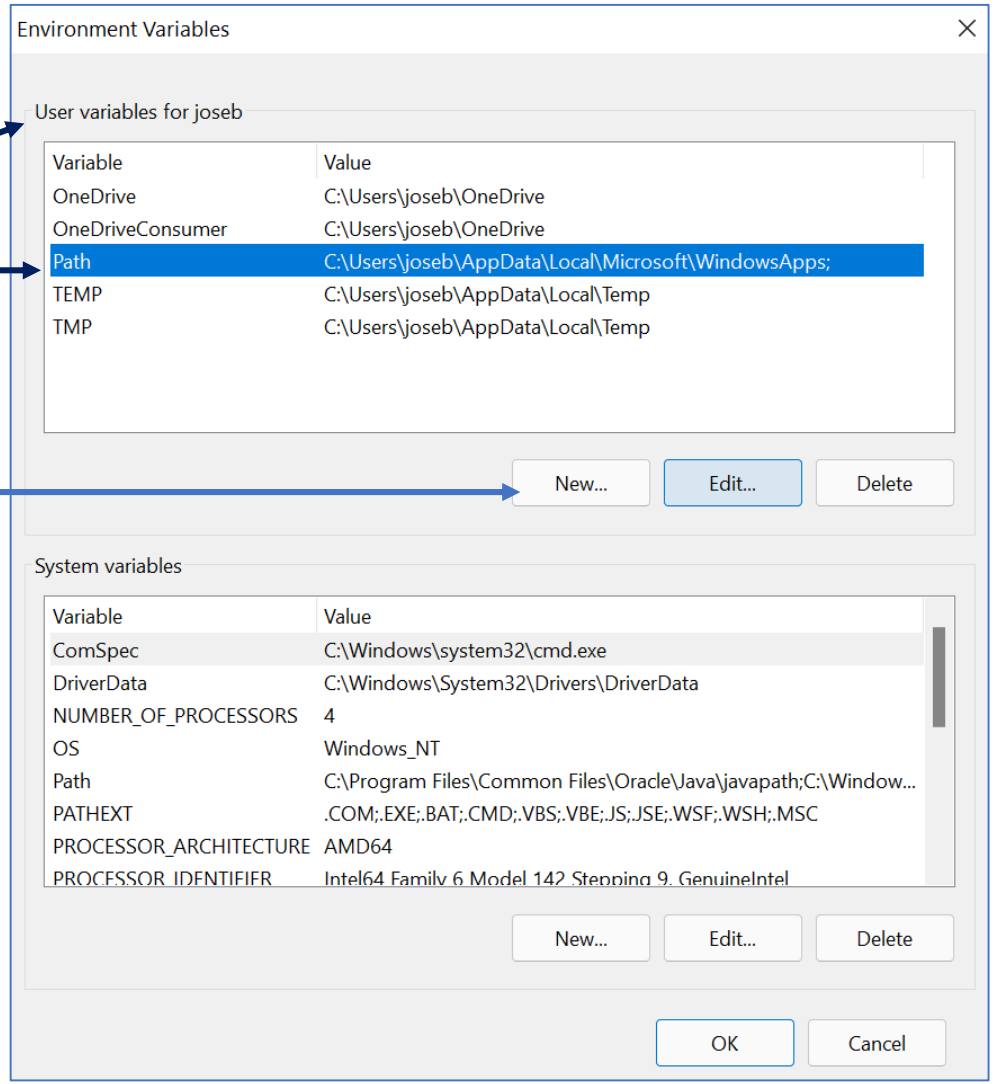
3. Then click on **Environment Variables** button on the bottom right corner.



Setting up java Environment

b) Now we need to paste the bin folder location to the computer environment Variable:

4. Under User variables for **your computer account username**, click on Path and click **Edit** button
5. **Or** click **New** if you donot see Path in the list of User variables



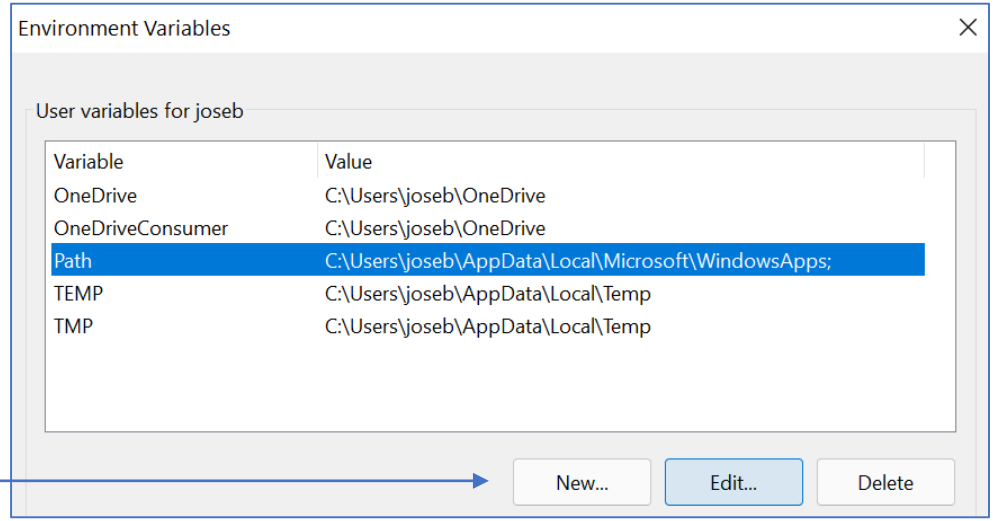
Setting up java Environment

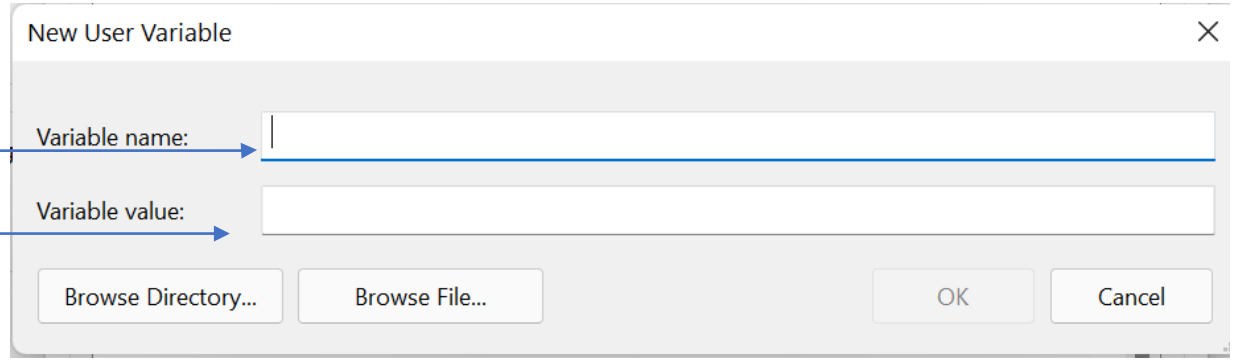
New Button Clicked under Environment variables

If You clicked **New** button User variables

i. Now enter *Variable name* as **Path**

ii. Paste the **bin** folder location address in the *Variable value* text box





Setting up java Environment

b) Now we need to paste the bin folder location to the computer environment Variable:

5. Pasting the address of the bin folder of the Java installation into the **Edit environment variable** path

i. After copying the bin folder-path or location address e.g. C:\Program Files\Java\jdk-16.0.2\bin that is if you installed JDK 16.0.2

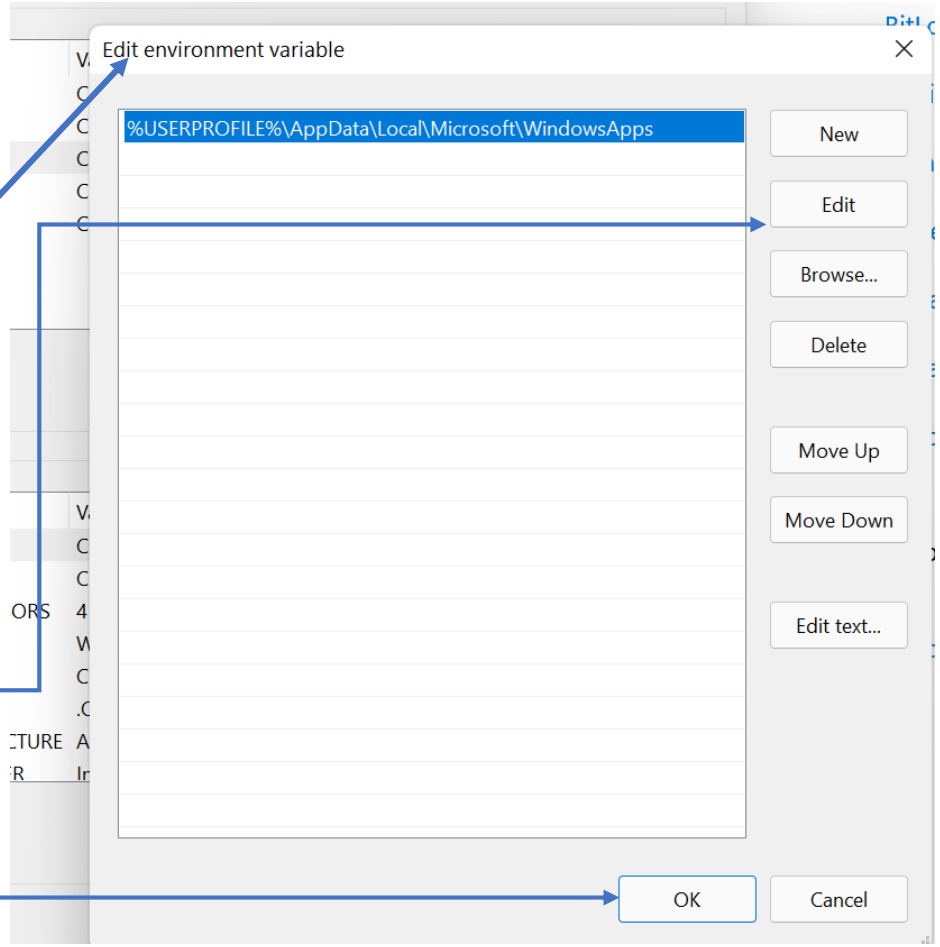
ii. Go back to the **Edit environment variable** window then click Edit button

iii. Click **Edit** button

iv. Paste the Address of your java bin folder into the Edit environment variable field

v. The click **OK**

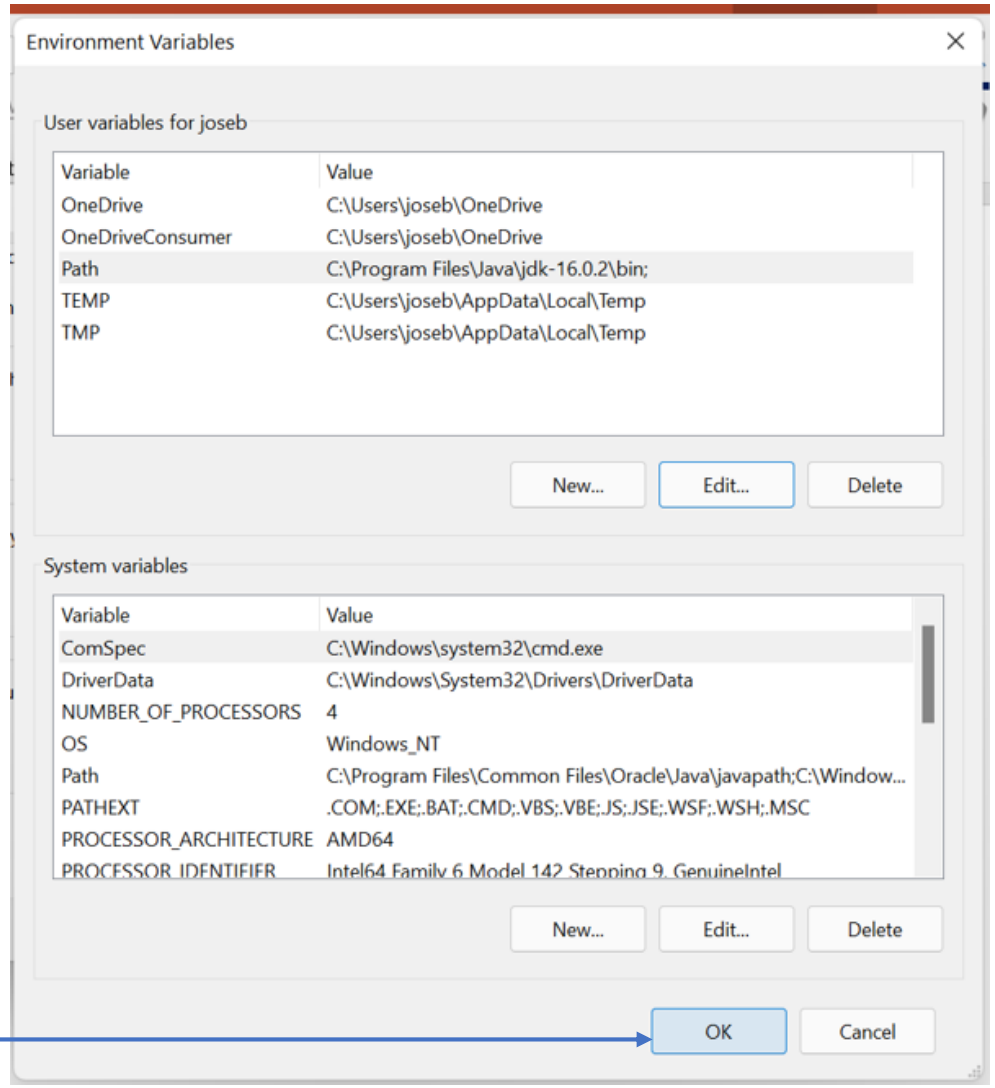
vi. Click OK on System **Properties window**



Setting up java Environment

c) Closing the **Edit environment variable** path

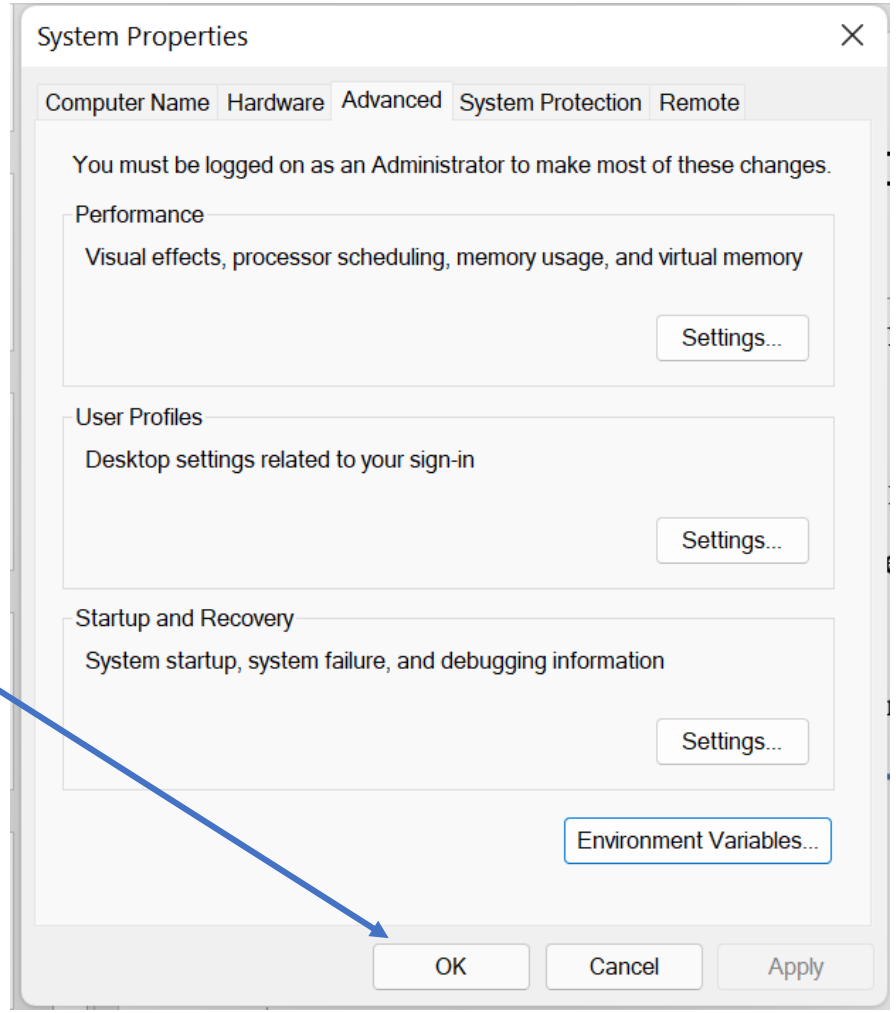
v. Click **OK** on Environment variable window



Setting up java Environment

7. Closing the **System Properties** window

   v. Click **OK** on System Properties window



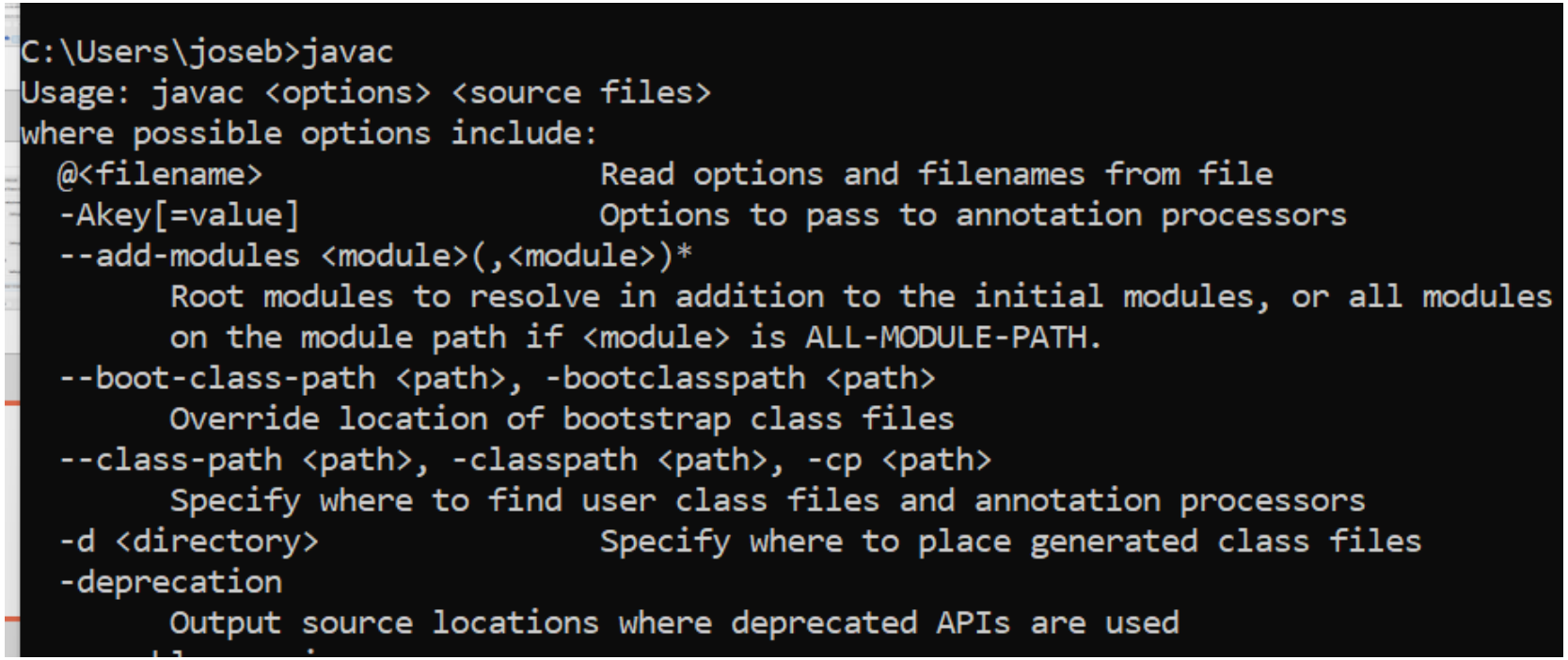
Check the Presence of Java in your PC again

Congs, you have successfully setup you java environment.

What Next?

First check again to see if javac is still detected

If you see the text below in you cmd then you are good to go.



Introduction to Java Virtual machine JVM

In this section we will cover what Java Virtual Machine - JVM, Java Runtime Environment and Java Development Kit- JDK is, in depth.

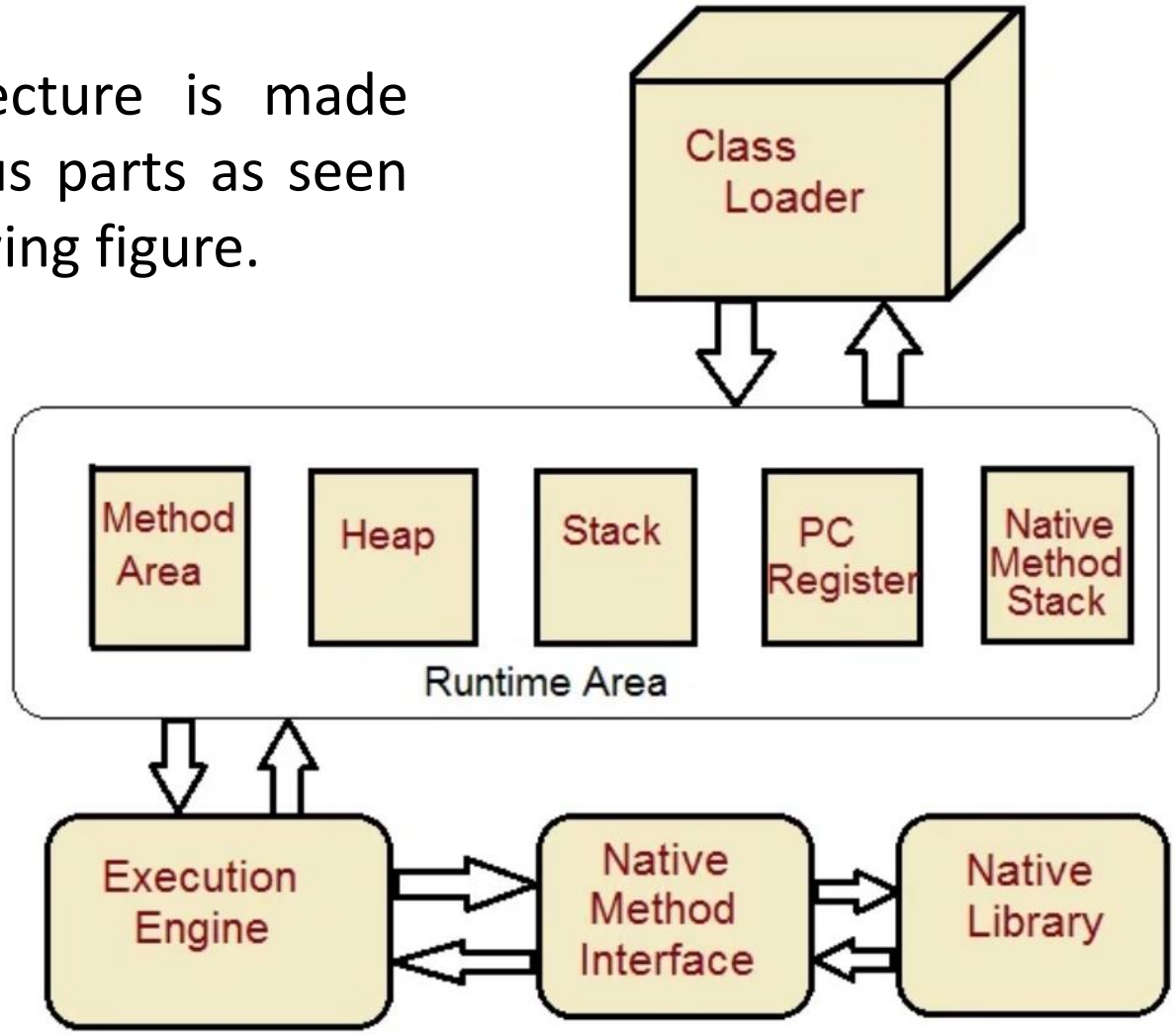
JVM is a virtual Machine that is provided by runtime environment to execute java bytecode.

The JVM doesn't understand Java typo, that's why you compile your *.java files to obtain *.class files that contain the bytecodes understandable by the JVM.

JVM control execution of every Java program. It enables features such as automated exception handling, Garbage-collected heap.

JVM Architecture

JVM architecture is made up of various parts as seen in the following figure.



JVM Architecture+

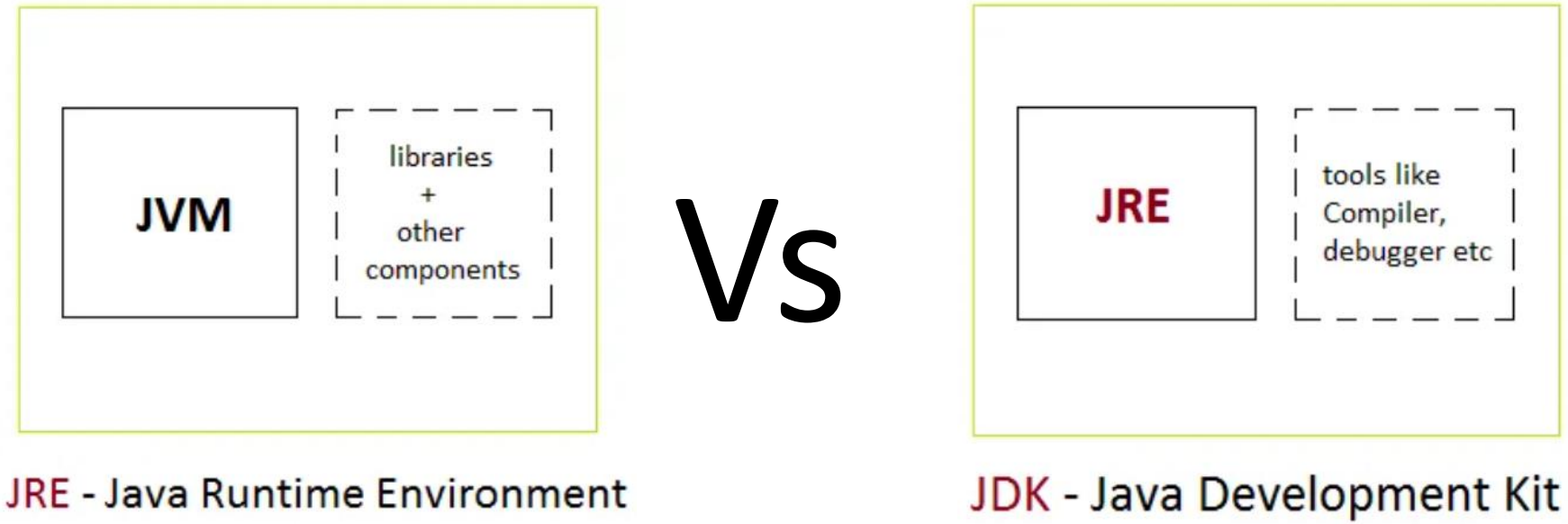
1. **Class Loader :** Class loader loads the Class for execution.
2. **Method area :** Stores pre-class structure as constant pool.
3. **Heap :** Heap is a memory area in which objects are allocated.
4. **Stack :** Local variables and partial results are stored here. Each thread has a private JVM stack created when the thread is created.
5. **Program register :** Program register holds the address of JVM instruction currently being executed.

JVM Architecture

6. **Native method stack :** It contains all native used in application.
7. **Execution Engine :** controls the execution of instructions contained in the methods of the classes.
8. **Native Method Interface :** Native method interface gives an interface between java code and native code during execution.
9. **Native Method Libraries :** Native Libraries consist of files required for the execution of native code.

Difference between JDK and JRE

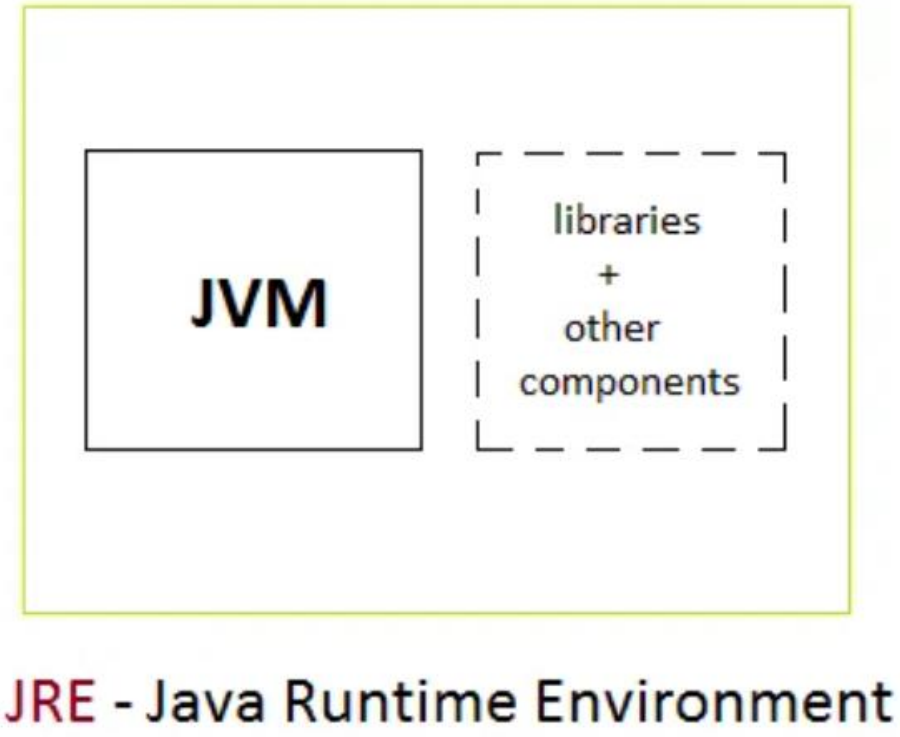
JRE is a subset of JDK while JDK is a Superset of JRE.



Java Runtime Environment

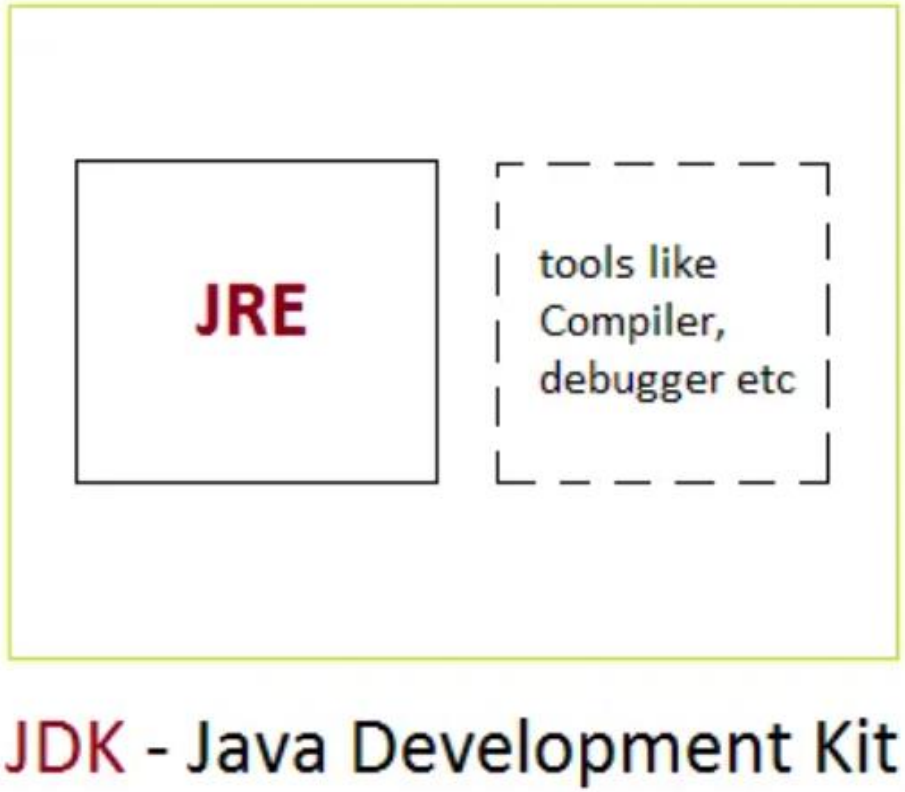
JRE provides the libraries such as:- the Java Virtual Machine, and other components to run applets and applications written in the Java programming language.

JRE does not contain tools and utilities such as compilers or debuggers for developing applets and applications.



JRE - Java Runtime Environment

Java Development Kit



The JDK is a superset of the JRE, and contains everything that is in the JRE, plus tools such as the compilers and debuggers necessary for developing applets and applications.

Integrated Development Environment IDE

According to Fezari, Mohamed & Al Dahoud, Ali. (2018). IDE stands for “Integrated Development Environment”. Which means it is mainly used for editing, compiling, debugging and general handling of program development code.

IDEs are applications that have all the tools necessary for the development of other applications. Designed to encompass all programming tasks in one application, one of the main benefits of an IDE is that they offer a central interface with all the tools a developer needs, including:

Common Components of an IDE

1. **Code editor:** Designed for writing and editing source code, these editors are distinguished from text editors because work to either simplify or enhance the process of writing and editing of code for developers
2. **Compiler:** Compilers transform source code that is written in a human readable/writable language in a form that computers can execute.
3. **Debugger:** Debuggers are used during testing and can help developers debug their application programs.
4. **Build automation tools:** These can help automate developer tasks that are more common to save time.

Other components of IDE

In addition to the above, some IDEs may also include:

1. **Class browser:** Used to study and reference properties of an object-oriented class hierarchy.
2. **Object browser:** Used to inspect objects instantiated in a running application program.
3. **Class hierarchy diagram:** Allows developers to visualize the structure of object-oriented programming code.

The IDE may be a stand-alone application, though it might also be included as part of one or more compatible applications.

History of IDEs

Prior to IDEs, programmers wrote their programs in text editors. This involved writing and saving an application in the text editor before running run the compiler, taking note of any error messages, and then going back to the text editor to revise their code.

It wasn't until 1983 that Borland Ltd. acquired a Pascal compiler and published it as TurboPascal, featuring an integrated editor and compiler for the very first time.

TurboPascal may have launched the idea of an integrated development environment, but many believe Microsoft's Visual Basic (VB), which was launched in 1991, was actually the first real IDE in history.

Built in the older BASIC language, Visual Basic was a popular programming language through the 1980s. The rise of Visual Basic meant that programming could instead be thought of in graphical terms, and noteworthy productivity benefits became apparent.

The Benefits of Using IDEs

Integrated development environments work to **improve developer productivity**. These IDEs improve productivity by **lessening setup time**, boosting the speed of development tasks, keeping developers up to date with the latest best practices and threats, and standardizing the development process so that everyone can get on board.

1. **Faster setup:** Programmers need to spend time configuring multiple development tools without an IDE interface in place. By integrating an IDE, programmers can have the same set of capabilities in one place without needing to constantly switch tools.
2. **Faster development tasks:** Tighter integration of development tasks means boosted developer productivity. For example, developers can parse code and check syntax while editing, which allows for instant feedback as syntax errors are introduced. Programmers no longer need to switch between apps to finish tasks.

The Benefits of Using IDEs+

3. **Continual learning:** Another benefit is the ability to stay up to date and educated. As an example, an IDE's help topics are constantly updated, along with new samples, project templates, and more. Developers who learn constantly and stay current on best practices are more likely to add value to their team and to the enterprise, boosting productivity.
4. **Standardization:** It also regulates the development process, helping programmers work together seamlessly and assisting new hires with getting up to speed so they can hit the ground running.

Languages That Are Supported by IDE

In some cases, IDEs are dedicated to a certain programming language or to a set of languages, which creates a feature set that aligns with the specifics of that language.

For example, Xcode for the Objective-C and Swift languages, Cocoa and Cocoa Touch APIs.

Multi-Language IDE

The multi-language IDEs – like Eclipse, Aptana, Komodo, NetBeans, and Geany – support multiple programming languages.

Multi-Language IDE

1. **Eclipse:** Supports C, C++, Perl, Python, Ruby, PHP, Java and others. It is a free and open source editor for many development frameworks. Although it began as a Java development environment, it has expanded through plugins.
2. **NetBeans:** Supports Java, PHP, JavaScript, C, C++, Python, Ruby, and more. It is also free and open source. Modules provide all functions of the IDE.
3. **Komodo IDE:** Supports Perl, PHP, Python, Tcl, JavaScript, Ruby, and more. This is an enterprise-level tool with a higher price point.
4. **Aptana:** Supports HTML, JavaScript, CSS, AJAX and others through plugins. It is a popular choice for programmers who do web app development.
5. **Geany:** Supports C, PHP, Java, HTML, Perl, Python, Pascal and many more. This is a very customizable environment with a big set of plugins.

Question

Find out other IDEs specifically designed for:-

1. Apple
2. Microsoft
3. Mobile phone development

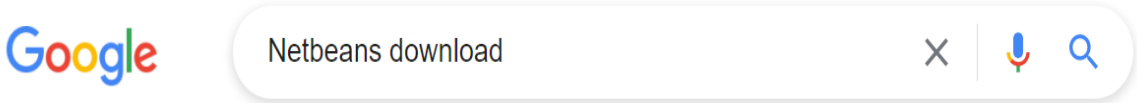
IDE of Choice

Of all the above IDEs, we shall be dealing with NetBeans and Eclipse in this course.

Where to find right IDE-NetBeans

Before start the process of installing NetBeans, we need to download it.

Lets do this by visiting google and typing “NetBeans Download”



Or just click Download NetBeans 13

Press Enter Key

You will see options but download the latest version e.g. NetBeans 13 or latest version. NetBeans 13 was released on 4th March 2022.

Start the installation

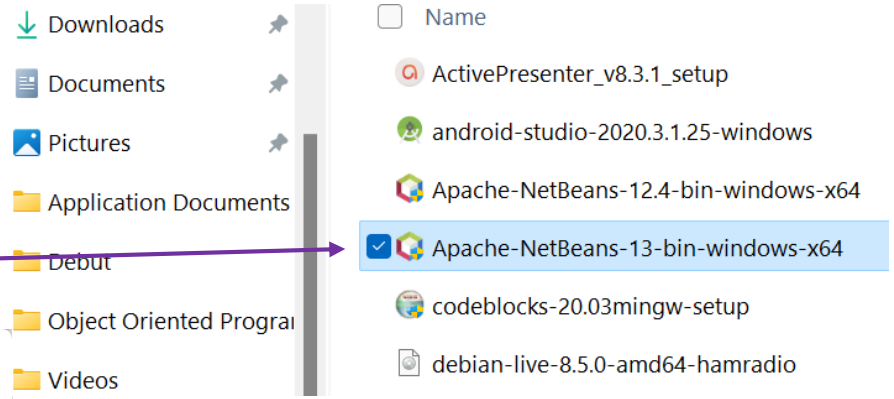
After successful download, Kindly open the file you downloaded and follow the prompts until you are done.

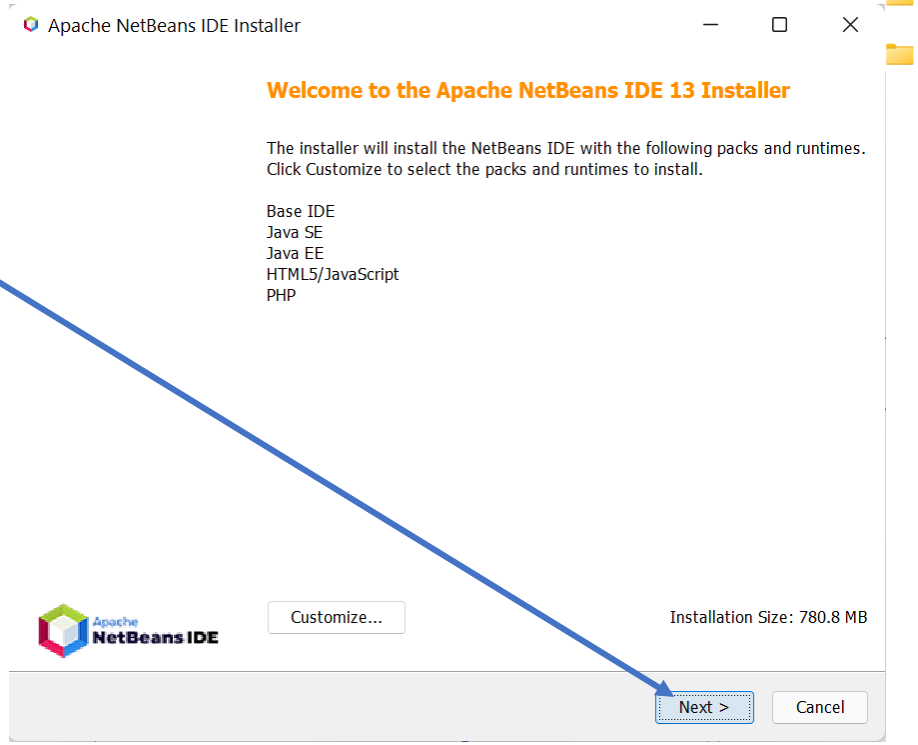
Note! Make sure you know where your downloaded file is.

Installation of NetBeans IDE

After downloading NetBeans, please go ahead and open it from the folder you download it to.

1. By double clicking it
2. Click Yes
3. Click Next



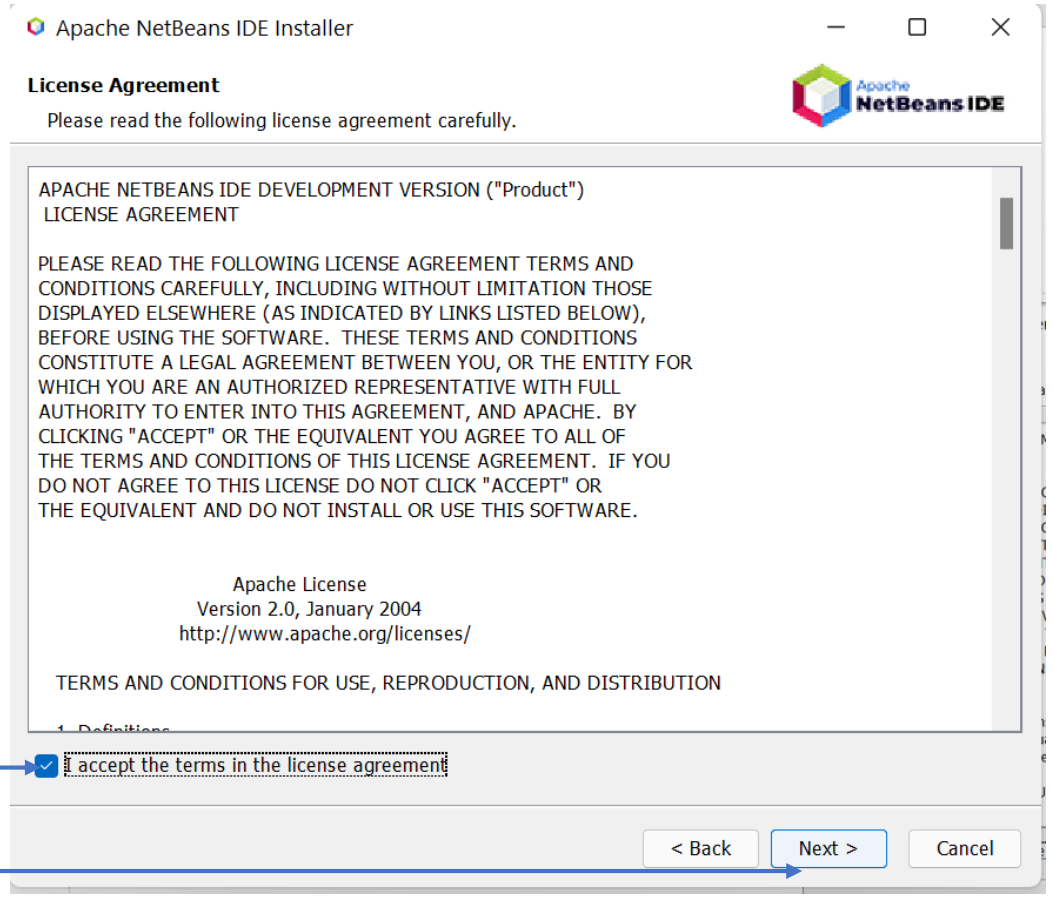


Installation of NetBeans IDE+

3. Check the “I accept the terms in the license agreement ”

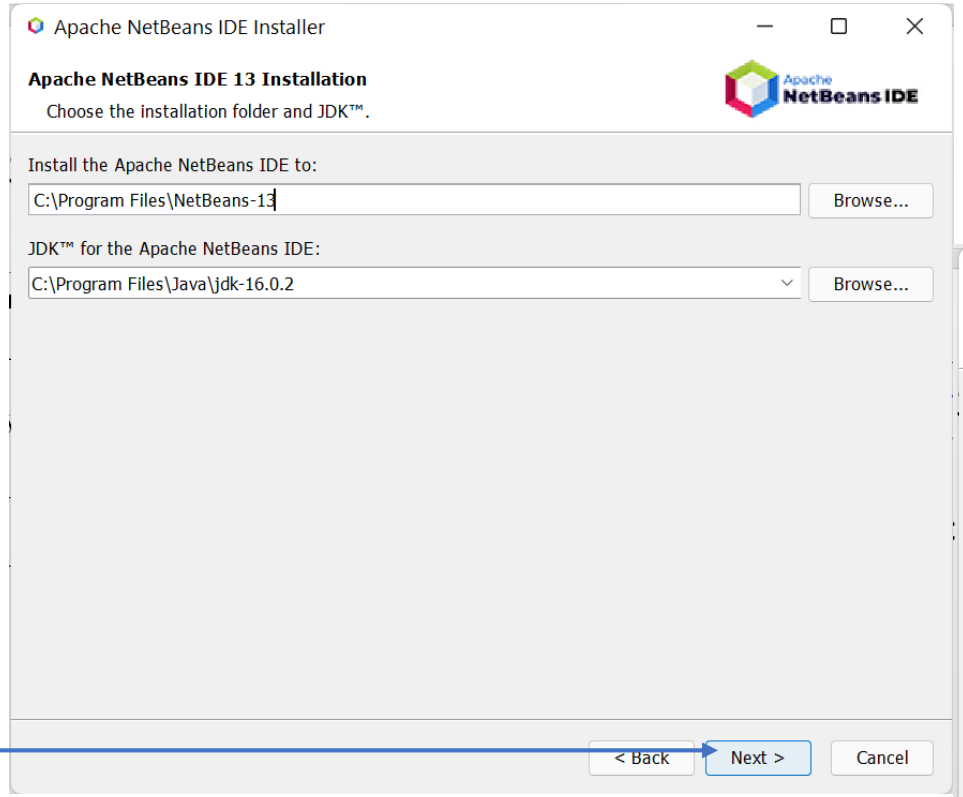
Check box

Click Next

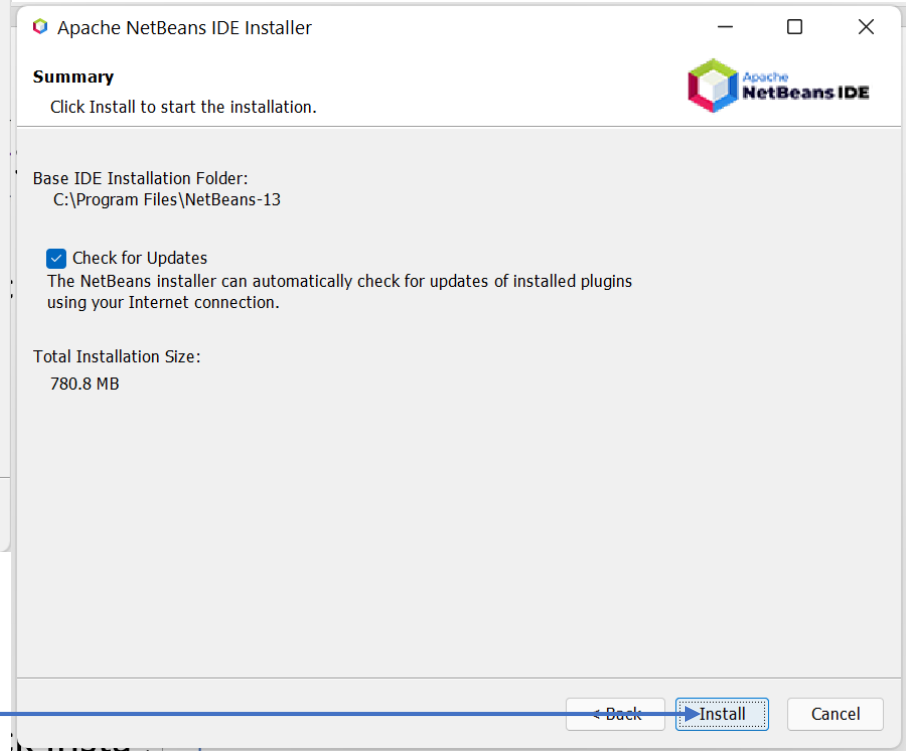


Installation of NetBeans IDE++

4. Click Next

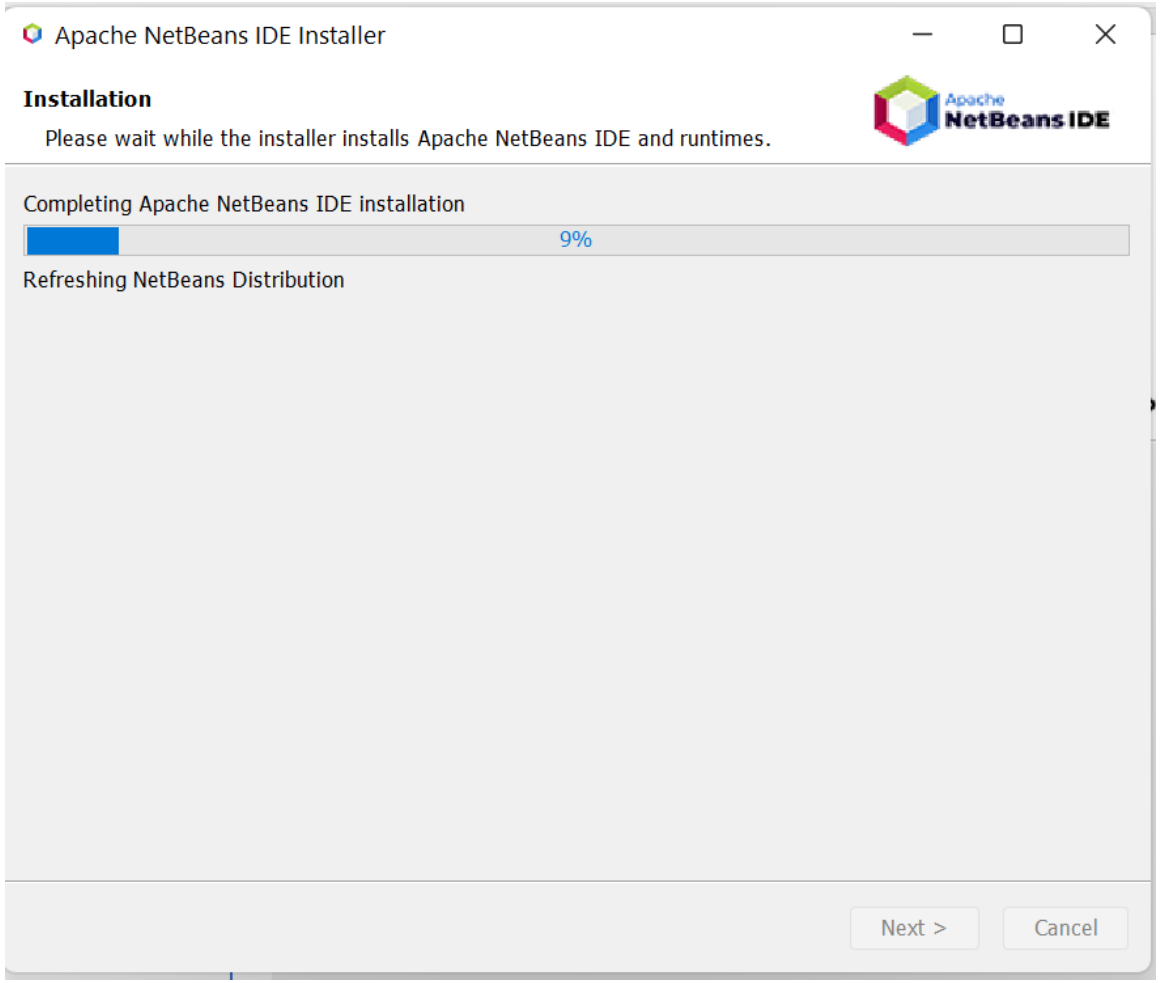


5. Click Install



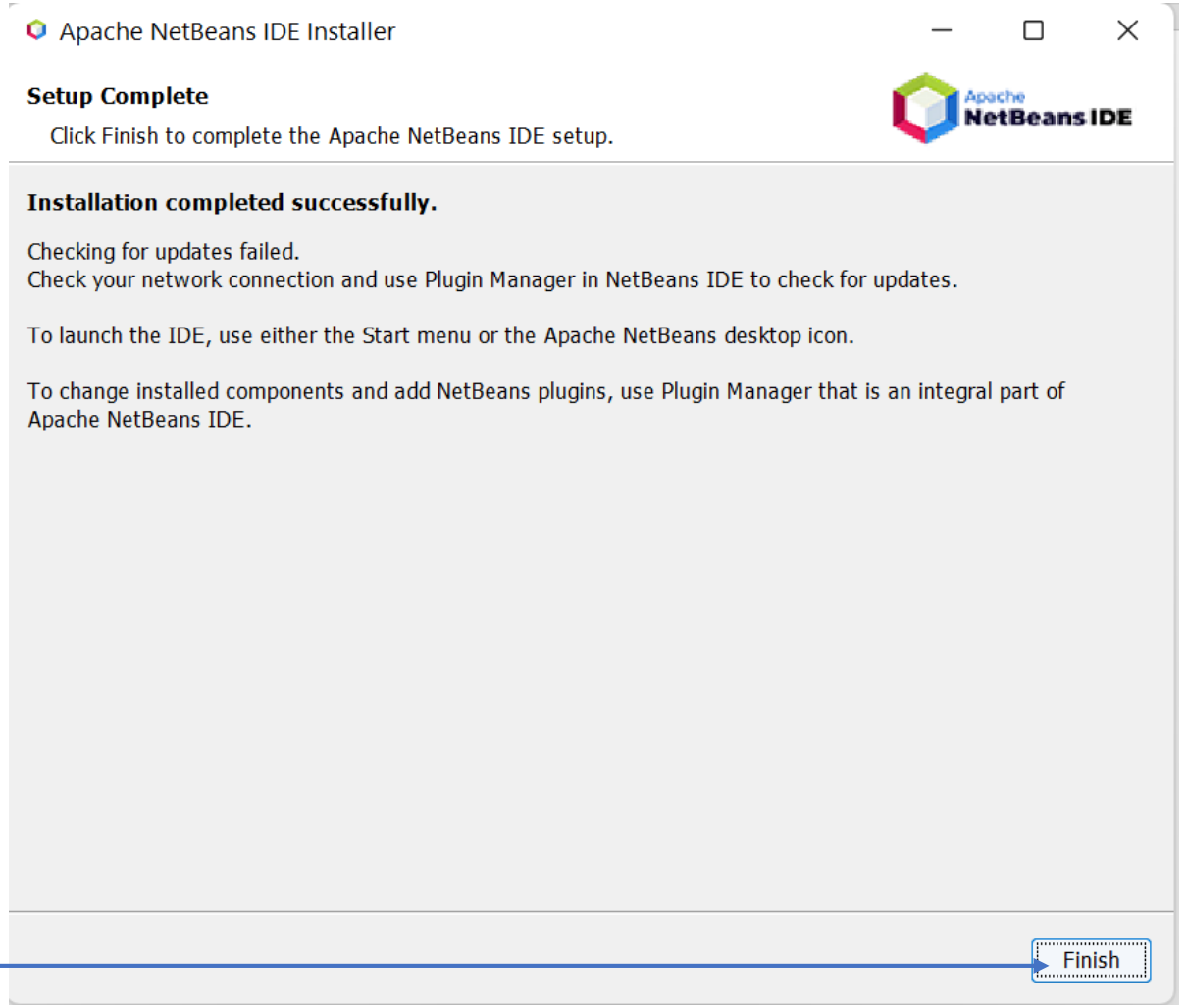
Installation of NetBeans IDE++

Wait until the installation process is done



Installation of NetBeans IDE+++

Click Finish

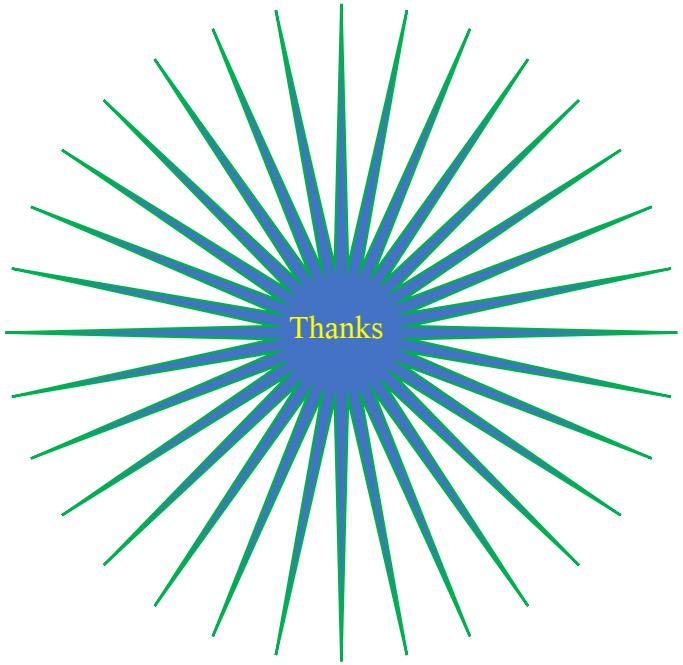


Summary

1. Setting Java Environment, Introduction to JVM, JRE and JDK. We looked at the difference between , JRE and JVM Architecture etc.

2. Overview and Installation java IDEs: History and benefits of IDEs, components of IDEs, types of IDEs and installation of NetBeans IDE

Thank you for Listening



Reference

Java JVM, JDK and Jre. Studytonight.com. (n.d.). Retrieved March 24, 2022, from https://www.studytonight.com/java/component-of-java.php

Fezari, Mohamed & Al Dahoud, Ali. (2018). Integrated Development Environment "IDE" For Arduino. *Java introduction*. Studytonight.com. (n.d.). Retrieved March 22, 2022, from https://www.studytonight.com/java/overview-of-java.php

What is IDE or Integrated Development Environments? Veracode. (n.d.). Retrieved March 24, 2022, from https://www.veracode.com/security/integrated-development-environment

JDK 17. (n.d.). Retrieved March 22, 2022, from https://openjdk.java.net/projects/jdk/17/