

Programming in Android



Session: 1

Introduction to Android

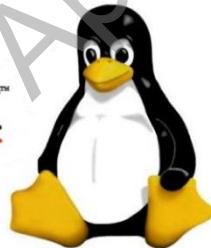
Objectives

- ◆ Explain Android
- ◆ Explain the history of Android
- ◆ Describe the architectural framework of Android
- ◆ Explain the downloading and installation process of Android SDK and IDEs



Introduction

- ◆ An Operating System is a software program that enables communication and utilization of the hardware resources by the software programs
- ◆ Each OS can be broadly divided into:
 - ◆ Application Layer
 - ◆ Kernel Layer
 - ◆ Hardware and device driver layers
- ◆ Kernel translates requests from one layer to another
- ◆ Android is a Mobile Operating System
- ◆ Mobile market is dominated by Android and iOS
- ◆ Applications are OS specific



Introduction to Android 1-5

◆ What is Android?

- ❖ A Mobile OS running on the Linux Kernel
- ❖ Android applications are written in Java
- ❖ Applications run on a virtual machine
- ❖ Dalvik VM was used until Android Kitkat
- ❖ Lollipop introduces Android Run Time (ART)

◆ History of Android

- ❖ Android 1.0 released in 2008
- ❖ Latest version is Android Lollipop released in November 20, 2014
- ❖ Several improvements made over years
- ❖ User base has grown exponentially



◆ Features of Android

- ❖ Ease of Programming
- ❖ 2D and 3D Graphics and Animation
- ❖ Multiple Languages
- ❖ Web Browsers
- ❖ Multi Touch
- ❖ Connectivity
- ❖ Media Processing
- ❖ Sensor Support
- ❖ Storage Capabilities
- ❖ Large Market Share
- ❖ Abstraction of Hardware Differences
- ❖ Open Source
- ❖ Free to Use
- ❖ Ease of Use
- ❖ Google Now



◆ New Features in Android Lollipop

- ❖ Improved Notification System
- ❖ Optimized Battery consumption
- ❖ OpenGL ES 3.1
- ❖ New Virtual Machine – ART
- ❖ UI Overhaul
- ❖ ‘Google Now’ became a full fledged personal assistant



- ◆ **Device types running Android**

- ◆ Smartphones
- ◆ Tablets
- ◆ Televisions
- ◆ Cars and In Vehicle Entertainment
- ◆ Android Wear Devices
- ◆ Google Glass

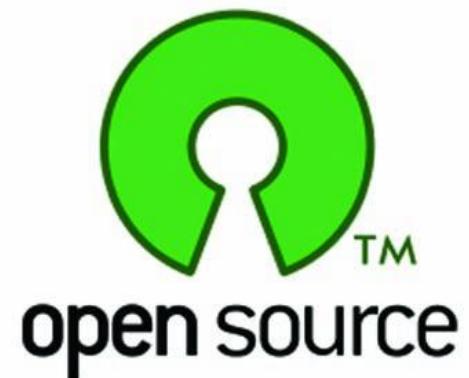


- ◆ **Challenges to Developing for Android**

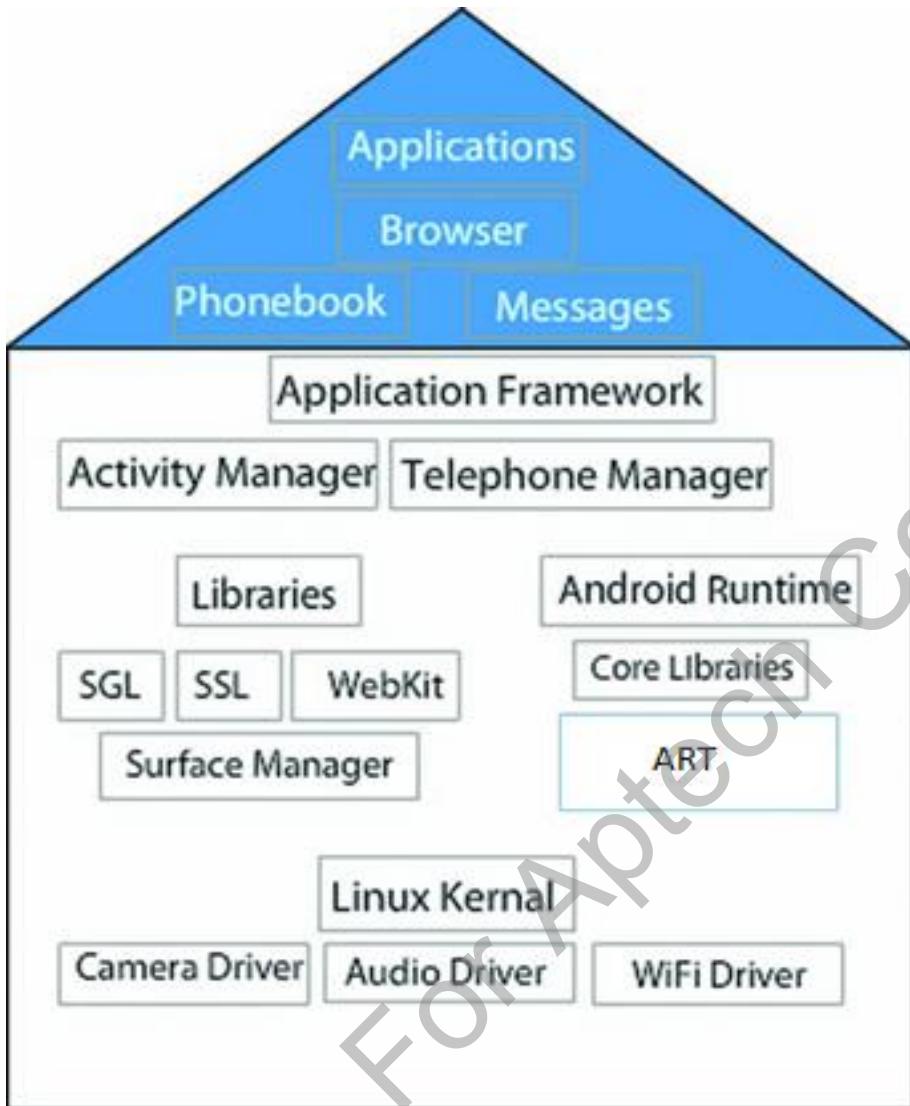
- ◆ Hardware Fragmentation
- ◆ Software Fragmentation
- ◆ Lack of Hardware Software Integration Standards
- ◆ Lack of Quality Control on Android devices

- ◆ **Android and Open Source platform**

- ◆ Android is developed privately by Google
- ◆ Later, source code is made available to everyone
- ◆ Anyone can make changes
- ◆ Huge community of mod'ers and developers
- ◆ Custom ROMs available to most devices



Android Architecture 1-2



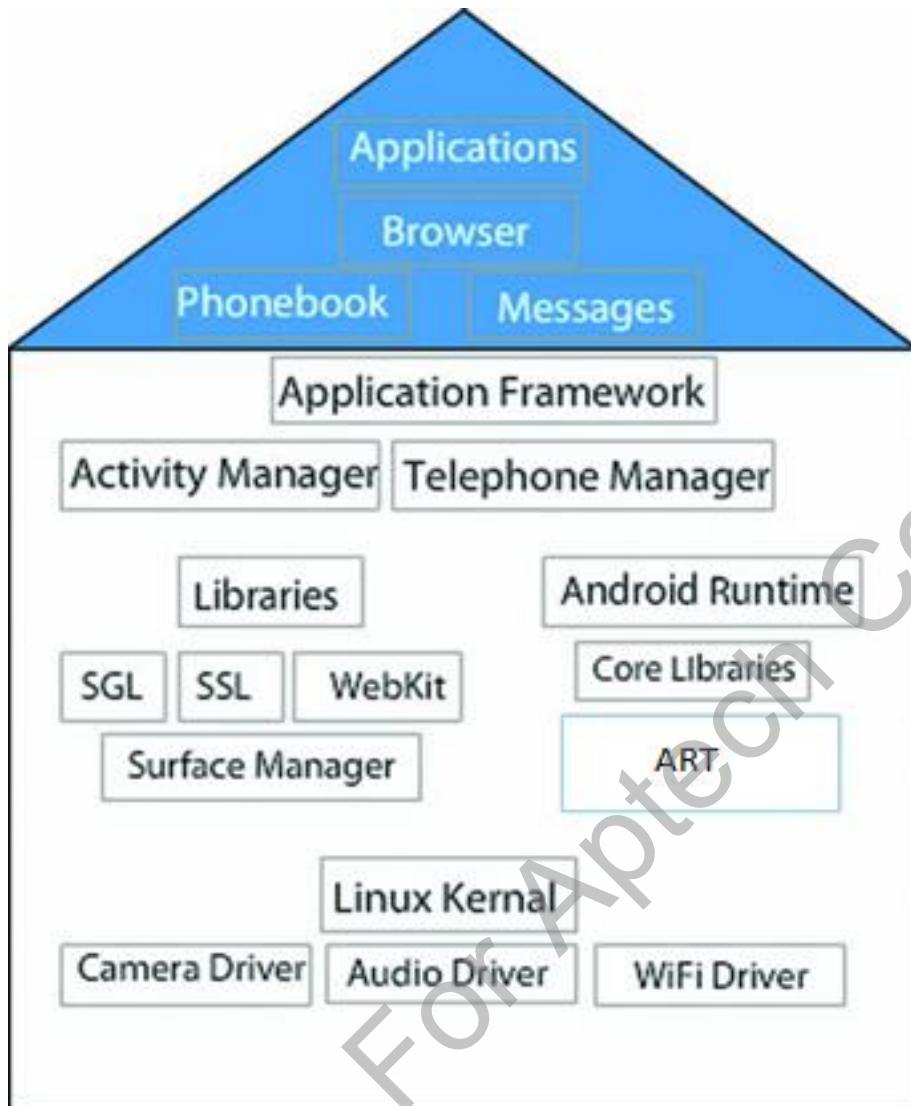
◆ Linux Kernel

- ❖ Base layer
- ❖ Communicates with the hardware
- ❖ Responsible for managing the connected devices
- ❖ Interacts with Libraries layer

◆ Libraries

- ❖ Consists of the libraries
- ❖ Surface Manager
- ❖ OpenGL
- ❖ Media Framework
- ❖ Webkit
- ❖ FreeType
- ❖ SSL
- ❖ SQLite

Android Architecture 2-2



Android Runtime

- ❖ Part of library layer
- ❖ ART is similar to JVM
- ❖ ART replaces Dalvik VM
- ❖ ART replaces JIT with AoT
- ❖ Applications are run in Native code
- ❖ .odex files replaced with ELF files

Application Framework

- ❖ It manages the applications for the basic functioning of the device
- ❖ Consists of Activity Manager, Package Manager, and so on
- ❖ This layer interacts with the Applications layer

Application Layer

- ❖ Consists of applications
- ❖ Includes default and user installed applications
- ❖ The layer interacts with other layers

Dalvik VM vs. ART

- Dalvik was the VM used earlier for running applications
- ART replaces Dalvik in Android Lollipop

Dalvik VM

- Just in time compilation
- Serves as an alternative to JVM
- Relatively high memory consumption
- Applications run in Byte code

ART

- Replaces Dalvik VM
- Ahead of Time (AoT) compilation
- Improved performance
- Reduced memory usage
- Improved garbage collection

Google Play Platform

- ◆ It was originally called Android Market
- ◆ Play Store is the official market place for Android Applications
- ◆ It comes pre-installed in almost all Android Devices
- ◆ Primary source for installing applications
- ◆ Millions of customers
- ◆ Available in 135 countries
- ◆ Music, Videos, Movies, and Books are also purchasable



Android Software Development Kit (SDK) 1-3

- ◆ A SDK is a package that consists of all the tools required for developing applications
- ◆ Android SDK comes with:
 - ❖ Documentation
 - ❖ Libraries
 - ❖ Sample Code
 - ❖ Emulator
 - ❖ Guides
 - ❖ Android Studio IDE (Bundle Only)
- ◆ Android Studio is Google's official IDE for developing Android Applications
- ◆ Eclipse can also be used as an IDE for Android development



Android Software Development Kit (SDK) 2-3

- The software requirements to install and use the Android SDK are given in the following table:

Requirement	Description
Operating System	<ul style="list-style-type: none">Windows 2003 (32-bit), Windows XP (32-bit), Vista (32- or 64-bit) or Windows 7 (32- or 64-bit).Mac OS X 10.5.8 or later (x86 only).Linux.
Development Environment	<ul style="list-style-type: none">Optional if using Android Studio:<ul style="list-style-type: none">✓ Eclipse 4.0 (Juno) or higher.✓ Eclipse Java Development Tools (JDT) plug-in.<ul style="list-style-type: none">❖ Eclipse IDE.❖ ADT plug-in. <p>Mandatory:</p> <p>JDK 7 or higher - Java Runtime Environment (JRE) alone is not sufficient.</p>

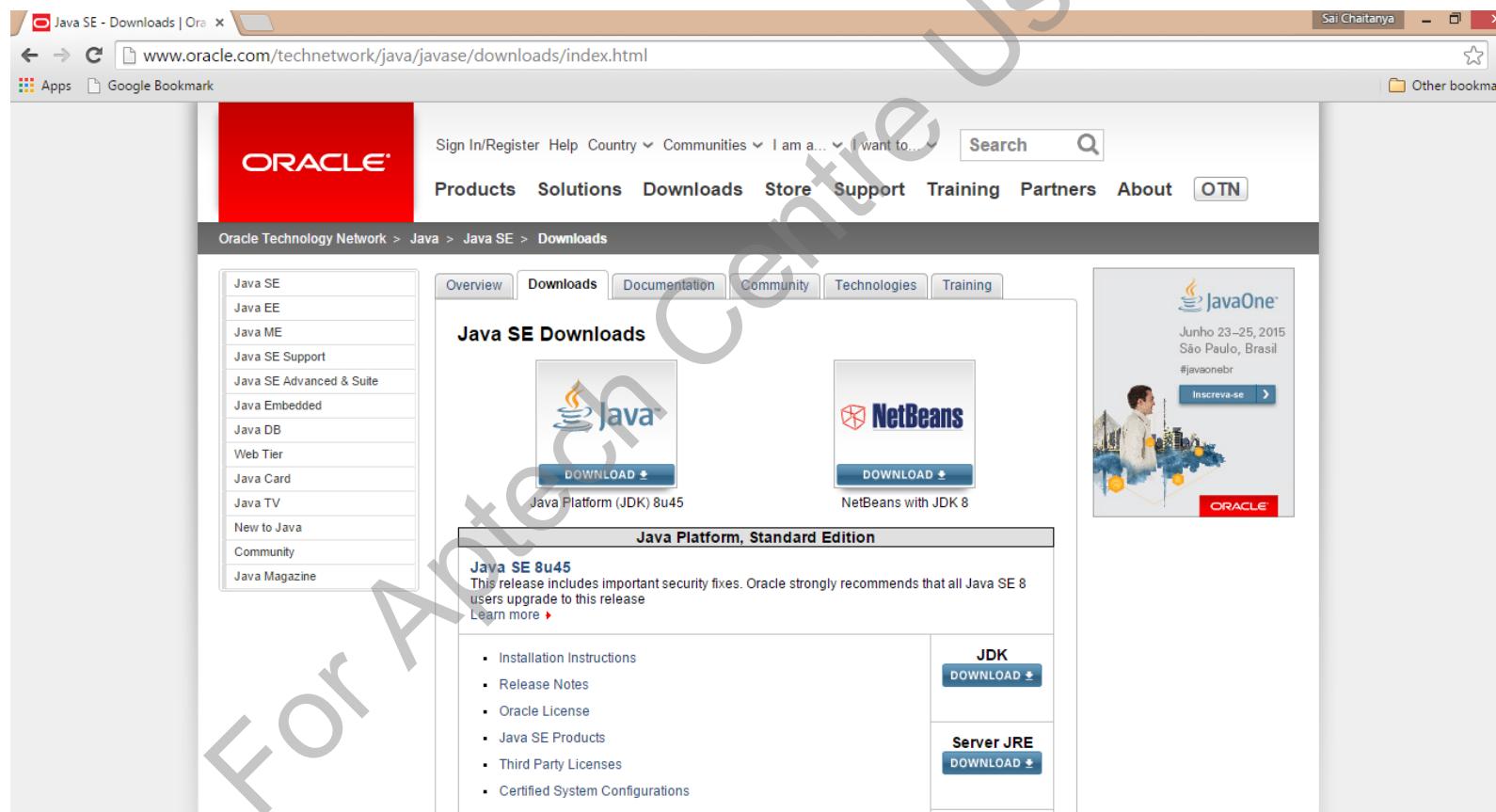
Android Software Development Kit (SDK) 3-3

- The hardware requirements to install and use the Android SDK are shown in the following table:

Requirement	Description
Hardware Requirements	<ul style="list-style-type: none">Minimum 2 Gigabyte (GB) of Random Access Memory (RAM).Intel Core2Due or equal processor for x86 architecture.4 GB hard disk space.

Installing JDK 1-6

- Check system requirements
- Go to download link and download the installation file as shown in the following figure:



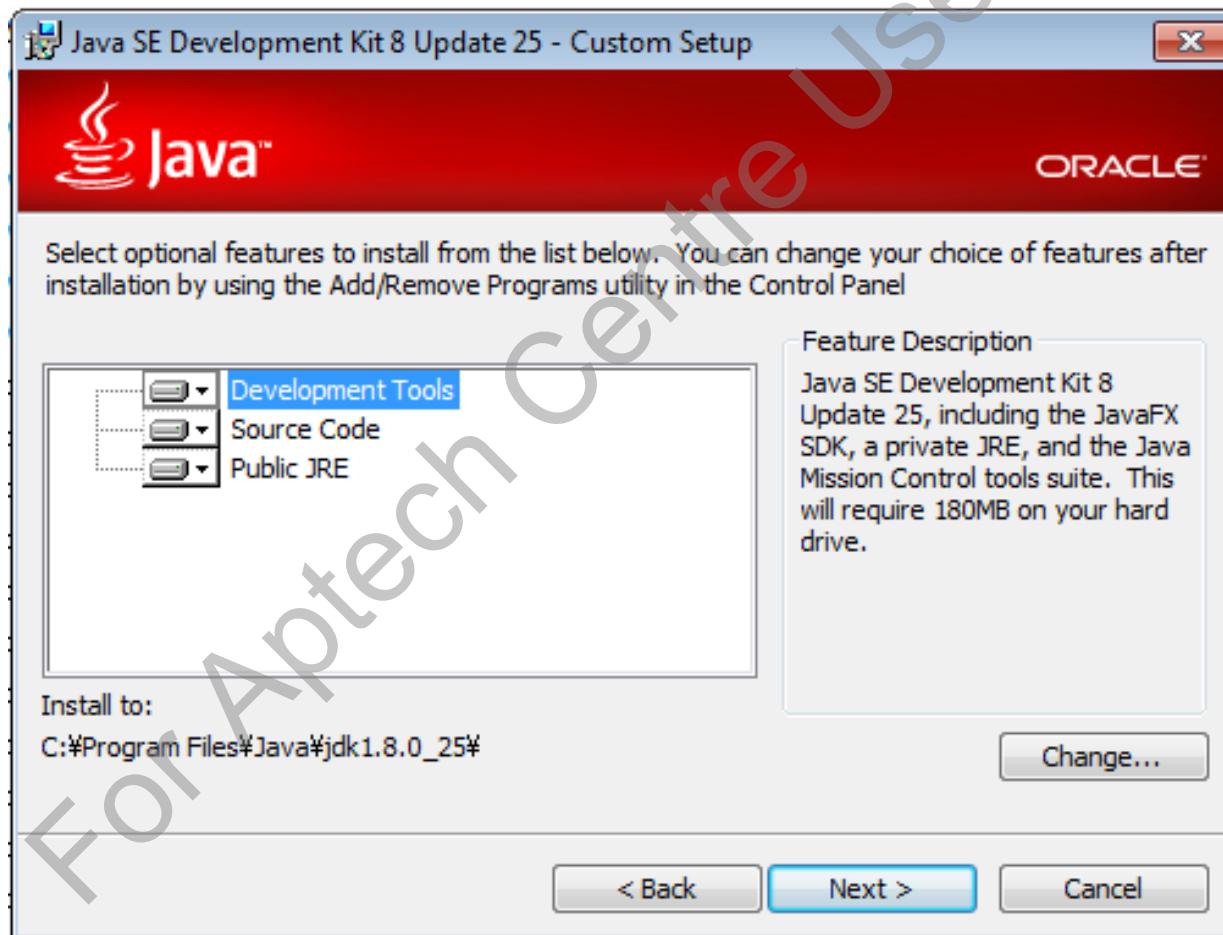
Installing JDK 2-6

- Start the installation running the downloaded setup file.
- Click Next to proceed with the installation as shown in the following figure:



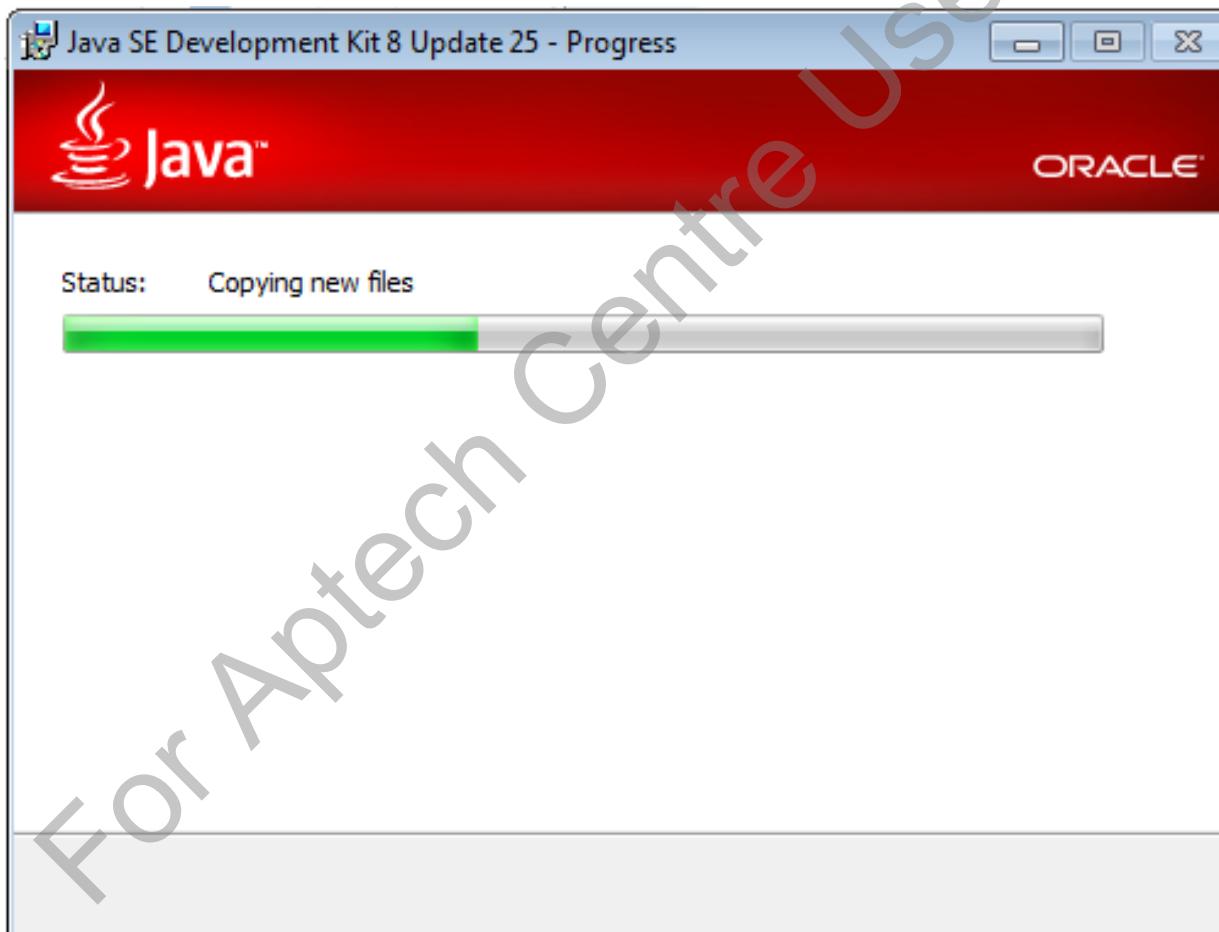
Installing JDK 3-6

- Select the components as shown in the following figure:



Installing JDK 4-6

- Click Next
- The installation begins as shown in the following figure:



Installing JDK 5-6

- Click Close to complete the installation as shown in the following figure:



Installing JDK 6-6

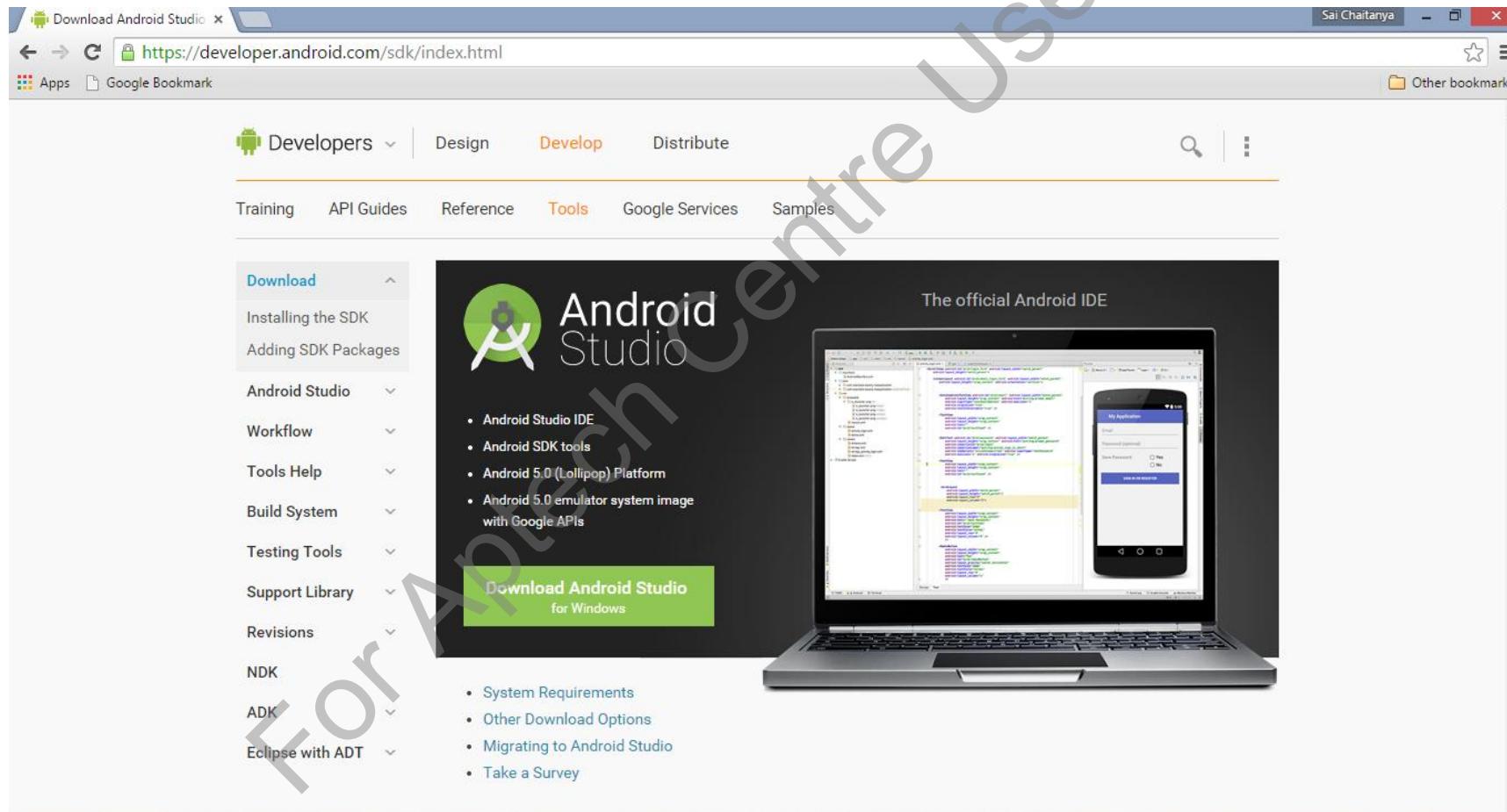
- The installation folder can be opened to verify the installation as shown in the following figure:

A screenshot of a Windows File Explorer window. The address bar shows the path: Local Disk (C:) > Program Files > Java > jdk1.8.0_25 >. The search bar at the top right contains the text "Search jdk1.8.0_25". Below the address bar, there are buttons for "Sort by" (set to Name), "Share with", "New folder", and various view options (grid, list, details, etc.). The main area displays a list of files and folders:

Name	Date modified	Type	Size
bin	5/22/2015 2:28 PM	File folder	
db	5/22/2015 2:28 PM	File folder	
include	5/22/2015 2:28 PM	File folder	
jre	5/22/2015 2:28 PM	File folder	
lib	5/22/2015 2:28 PM	File folder	
COPYRIGHT	10/7/2014 2:56 PM	File	4 KB
javafx-src.zip	5/22/2015 2:28 PM	Compressed (zipp...)	4,908 KB
jre.exe	10/7/2014 3:45 PM	Application	29,031 KB
LICENSE	5/22/2015 2:28 PM	File	1 KB
README.html	5/22/2015 2:28 PM	Chrome HTML Do...	1 KB
src.zip	10/7/2014 2:56 PM	Compressed (zipp...)	20,705 KB
THIRDPARTYLICENSEREADME.txt	5/22/2015 2:28 PM	Text Document	175 KB
THIRDPARTYLICENSEREADME-JAVAFX.txt	5/22/2015 2:28 PM	Text Document	108 KB
tools.zip	10/7/2014 3:46 PM	Compressed (zipp...)	202,250 KB

Downloading Android Studio Bundle 1-3

- Go to download link and click download as shown in the following figure:



Downloading Android Studio Bundle 2-3

- In the Terms and Conditions page, select the 'I have read and agree with the above terms and conditions' check box as shown in the following figure:

The screenshot shows a web browser window with the URL <https://developer.android.com/sdk/index.html#top>. The page title is "Download". On the left, there's a sidebar with a "Download" dropdown menu containing links like "Installing the SDK" and "Adding SDK Packages", and a list of tools: "Android Studio", "Workflow", "Tools Help", "Build System", "Testing Tools", "Support Library", "Revisions", "NDK", "ADK", and "Eclipse with ADT". The main content area displays the "Terms and Conditions" document. It starts with "1. Introduction" which includes definitions for "Android" and "Google". Below that is "2. Accepting this License Agreement" with a note that accepting it is required to use the SDK. At the bottom, there's a checkbox labeled "I have read and agree with the above terms and conditions" followed by a "Download Android Studio for Windows" button.

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Download

Before installing Android Studio or the standalone SDK tools, you must agree to the following terms and conditions.

1. Introduction

1.1 The Android Software Development Kit (referred to in this License Agreement as the "SDK" and specifically including the Android system files, packaged APIs, and Google APIs add-ons) is licensed to you subject to the terms of this License Agreement. This License Agreement forms a legally binding contract between you and Google in relation to your use of the SDK.

1.2 "Android" means the Android software stack for devices, as made available under the Android Open Source Project, which is located at the following URL: <http://source.android.com/>, as updated from time to time.

1.3 "Google" means Google Inc., a Delaware corporation with principal place of business at 1600 Amphitheatre Parkway, Mountain View, CA 94043, United States.

2. Accepting this License Agreement

2.1 In order to use the SDK, you must first agree to this License Agreement. You may not use the SDK if you do not accept this License Agreement.

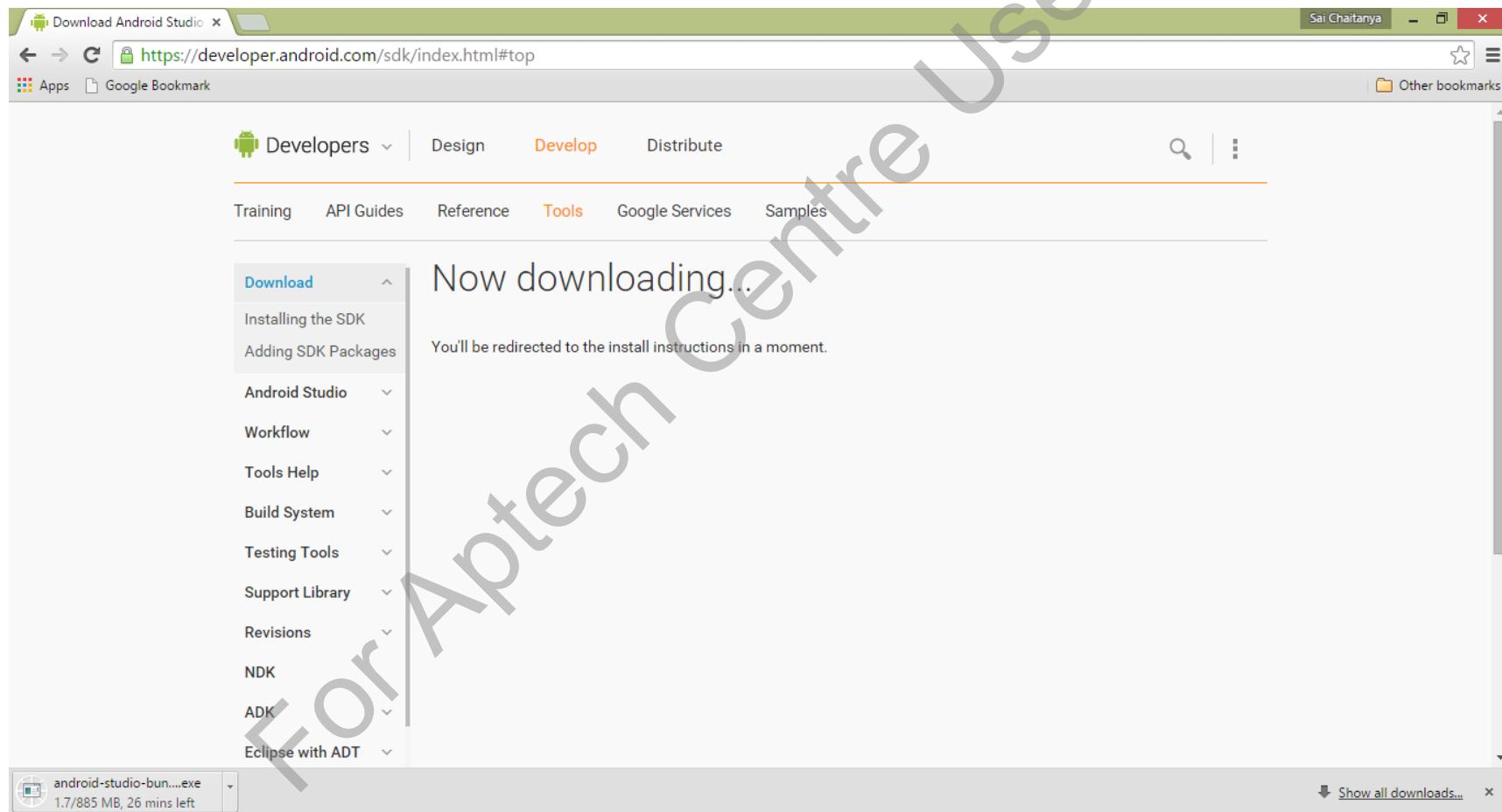
[? ? By clicking to accept, you hereby agree to the terms of this License Agreement.](#)

I have read and agree with the above terms and conditions

Download Android Studio for Windows

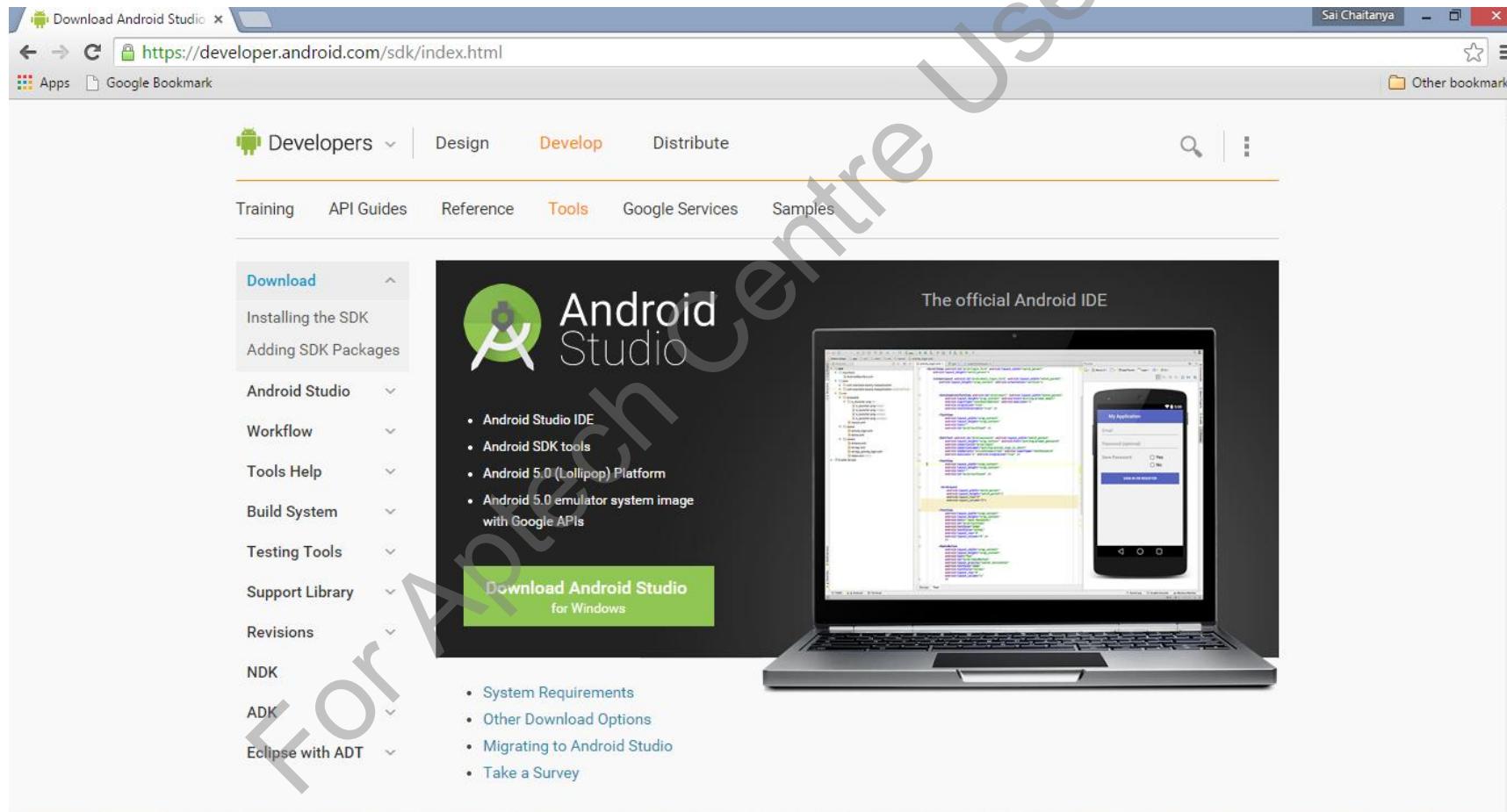
Downloading Android Studio Bundle 3-3

- Click the ‘Download Android Studio for Windows’ button. The download begins as shown in the following figure:



Downloading Android SDK Standalone 1-3

- Go to download link and click download as shown in the following figure:



Downloading Android SDK Standalone 2-3

- Scroll down to the Other Download Options section as shown in the following figure:

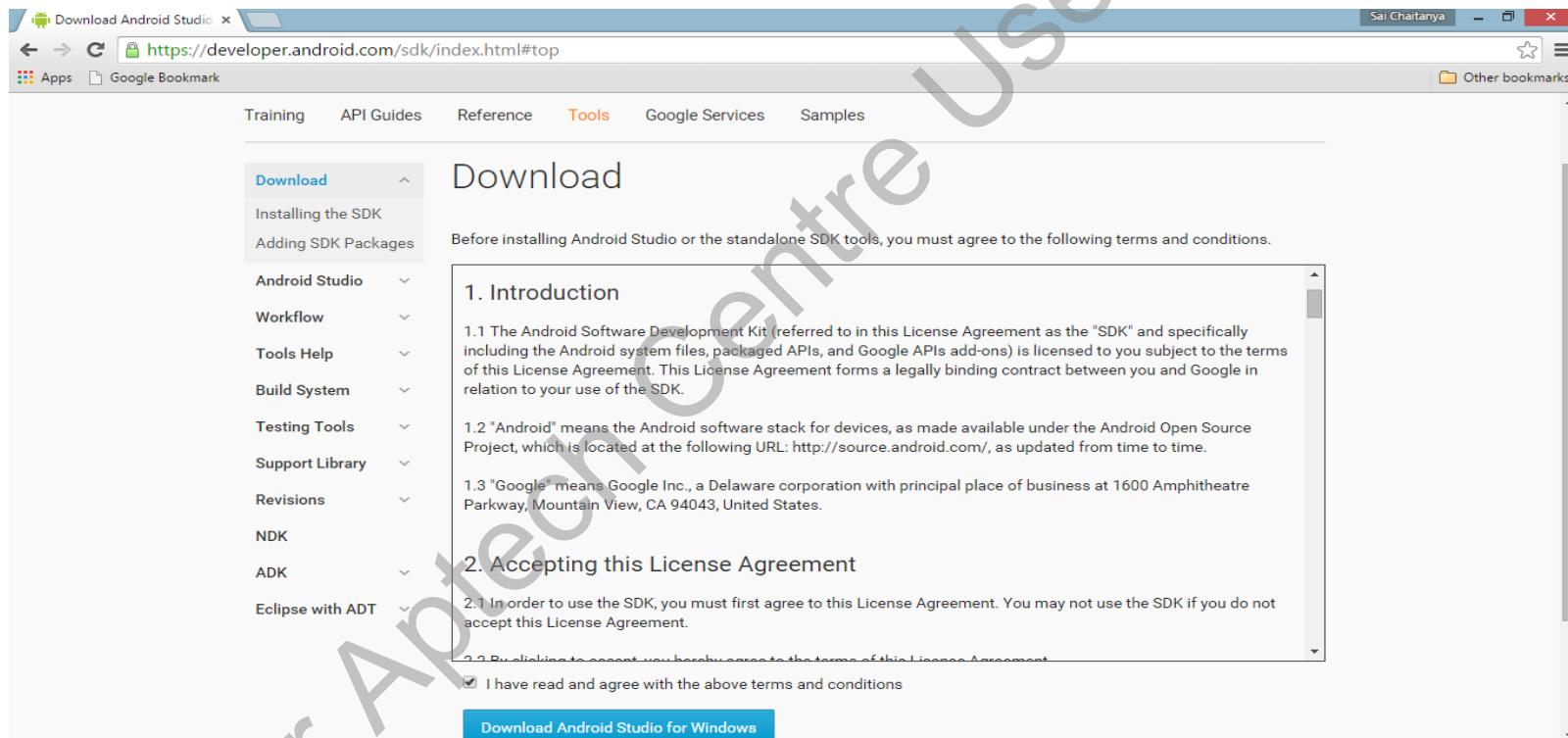
The screenshot shows a web browser window with the URL <https://developer.android.com/sdk/index.html#Other>. The browser title bar says "Download Android Studio". The left sidebar has a "Download" dropdown menu open, showing options like "Installing the SDK" and "Adding SDK Packages". Under "Android Studio", there are links for "Workflow", "Tools Help", "Build System", "Testing Tools", "Support Library", "Revisions", "NDK", "ADK", and "Eclipse with ADT". The main content area is titled "Other Download Options" and "SDK Tools Only". It explains that users can download stand-alone SDK tools instead of using an IDE. It links to "SDK tools release notes". Below this is a table with four columns: Platform, Package, Size, and SHA-1 Checksum. The table lists packages for Windows, Mac OS X, and Linux. At the bottom, there's a section titled "All Android Studio Packages" with a table for the Windows package.

Platform	Package	Size	SHA-1 Checksum
Windows	installer_r24.2-windows.exe (Recommended)	107849819 bytes	e764ea93aa72766737f9be3b9fb3e42d879ab599
	android-sdk_r24.2-windows.zip	155944165 bytes	2611ed9a6080f4838f1d4e55172801714a8a169b
Mac OS X	android-sdk_r24.2-macosx.zip	88949635 bytes	256c9bf642f56242d963c090d147de7402733451
Linux	android-sdk_r24.2-linux.tgz	168119905 bytes	1a29f9827ef395a96db629209b0e38d5e2dd8089

Platform	Package	Size	SHA-1 Checksum
Windows	android-studio-bundle-141.1890965-windows.exe (Recommended)	928285584 bytes	47be67749409f0d710c05b9a8f22d9191c47a9d0

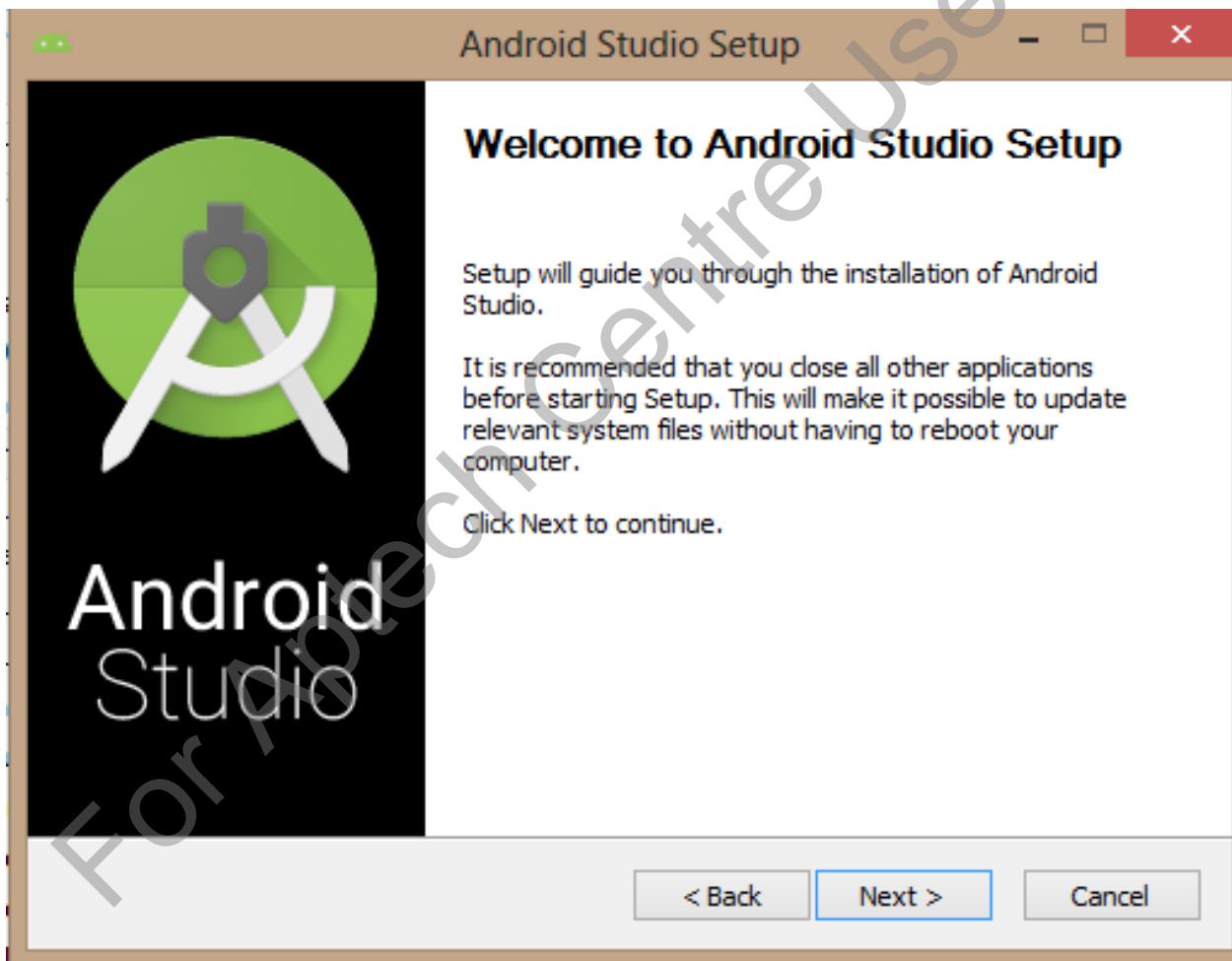
Downloading Android SDK Standalone 3-3

- In the Terms and Conditions page, select the 'I have read and agree with the above terms and conditions' check box as shown in the following figure:



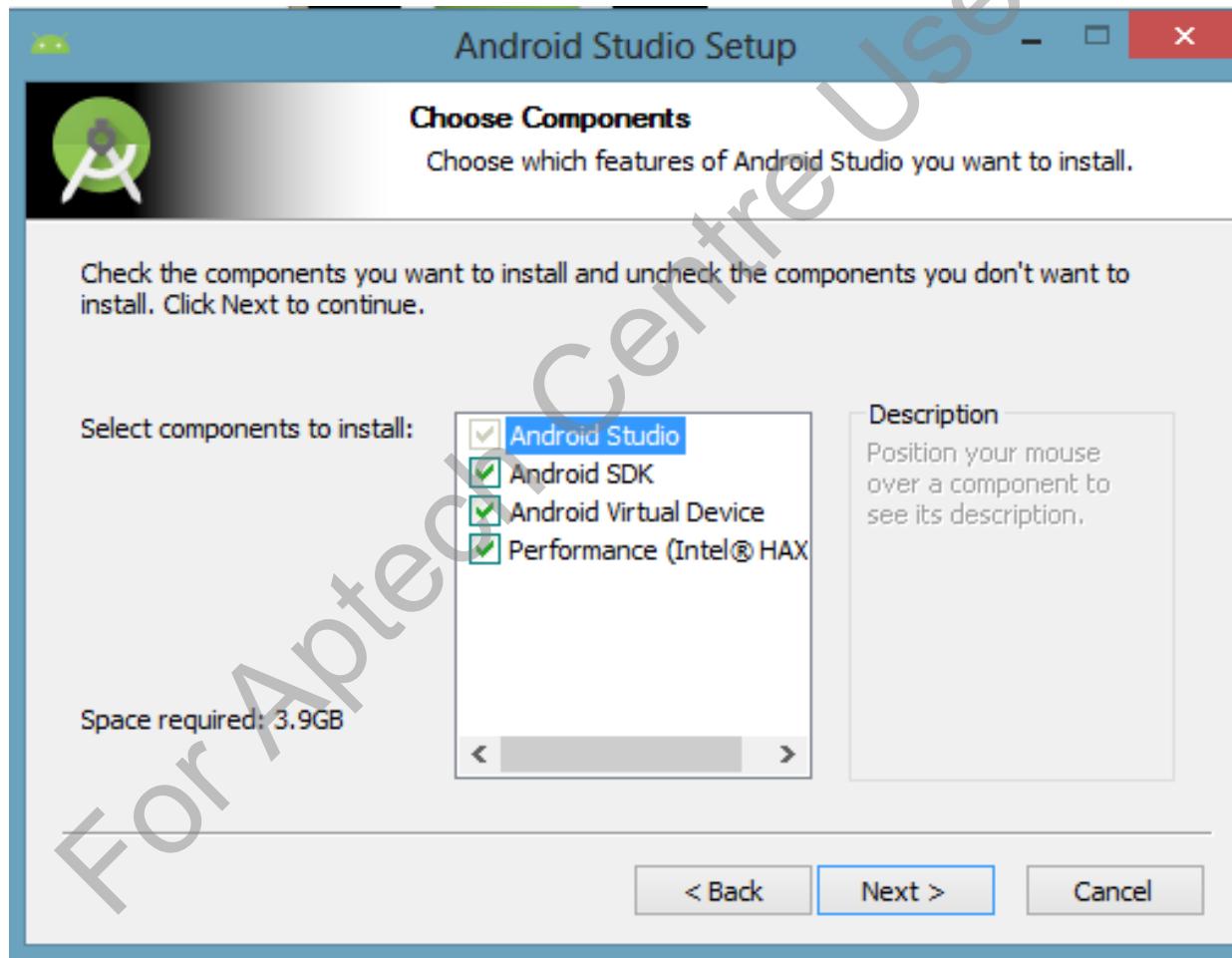
Installing Android SDK 1-10

- Go to the directory where the SDK has been downloaded
- Double-click the Installer. The wizard appears as shown in the following figure:



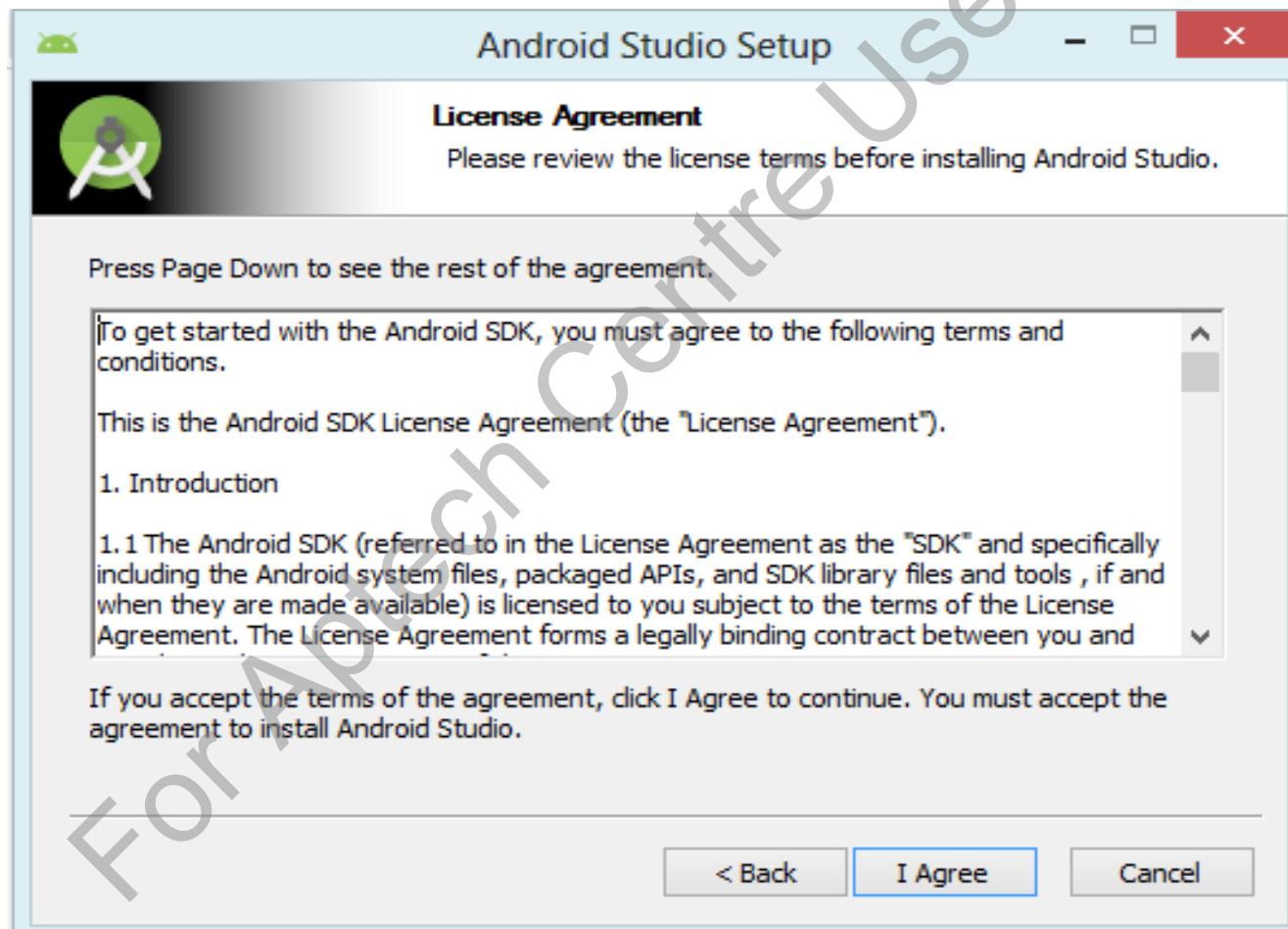
Installing Android SDK 2-10

- Select all the components in the components screen as shown in the following figure and click Next.



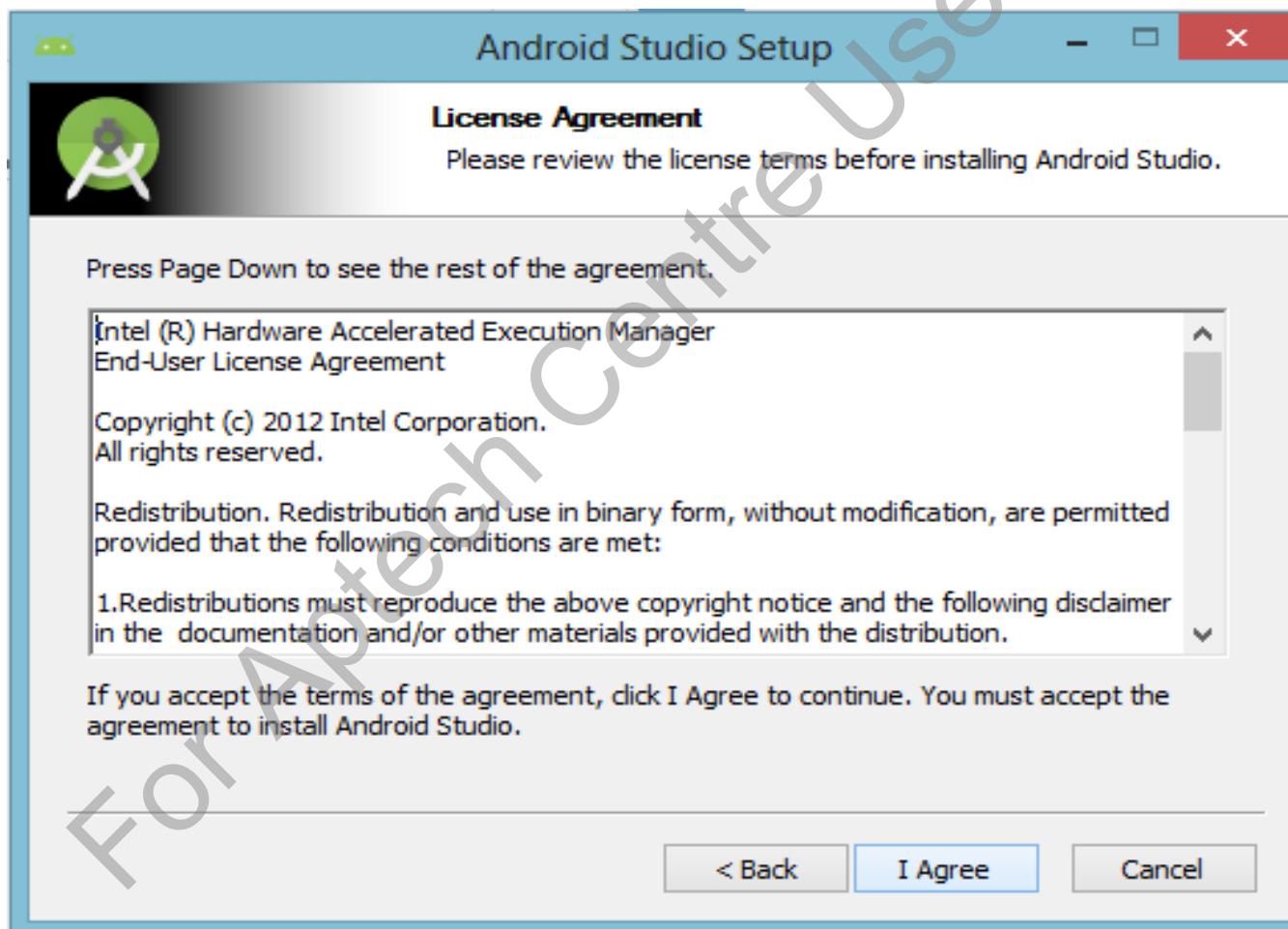
Installing Android SDK 3-10

- The SDK license agreement appears. Click the 'I Agree' button as shown in the following figure:



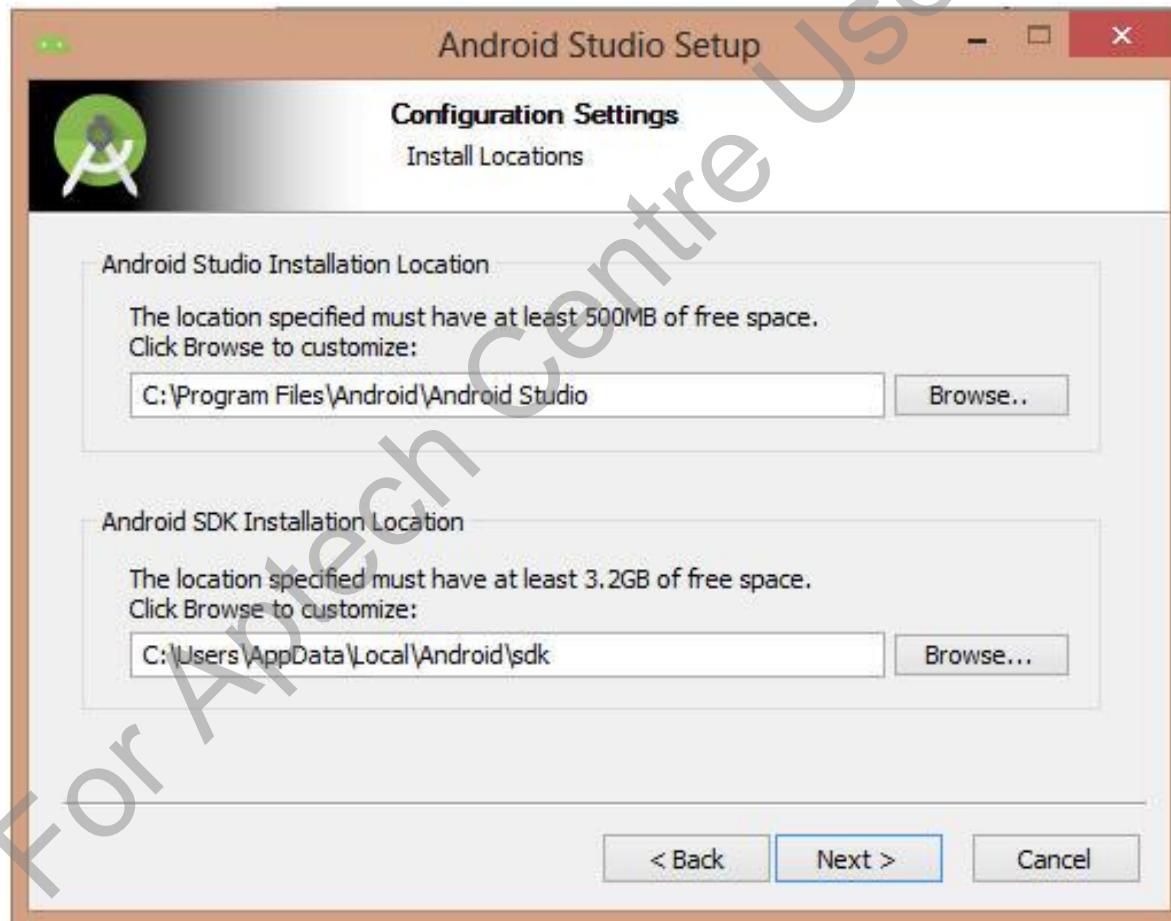
Installing Android SDK 4-10

- The Intel Hardware Accelerated Execution Manager License Agreement appears if the component was selected as shown in the following figure:



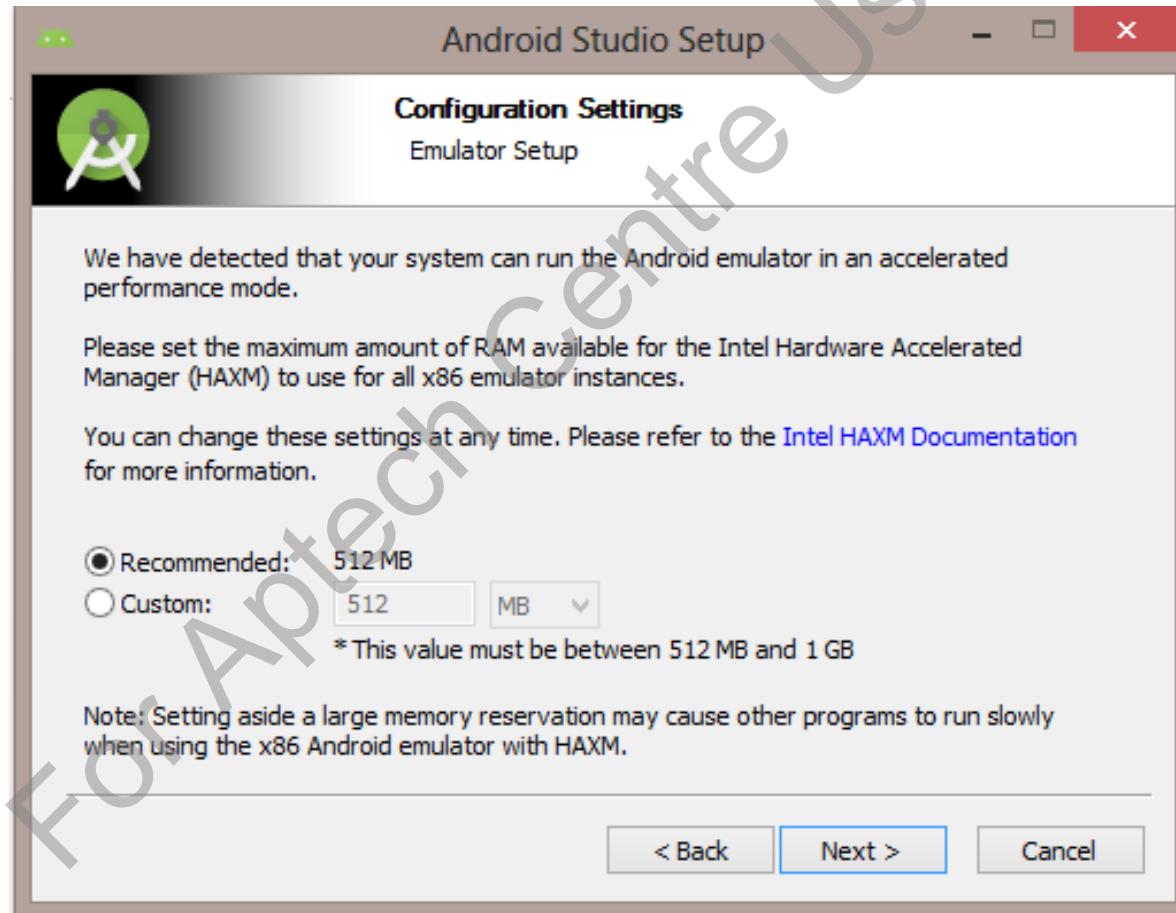
Installing Android SDK 5-10

- Select 'I Agree'
- The installation path as shown in the following figure:



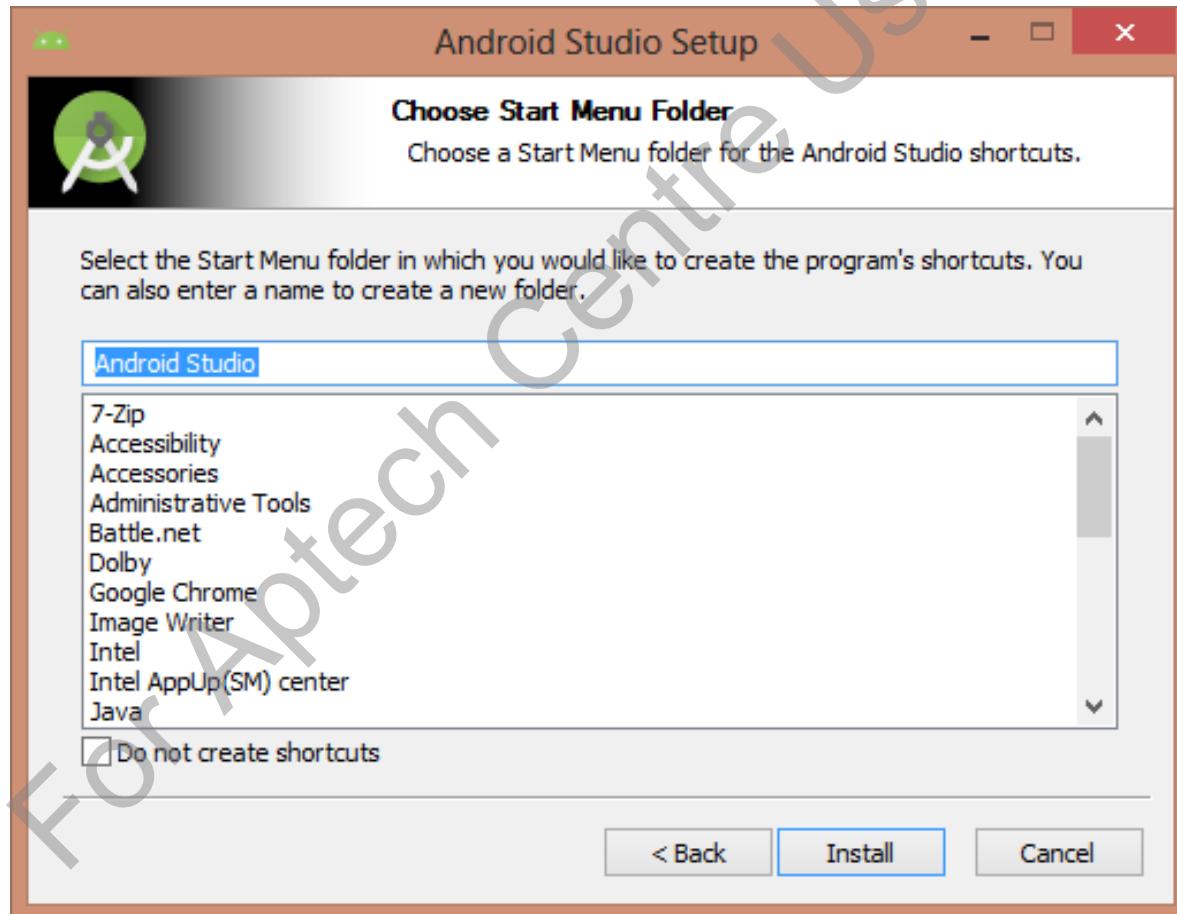
Installing Android SDK 6-10

- Select the path of installation and click Next. The AVD configuration page appears as shown in the following figure:
- Select the default RAM size for the device and click Next



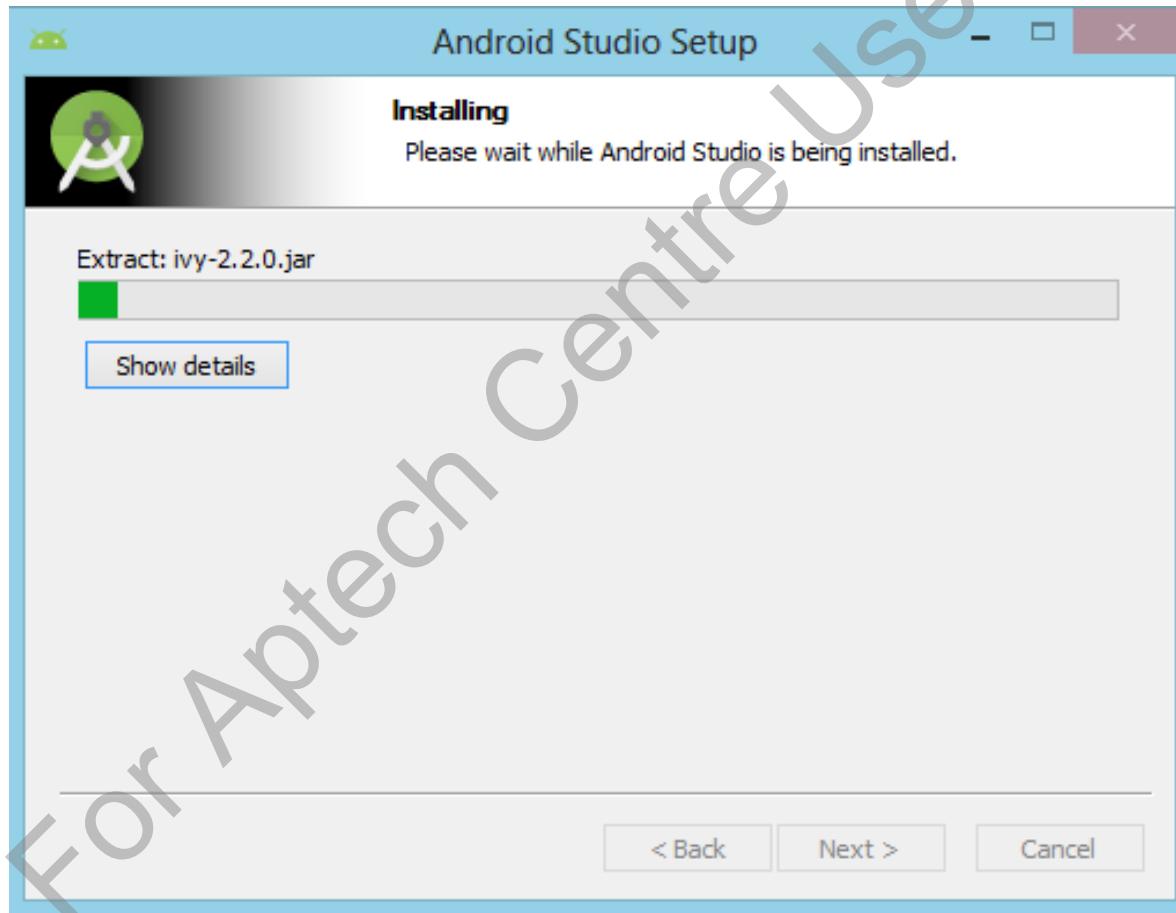
Installing Android SDK 7-10

- The start menu selection screen appears as shown in the following figure:
- Click Install



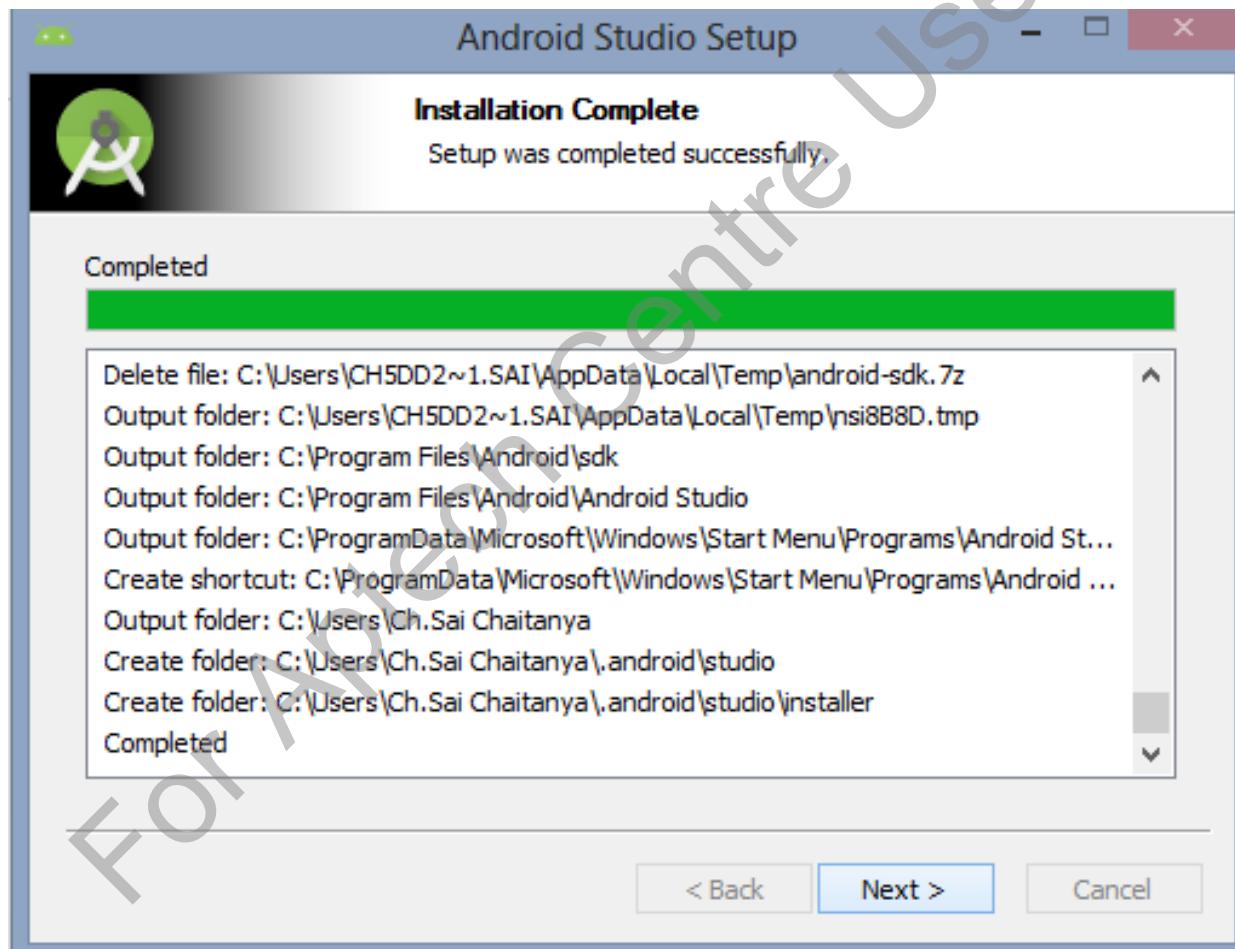
Installing Android SDK 8-10

- The installation begins as shown in the following figure:



Installing Android SDK 9-10

- Click Next after the installation completes as shown in the following figure:



Installing Android SDK 10-10

- The successfully installed screen appears as shown in the following figure:



- Click Finish

Installing Android SDK from Zip File

- ◆ Navigate to the .zip file
- ◆ Extract contents to a known location
- ◆ Make a note of the name and location of the SDK directory
- ◆ Use the command line to use the SDK tools
- ◆ If the OS is Windows, the SDK manager GUI can be used

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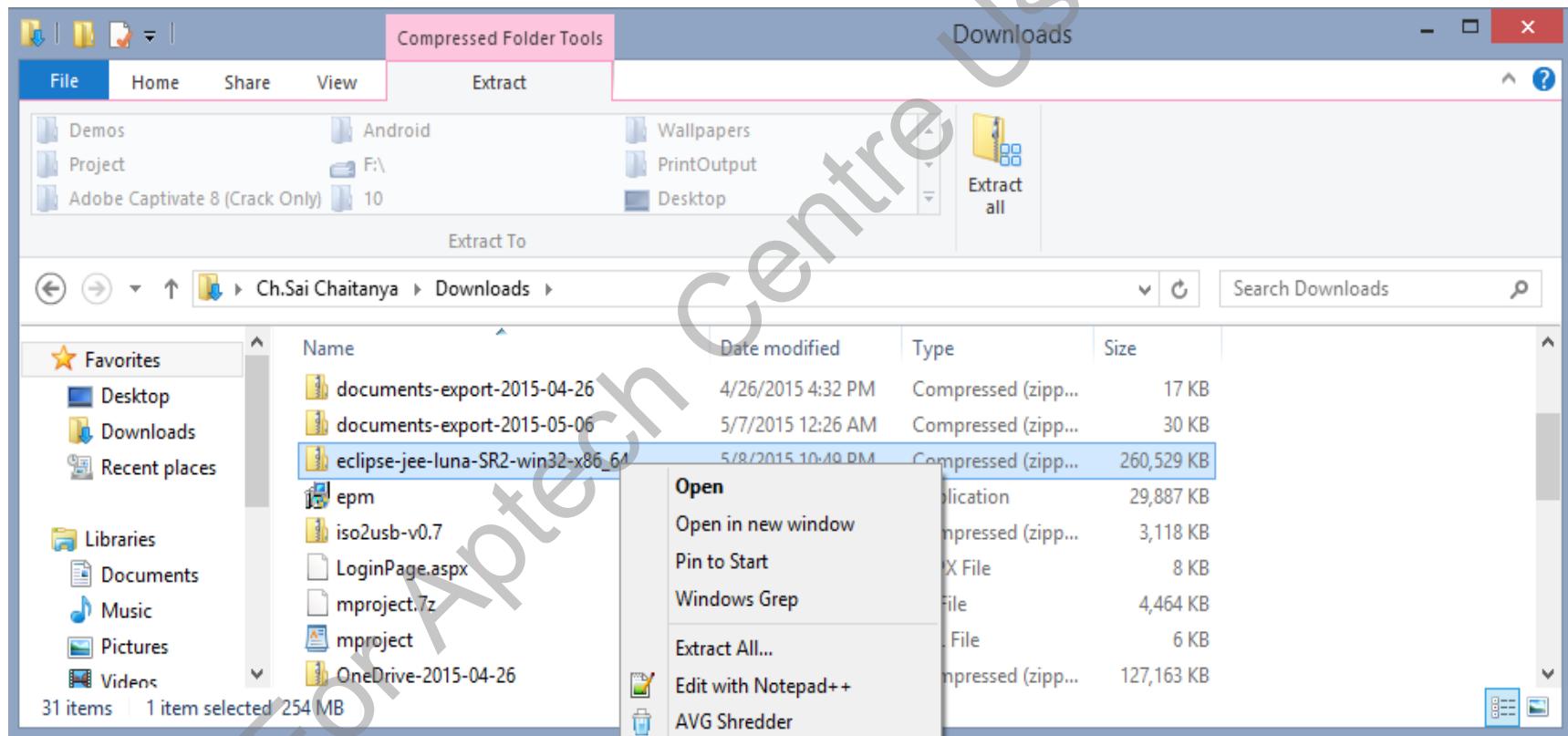
Requirements for Eclipse IDE

- The requirements to install and use the Eclipse IDE are as shown in the following table:

Requirement	Description
Operating System	<ul style="list-style-type: none">Windows 2003 (32-bit), Windows XP (32-bit), Vista (32- or 64-bit) or Windows 7 (32- or 64-bit).Mac OS X 10.5.8 or later (x86 only).Linux.
Development Environment	<ul style="list-style-type: none">JDK 7 or higher - Java Runtime Environment (JRE) alone is not sufficient.
Recommended Hardware Requirements	<ul style="list-style-type: none">Minimum 2 Gigabyte (GB) of Random Access Memory (RAM).Intel Core2Due or equal processor for x86 architecture.1 GB hard disk space.

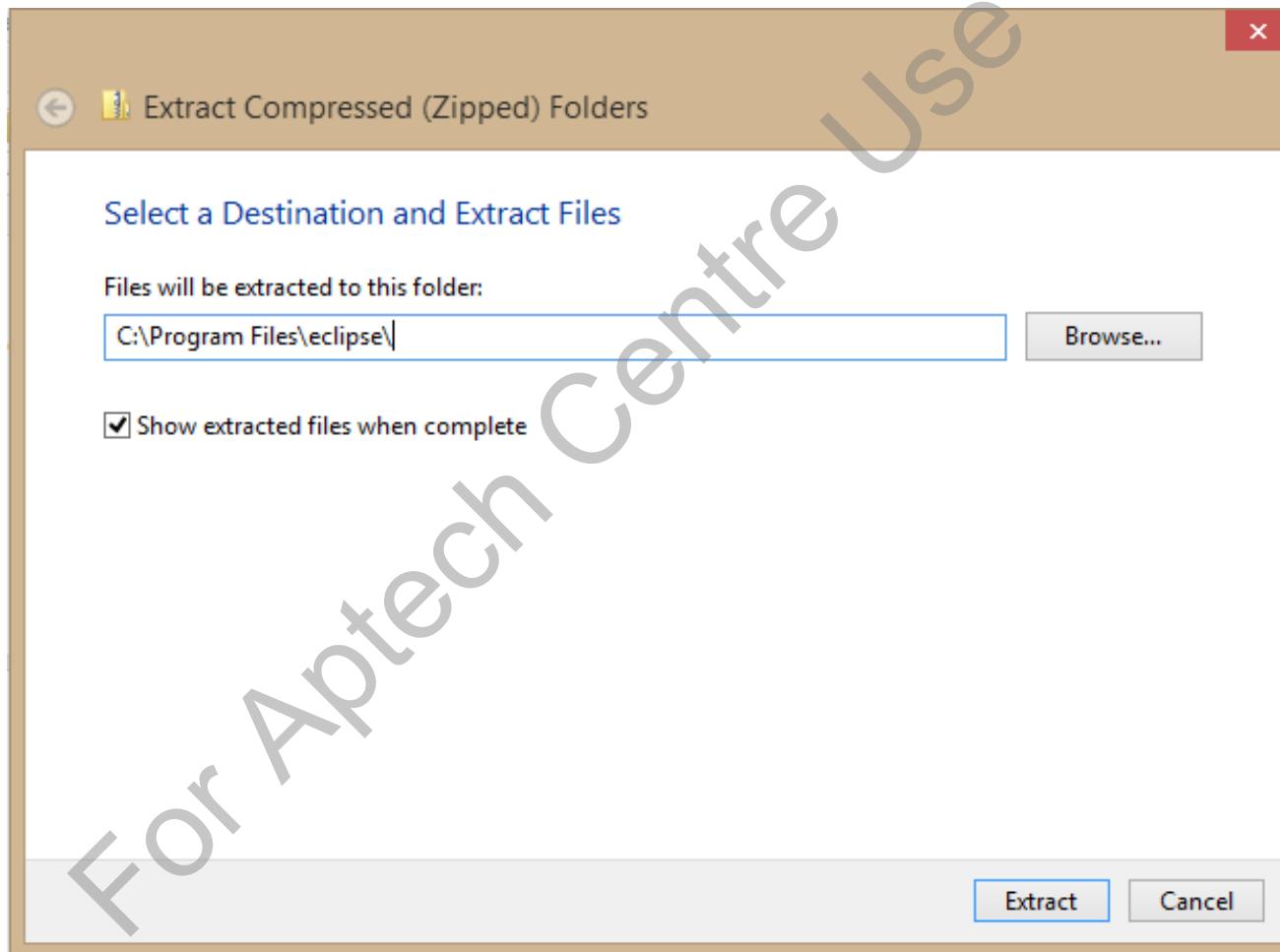
Installing Eclipse IDE 1-3

- Navigate to the location of the Eclipse setup is downloaded
- Right-click the file and Click ‘Extract All’ as shown in the following figure:



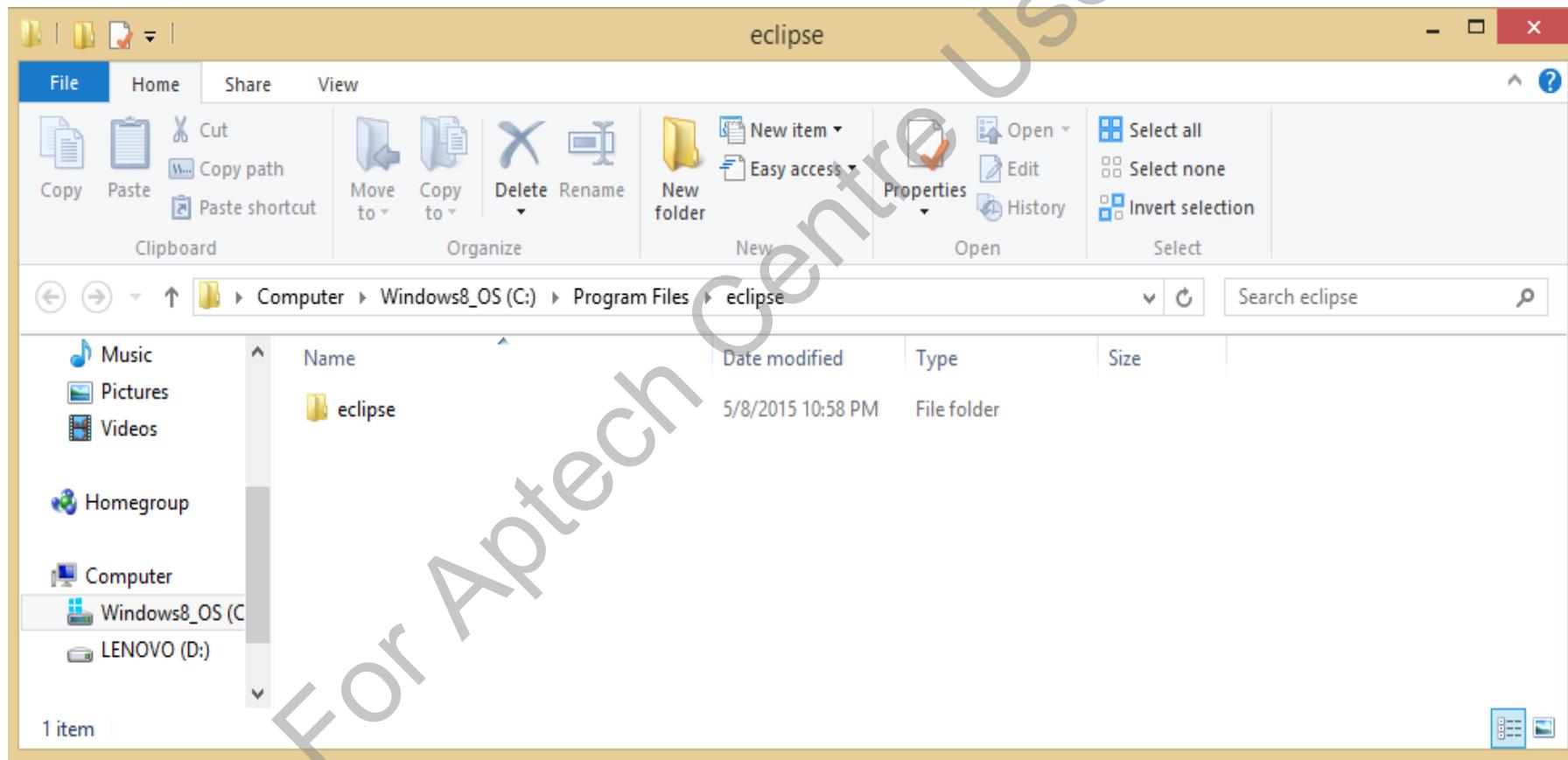
Installing Eclipse IDE 2-3

- Provide the path for extracting the files as shown in the following figure:



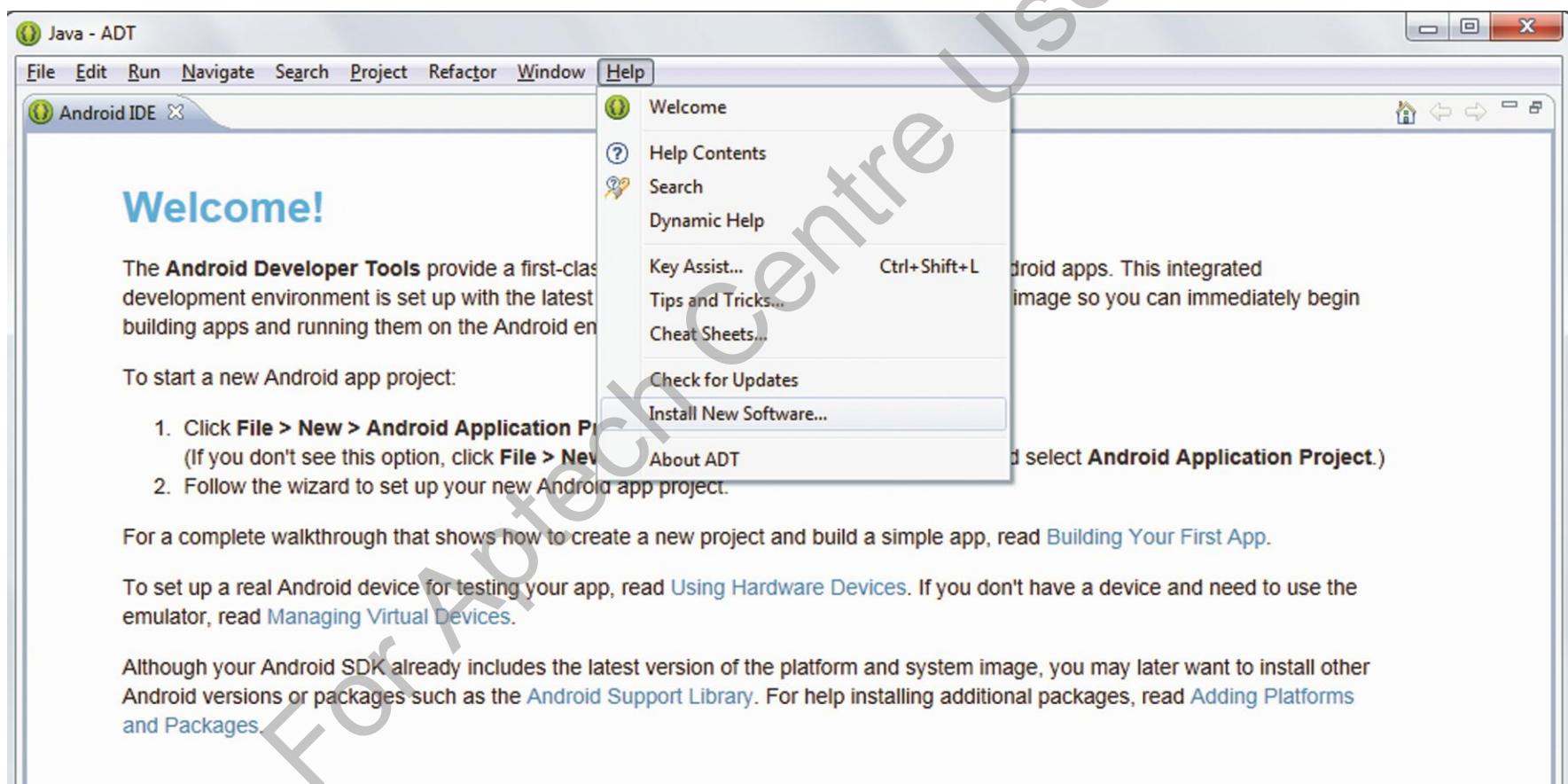
Installing Eclipse IDE 3-3

- Click Extract
- The contents are extracted in the mentioned folder as shown in the following figure:



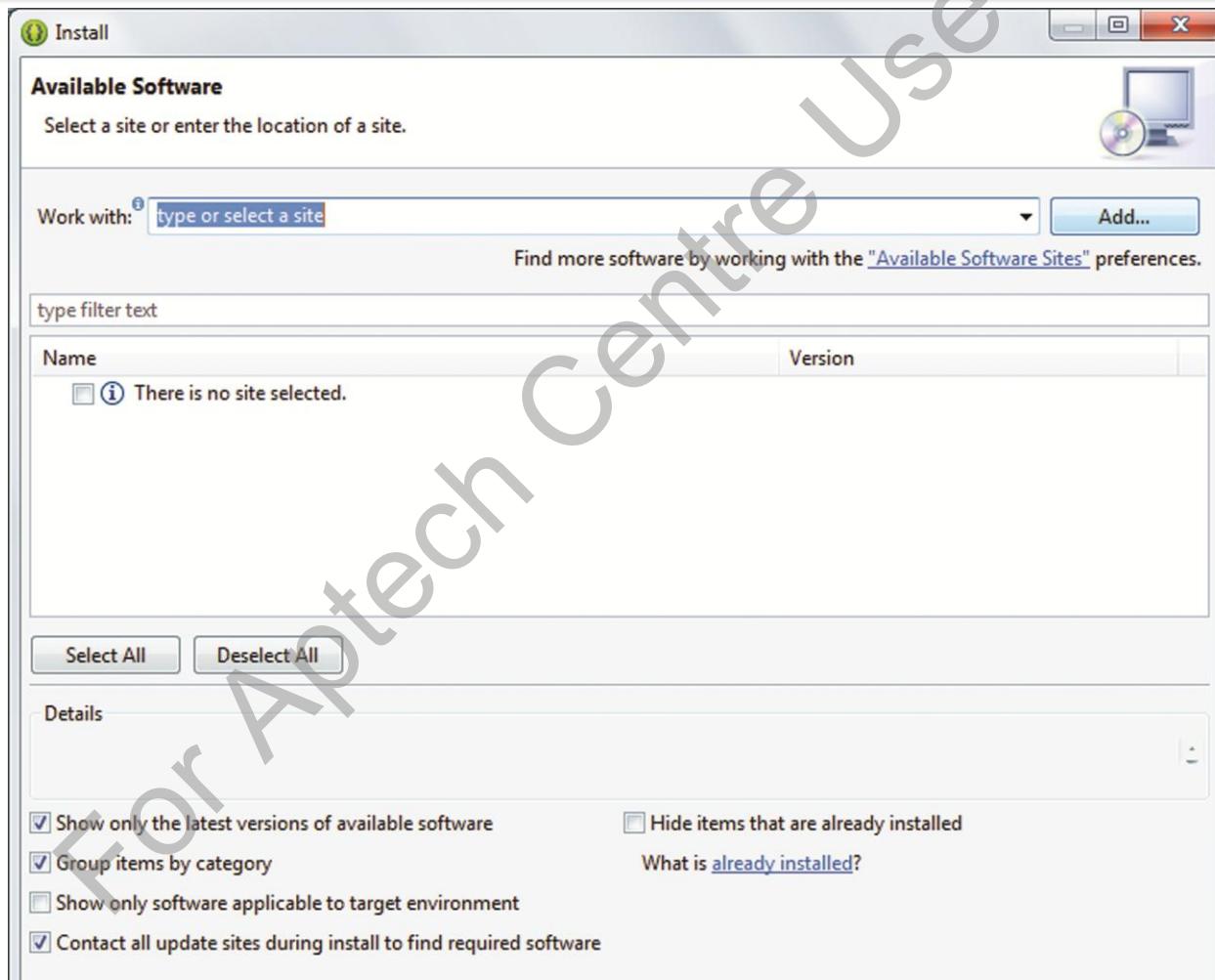
Installing ADT Plugin 1-8

- Start Eclipse
- Click Help → Install New Software as shown in the following figure:



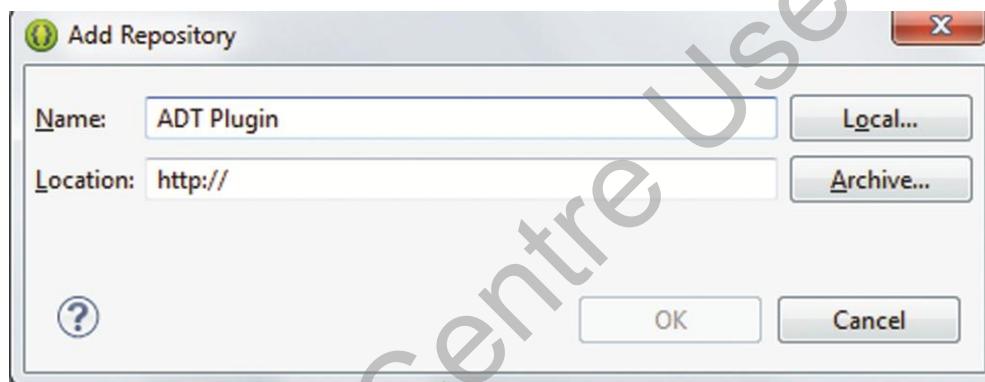
Installing ADT Plugin 2-8

- In the Available Software pane of the Install dialog box, click Add, next to the Work with list, as shown in the following figure:

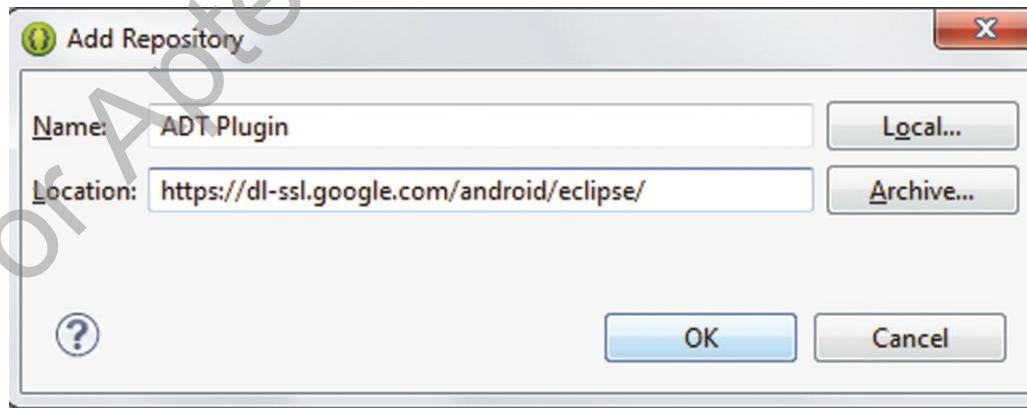


Installing ADT Plugin 3-8

- In the Add Repository dialog box, in the Name box, type ADT Plugin as shown in the following figure:

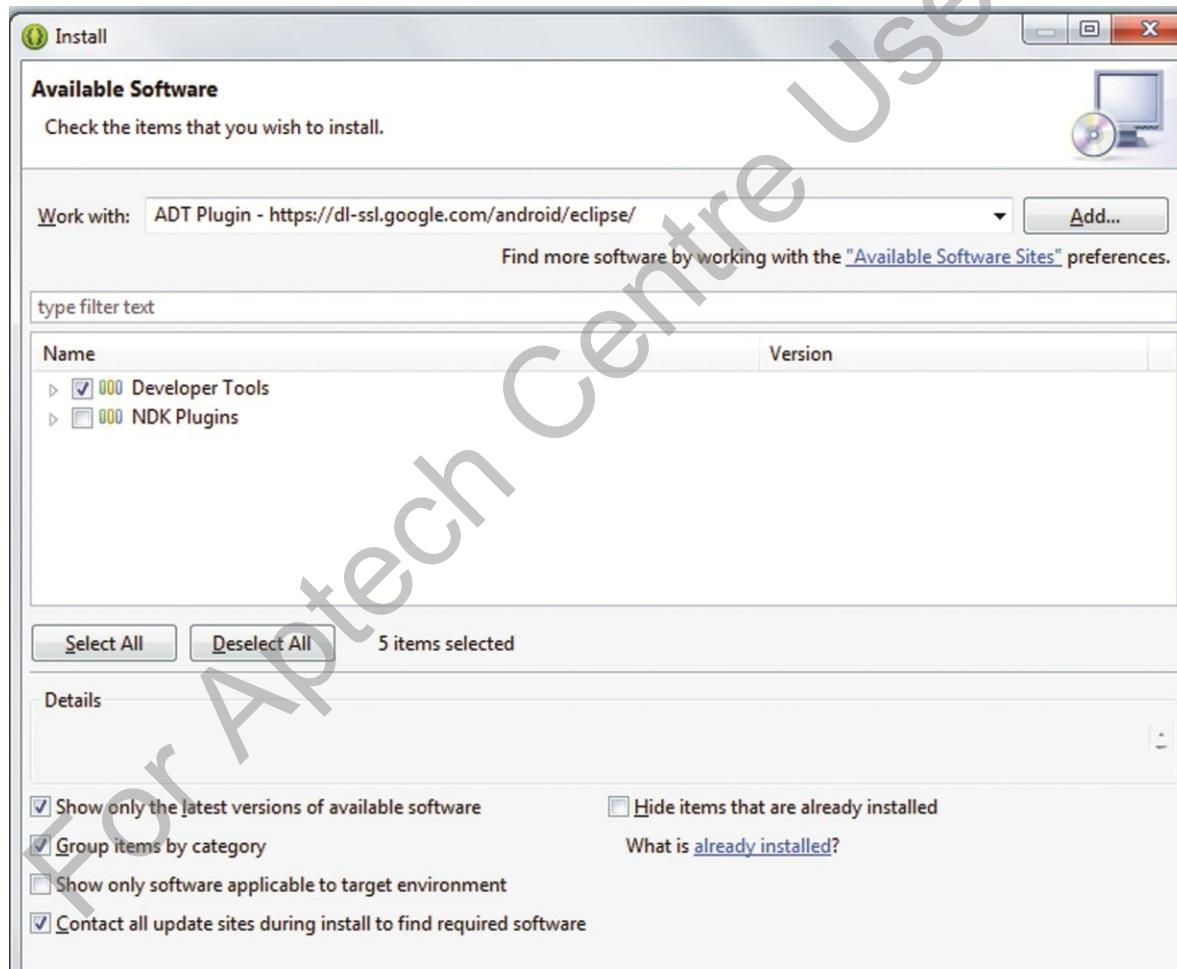


- In the Location box, type the URL <https://dl-ssl.google.com/android/eclipse/> and click OK as shown in the following figure:



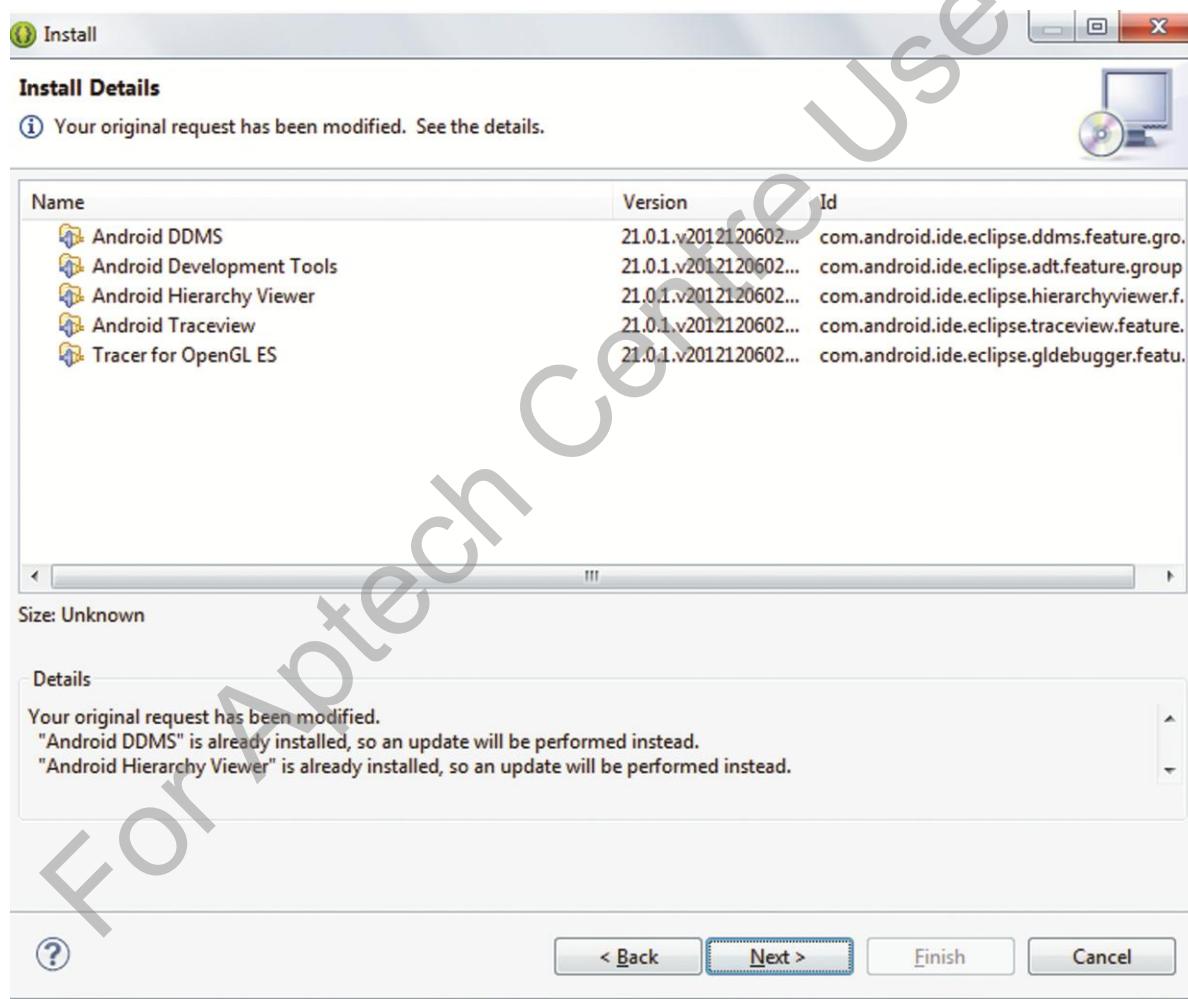
Installing ADT Plugin 4-8

- In the Available Software pane of the Install dialog box, select Developer Tools as shown in the following figure:



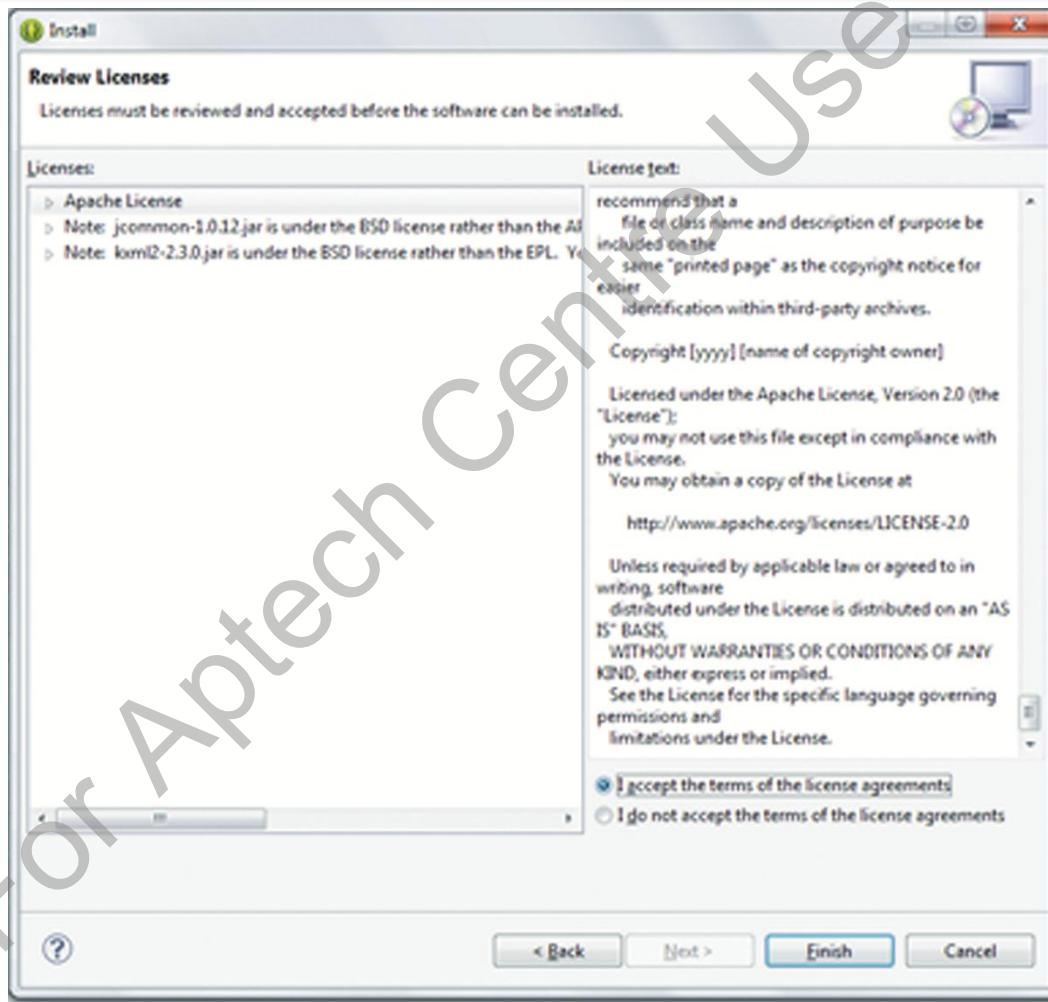
Installing ADT Plugin 5-8

- In the Install Details pane of the Install dialog box, click Next as shown in the following figure:



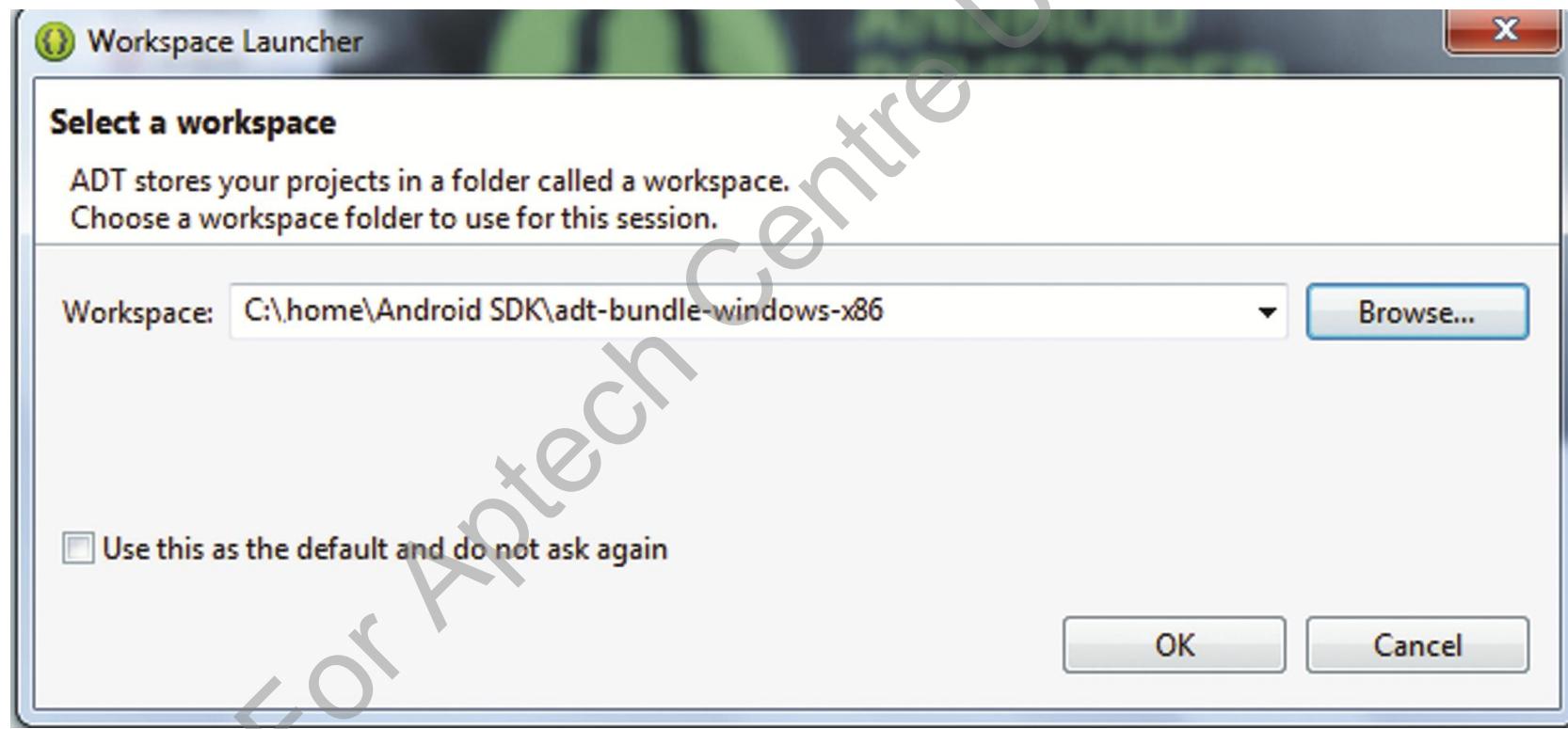
Installing ADT Plugin 6-8

- Read and accept the license agreement and click Finish as shown in the following figure:



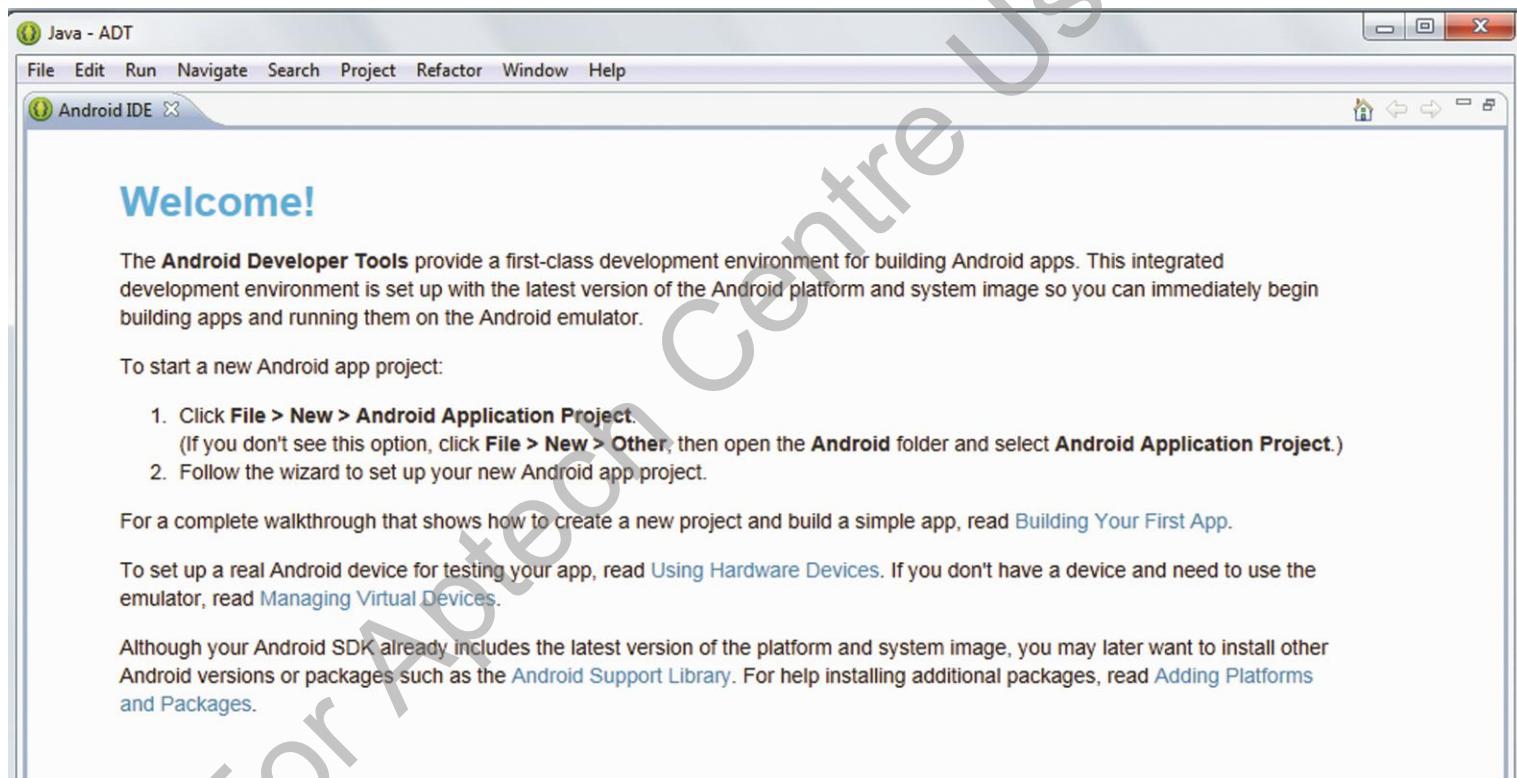
Installing ADT Plugin 7-8

- In the Select a workspace pane in the Workspace Launcher dialog box browse and select the Android SDK directory
- Click OK as shown in the following figure:



Installing ADT Plugin 8-8

- The installation is complete as shown in the following figure:



Summary

- ◆ An Operating System (OS) is a software program that enables communication and utilization of the hardware resources by the software programs
- ◆ Android is an Operating System (OS) for mobile devices running on the Linux Kernel
- ◆ Android Lollipop aims to provide major improvements in terms of performance and 64 bit CPU support along with a brand new UI scheme
- ◆ The Android architecture consists four layers namely Kernel, Libraries and Runtime, Application Framework and Applications
- ◆ Google Play (originally called Android Market) is Google's official market place for Android
- ◆ The Linux Kernel is the base layer. This is the OS layer upon which the entire framework is built
- ◆ The Android Studio Bundle comes with the official IDE for developing Android application recommended by Google, the Android Studio

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