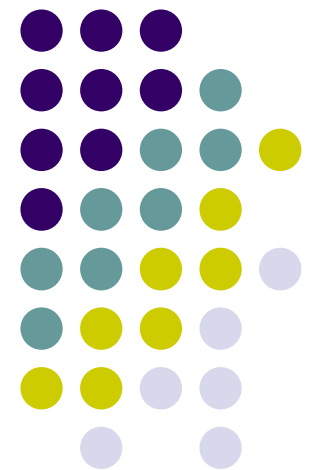


CS 528 Mobile and Ubiquitous Computing

Lecture 2: Android Introduction and Setup

Emmanuel Agu





What is Android?

- Android is world's leading mobile operating system
- **Google:**
 - Owns Android, maintains it, extends it
 - Distributes Android OS, developer tools, free to use
 - Runs Android app market

Android is Multi-Platform



In-car console



Smartwatch



Android runs on all these devices



Tablet



Smartphone

Television

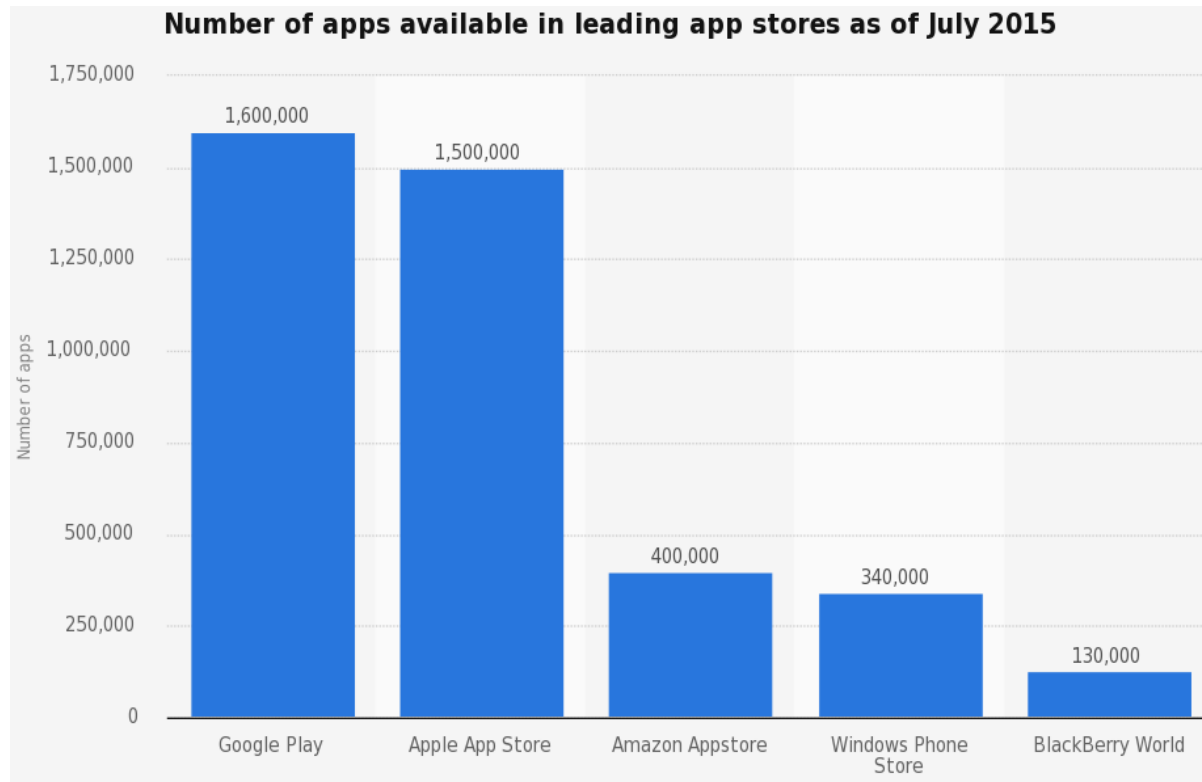


This Class: Focuses Mostly on Smartphones!



Android Growth

- October 2015, 1.4 billion Android users (ref: [WSJ](#))
- 1.6 million apps on the Android app market (ref: [statista.com](#))
 - Games, organizers, banking, entertainment, etc



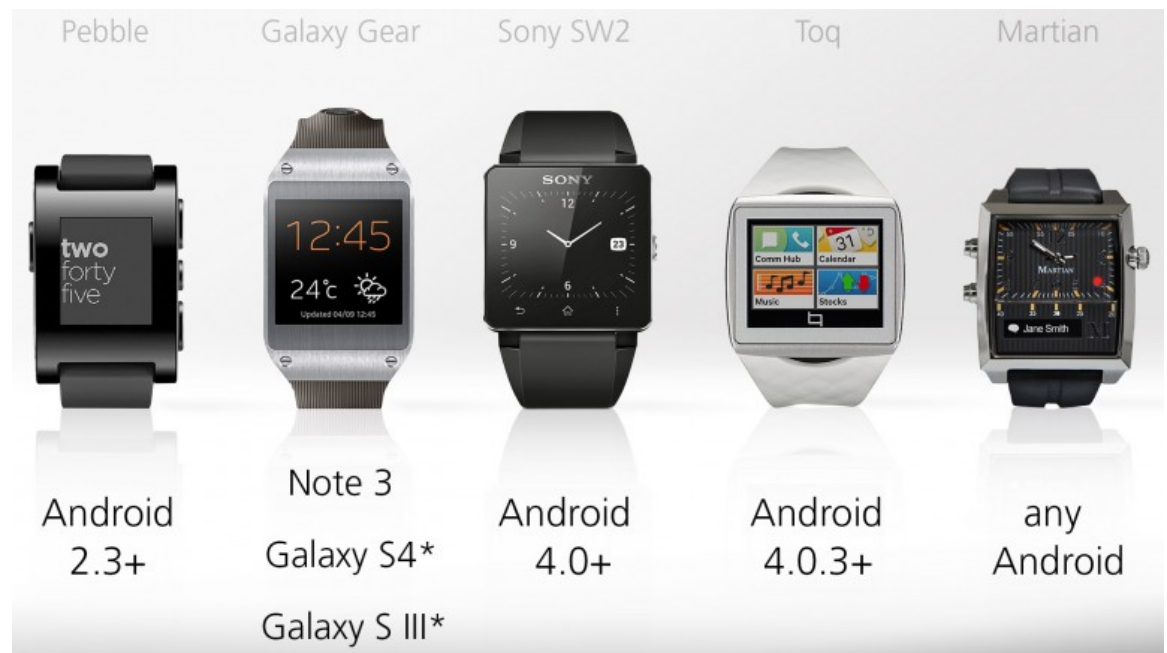


Other Types of Android Hardware (Apart from Smartphones)

Android Wearables: Smartwatches



- Minimal UI, at-a-glance
- Mostly notifications, Not full functionality
 - Voice Commands, phone calls
 - Directions, texts, run apps
 - Heart Rate monitor
 - Count Steps
 - Wireless charging



Android Wearables: Google Glass



- Head-mounted display, displays information, touch-free
- **Example application:** Records babies life steps
- Features:
 - Touchpad (on side), camera for photoes video, display, voice commands
- Google recently announced discontinuing Google Glass



Android Hardware: TV programming



- Smart, interactive TV platform (Android 5.0) featuring:
 - Recommends shows to user based on their watching habits
 - Media apps downloadable from Google Play. E.g. Netflix streaming app
 - Games
 - Voice Search to answer questions. E.g. which movies were nominated for academy awards



Android Hardware: in-Car Entertainment and Navigation System



- Example: Honda Connect system
- Integrated audio, phone, navigation, information system
- Runs Android 4.0.4
- **Android Auto** announced by automotive alliance in Jan 2014

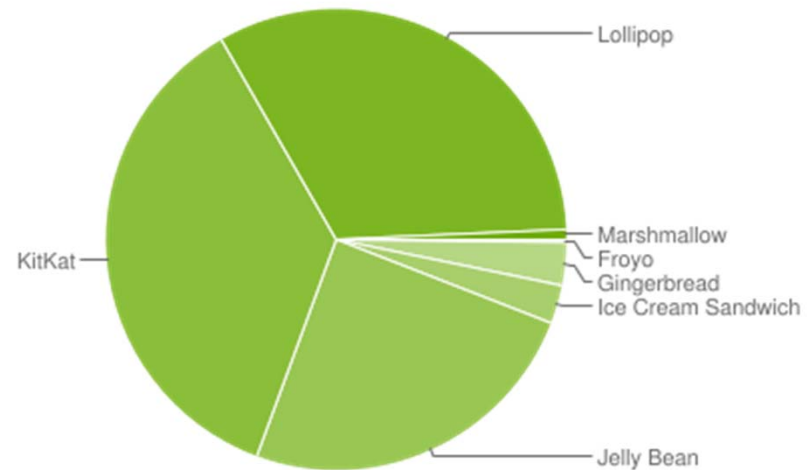


Android Versions



- Most recent Android version is Android L (6.0) or “Marshmallow”
- Officially released December 7, 2015
- Class will use Android 5.0 (lollipop)
- Android version distribution as at January 4, 2016

Version	Codename	API	Distribution
2.2	Froyo	8	0.2%
2.3.3 - 2.3.7	Gingerbread	10	3.0%
4.0.3 - 4.0.4	Ice Cream Sandwich	15	2.7%
4.1.x	Jelly Bean	16	9.0%
4.2.x		17	12.2%
4.3		18	3.5%
4.4	KitKat	19	36.1%
5.0	Lollipop	21	16.9%
5.1		22	15.7%
6.0	Marshmallow	23	0.7%

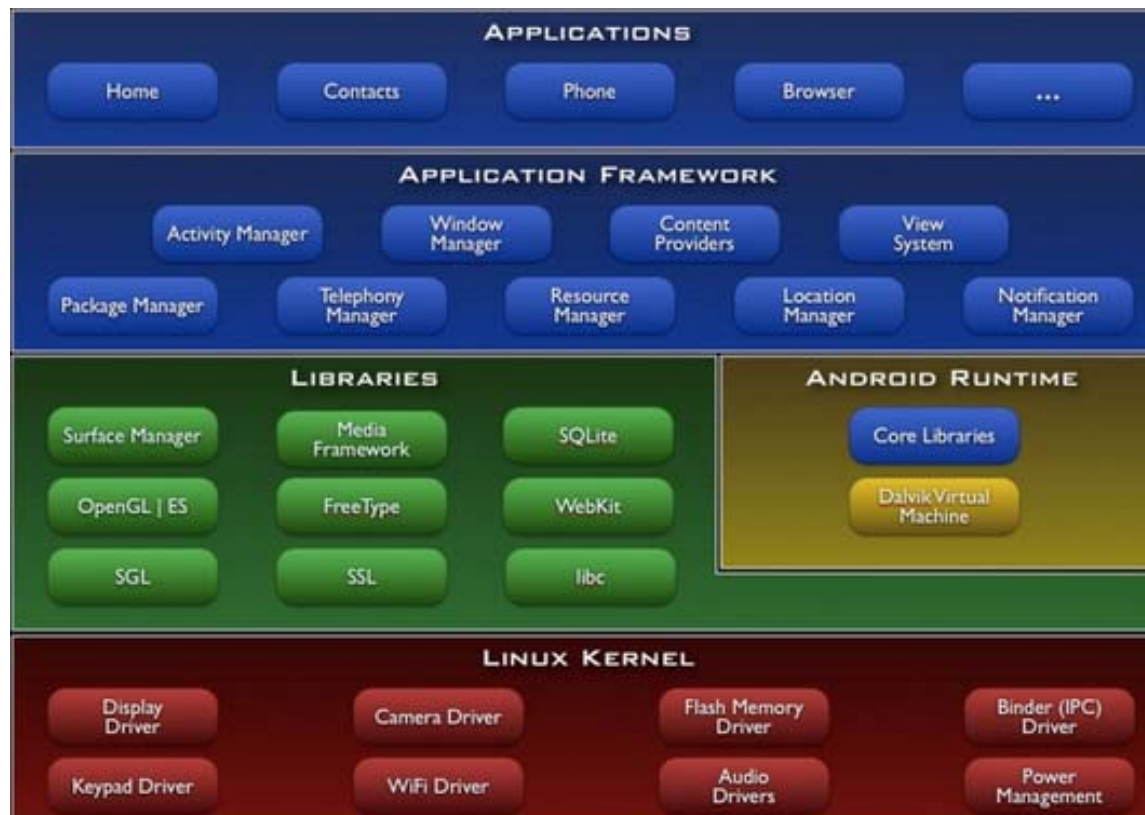


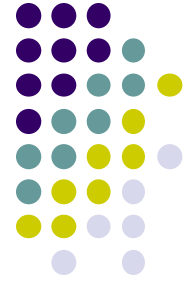
Source: <http://developer.android.com/about/dashboards/index.html>



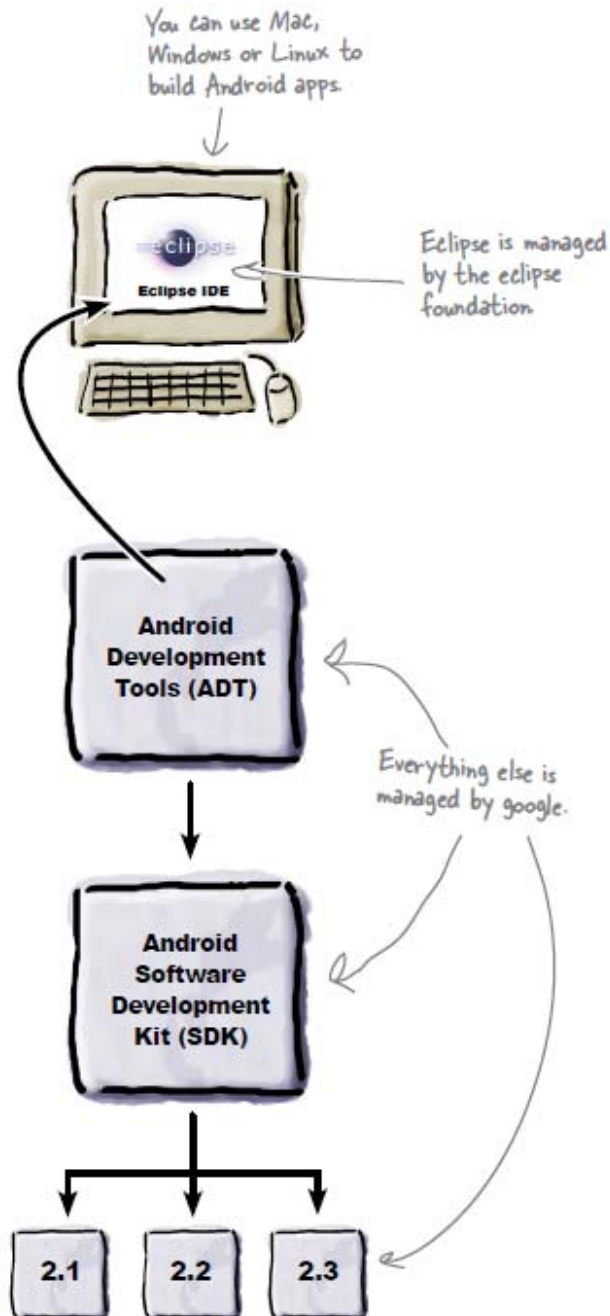
Android Software Framework

- Android OS has Linux kernel, drivers
- Android Applications: Programmed in Java
- Android Libraries: OpenGL ES (graphics), SQLite (database), etc





Old Developer Android Environment

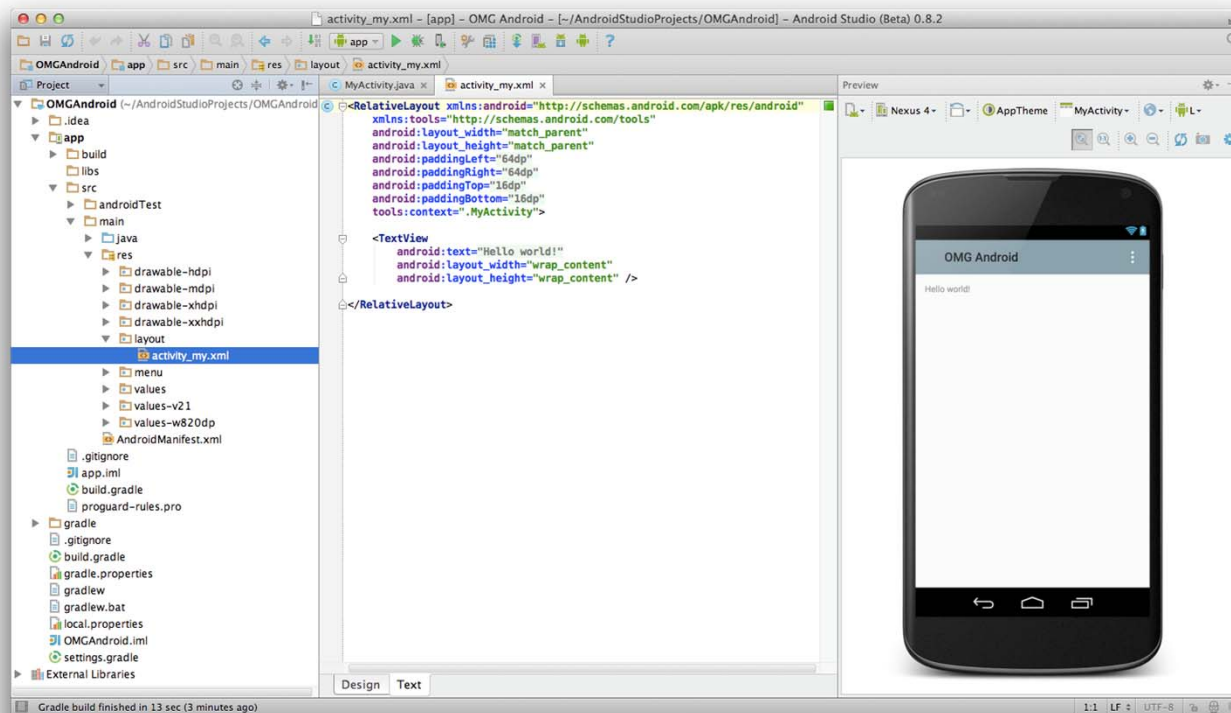


- **Eclipse as IDE:** type code in, compile, not Android-specific
- **Android Dev Tools (ADT):** Eclipse plugin, adds Android functionality
- **Android Software Dev Kit (SDK):** Tools to build, test and run apps
- **Packages:** Enables developing for various Android versions

New Android Environment: Android Studio



- Google developed it's own IDE called **Android Studio**
- Combines tools in old development environment into 1
- Cleaner interface specifically for Android Development (e.g. drag and drop app design)
- In December 2014, Google announced it will stop supporting Eclipse IDE





Installing Android Studio

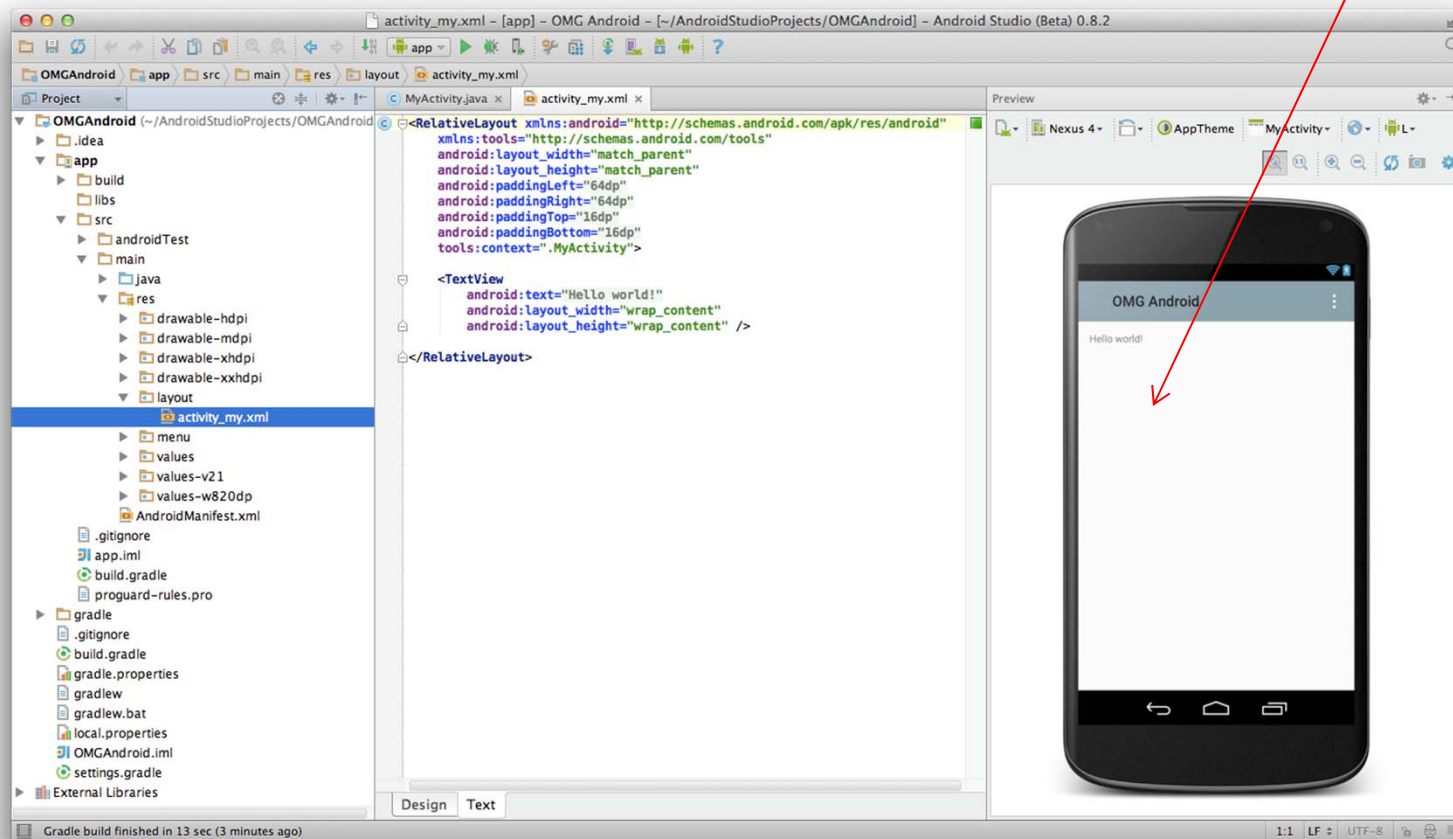
- **Step 1:** Install Java (at least version 1.7)
 - **Note:** You may already have Java installed. Check first
- **Step 2:** Set JAVA_HOME system variable
 - This variable tells applications that need Java where it is installed
- **Step 3:** Install Android Studio (version 1.1 is the latest)
- Bucky Roberts (thenewboston): nice youtube Android tutorials
 - **Tutorial 1:** Install Java [\[Watch it \]](#)
 - **Tutorial 2:** Install Android Studio [\[Watch it \]](#)

Where to Run Android App



- Android app can run on:
 - Real phone (or device)
 - Emulator (software version of phone)

Emulated phone
in Android Studio





Running Android App on Real Phone

- Need USB cord to copy app over from development PC to phone





Emulator Vs Real Phone Pros and Cons

- Pros:
 - Conveniently test app on basic hardware by clicking in software
 - Easy to test app on various devices (phones, tablets, TVs, etc), various screen sizes
- Cons:
 - Some hardware missing, especially hardware for sensing environment
 - E.g. GPS, camera, video recording, etc

Emulator Limitations



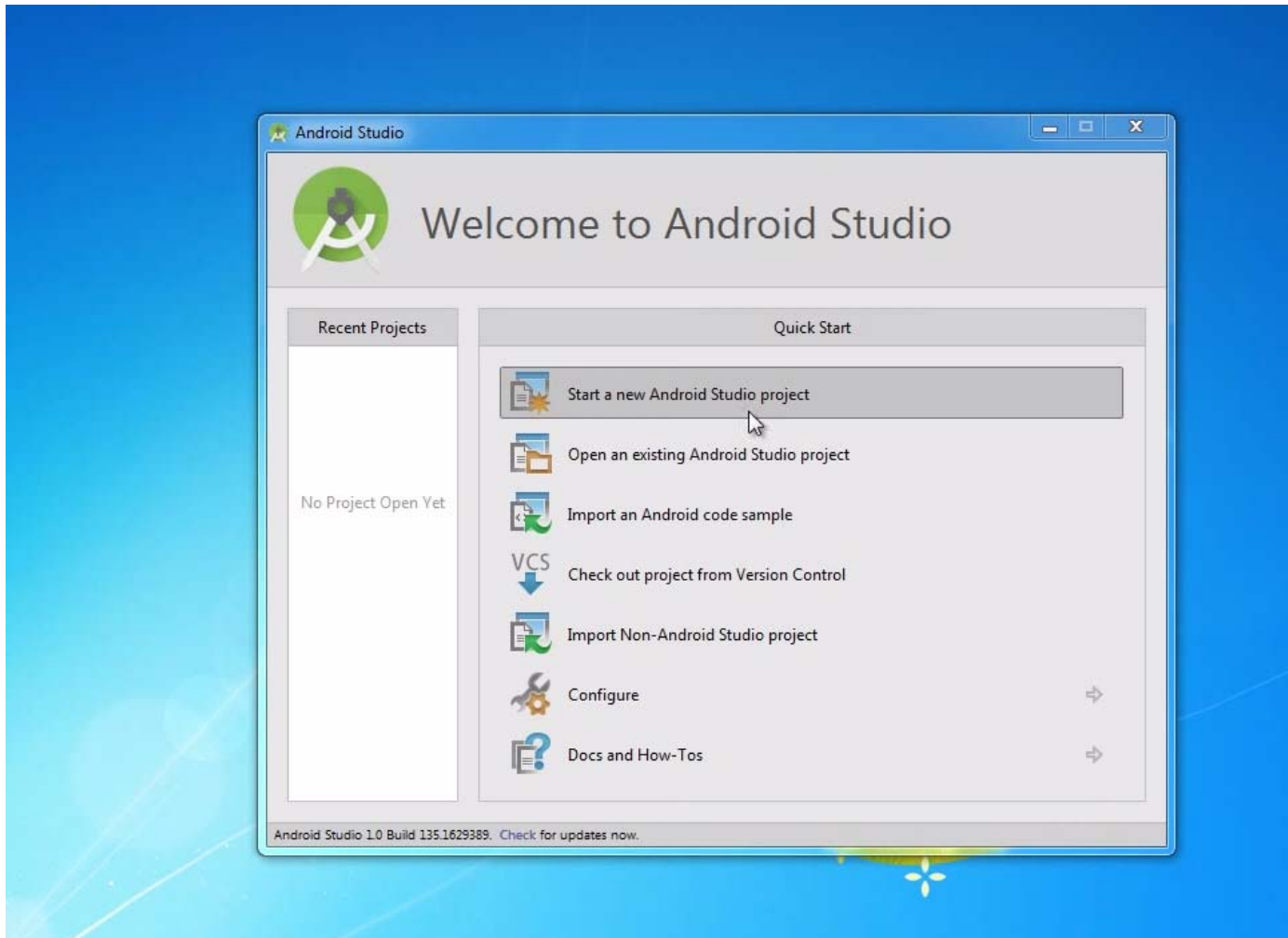
- No support for
 - Phone calls (calling or receiving)
 - USB connections
 - Camera/video capture (input)
 - Bluetooth
 - Sensors, accelerometer, gyroscope, etc
 - Device-attached headphones
 - Determining connected state
 - Determining battery charge level and AC charging state
 - Determining SD card insert/eject
- Slow!!!



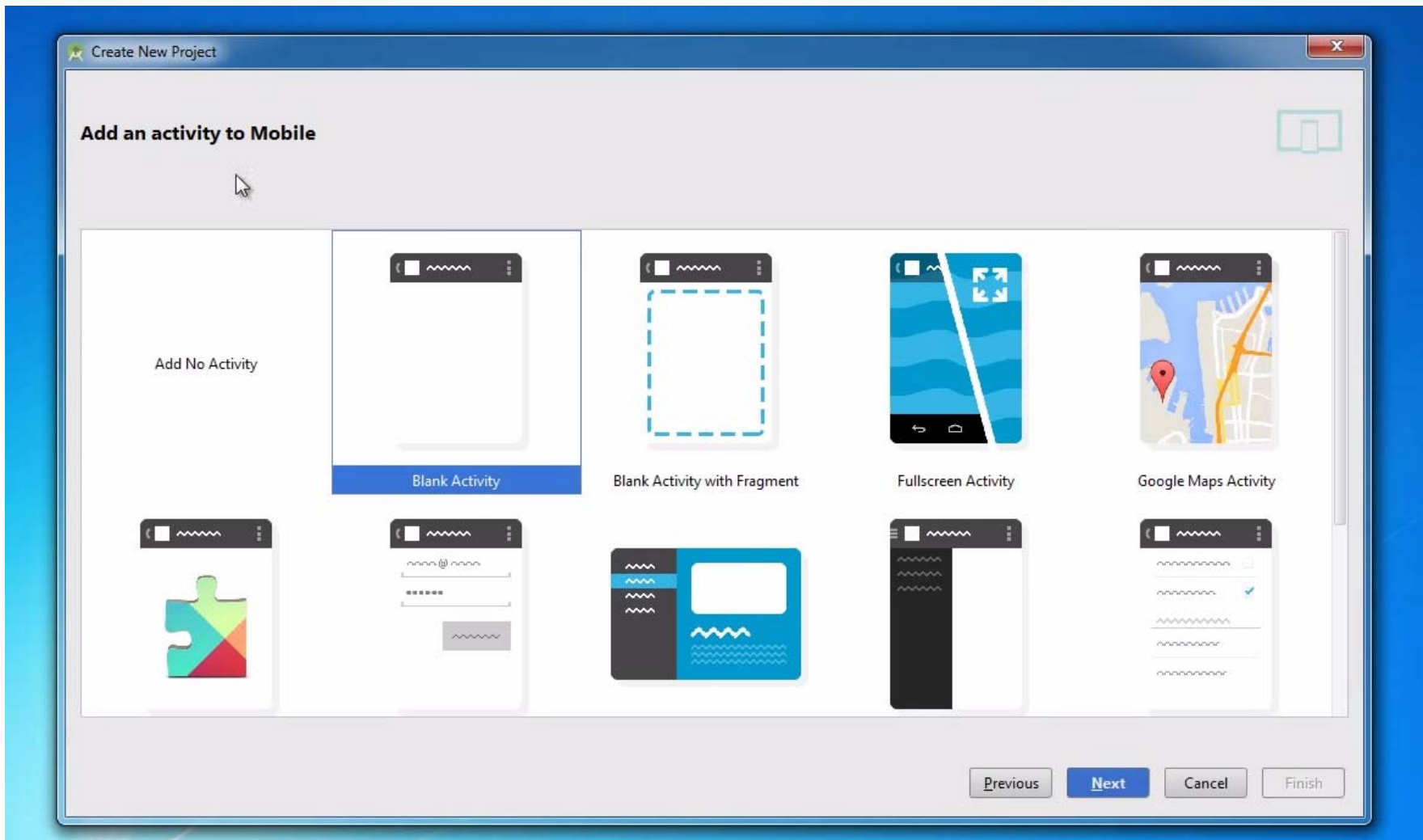
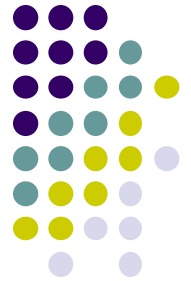
Setting up your Project

- After installing Android Studio, need to set up your project
- Tutorial: Android App Development for Beginners - 3
 - Setting up your project by Bucky Roberts (thenewboston)
 - <https://www.youtube.com/watch?v=r4olez0sfvY>
- Main steps to set up Android Project
 - Start a new Android Project
 - Configure new Android Project (select app name, domain name, etc)
 - Set platform and minimum SDK
 - Add an Activity

Start a new Android Project



Add an Activity (Blank Activity is Simplest)

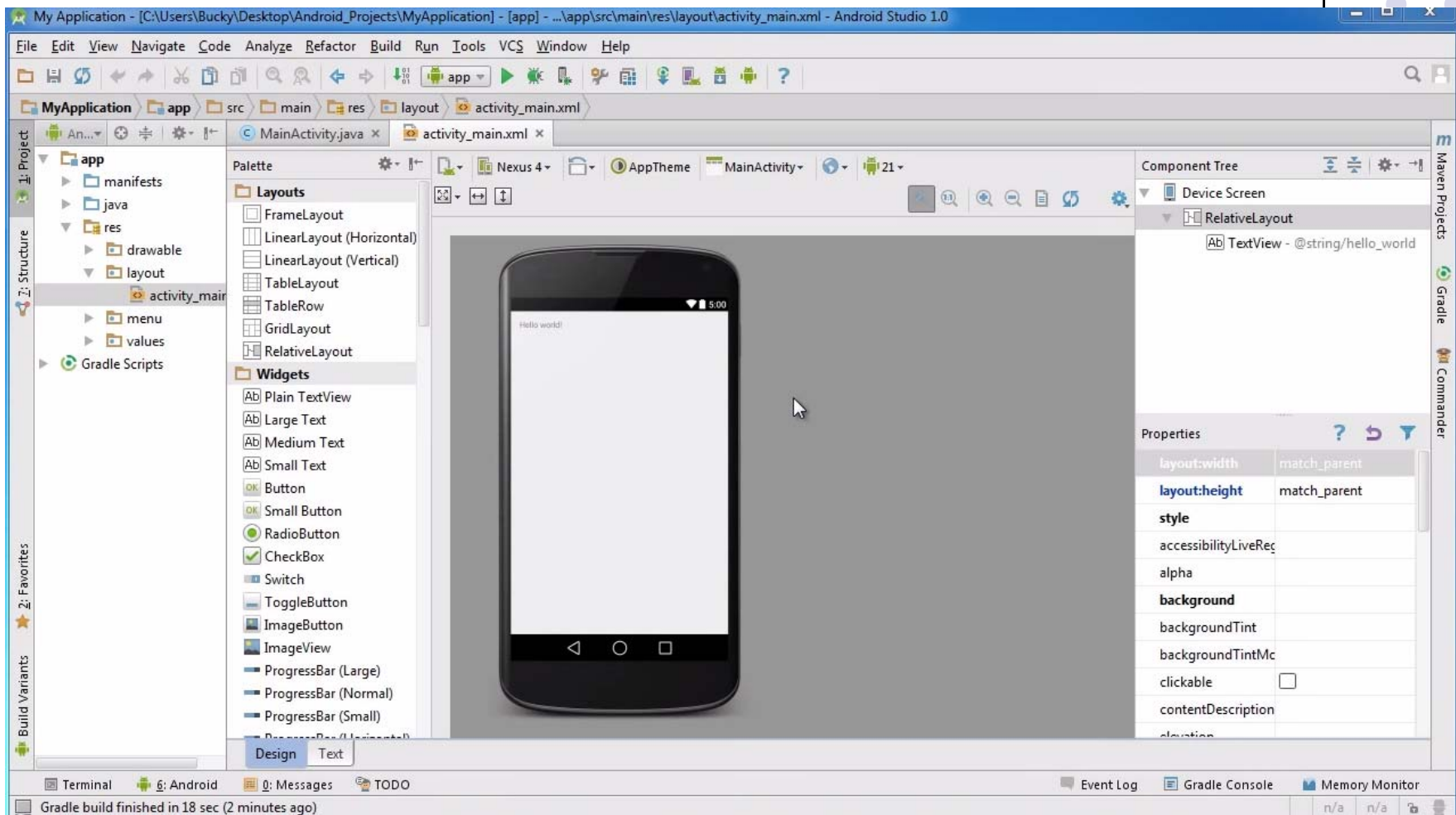
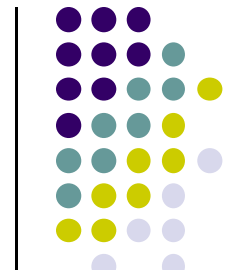




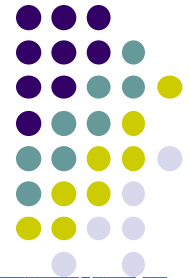
Running a Simple App

- Tutorial 4: Android App Development for Beginners - 4 – Running a Simple App [10:48 mins] by Bucky Roberts
 - <https://www.youtube.com/watch?v=qKRWC3Q8wRw>
- Main steps
 - Run Android Studio
 - Fix any remaining issues
 - Run AVD, select virtual device
 - Run App on selected virtual device

Open Android Studio



Run AVD Manager



Type	Name	Resolution	API	Target	CPU/ABI	Size on Disk	Actions
	Buckys Phone	1080 × 1920: xxhdpi	21	Android 5.0.1	arm	1 GB	
	Nexus 5 API 21 x86	1080 × 1920: xxhdpi	21	Google APIs	x86	1 GB	

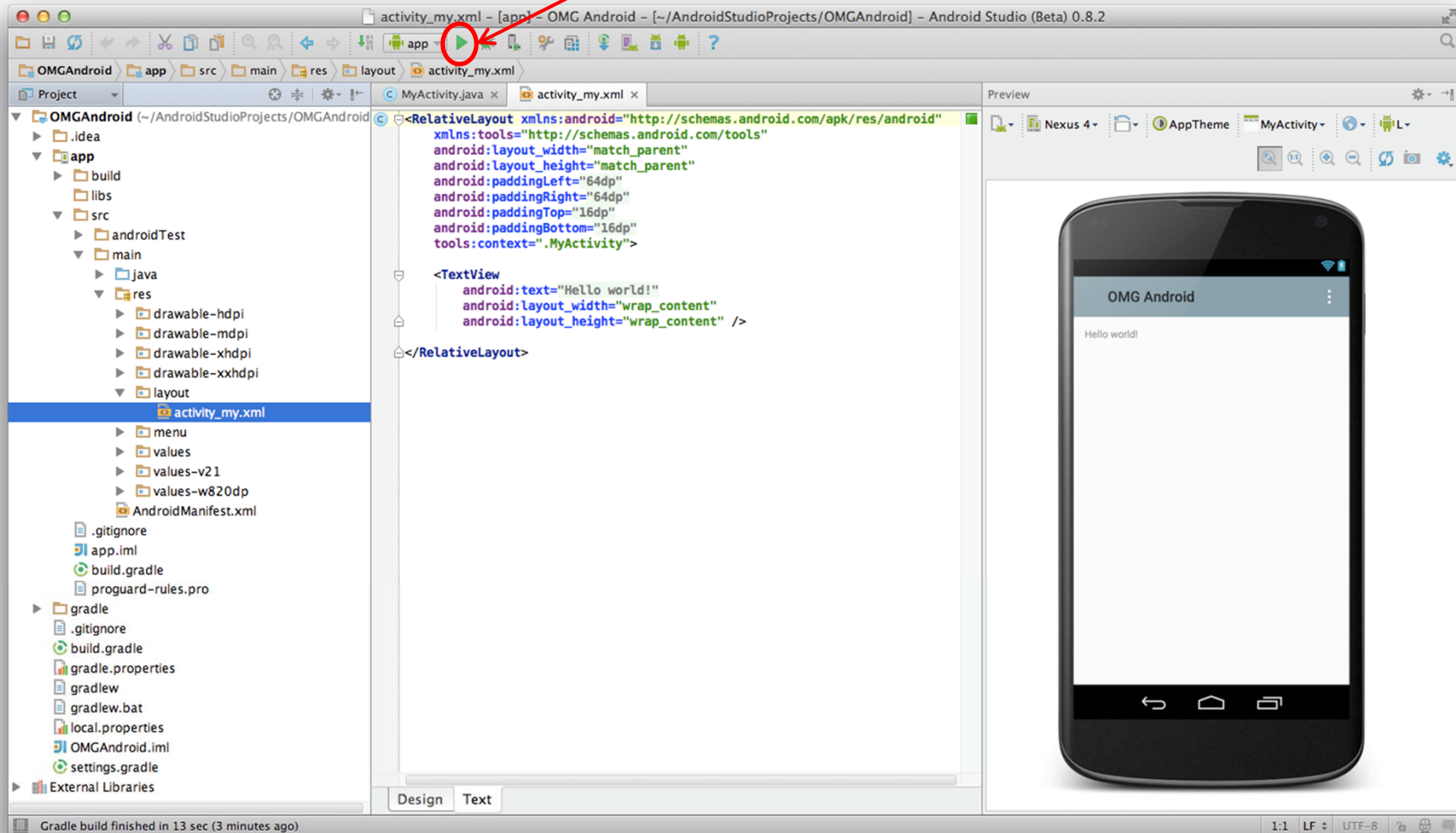
[+ Create Virtual Device...](#)

OK **Cancel**

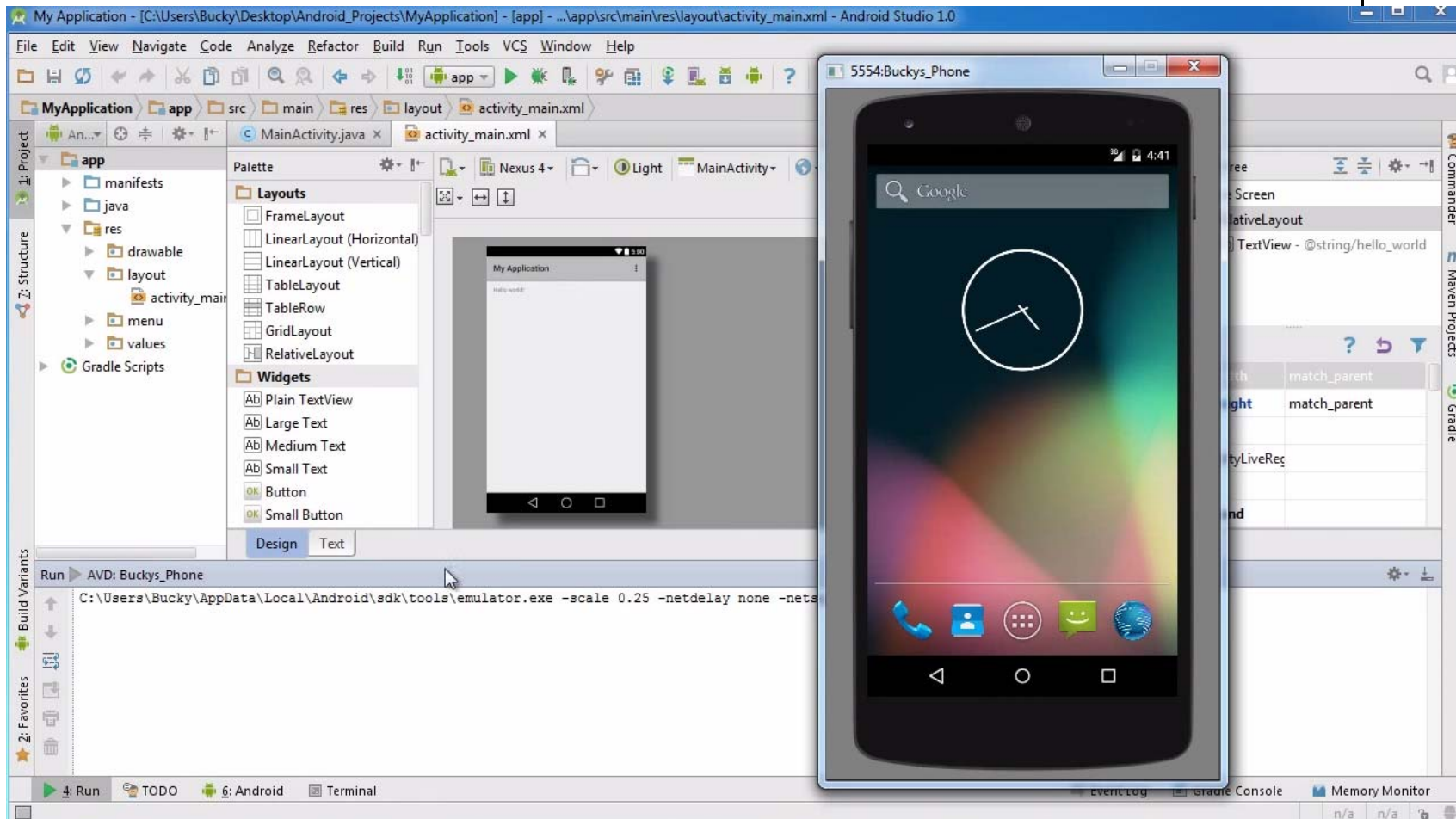
How to Run the App?



Click here to run the app



Run App on Virtual Device (Phone)

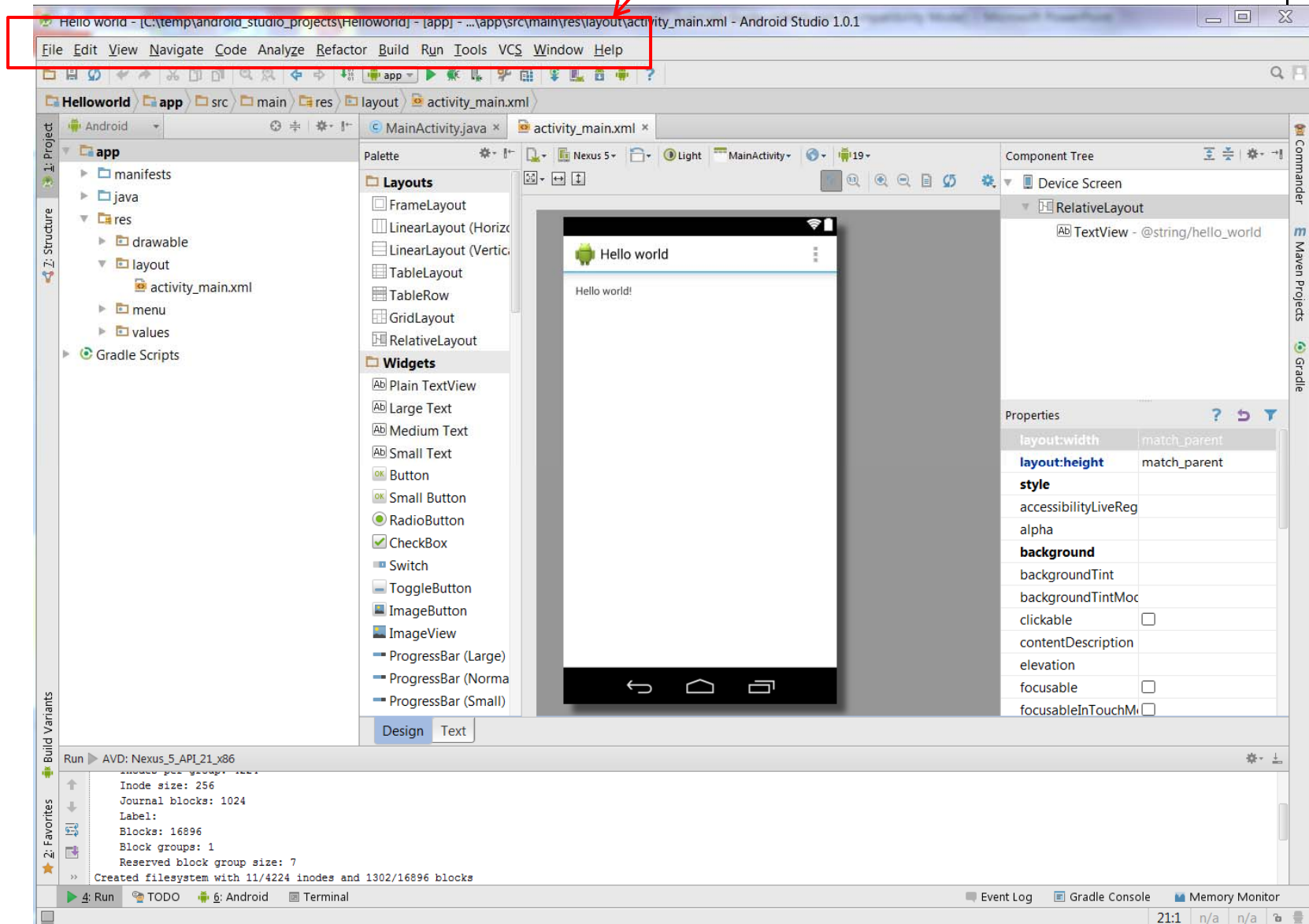


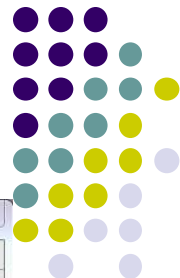


Tour of Android Studio Interface

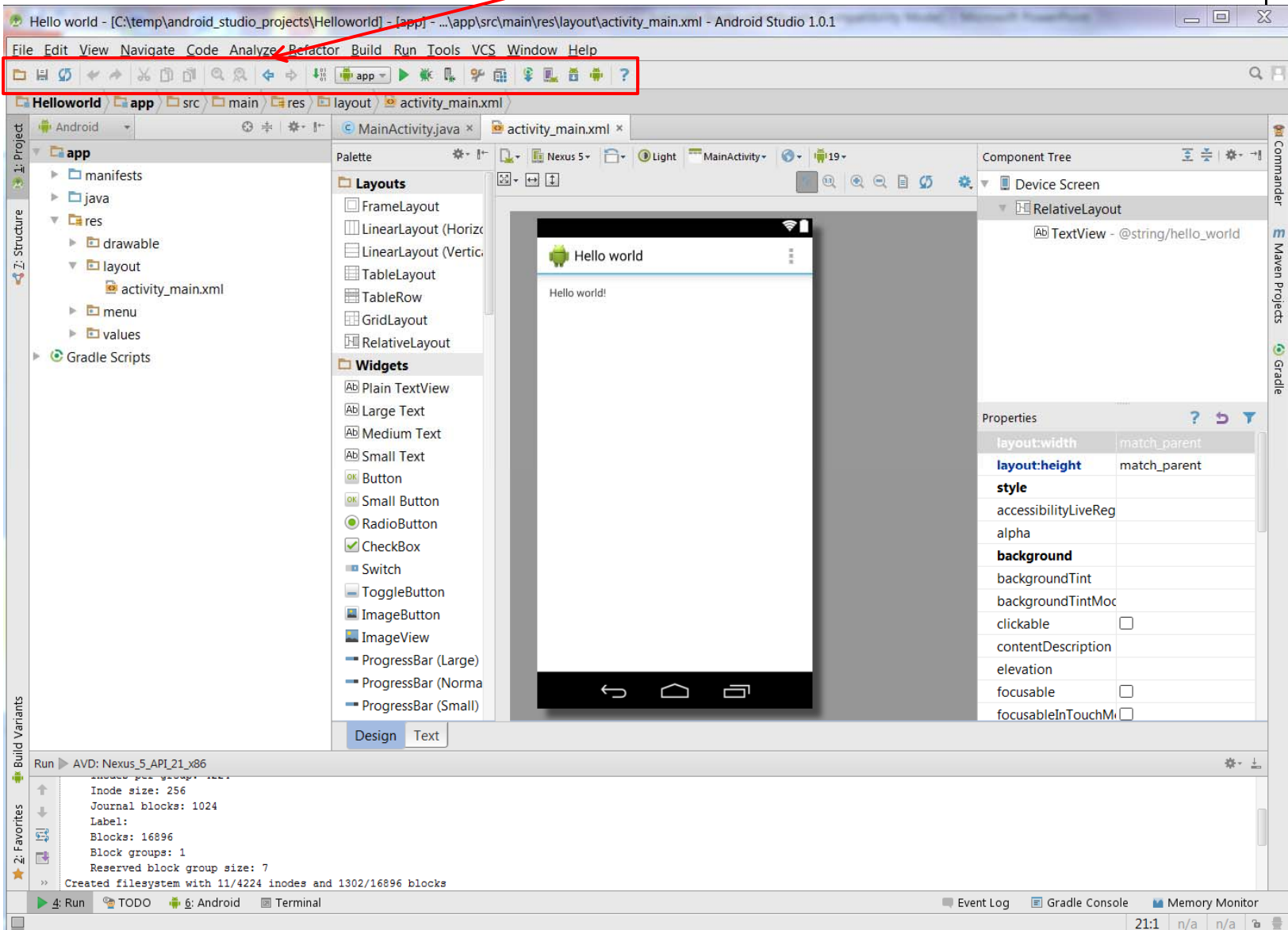
- Tutorial 5: Tour of Android Studio Interface [6:01 mins]
 - <https://www.youtube.com/watch?v=-pdTqBq2TFQ>
- Quick overview of main sections of Android Studio
 - Windows menu bar
 - Android tool bar
 - Project window
 - Editor Window
 - Palette for Drag-and-Drop Design of Android buttons
- More detailed coverage of specific UI aspects later

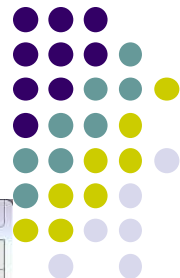
Typical Windows Menu Bar (File, edit, etc)





Tool Bar: Shortcuts to Frequently used Android-specific Functions (E.g. One-click access to SDK manager)



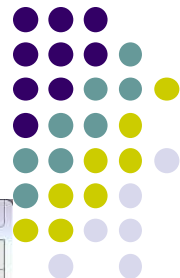


Path to Current File in IDE Window (Clickable)

The screenshot shows the Android Studio IDE interface. A red box highlights the breadcrumb path at the top of the editor window: `Android - [C:\temp\android_studio_projects\HelloWorld] - [app] - ...\app\src\main\res\layout\activity_main.xml`. A red arrow points to this path. The breadcrumb path is clickable and provides a quick way to navigate to the current file.

The IDE interface includes the following components:

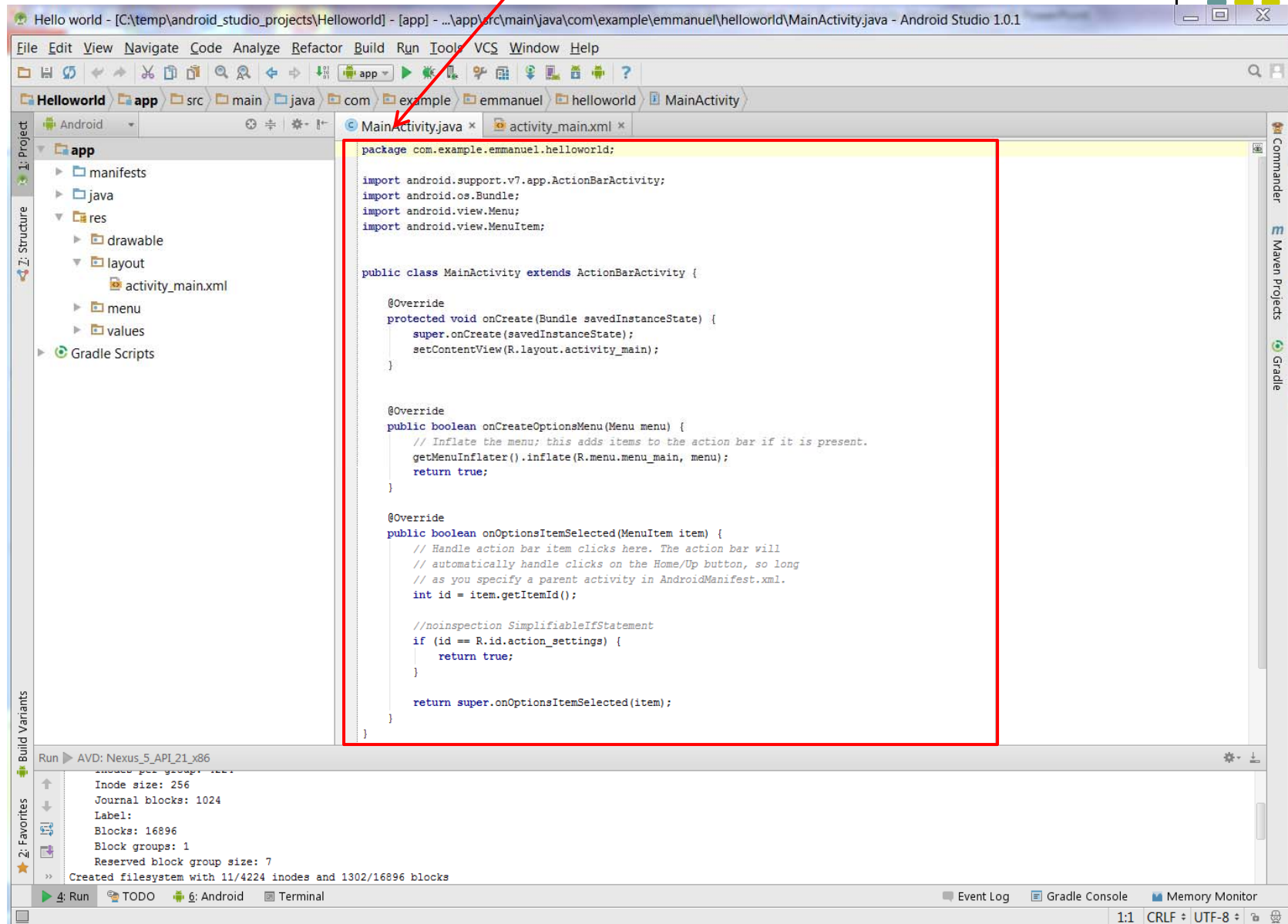
- Project Structure:** Shows the project hierarchy with folders like `manifests`, `java`, `res`, `drawable`, `layout`, `menu`, and `values`.
- Palette:** Displays layout and widget options such as `LinearLayout`, `RelativeLayout`, `TextView`, and `Button`.
- Design View:** Shows a visual representation of the app's UI, displaying "Hello world" on a screen.
- Component Tree:** Shows the hierarchy of UI components, including `RelativeLayout` and `TextView`.
- Properties:** Lists various attributes for the selected component, such as `layout:width`, `layout:height`, and `style`.
- Run Console:** Displays the output of the app's execution, including system logs.



Editor Window (Allows editing of current file we are working on)

The screenshot displays the Android Studio IDE interface. The main Editor Window, which is highlighted with a red box and a red arrow pointing to it from the text above, shows the design view of the `activity_main.xml` file. The design view displays a mobile application screen with the text "Hello world!" and the Android logo. The interface includes several panels: the Project view on the left showing the file structure, the Palette in the center-left with Layouts and Widgets, the Component Tree on the right showing the `RelativeLayout` and `TextView` components, and the Properties panel at the bottom right showing attributes like `layout:width` and `layout:height`. The bottom status bar shows the device configuration as "AVD: Nexus_5_API_21_x86" and the time as 21:1.

Clicking on Editor Window Tabs switches between Java code and Visual Interface



Project Window (Shows project files, packages, etc)



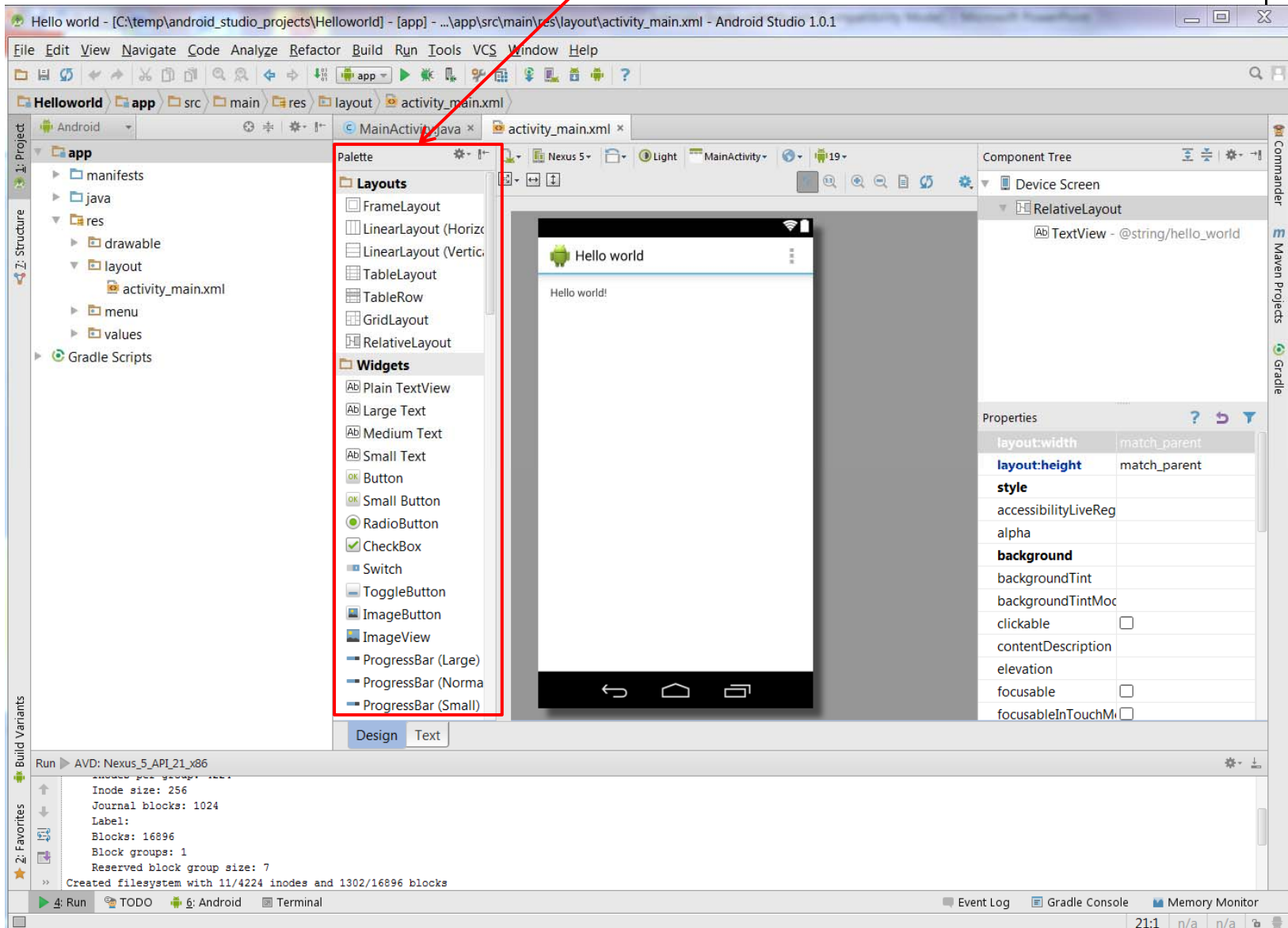
The screenshot displays the Android Studio IDE with the following components:

- Project Window (Left):** A tree view showing the project structure for 'Hello world'. The 'app' folder is expanded, revealing subfolders for 'manifests', 'java', 'res' (containing 'drawable', 'layout', 'menu', and 'values'), and 'Gradle Scripts'. A red box highlights this window, with a red arrow pointing to the 'res/layout' folder.
- Palette (Middle-Left):** A list of UI components categorized into 'Layouts' (FrameLayout, LinearLayout, TableLayout, GridLayout, RelativeLayout) and 'Widgets' (Plain TextView, Large Text, Medium Text, Small Text, Button, Small Button, RadioButton, CheckBox, Switch, ToggleButton, ImageButton, ImageView, ProgressBar).
- Design View (Center):** A visual representation of the app's main screen on a Nexus 5 device. It shows a white background with the text 'Hello world!' and an Android logo in the top left corner.
- Component Tree (Middle-Right):** A hierarchical view of the UI components. It shows a 'RelativeLayout' containing a 'TextView' with the text '@string/hello_world'.
- Properties Panel (Bottom-Right):** A table of properties for the selected 'TextView' component.

Property	Value
layout:width	match_parent
layout:height	match_parent
style	
accessibilityLiveReg	
alpha	
background	
backgroundTint	
backgroundTintMoc	
clickable	<input type="checkbox"/>
contentDescription	
elevation	
focusable	<input type="checkbox"/>
focusableInTouchM	<input type="checkbox"/>

At the bottom of the screen, the 'Run' console shows the output of the AVD (Android Virtual Device) creation process, including details like 'Inode size: 256', 'Journal blocks: 1024', and 'Created filesystem with 11/4224 inodes and 1302/16896 blocks'.

Palette of Drag-and-Drop Elements for Designing Interface (Layout, widgets, etc)



Parameters of Drag-and-Drop Elements for Designing Interface (e.g. colors, dimensions of widgets, etc)



The screenshot displays the Android Studio IDE with the design interface for an activity. The main window shows a preview of a mobile device with the text "Hello world!". The Properties panel on the right is highlighted with a red box and contains the following parameters:

Property	Value
layout:width	match_parent
layout:height	match_parent
style	
accessibilityLiveReg	
alpha	
background	
backgroundTint	
backgroundTintMoc	
clickable	<input type="checkbox"/>
contentDescription	
elevation	
focusable	<input type="checkbox"/>
focusableInTouchM	<input type="checkbox"/>



Platform Version	API Level	VERSION_CODE	Notes
Android 6.0	23	M	API Changes
Android 5.1	22	LOLLIPOP_MR1	Platform Highlights
Android 5.0	21	LOLLIPOP	
Android 4.4W	20	KITKAT_WATCH	KitKat for Wearables Only
Android 4.4	19	KITKAT	Platform Highlights
Android 4.3	18	JELLY_BEAN_MR2	Platform Highlights
Android 4.2, 4.2.2	17	JELLY_BEAN_MR1	Platform Highlights
Android 4.1, 4.1.1	16	JELLY_BEAN	Platform Highlights
Android 4.0.3, 4.0.4	15	ICE_CREAM_SANDWICH_MR1	Platform Highlights
Android 4.0, 4.0.1, 4.0.2	14	ICE_CREAM_SANDWICH	
Android 3.2	13	HONEYCOMB_MR2	
Android 3.1.x	12	HONEYCOMB_MR1	Platform Highlights
Android 3.0.x	11	HONEYCOMB	Platform Highlights
Android 2.3.4	10	GINGERBREAD_MR1	Platform Highlights
Android 2.3.3			
Android 2.3.2			
Android 2.3.1	9	GINGERBREAD	
Android 2.3			
Android 2.2.x	8	FROYO	Platform Highlights
Android 2.1.x	7	ECLAIR_MR1	Platform Highlights
Android 2.0.1	6	ECLAIR_0_1	
Android 2.0	5	ECLAIR	
Android 1.6	4	DONUT	Platform Highlights
Android 1.5	3	CUPCAKE	Platform Highlights
Android 1.1	2	BASE_1_1	
Android 1.0	1	BASE	

Android Versions/API Levels



References

- Ask A Dev, Android Wear: What Developers Need to Know, <https://www.youtube.com/watch?v=zTS2NZpLyQg>
- Ask A Dev, Mobile Minute: What to (Android) Wear, https://www.youtube.com/watch?v=n5Yjzn3b_aQ
- Busy Coder's guide to Android version 4.4
- CS 65/165 slides, Dartmouth College, Spring 2014
- CS 371M slides, U of Texas Austin, Spring 2014