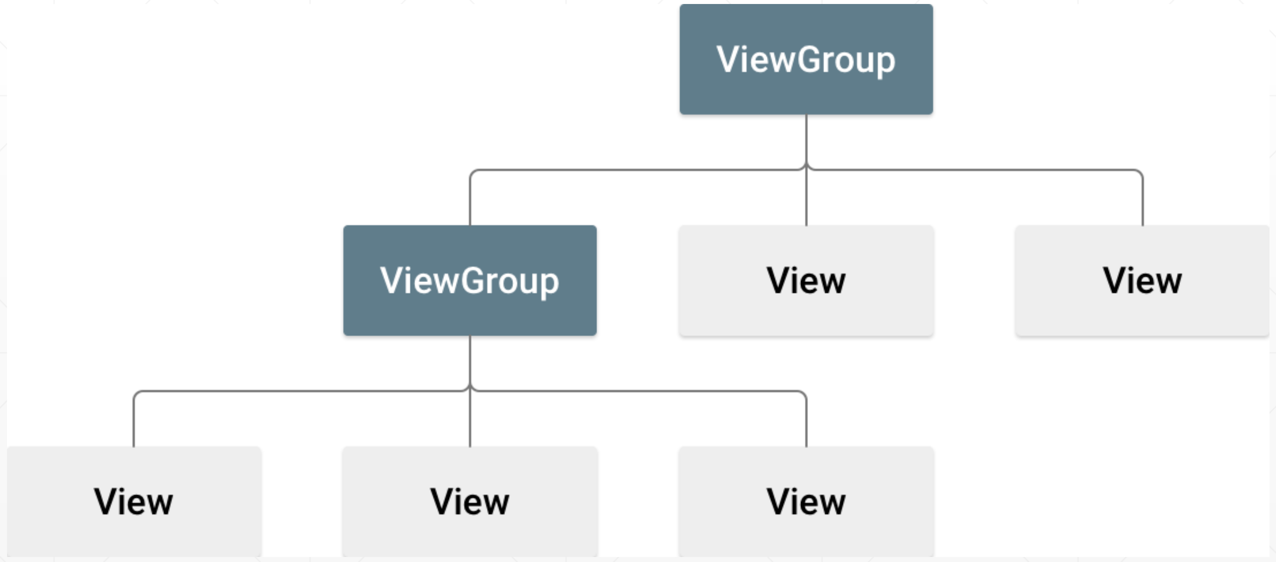
Mobile Programming

Layout & Widgets

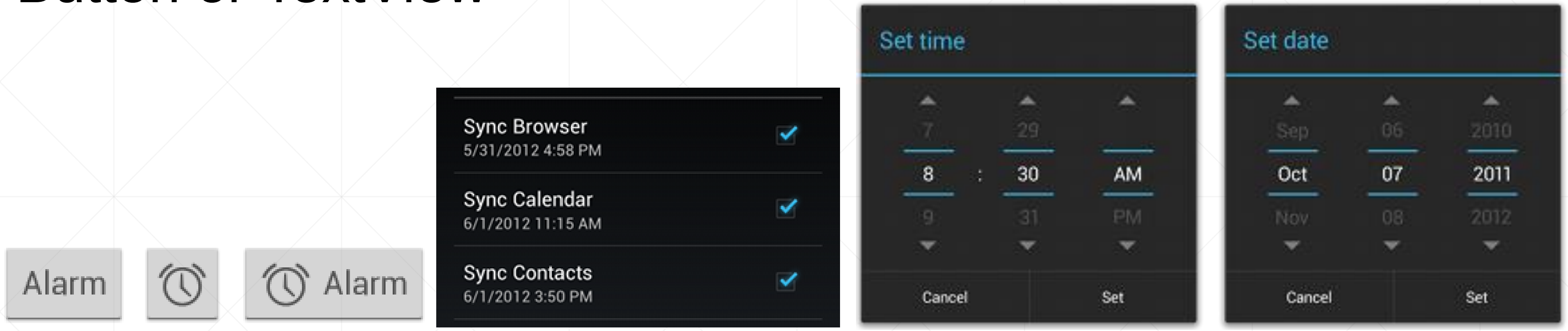
View (1/2)

- A layout defines the structure for a user interface in your app
- All elements in the layout are built using a hierarchy of View and ViewGroup objects
  - View usually draws something the user can see and interact with
  - ViewGroup is an invisible container that defines the layout structure for View and other ViewGroup objects

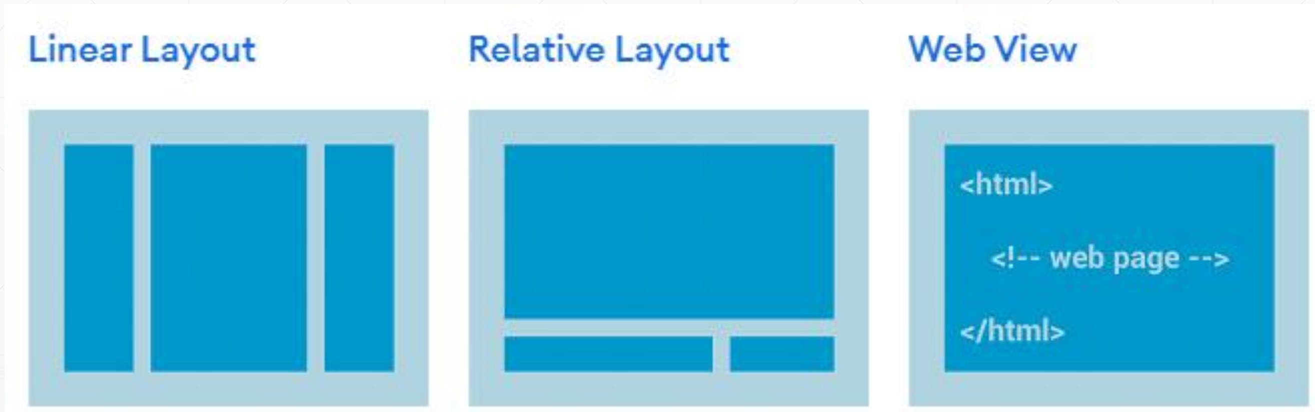


View (2/2)

- The View objects are usually called "widgets" and can be one of many subclasses, such as Button or TextView



- The ViewGroup objects are usually called "layouts" can be one of many types that provide a different layout structure, such as LinearLayout or ConstraintLayout

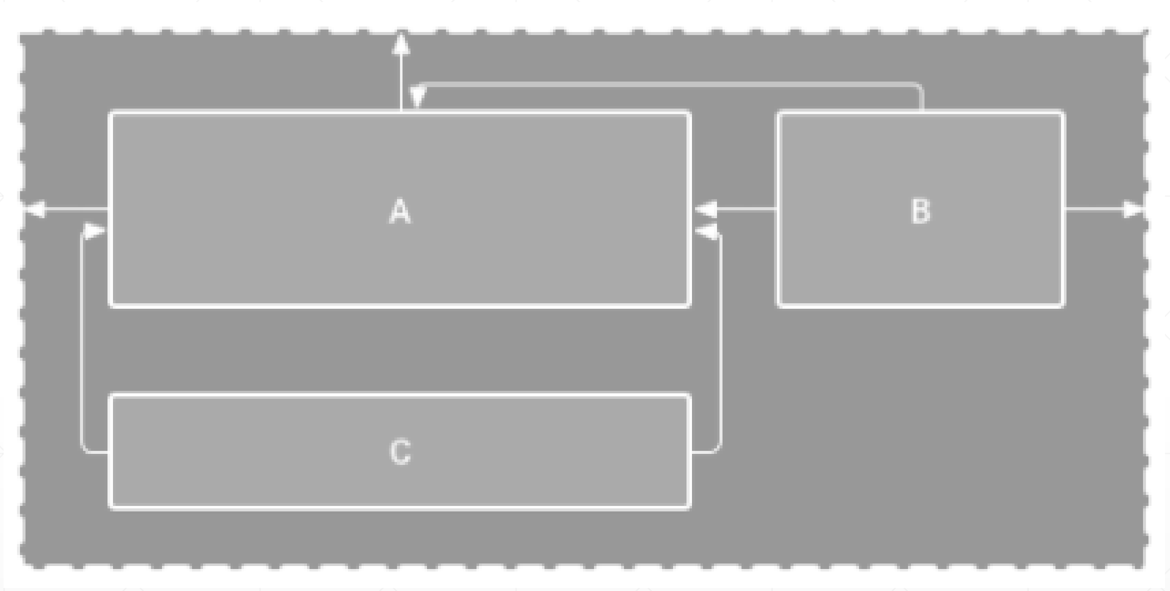


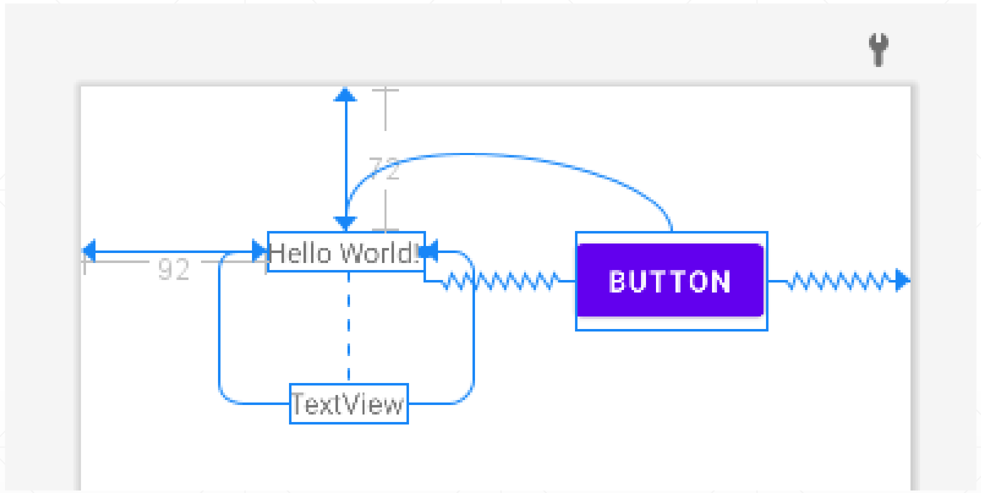
ConstraintLayout: Overview (1/4)

- Flexible and easy-to-use layout
- Position of View in ConstraintLayout is determined based on constraints
  - You must add at least one horizontal and one vertical constraint for the view
- Constraint
  - Represents a connection or alignment to another view, the parent layout, or an invisible guideline
  - Defines the view's position along either the vertical or horizontal axis

ConstraintLayout: Overview (2/4)

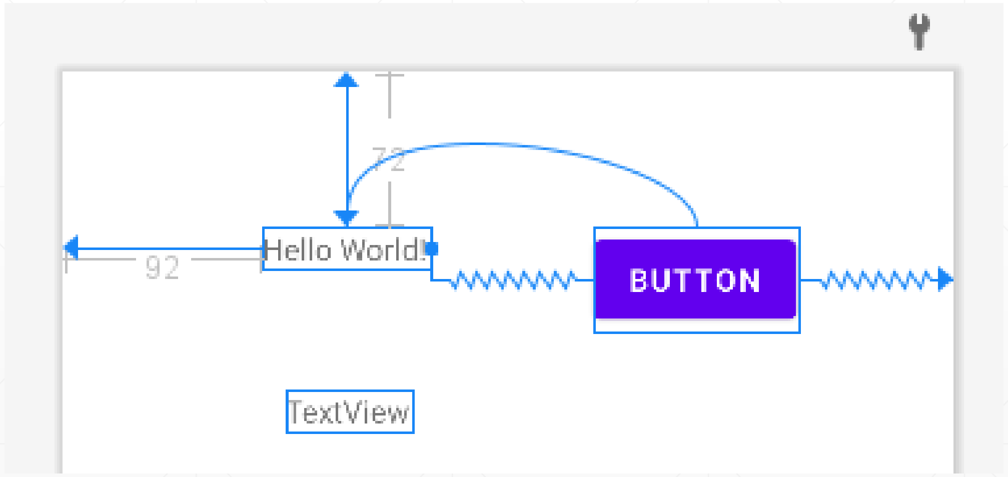
- Where will the view “C” appear on the screen?

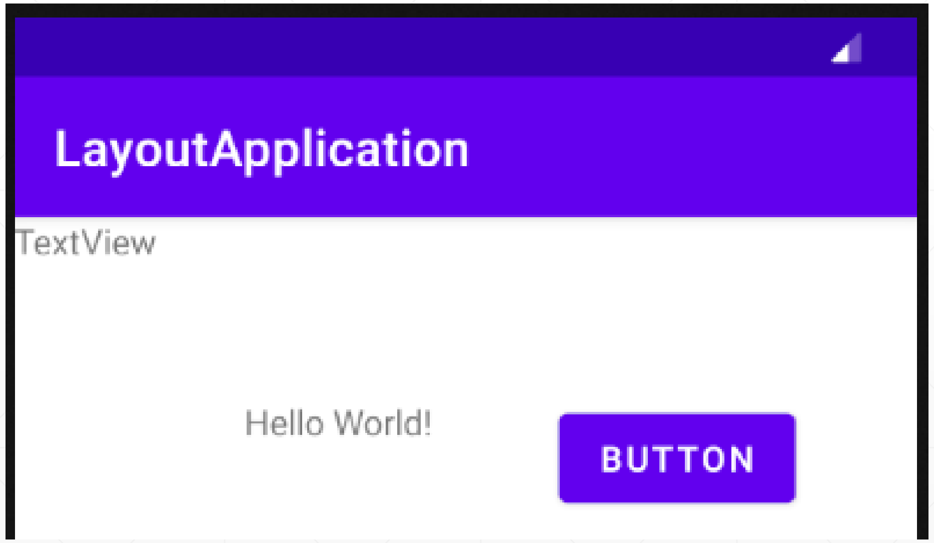




ConstraintLayout: Overview (3/4)

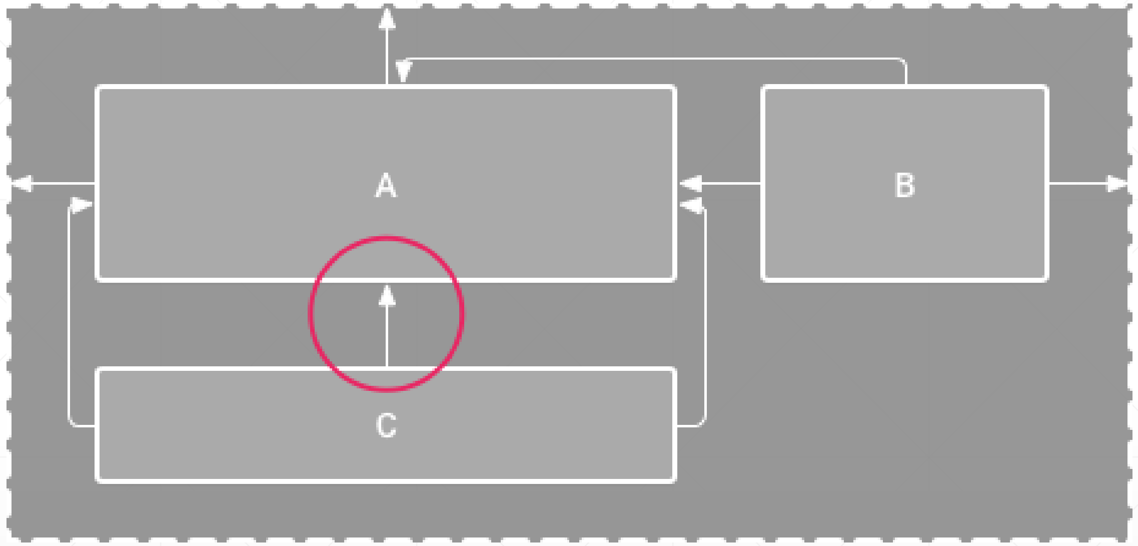
- When you drop a view into the Layout Editor, it stays where you leave it even if it has no constraints
  - However, this is only to make editing easier!
  - if a view has no constraints when you run your layout on a device, it is drawn at position [0,0]

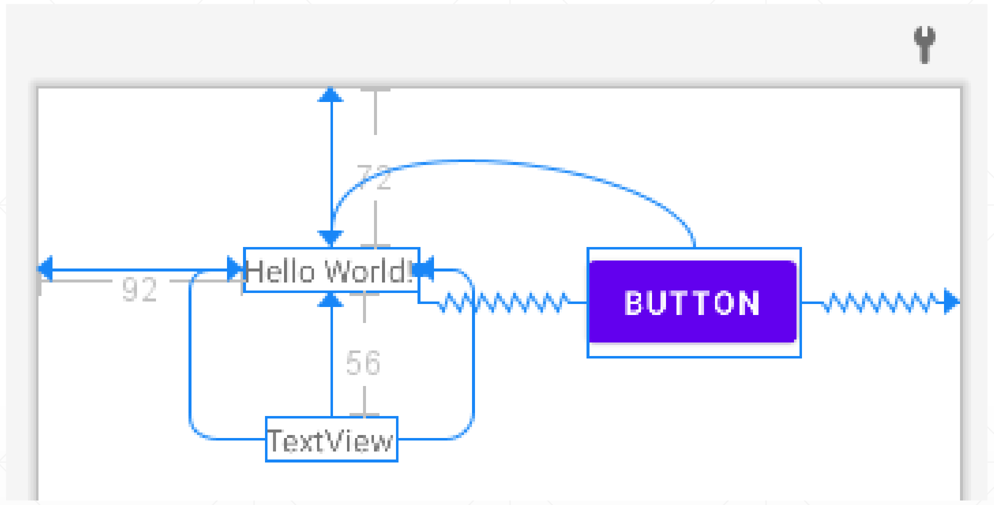




ConstraintLayout: Overview (4/4)

- Where will the view “C” appear on the screen?

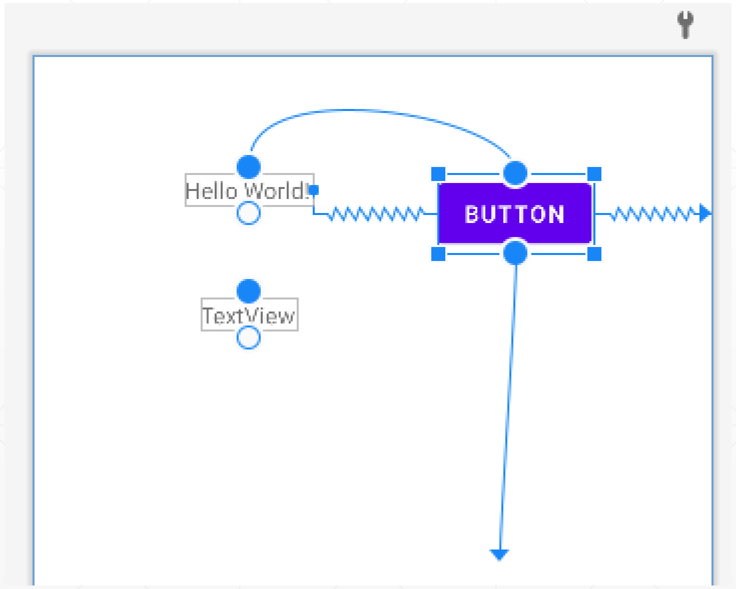


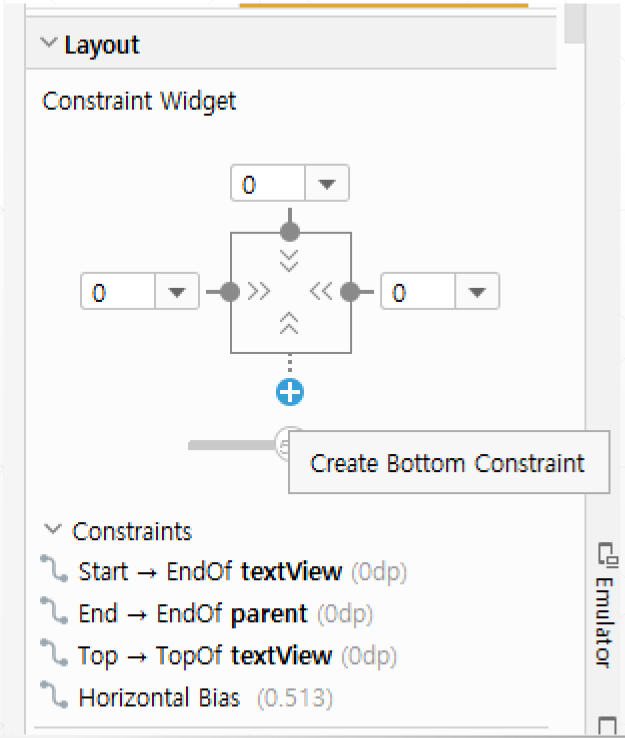


- Although a missing constraint won't cause a compilation error, the Layout Editor indicates missing constraints as an error in the toolbar!

ConstraintLayout: Constraints (1/6)

- Adding constraints
  - Click a constraint handle and drag it to an available anchor point!
    - This point can be the edge of another view, the edge of the layout, or a guideline
  - Click one of the "Create a connection" buttons ⊕ in the Layout section of the Attributes window

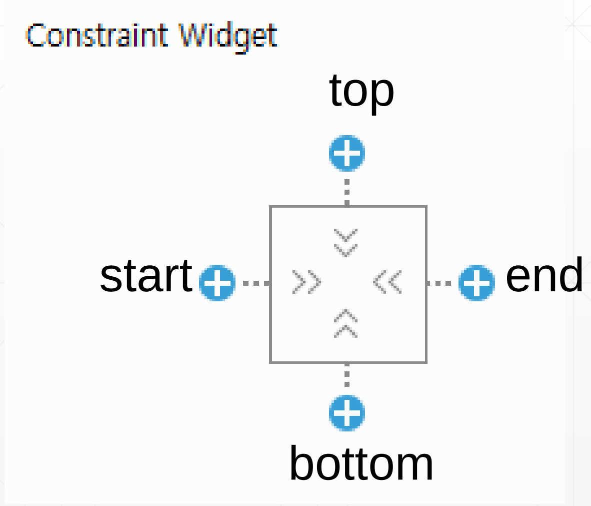




Constraints
- Start → EndOf **textView** (0dp)
- End → EndOf **parent** (0dp)
- Top → TopOf **textView** (0dp)
- Horizontal Bias (0.513)

ConstraintLayout: Constraints (2/6)

- Adding constraints (rules)
  - Every view must have at least two constraints: one horizontal and one vertical
  - You can create constraints only between a constraint handle and an anchor point that share the same plane
    - A vertical plane (the left and right sides) of a view can be constrained only to another vertical plane
  - Each constraint handle can be used for just one constraint, but you can create multiple constraints (from different views) to the same anchor point

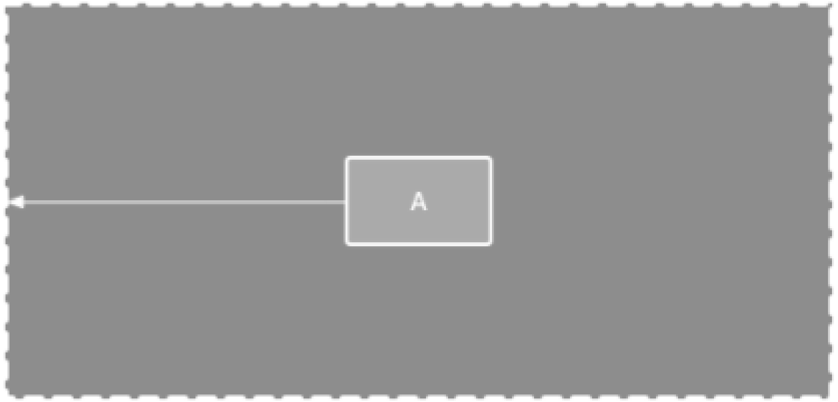


ConstraintLayout: Constraints (3/6)

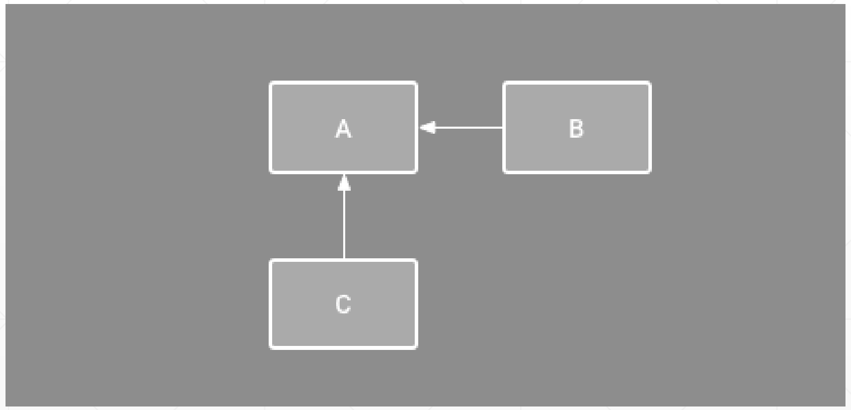
- Removing constraints
  - Click on a constraint to select it, and then press Delete button
  - Press and hold Control button, and then click on a constraint anchor
    - Note that the constraint turns red to indicate that you can click to delete it!
  - In the **Layout** section of the **Attributes** window, click on a constraint anchor

ConstraintLayout: Constraints (4/6)

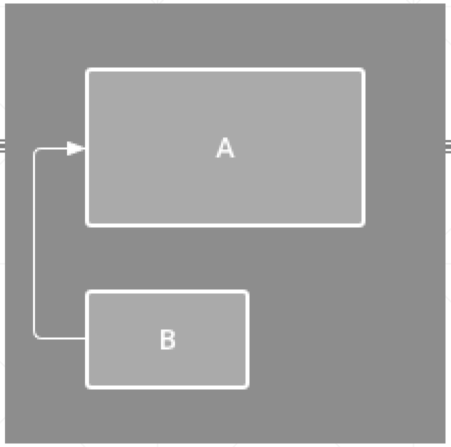
- Parent position
  - Constrain the side of a view to the corresponding edge of the layout
    - e.g.) The left side of the view is connected to the left edge of the parent layout
    - You can define the distance from the edge with margin



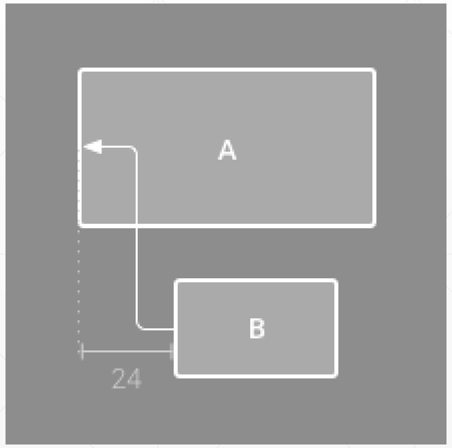
- Order position
  - Define the order of appearance for two views, either vertically or horizontally
  - e.g.) B is constrained to always be to the right of A, and C is constrained below A
    - However, these constraints do not imply alignment, so B can still move up and down



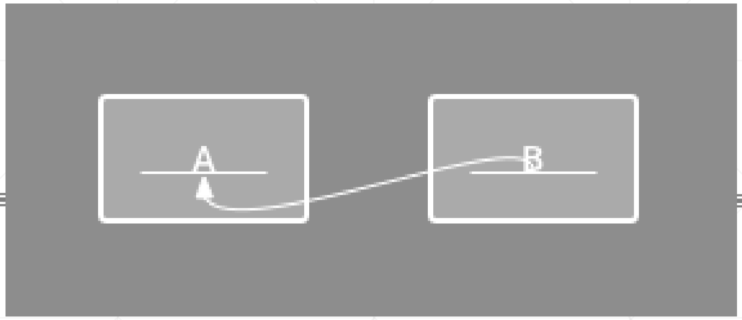
ConstraintLayout: Constraints (5/6)



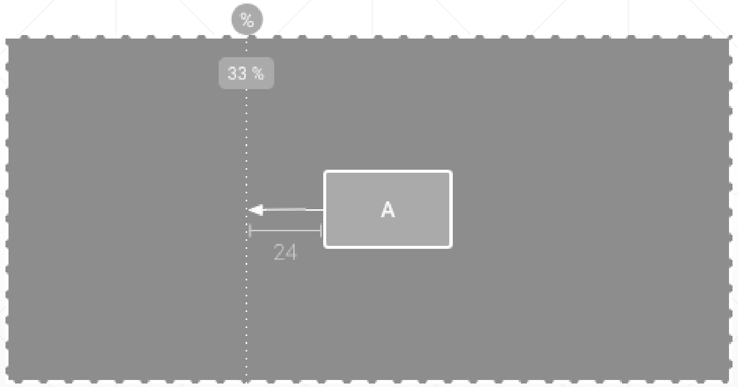
- Alignment
  - Align the edge of a view to the same edge of another view
  - e.g., the left side of B is aligned to the left side of A
    If you want to align the view centers, create a constraint on both sides
  - You can offset the alignment by dragging the view inward from the constraint
  - e.g.) B with a 24dp offset alignment
    - The offset is defined by the constrained view's margin



ConstraintLayout: Constraints (6/6)



- Baseline alignment
  - Align the text baseline of a view to the text baseline of another view
  - Right-click the text view you want to constrain and then click **Show Baseline!**
  - Then click on the text baseline and drag the line to another baseline

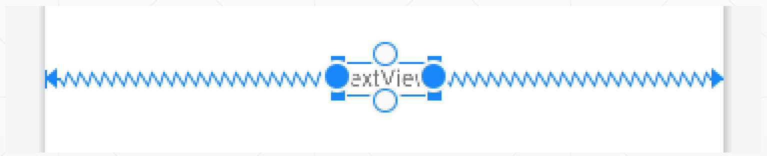


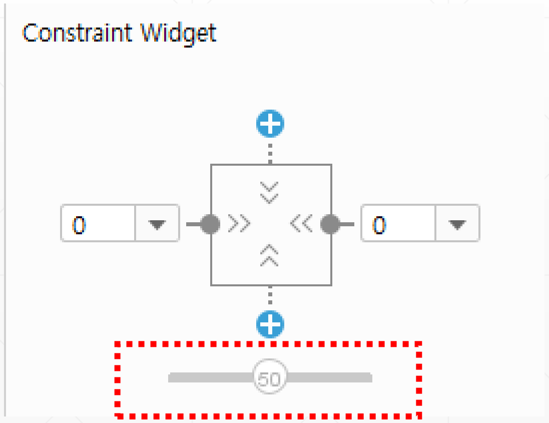
- Constrain to a guideline
  - You can add a vertical or horizontal guideline to which you can constrain views
  - Guideline is invisible to app users
  - To create a guideline, click Guidelines in the toolbar, and then click either "Add Vertical Guideline" or "Add Horizontal Guideline"

ConstraintLayout: Constraint bias

- When you add a constraint to both sides of a view, and the view size for the same dimension is either "fixed" or "wrap content“, the view becomes centered between the two constraints with a bias of 50% by default

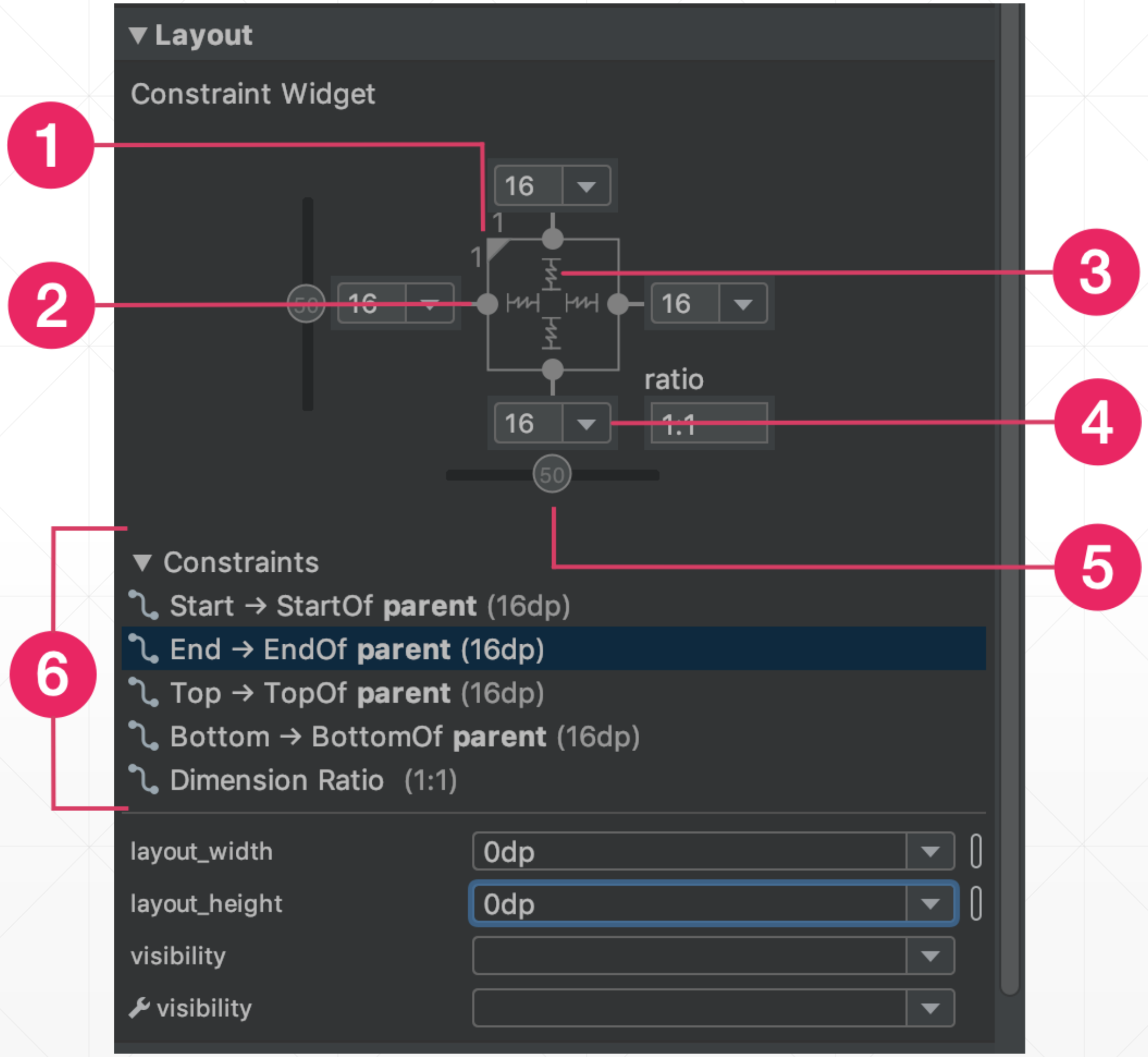
- You can adjust the bias by dragging the bias slider in the **Attributes** window or by dragging the view





ConstraintLayout: View Size (1/2)

- View inspector
  - ① Aspect ratio
  - ② Adding/Deleting constraints
  - ③ Height/width mode
  - ④ Margins
  - ⑤ Constraint bias
  - ⑥ Constraint list



▼ Constraints
Start → StartOf **parent** (16dp)
End → EndOf **parent** (16dp)
Top → TopOf **parent** (16dp)
Bottom → BottomOf **parent** (16dp)
Dimension Ratio (1:1)

layout_width 0dp
layout_height 0dp
visibility
visibility

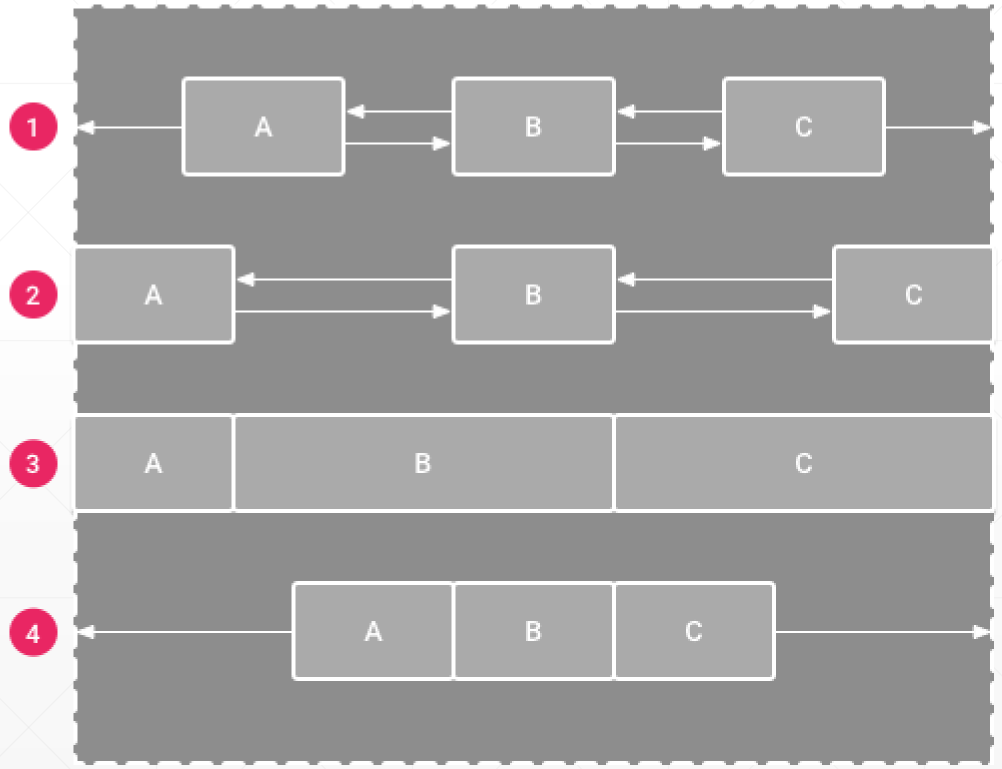
ConstraintLayout: View Size (2/2)

- Height/width mode
  - Fixed: Specify a specific dimension in the text box below or by resizing the view in the editor
  - Wrap Content: The view expands only as much as needed to fit its contents
  - Match Constraints: The view expands as much as possible to meet the constraints on each side

- Aspect ratio
  - To enable the ratio, click **Toggle Aspect Ratio Constraint**, and then enter the ***width***:***height*** ratio in the input that appears (e.g., 16:9, 4:3, etc.)
  - **Aspect Ratio Constraint** is enabled when the width/height of a view is set to set to "match constraints" (0dp)

ConstraintLayout: Chains

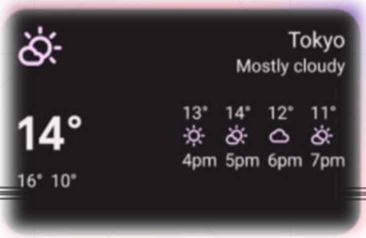
- Group of views that are linked to each other with bi-directional position constraints
  - The views within a chain can be distributed either vertically or horizontally
- Types
  - **Spread:** The views are evenly distributed (default)
  - **Spread inside:** The first and last view are affixed to the constraints on each end of the chain and the rest are evenly distributed
  - **Weighted:** When the chain is set to either spread or spread inside, you can fill the remaining space by setting one or more views to "match constraints"
  - **Packed:** The views are packed together



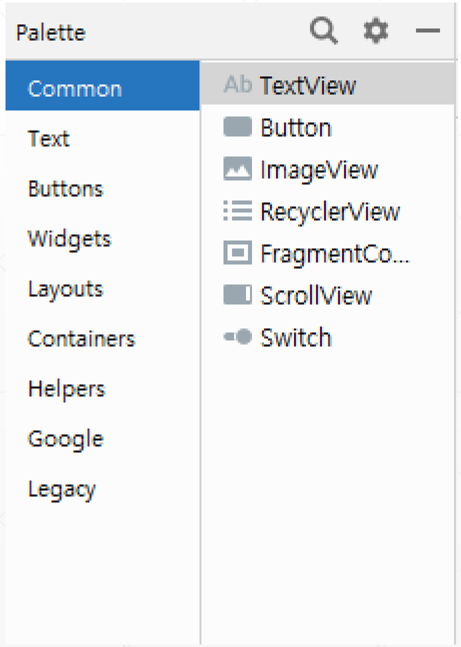
More Lyaouts

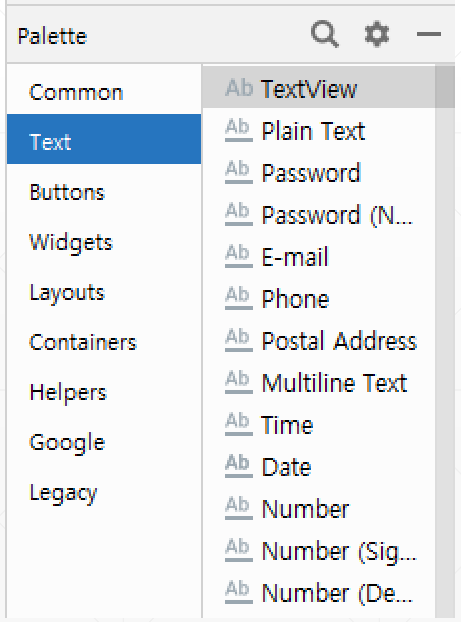
- LinearLayout (https://developer.android.com/guide/topics/ui/layout/linear)
- RelativeLayout (https://developer.android.com/guide/topics/ui/layout/relative)
- FrameLayout
- …

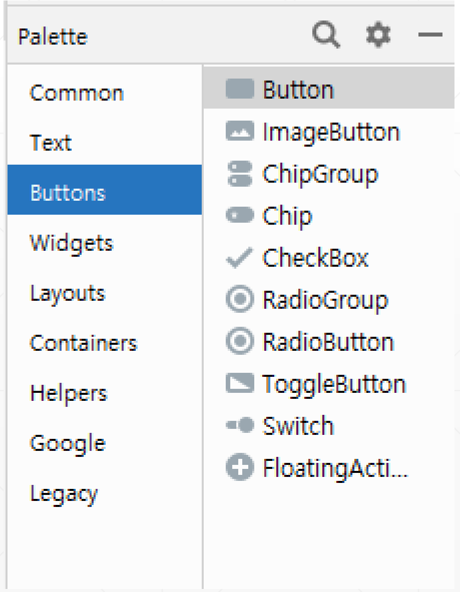
Widgets

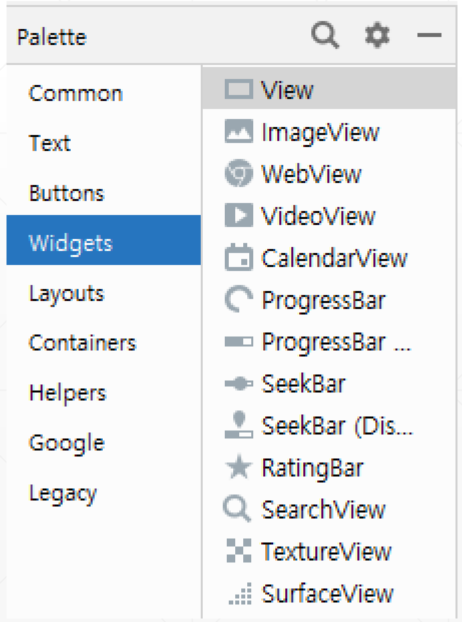


- UI components such as Buttons, Textview, and ImageView
- Widget != App widget
  - App widgets: "at-a-glance" views of an app's most important data and functionality accessible right from the user's home screen
    - For Homescreen customization!



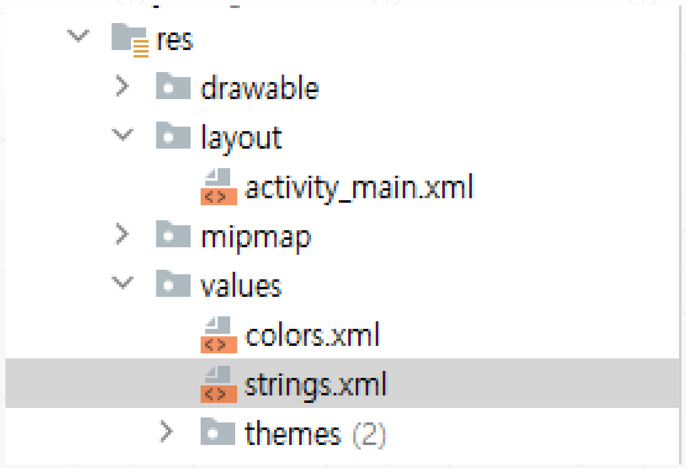






Widgets: TextView (1/4)

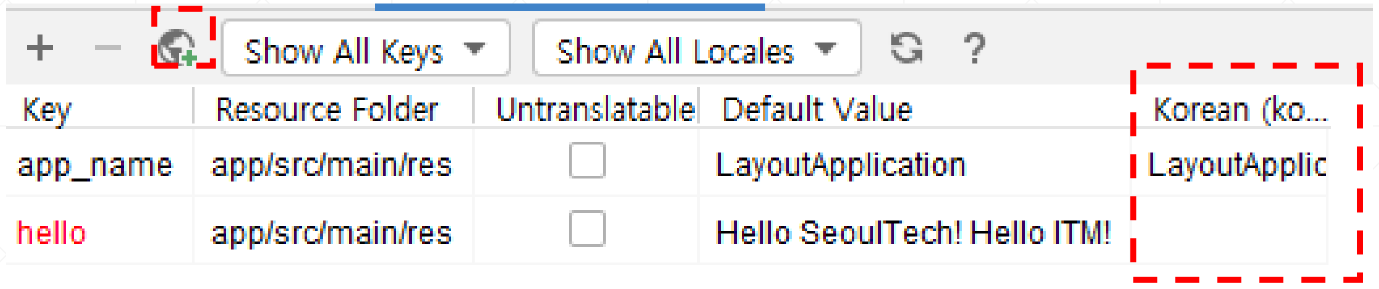
- Basic widget to show text contents
- Attributes
  - text: text context to show
    - You can input strings directly here, but not recommended
    - Instead, use strings.xml resource for further processing such as localization
    - Now, you can refer the string resource using resource ID



```
<resources>
    <string name="app_name">LayoutApplication</string>
    <string name="hello">Hello SeoulTech! Hello ITM!</string>
</resources>
```

Widgets: TextView (2/4)

- String localization
  - Use translation editor (right click on strings.xml → open translation editor)

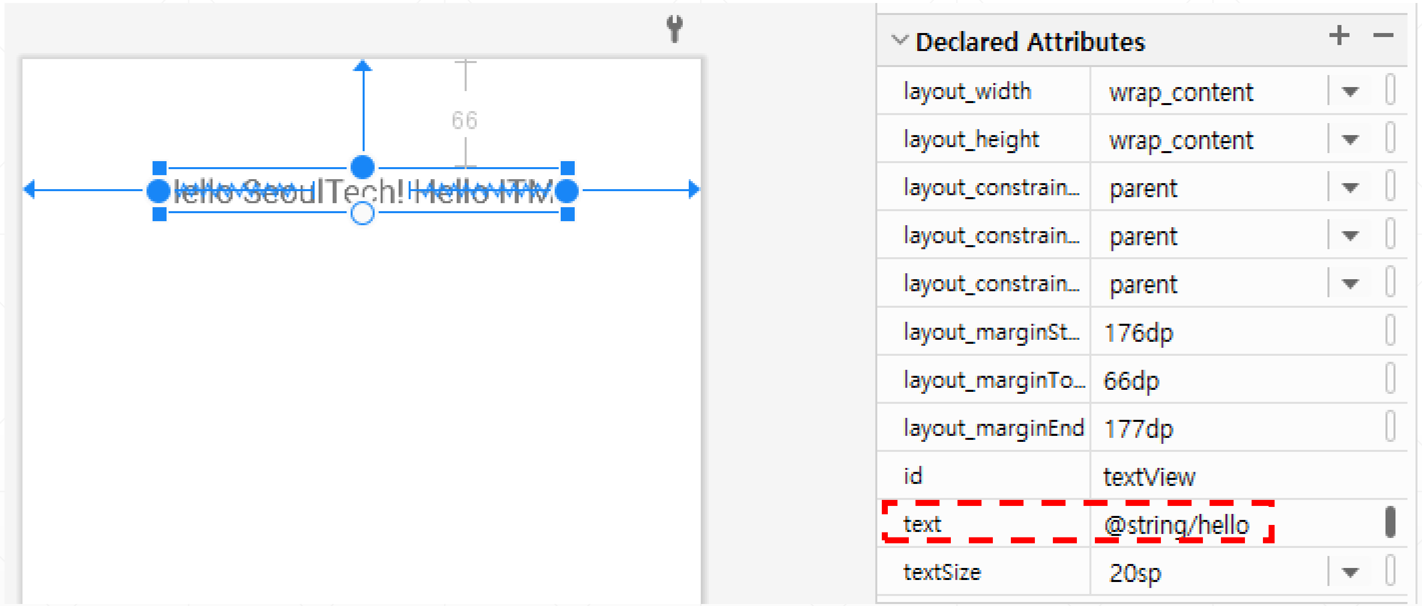


Key	Resource Folder	Untranslatable	Default Value	Korean (ko...
app_name	app/src/main/res	☐	LayoutApplication	LayoutApplic
hello	app/src/main/res	☐	Hello SeoulTech! Hello ITM!	

  - Put your translated text for each added locale
    - e.g., “ITM 친구들 안녕~?”

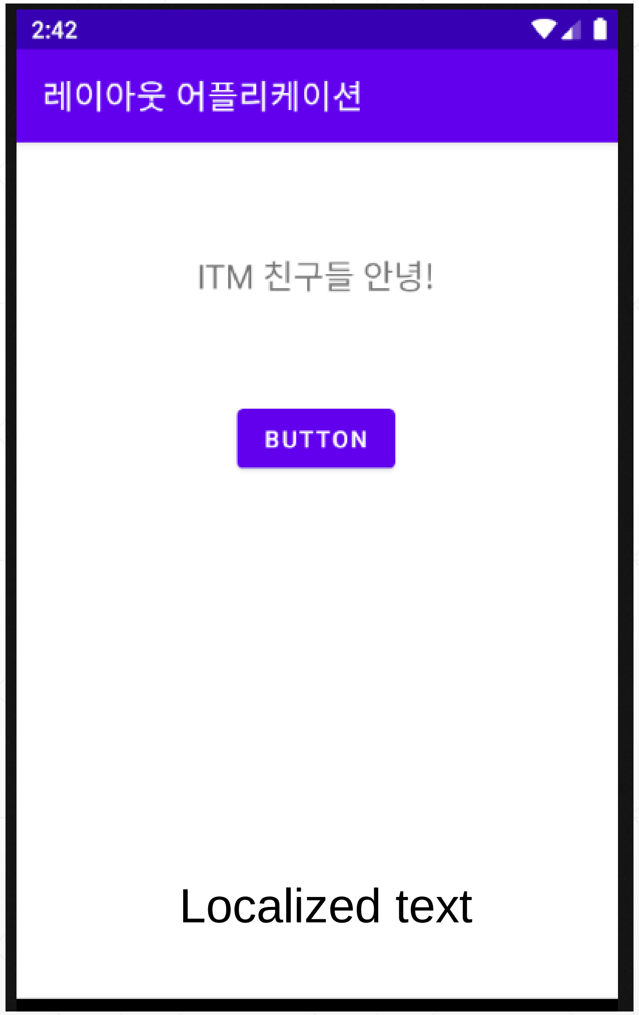
Widgets: TextView (3/4)

- Usage



Declared Attributes

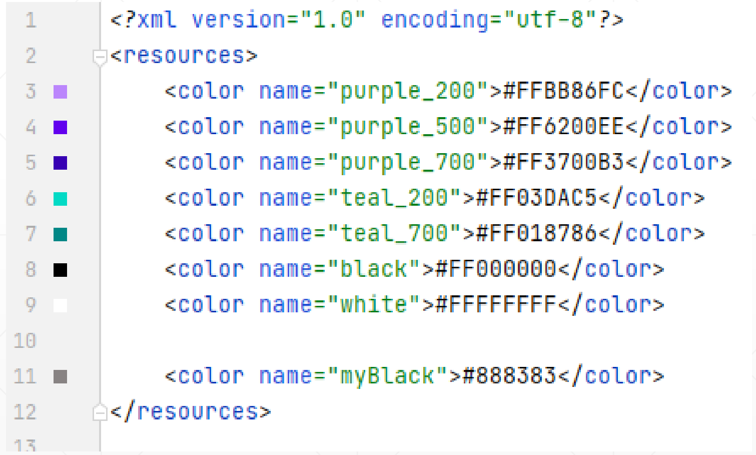
layout_width	wrap_content
layout_height	wrap_content
layout_constrain...	parent
layout_constrain...	parent
layout_constrain...	parent
layout_marginSt...	176dp
layout_marginTo...	66dp
layout_marginEnd	177dp
id	textView
text	@string/hello
textSize	20sp



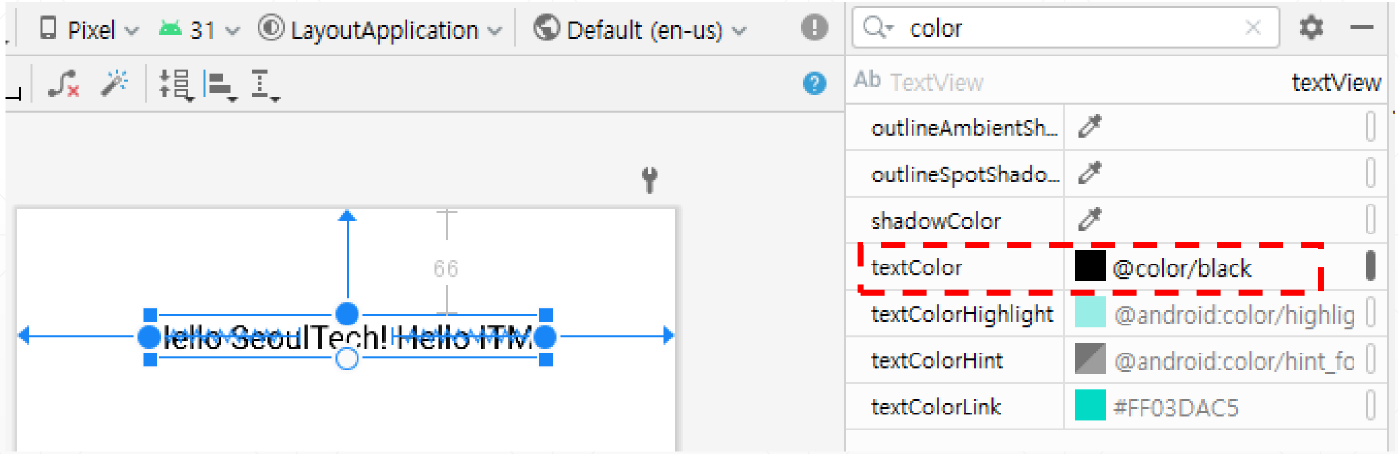
Localized text

Widgets: TextView (4/4)

- Attributes
  - textColor: Color of text
    - Use colors in colors.xml resource file
    - Each color is defined by #RGB/#ARGB/#RRGGBB/#AARRGGBB code



```
<?xml version="1.0" encoding="utf-8"?>
<resources>
    <color name="purple_200">#FFBB86FC</color>
    <color name="purple_500">#FF6200EE</color>
    <color name="purple_700">#FF3700B3</color>
    <color name="teal_200">#FF03DAC5</color>
    <color name="teal_700">#FF018786</color>
    <color name="black">#FF000000</color>
    <color name="white">#FFFFFFFF</color>

    <color name="myBlack">#888383</color>
</resources>
```



outlineAmbientSh...	
outlineSpotShado...	
shadowColor	
textColor	■ @color/black
textColorHighlight	@android:color/highlig
textColorHint	@android:color/hint_fo
textColorLink	#FF03DAC5

  - textSize: size of text (unit: sp)
  - textStye: style of text
  - … (https://developer.android.com/reference/android/widget/TextView)

Widgets: EditText (1/2)

- Basic widgets to show and input string values
- Attributes
  - inputType

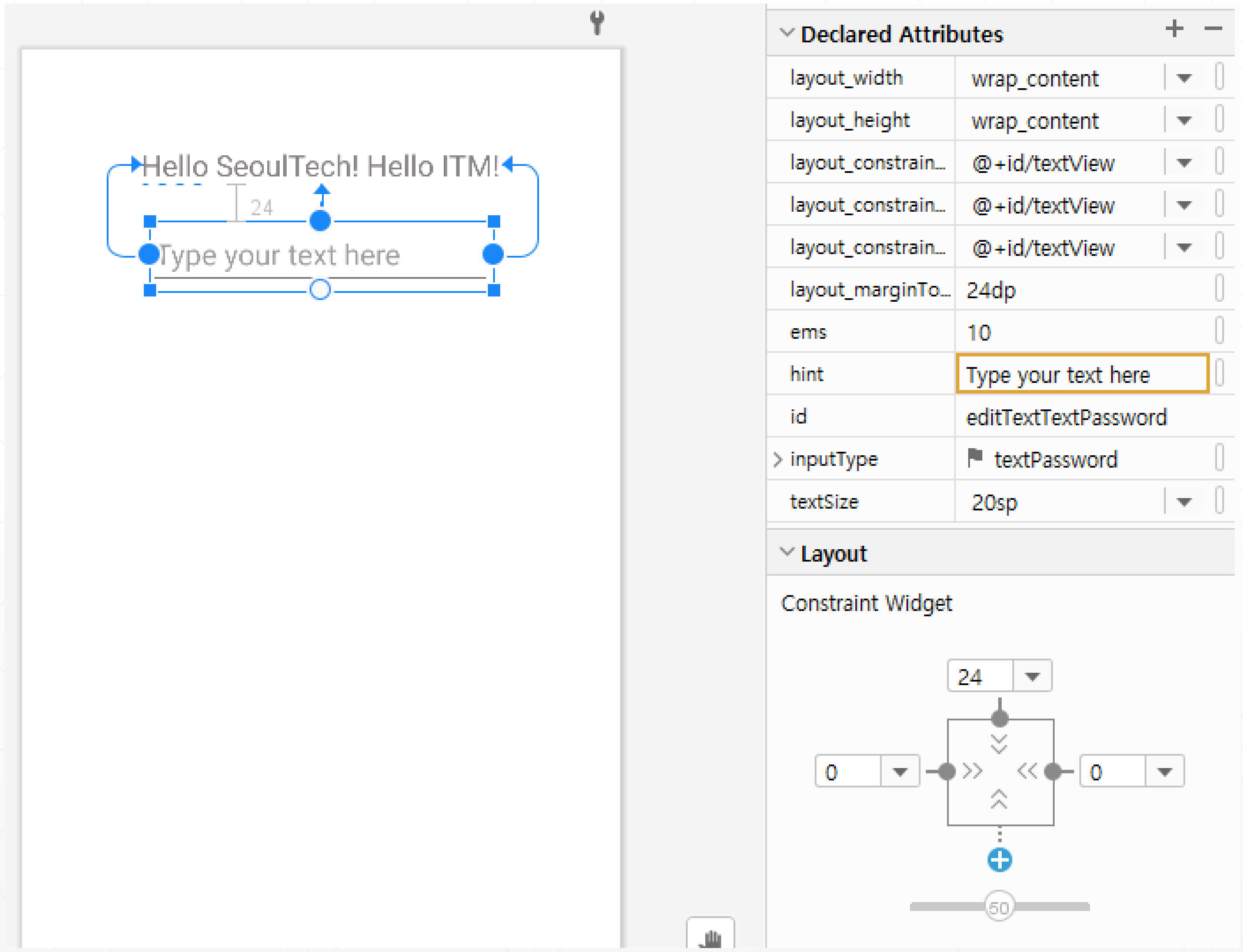
Constant	Description
date	For entering a date
datetime	For entering a date and time
number	A numeric only field
numberPassword	A numeric password field
phone	For entering a phone number
textPassword	Text that is a password
…	

  - … (https://developer.android.com/reference/android/widget/EditText)

Widgets: EditText (2/2)

- EditText example)
  - Capturing user input text
  - Add edittext
    - Set hint
    - Set layout
    - Add textChangedListener

```
class MainActivity : AppCompatActivity() {
    val binding by lazy { ActivityMainBinding.inflate(layoutInflater)}
    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(binding.root)

        binding.editTextTextPassword.addTextChangedListener{
            Log.d("ITM",binding.editTextTextPassword.text.toString())
        }

    }

}
```



Declared Attributes

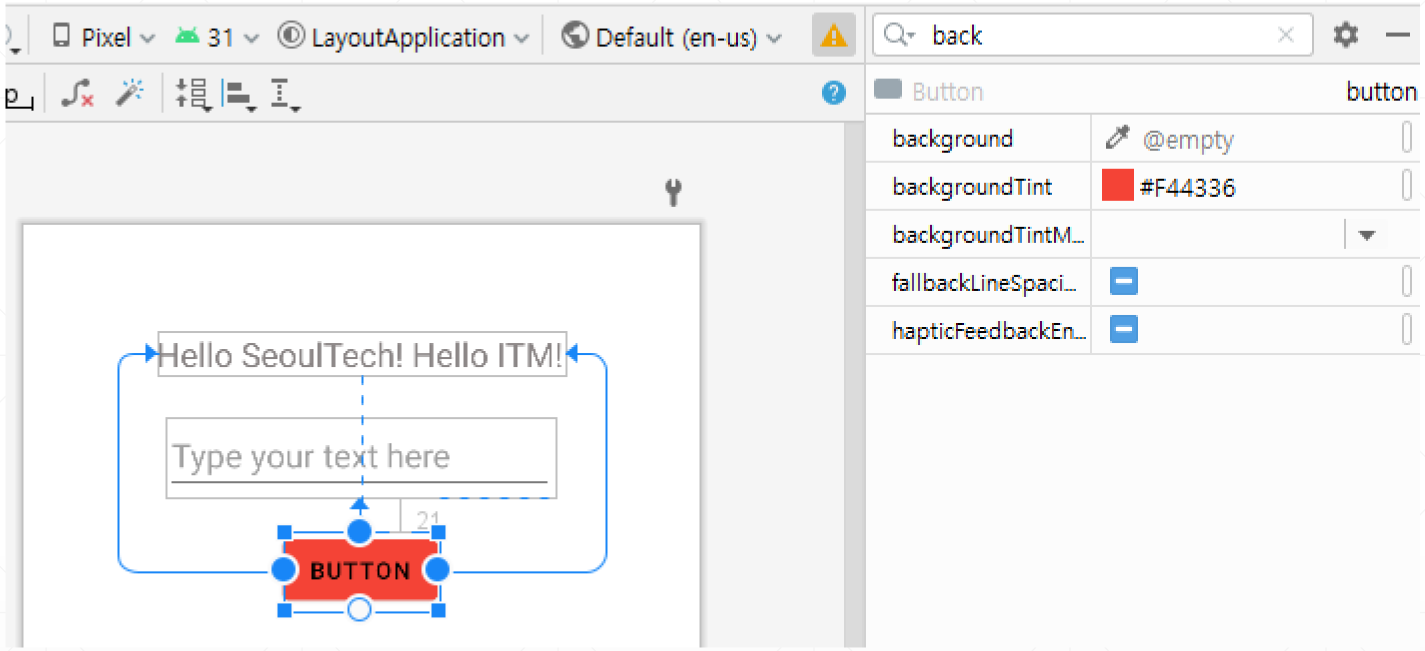
layout_width	wrap_content
layout_height	wrap_content
layout_constrain...	@+id/textView
layout_constrain...	@+id/textView
layout_constrain...	@+id/textView
layout_marginTo...	24dp
ems	10
hint	Type your text here
id	editTextTextPassword
inputType	textPassword
textSize	20sp

Layout

Constraint Widget

Widgets: Buttons/ImageButtons (1/5)

- With text, Button class!
- With an icon, ImageButton class!
- Attributes
  - onClick (clickListener)
  - Background
  - …

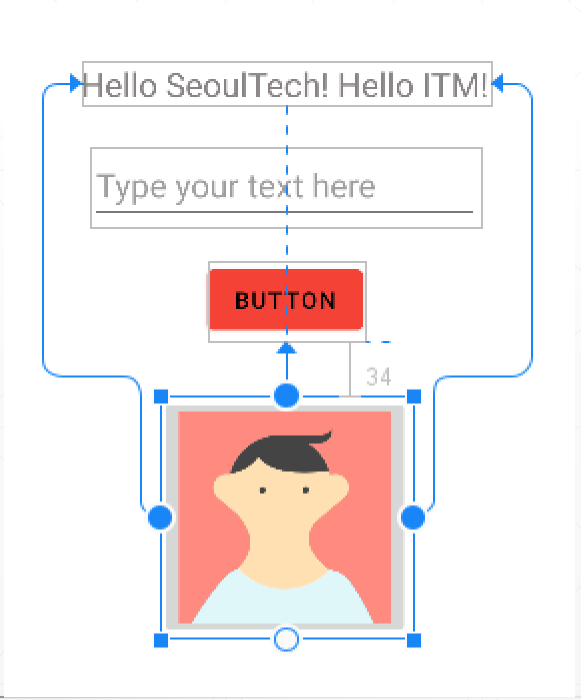


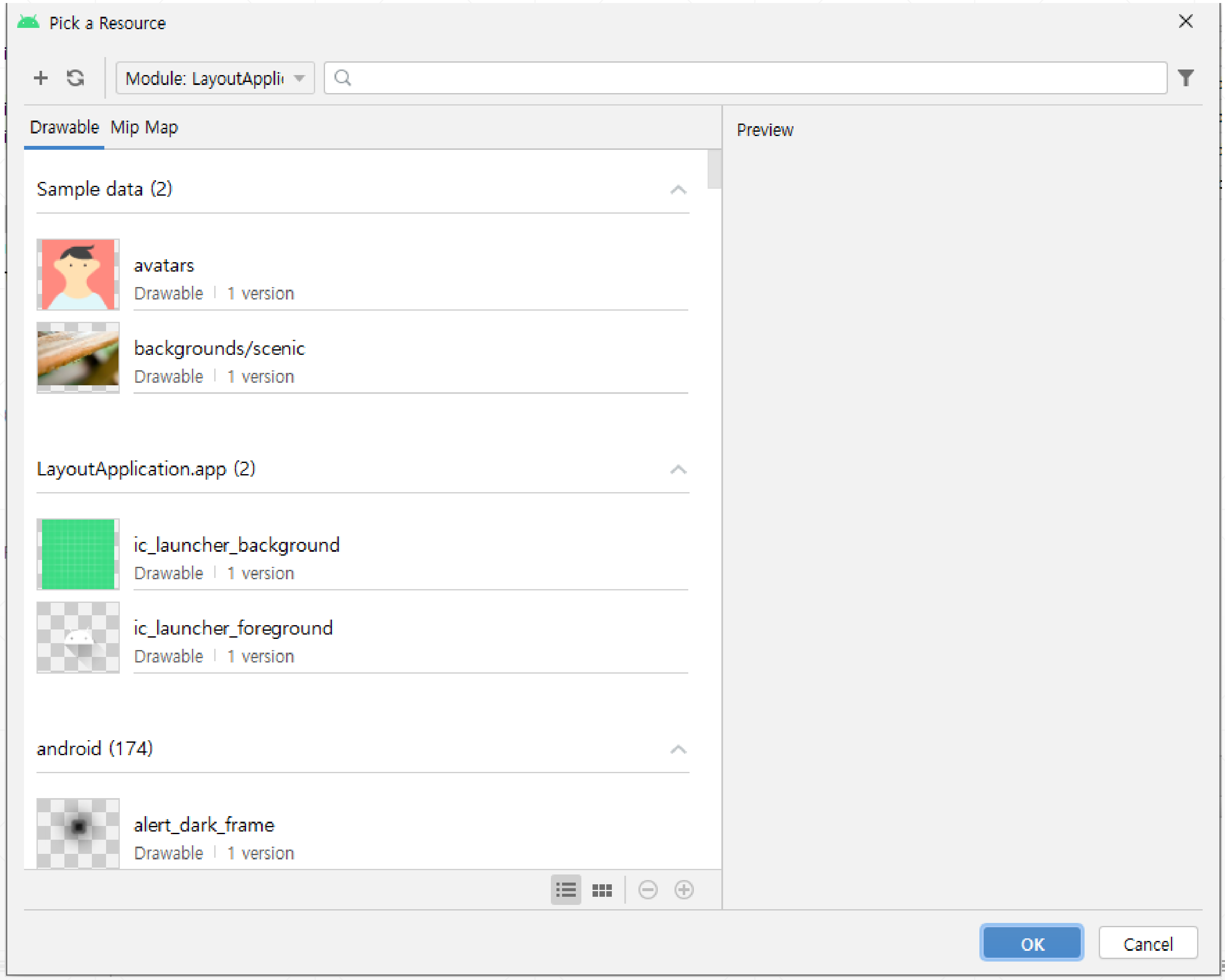
Button	button
background	@empty
backgroundTint	#F44336
backgroundTintM…	
fallbackLineSpaci…	
hapticFeedbackEn…	

- More
  - https://developer.android.com/reference/android/widget/Button
  - https://developer.android.com/reference/android/widget/ImageView

Widgets: Buttons/ImageButtons (2/5)

- Adding ImageButton
  - Choose an image resource!





Sample data (2)

avatars
Drawable | 1 version

backgrounds/scenic
Drawable | 1 version

LayoutApplication.app (2)

ic_launcher_background
Drawable | 1 version

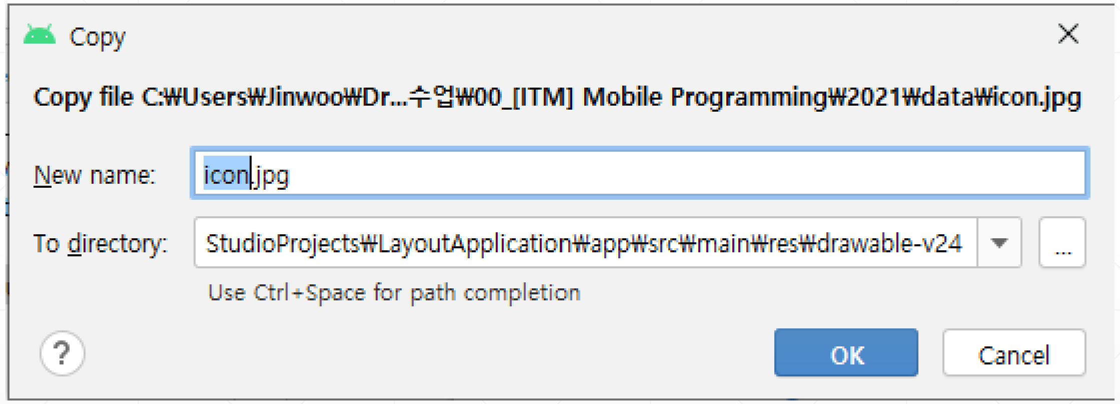
ic_launcher_foreground
Drawable | 1 version

android (174)

alert_dark_frame
Drawable | 1 version

Widgets: Buttons/ImageButtons (3/5)

- Adding ImageButton: Use your image resource!
  - Prepare your image file
  - Copy/Move your image under res/drawable

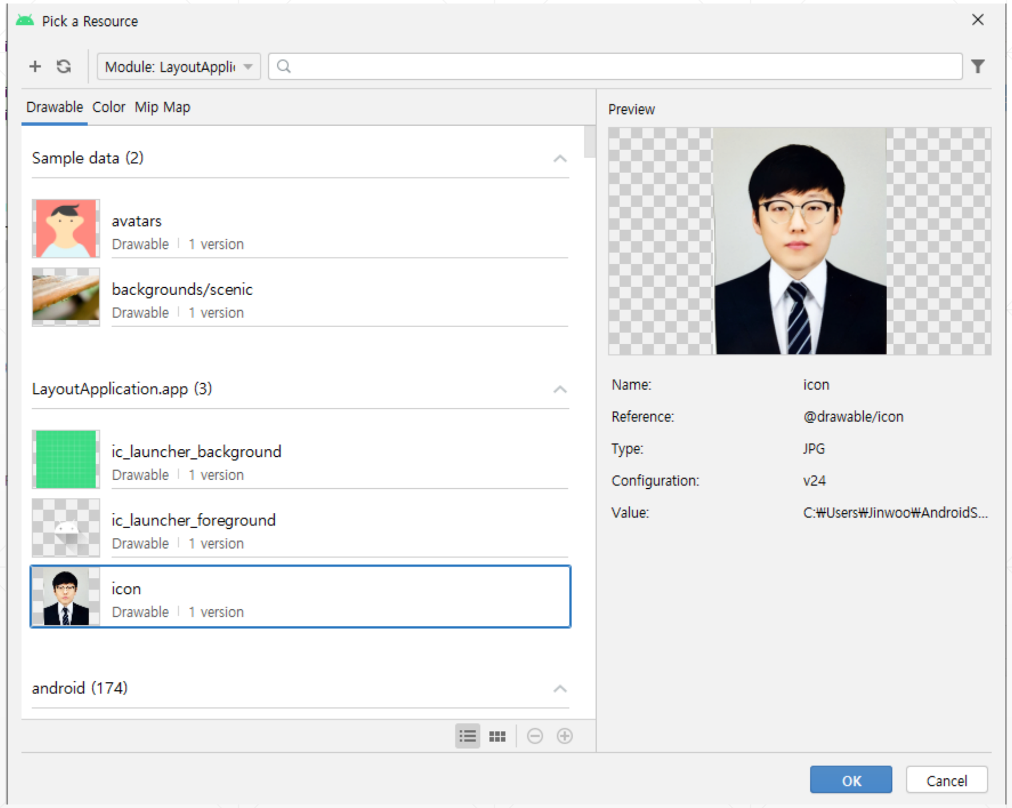

Copy

Copy file C:₩Users₩Jinwoo₩Dr...수업₩00_[ITM] Mobile Programming₩2021₩data₩icon.jpg

New name: icon.jpg

To directory: StudioProjects₩LayoutApplication₩app₩src₩main₩res₩drawable-v24

Use Ctrl+Space for path completion


Pick a Resource

Module: LayoutAppli

Sample data (2)
- avatars — Drawable | 1 version
- backgrounds/scenic — Drawable | 1 version

LayoutApplication.app (3)
- ic_launcher_background — Drawable | 1 version
- ic_launcher_foreground — Drawable | 1 version
- icon — Drawable | 1 version

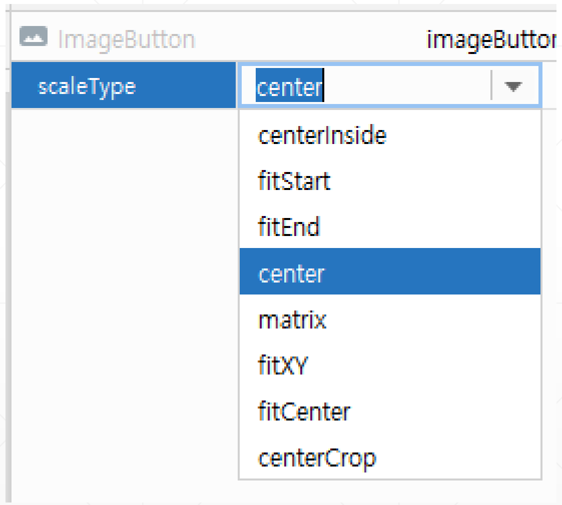
android (174)

Name:	icon
Reference:	@drawable/icon
Type:	JPG
Configuration:	v24
Value:	C:₩Users₩Jinwoo₩AndroidS...

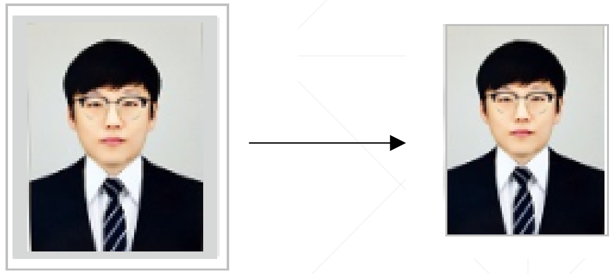
  - Update your src image of ImageButton

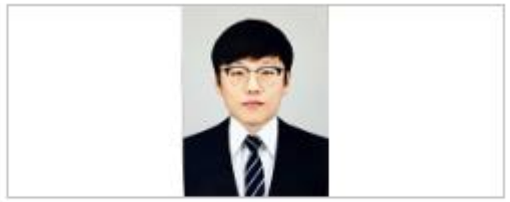
Widgets: Buttons/ImageButtons (4/5)

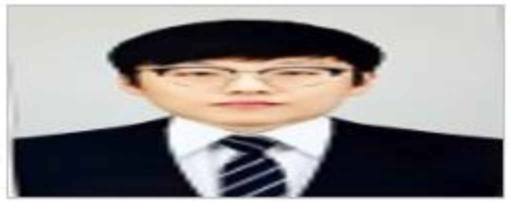
- Adding ImageButton: Some useful attributes
  - Background: @android:color/transparent
  - ScaleType



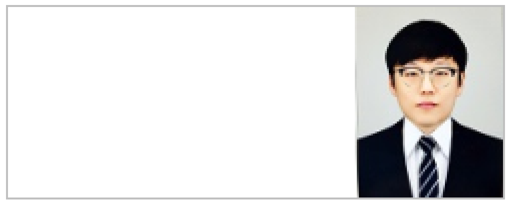
ImageButton	imageButtor
scaleType	center

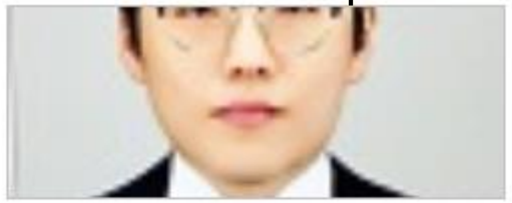



centerInside


fitXY

fitStart


fitEnd


centerCrop

  - Tint
  - …

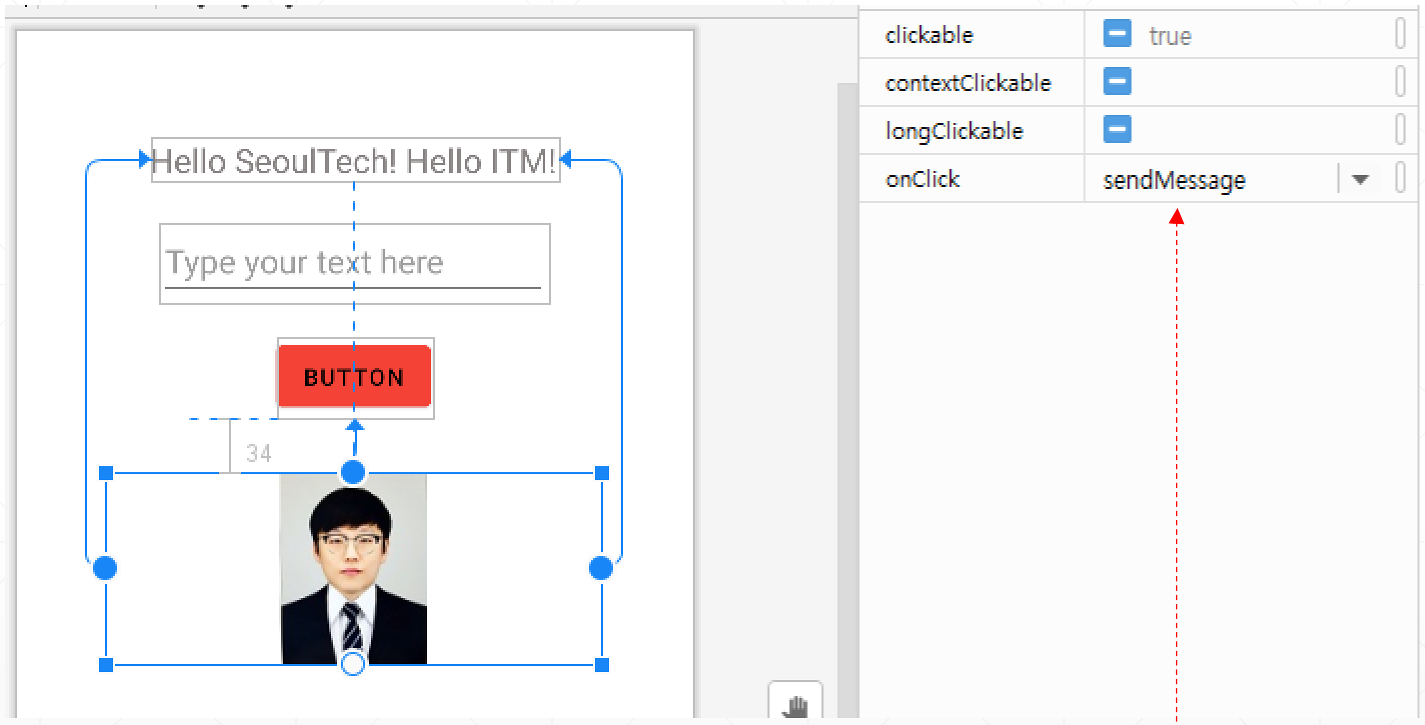
Widgets: Buttons/ImageButtons (5/5)

- ClickListener
  - Add onClick listener!

```
…
binding.button.setOnClickListener{
    binding.textView.text="Button Clicked!"
}
…
```

  - Use onClick attribute

```
…
fun sendMessage(view: View) {
    binding.textView.text = "My face touched!"
}
…
```



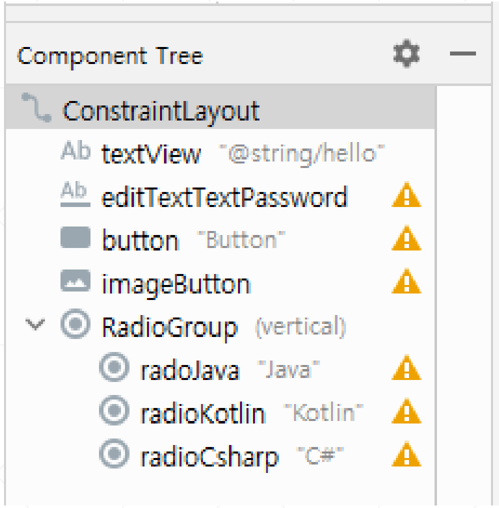
clickable	true
contextClickable	
longClickable	
onClick	sendMessage

  - Note! The following code should be added first! as a class property initializer!

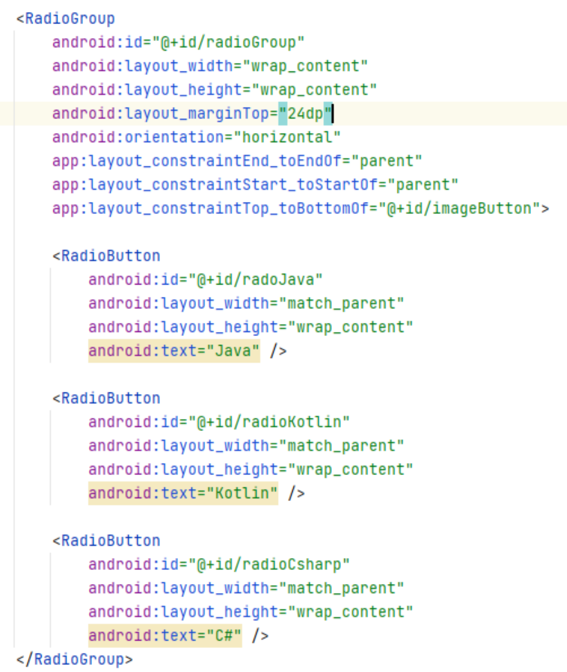
```
val binding by lazy{ActivityMainBinding.inflate(layoutInflater)}
```

Widgets: RadioButton (1/2)

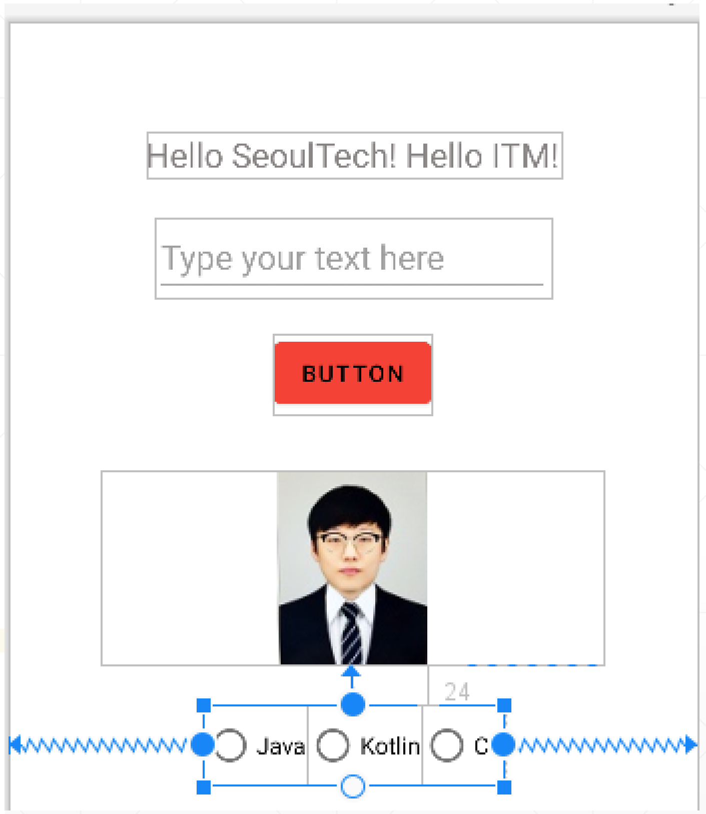
- RadioGroup and RadioButton
  - Choose one out of multiple items!
  - RadioGroup
    - Container for radioButtons
    - orientation attribute (vertical/horizontal)
    - …
  - RadioButtons
    - Selectable items
    - Contained in the radioGroup
  - More
    - https://developer.android.com/reference/andro



Component Tree
- ConstraintLayout
  - textView "@string/hello"
  - editTextTextPassword
  - button "Button"
  - imageButton
  - RadioGroup (vertical)
    - radoJava "Java"
    - radioKotlin "Kotlin"
    - radioCsharp "C#"



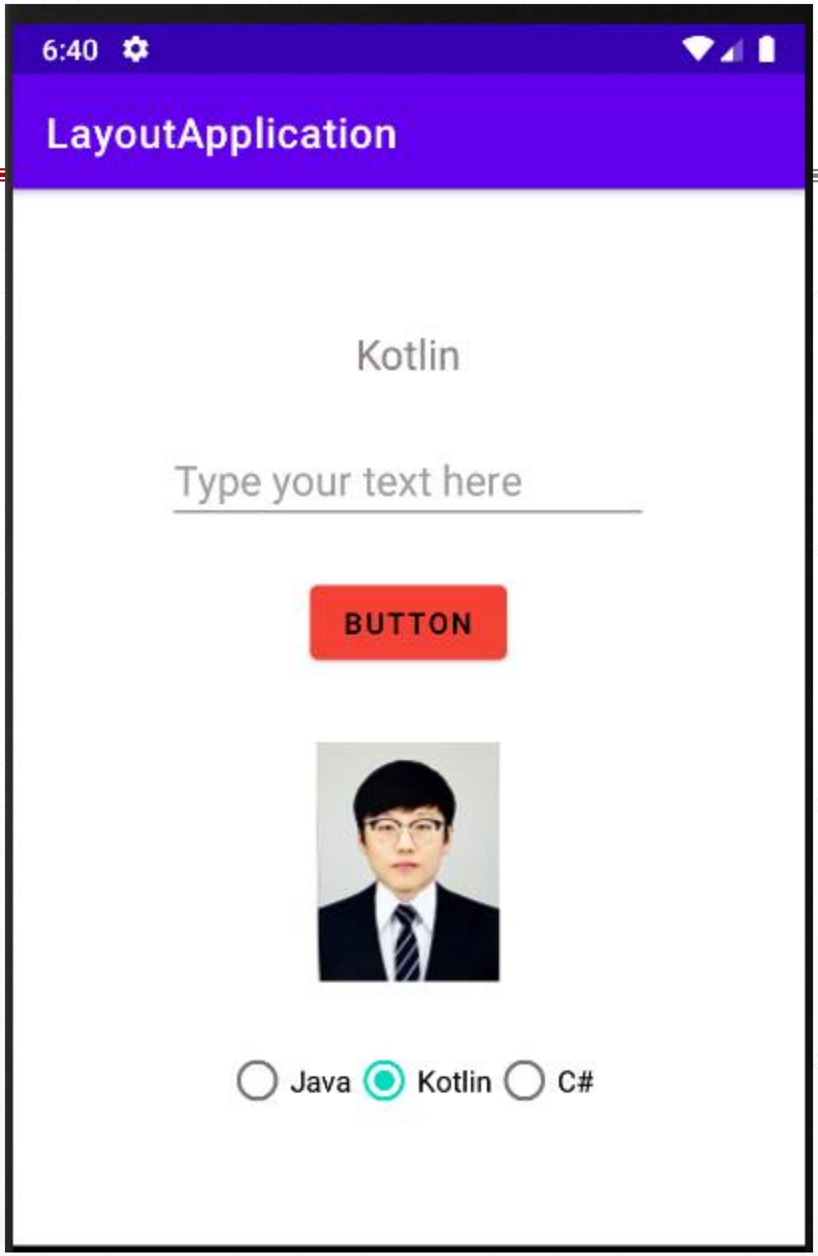
```
<RadioGroup
    android:id="@+id/radioGroup"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_marginTop="24dp"
    android:orientation="horizontal"
    app:layout_constraintEnd_toEndOf="parent"
    app:layout_constraintStart_toStartOf="parent"
    app:layout_constraintTop_toBottomOf="@+id/imageButton">

    <RadioButton
        android:id="@+id/radoJava"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text="Java" />

    <RadioButton
        android:id="@+id/radioKotlin"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text="Kotlin" />

    <RadioButton
        android:id="@+id/radioCsharp"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text="C#" />
</RadioGroup>
```



Widgets: RadioButton (2/2)

- RadioGroup and RadioButton
  - Getting a selected item
    - Set onCheckedChangeLister for your radioGroup
    - The ID of the selected radioButton will be passed

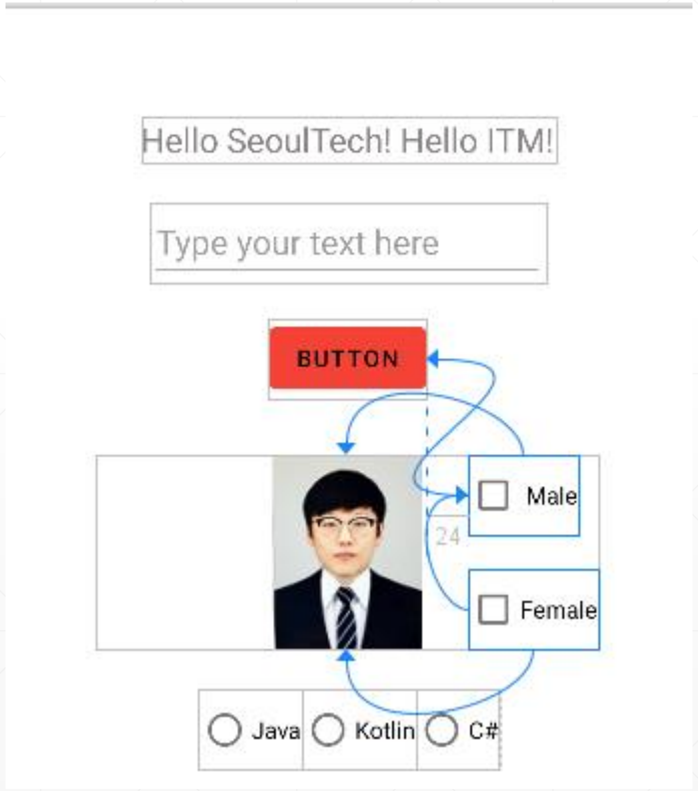
```
…
binding.radioGroup.setOnCheckedChangeListener { radioGroup, id ->
    binding.textView.text =
        when(id){
        binding.radioCsharp.id -> binding.radioCsharp.text
        binding.radioKotlin.id -> binding.radioKotlin.text
        binding.radioJava.id -> binding.radioJava.text
        else -> ""
    }
}
…
```



Widgets: CheckBox (1/2)

- Choose multiple items!
- You can set onCheckedChangeLister or onClickListener for your checkbox

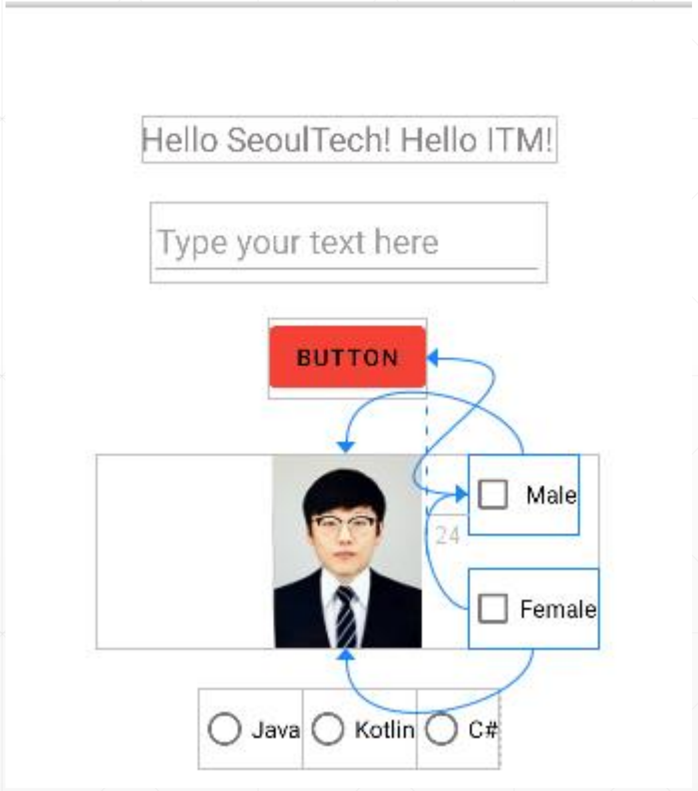
```
<CheckBox
    android:id="@+id/checkMale"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_marginStart="24dp"
    android:onClick="onCheckBoxClicked"
    android:text=" Male"
    app:layout_constraintStart_toEndOf="@+id/button"
    app:layout_constraintTop_toTopOf="@+id/imageButton" />

<CheckBox
    android:id="@+id/checkFemale"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:onClick="onCheckBoxClicked"
    android:text="Female"
    app:layout_constraintBottom_toBottomOf="@+id/imageButton"
    app:layout_constraintStart_toStartOf="@+id/checkMale" />
```



Widgets: CheckBox (2/2)

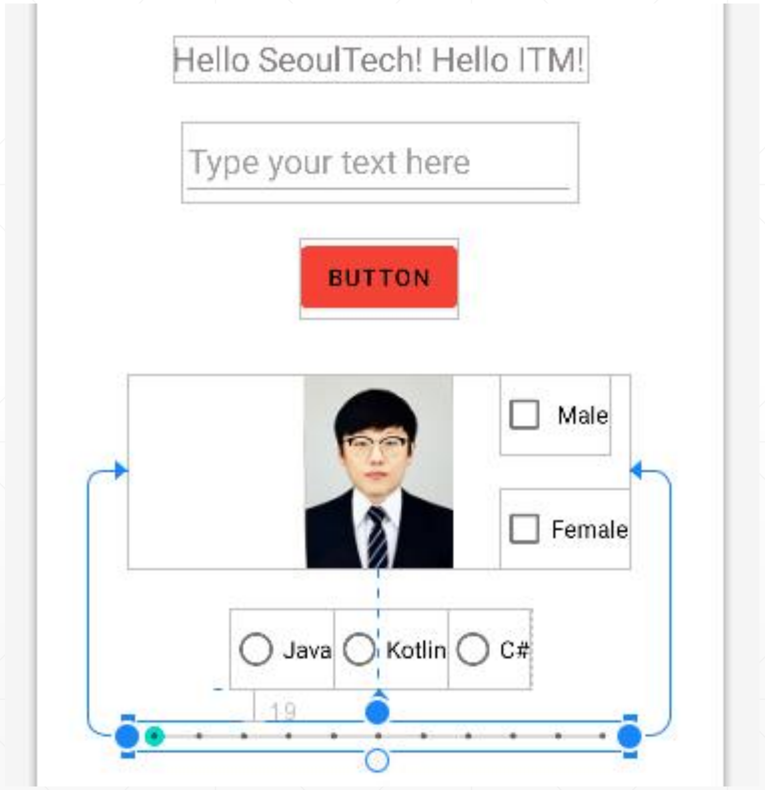
- Choose multiple items!
- You can set onCheckedChangeLister or onClickListener for your checkbox

```
fun onCheckBoxClicked(view: View){
    var txt=""

    when(view.id){
        binding.checkMale.id -> Log.d("ITM", "Male checked!")
        binding.checkFemale.id -> Log.d("ITM", "Female checked!")
    }

    if(binding.checkMale.isChecked) txt += "Male"
    if(binding.checkFemale.isChecked) txt += "Female"

    binding.textView.text = txt

}
```



Widgets: SeekBar (1/3)

- Widget to set a value using a range-style bar
- Attributes
  - progress: default value
  - max: maximum value
- onSeekBarChangeListener()
  - onProgressChanged()
  - onStartTrackingTouch()
  - onStopTrackingTouch()
- More
  - https://developer.android.com/reference/kotlin/android/widget/SeekBar



Widgets: SeekBar (2/3)

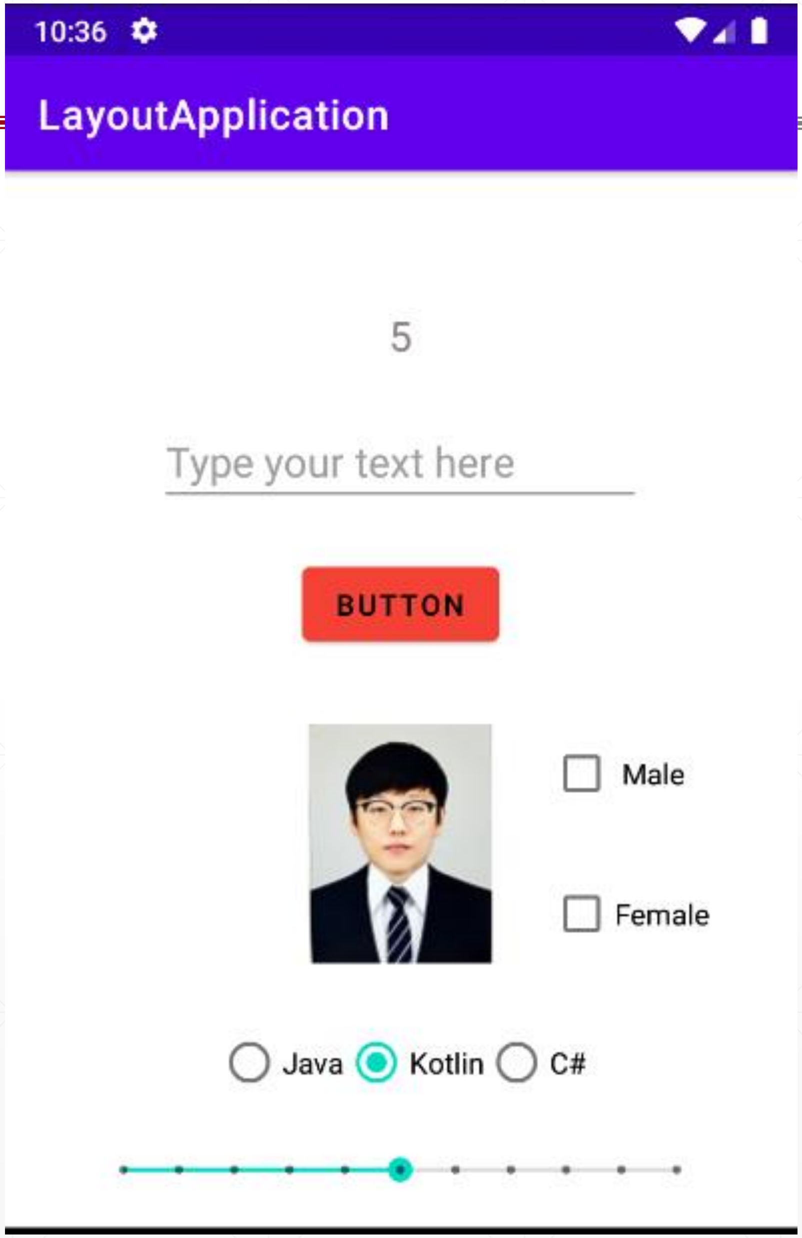
- onSeekBarChangeListener()
  - onProgressChanged(seekBar: SeekBar!, progress: Int, fromUser: Boolean)
    - progress: the current progress level
    - fromUser: True if the progress change was initiated by the user
  - onStartTrackingTouch(…)
    - Notification that the user has started a touch gesture
  - onStopTrackingTouch(…)
    - Notification that the user has finished a touch gesture

```
binding.seekBar.setOnSeekBarChangeListener(object:
OnSeekBarChangeListener{
    override fun onProgressChanged(p0: SeekBar?, p1: Int, p2: Boolean) {
        binding.textView.text= p1.toString()
    }

    override fun onStartTrackingTouch(p0: SeekBar?) {
        Log.d("ITM","Start Touch!")
    }

    override fun onStopTrackingTouch(p0: SeekBar?) {
        Log.d("ITM","Stop Touch!")
    }
})
```

Widgets: SeekBar (3/3)

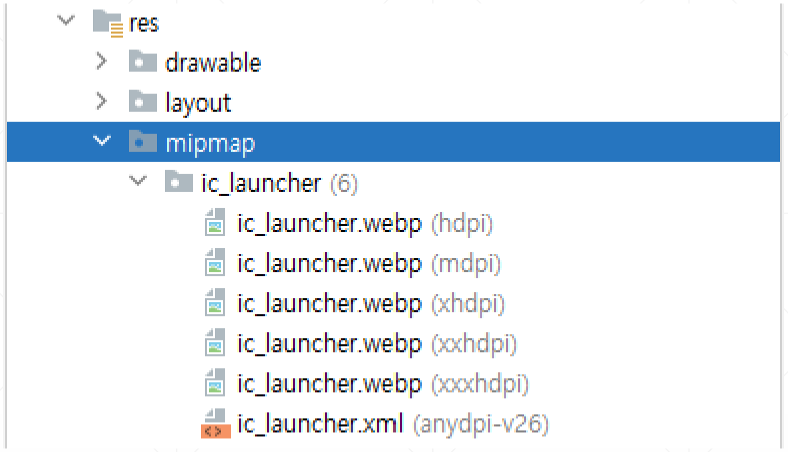
- onSeekBarChangeListener()

```
binding.seekBar.setOnSeekBarChangeListener(object: OnSeekBarChangeListener{
    override fun onProgressChanged(p0: SeekBar?, p1: Int, p2: Boolean) {
        binding.textView.text= p1.toString()
    }

    override fun onStartTrackingTouch(p0: SeekBar?) {
        Log.d("ITM","Start Touch!")
    }

    override fun onStopTrackingTouch(p0: SeekBar?) {
        Log.d("ITM","Stop Touch!")
    }
})
```



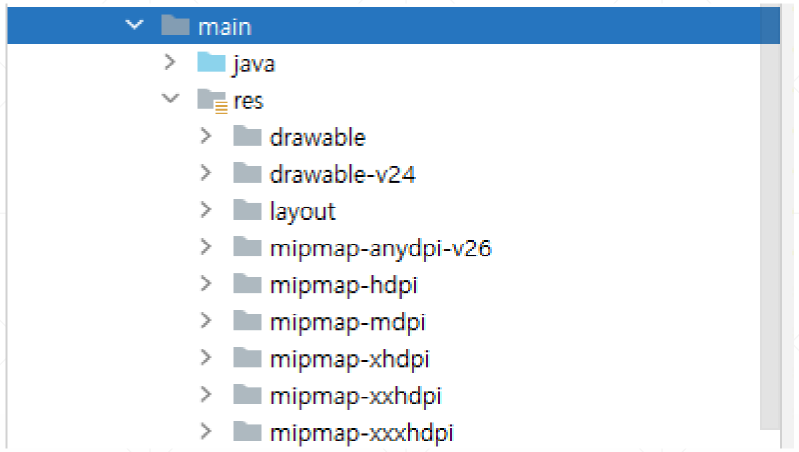
Mipmap (1/2)

- Resource location for your Application icon



```
res
  drawable
  layout
  mipmap
    ic_launcher (6)
      ic_launcher.webp (hdpi)
      ic_launcher.webp (mdpi)
      ic_launcher.webp (xhdpi)
      ic_launcher.webp (xxhdpi)
      ic_launcher.webp (xxxhdpi)
      ic_launcher.xml (anydpi-v26)
```

Android view



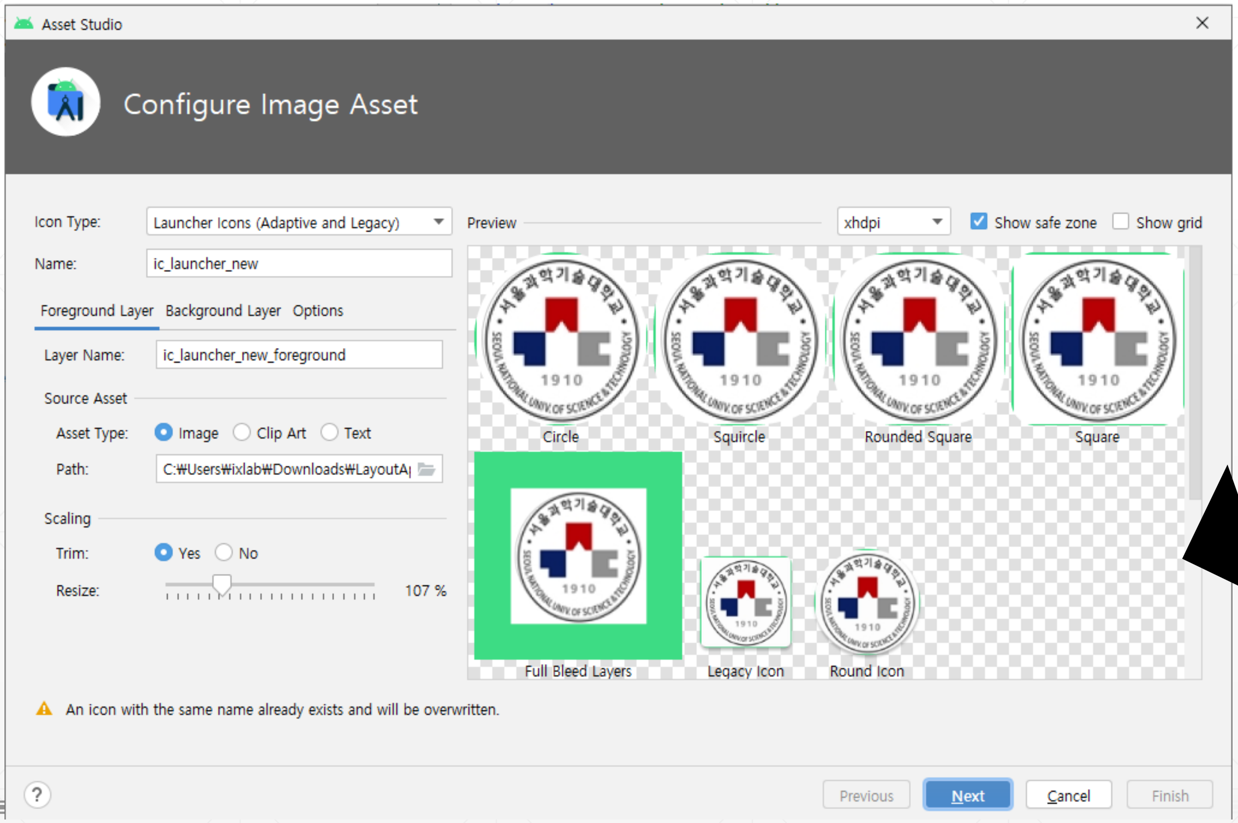
```
main
  java
  res
    drawable
    drawable-v24
    layout
    mipmap-anydpi-v26
    mipmap-hdpi
    mipmap-mdpi
    mipmap-xhdpi
    mipmap-xxhdpi
    mipmap-xxxhdpi
```

Project view

- DPI (dots per inch)
  - Pixel densities (the number of pixels within a physical area of the screen)
  - E.g.,) mdpi (160 dpi), hdpi (240 dpi), xhdpi (320 dpi), xxhdpi (480 dpi), xxxhdpi (640 dpi)

Mipmap (2/2)

- Resource location for your Application icon
  - res → New → Image Asset
  - Now, design your app icon!



Asset Studio

Configure Image Asset

Icon Type: Launcher Icons (Adaptive and Legacy)

Name: ic_launcher_new

Foreground Layer | Background Layer | Options

Layer Name: ic_launcher_new_foreground

Source Asset

Asset Type: [✓ Image] Clip Art Text

Path: C:₩Users₩ixlab₩Downloads₩LayoutA|

Scaling

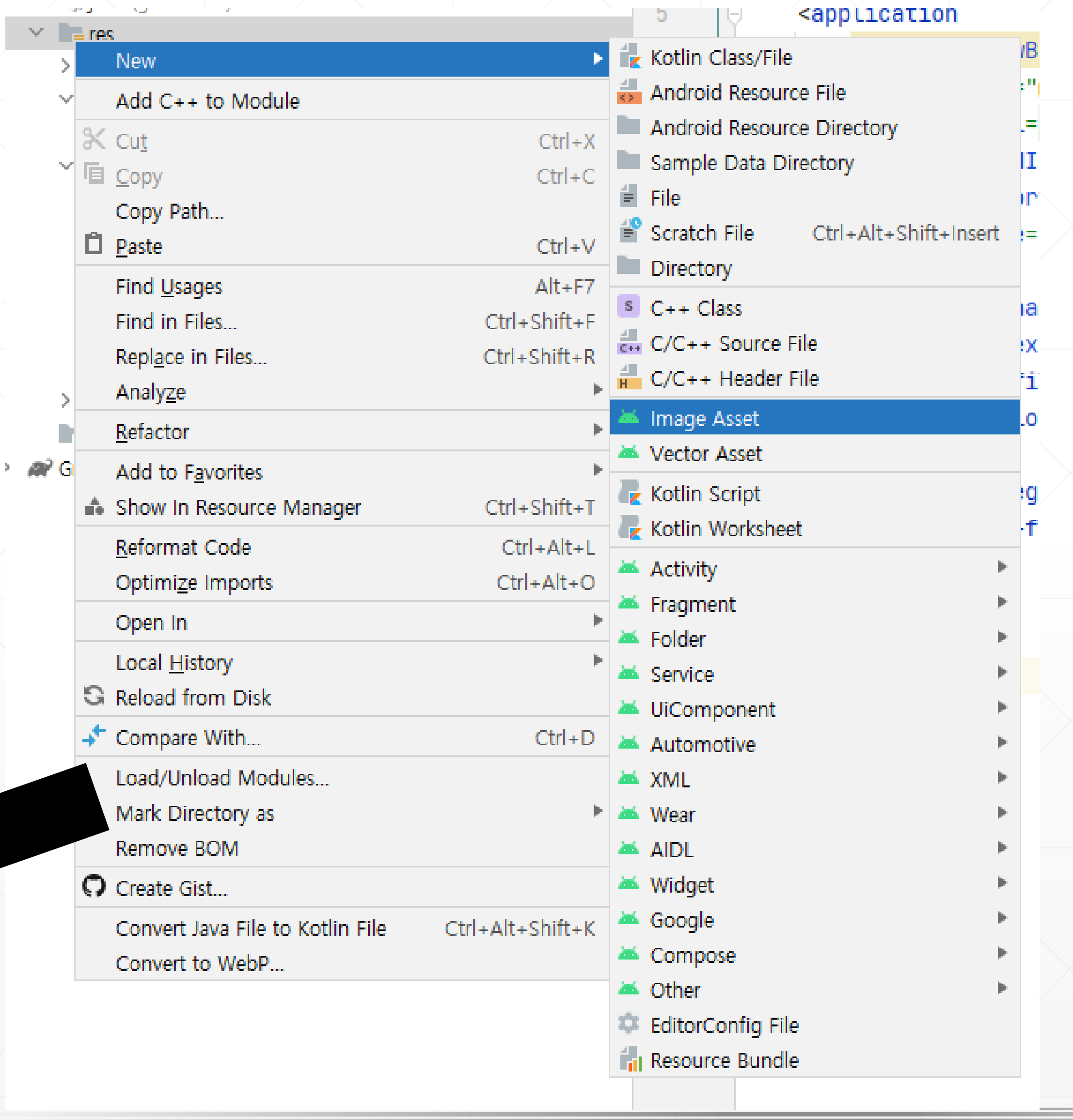
Trim: [✓ Yes] No

Resize: 107 %

Preview: xhdpi [✓ Show safe zone] Show grid

⚠ An icon with the same name already exists and will be overwritten.

Circle
Squircle
Rounded Square
Square
Full Bleed Layers
Legacy Icon
Round Icon
Previous
Next
Cancel
Finish



res
New
Add C++ to Module
Cut Ctrl+X
Copy Ctrl+C
Copy Path...
Paste Ctrl+V
Find Usages Alt+F7
Find in Files... Ctrl+Shift+F
Replace in Files... Ctrl+Shift+R
Analyze
Refactor
Add to Favorites
Show In Resource Manager Ctrl+Shift+T
Reformat Code Ctrl+Alt+L
Optimize Imports Ctrl+Alt+O
Open In
Local History
Reload from Disk
Compare With... Ctrl+D
Load/Unload Modules...
Mark Directory as
Remove BOM
Create Gist...
Convert Java File to Kotlin File Ctrl+Alt+Shift+K
Convert to WebP...
Kotlin Class/File
Android Resource File
Android Resource Directory
Sample Data Directory
File
Scratch File Ctrl+Alt+Shift+Insert
Directory
C++ Class
C/C++ Source File
C/C++ Header File
Image Asset
Vector Asset
Kotlin Script
Kotlin Worksheet
Activity
Fragment
Folder
Service
UiComponent
Automotive
XML
Wear
AIDL
Widget
Google
Compose
Other
EditorConfig File
Resource Bundle
<application