Android Studio & Jetpack Compose

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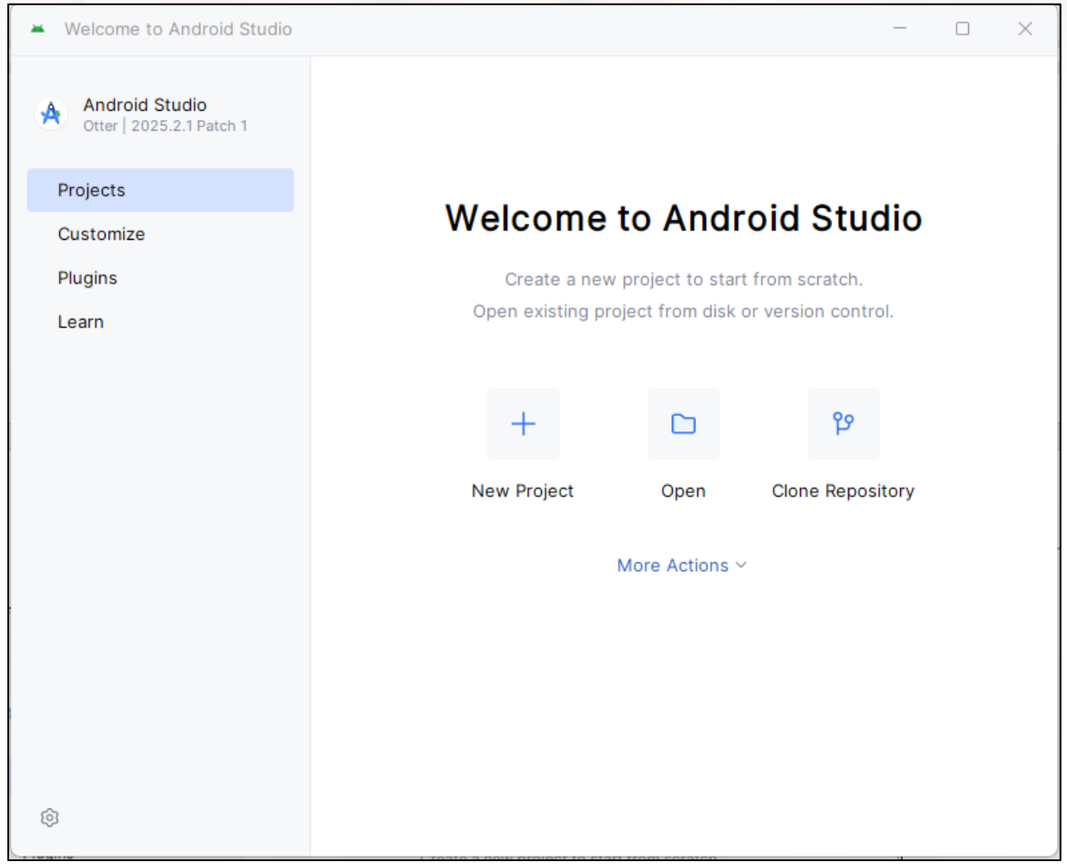
SC 362 007 Mobile Device Programming
CP 410 804 Programming for Mobile Application

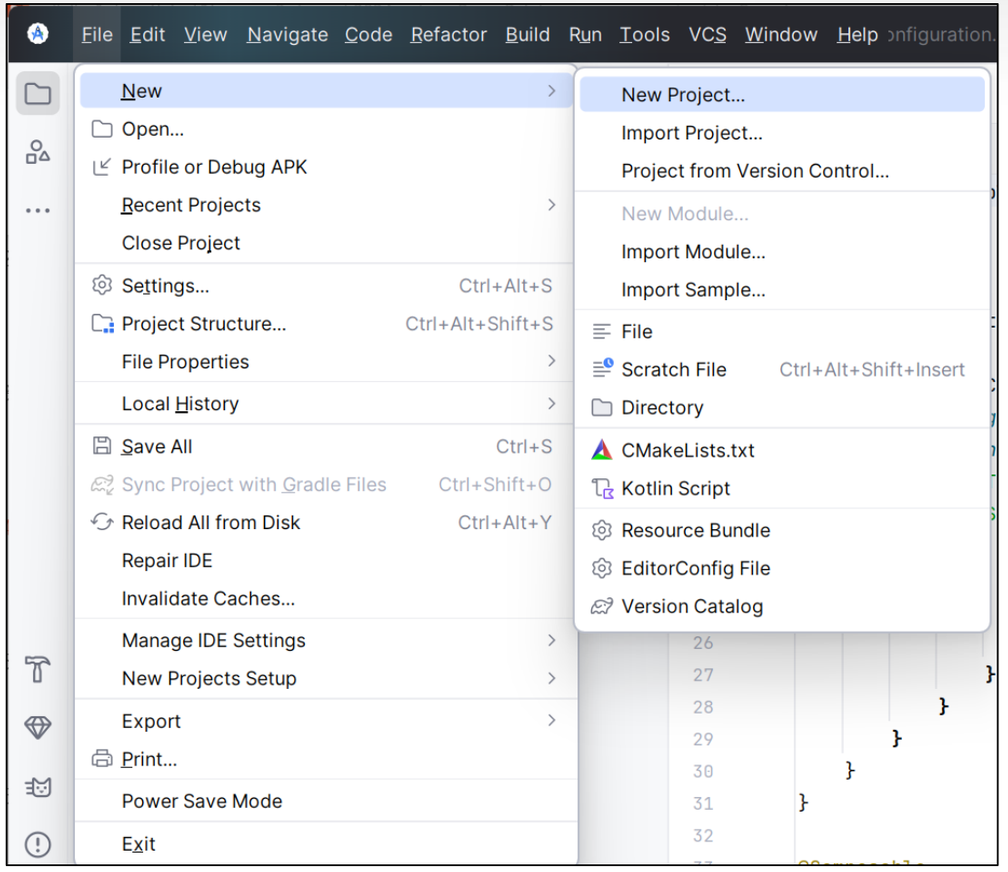
Outline

- Android Studio
- Jetpack Compose
- Layout

Android Studio

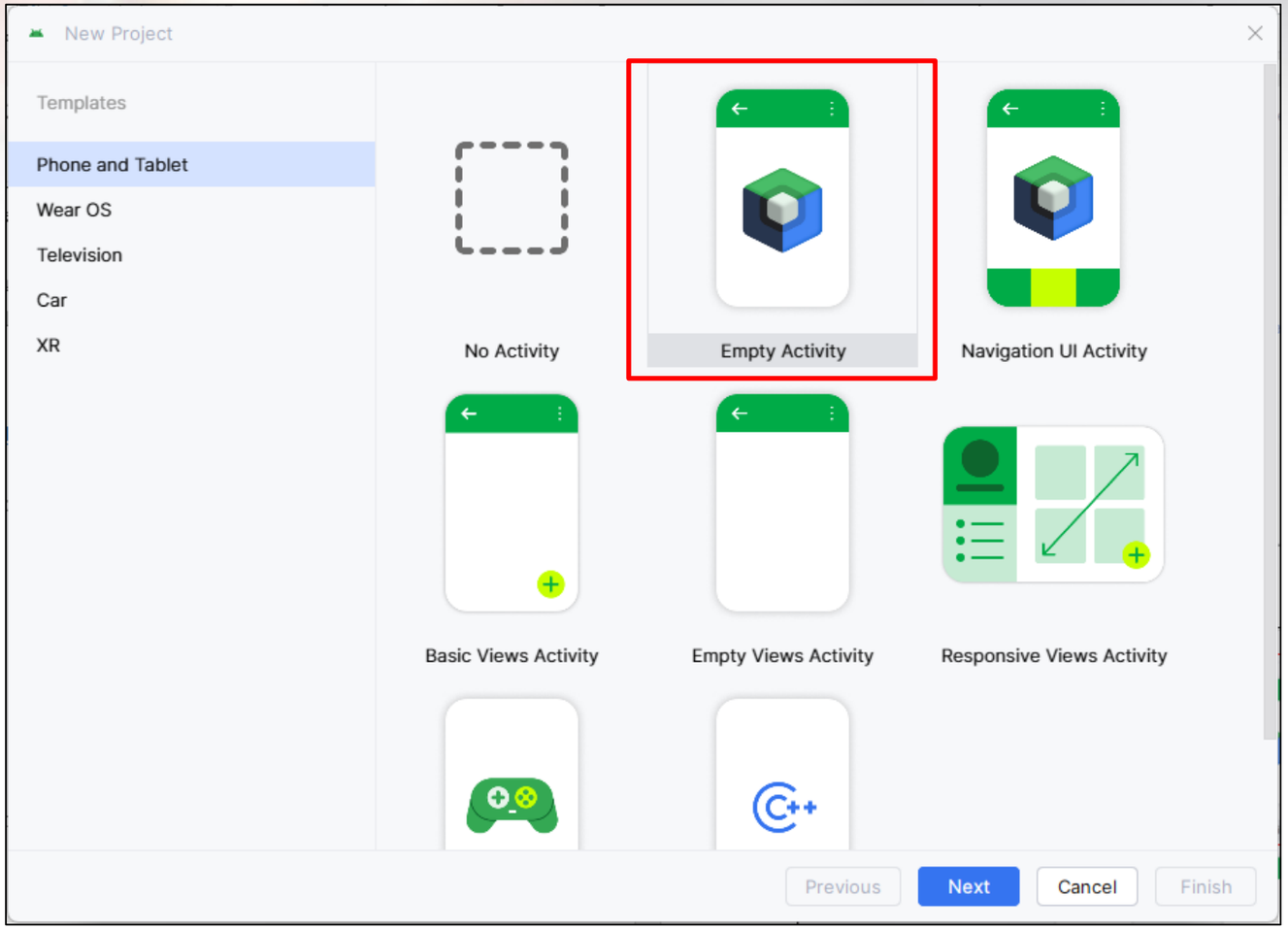
New Project



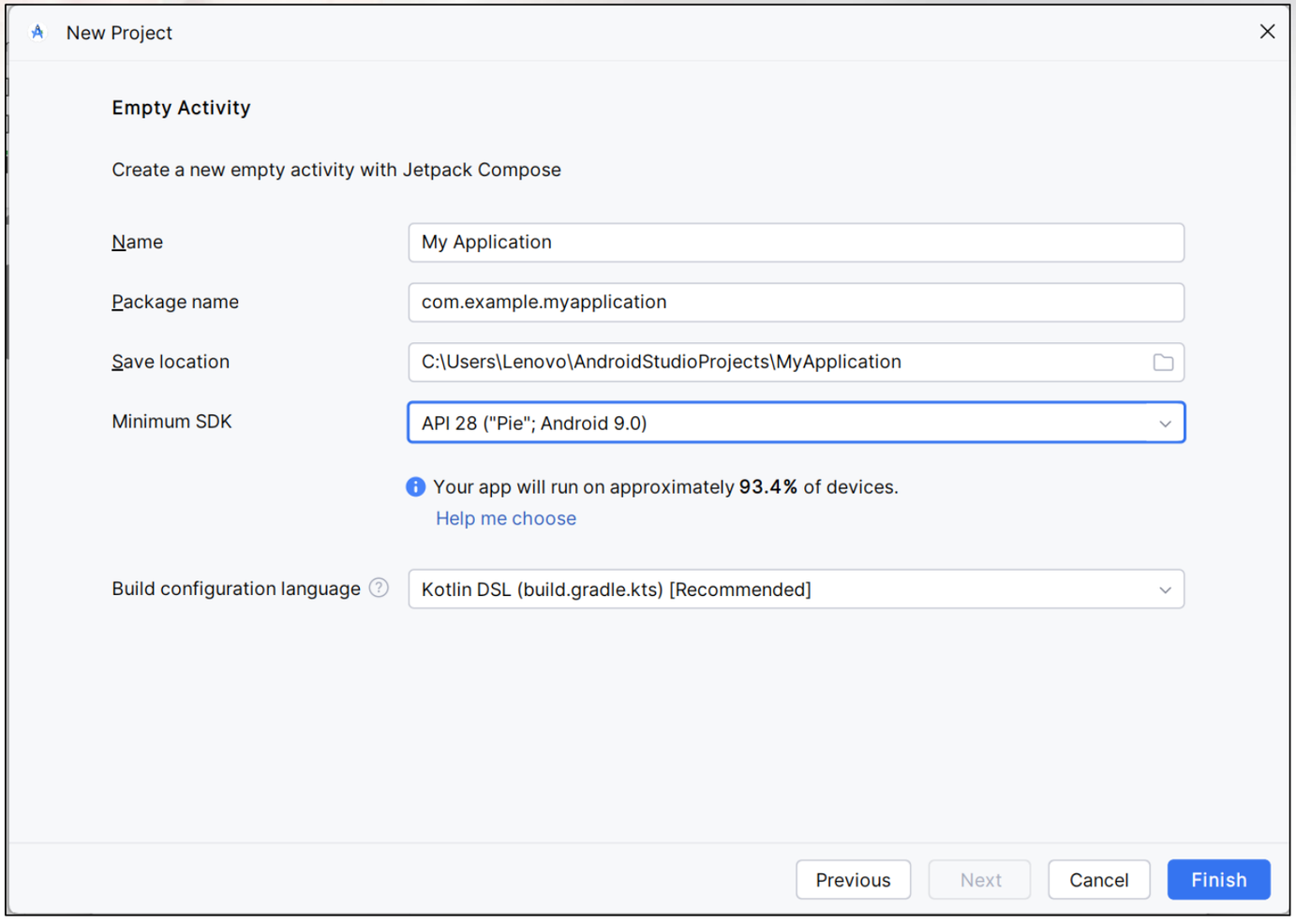


Android Studio

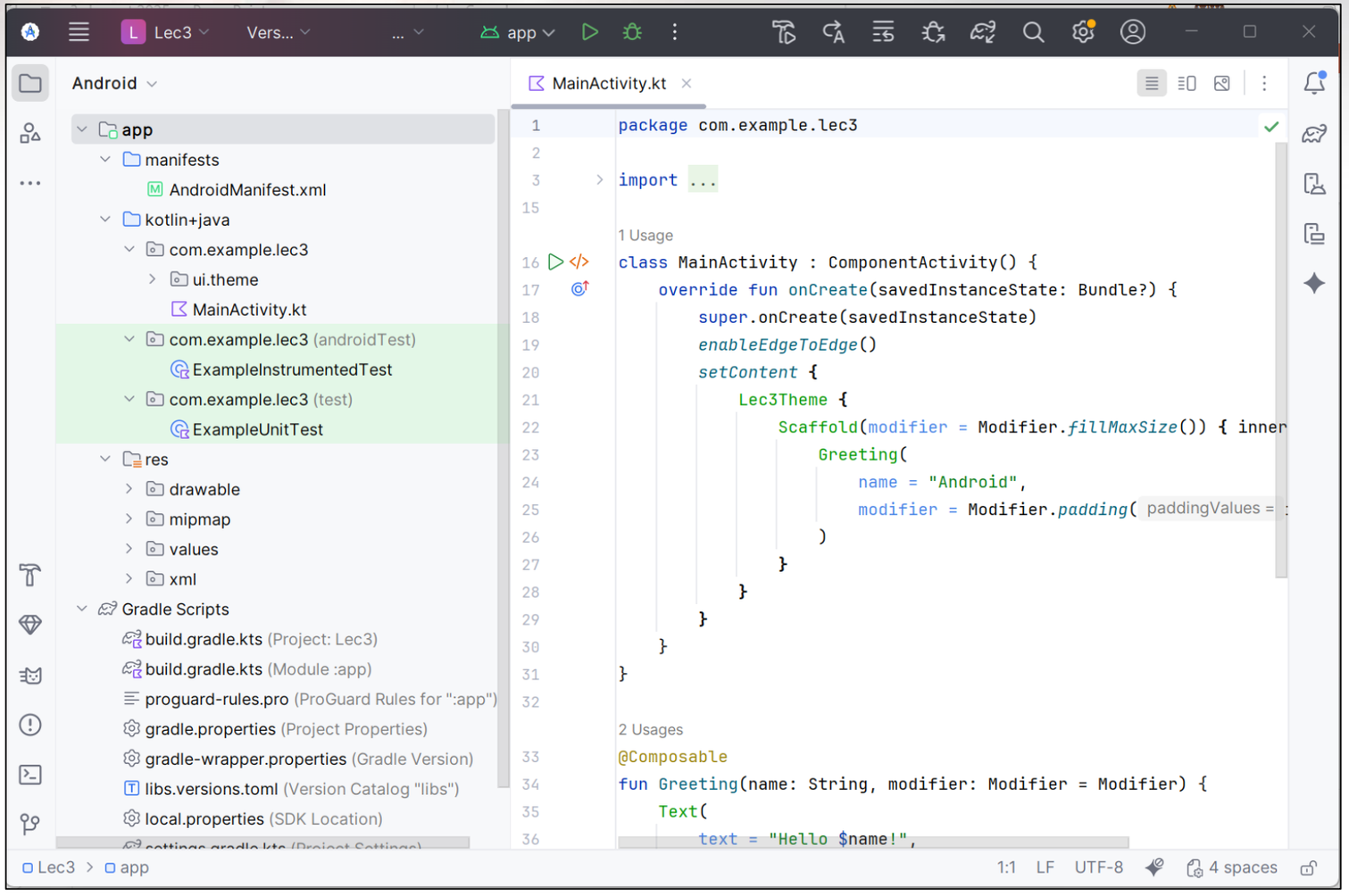
New Project



Android Studio

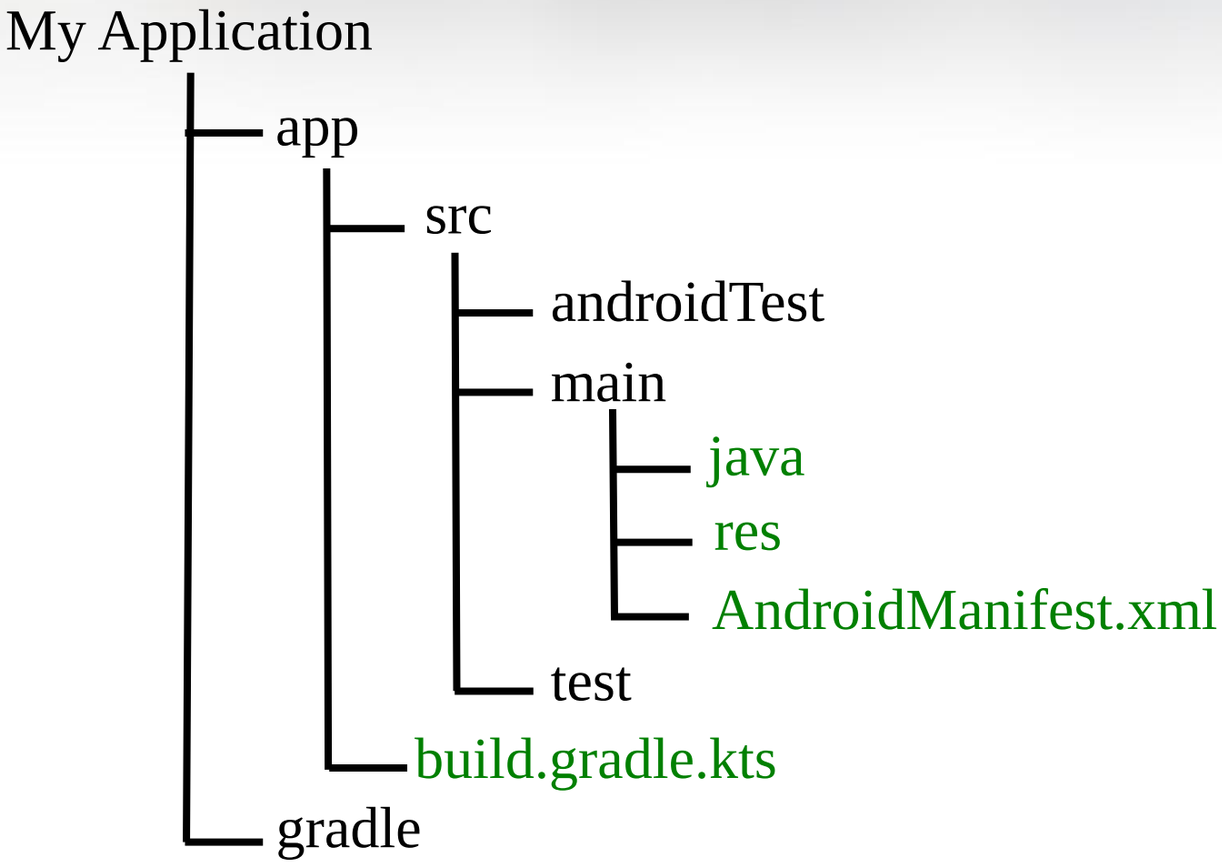


Android Studio

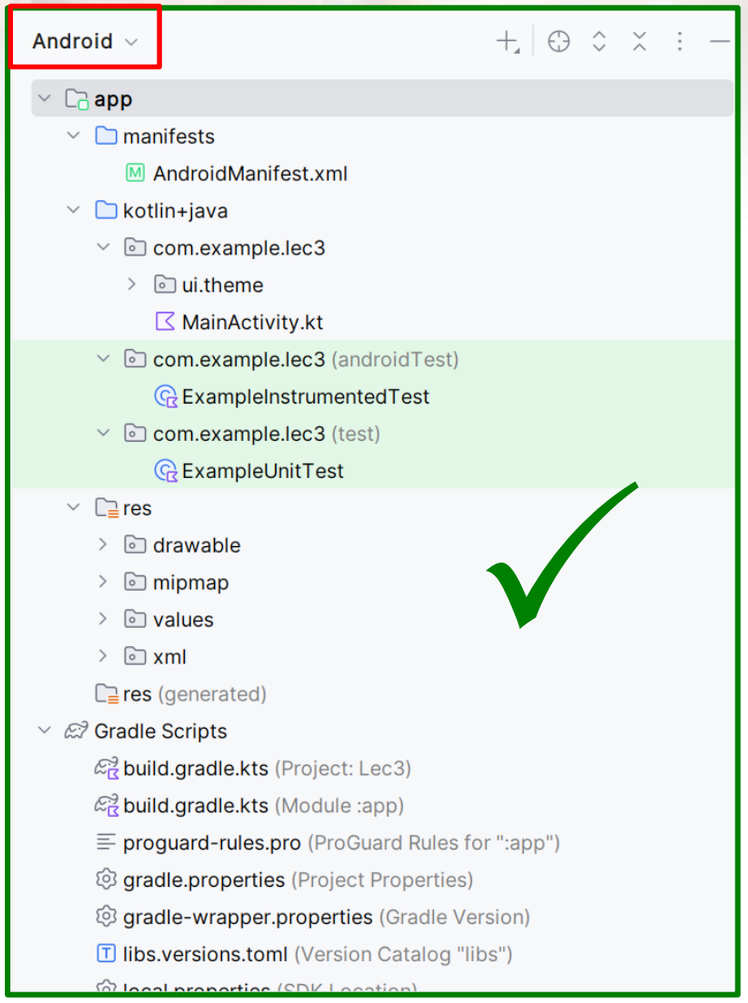


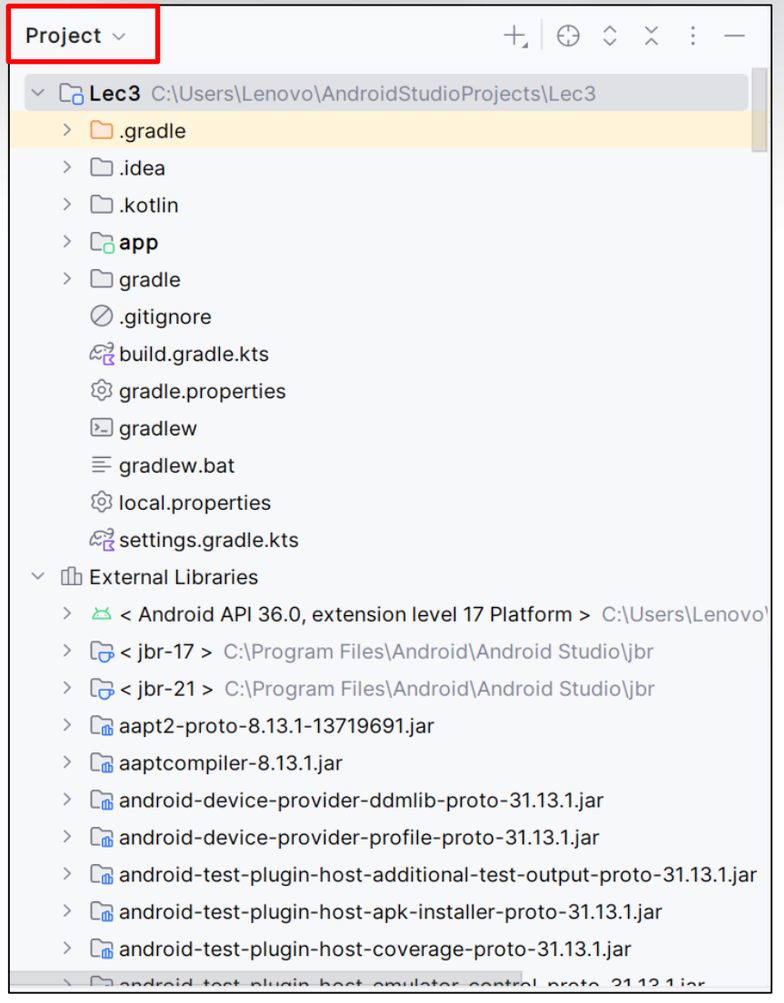
Structure of an Android App project

- Activity
- Resources
- Gradle files



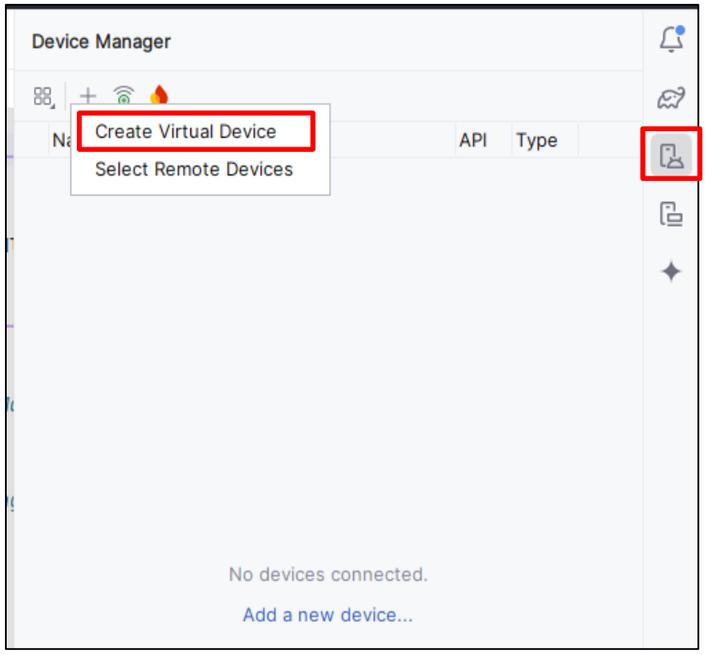
Structure of an Android App project

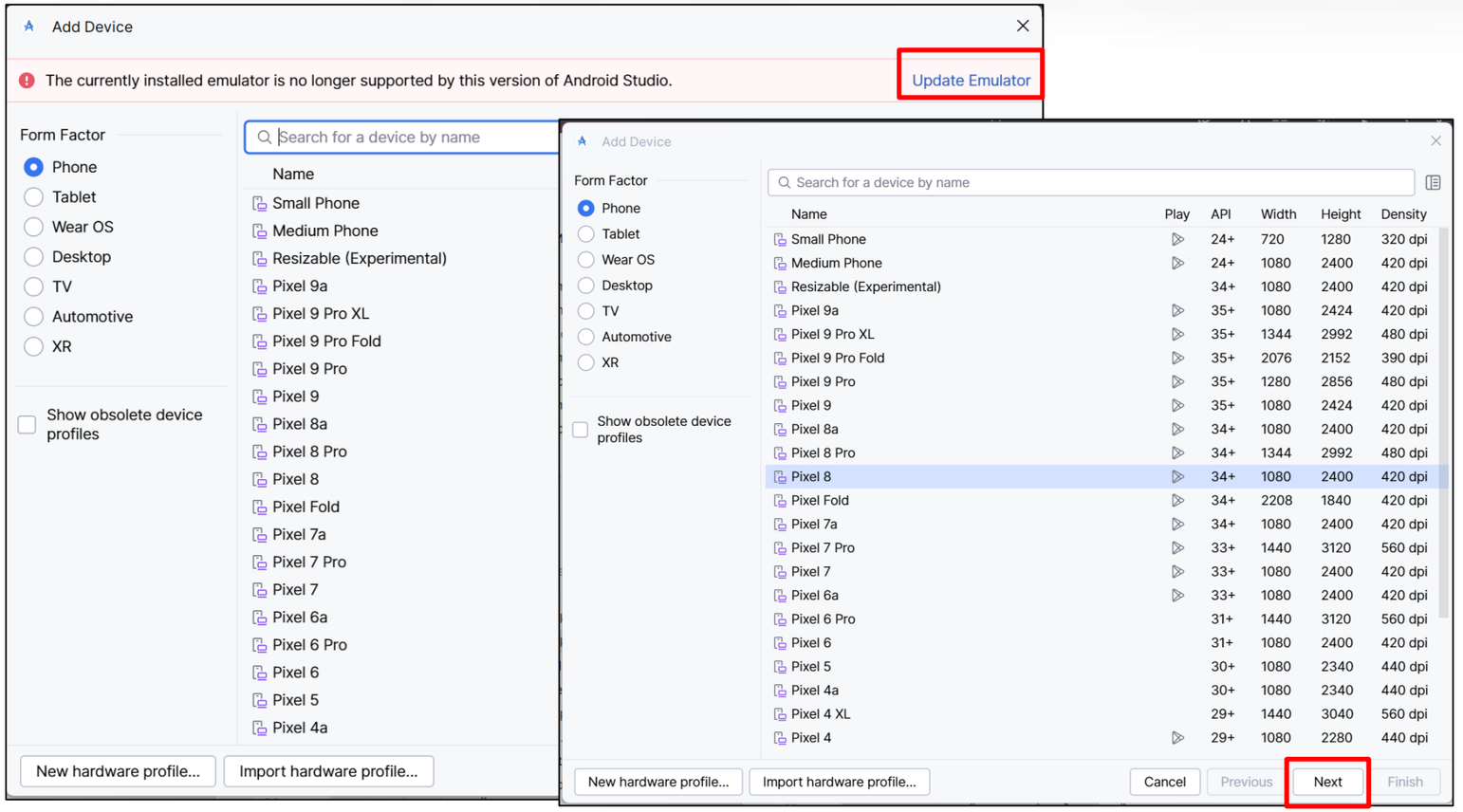




Run Apps

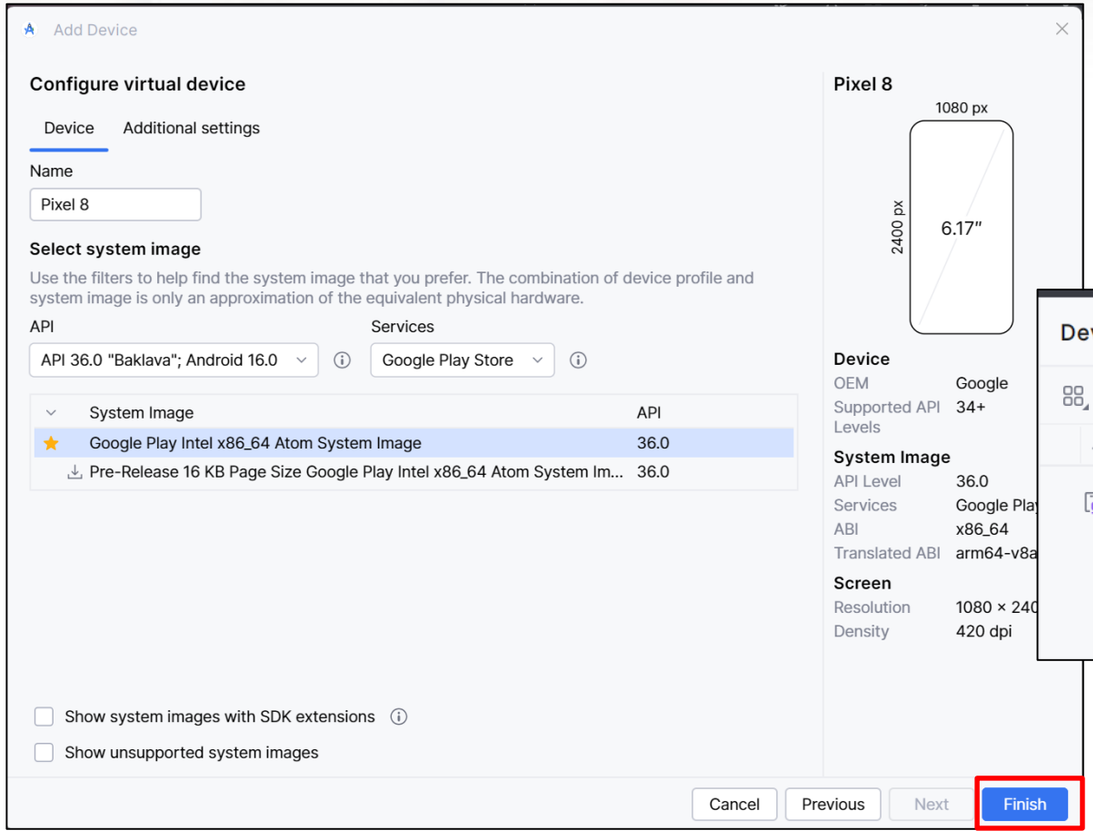
- Android Device
- Emulator: Android Virtual Device (AVD) Manager

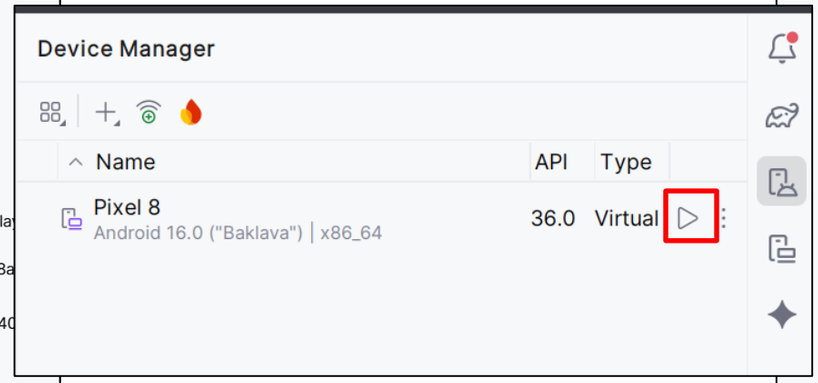


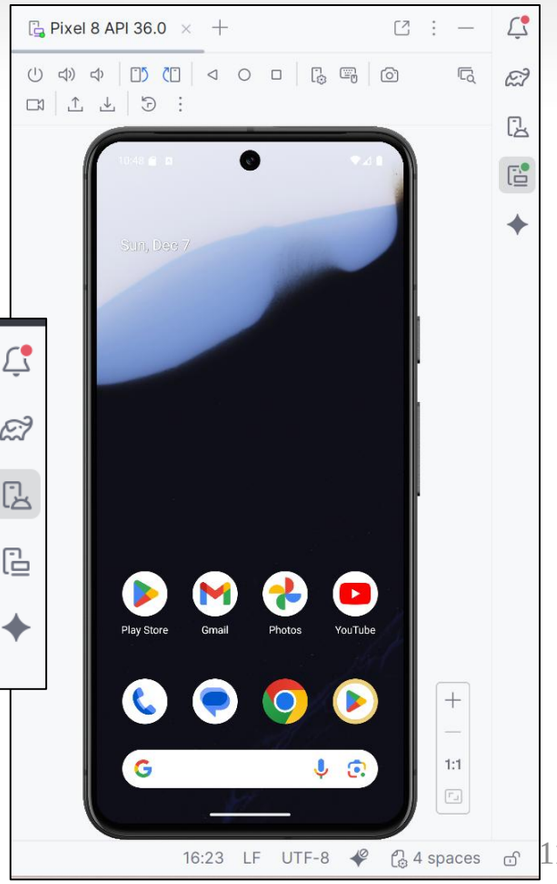


Run Apps

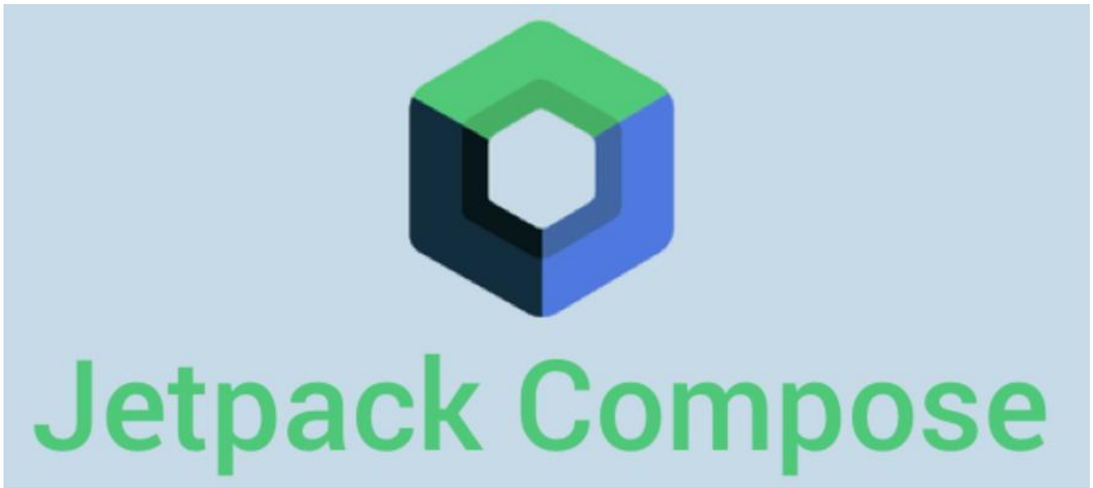
- Android Device
- Emulator: Android Virtual Device (AVD) Manager







Jetpack Compose



Jetpack Compose

- Jetpack Compose is Android’s recommended modern toolkit for building native UI.
- It simplifies and accelerates UI development on Android.
- Quickly bring the app to life with less code, powerful tools, and intuitive Kotlin APIs.
- Jetpack Compose is totally declarative programming, which means you can describe your user interface by invoking a set of composable.

Jetpack Compose

- MainActivity.kt

```
class MainActivity : ComponentActivity() {
    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        enableEdgeToEdge()
        setContent {
            Lec3Theme {
                Scaffold(modifier = Modifier.fillMaxSize()) { innerPadding ->
                    Greeting(
                        name = "Android",
                        modifier = Modifier.padding( paddingValues = innerPadding)
                    )
                }
            }
        }
    }
}
```

```
@Composable
fun Greeting(name: String, modifier: Modifier = Modifier) {
    Text(
        text = "Hello $name!",
        modifier = modifier
    )
}

@Preview(showBackground = true)
@Composable
fun GreetingPreview() {
    Lec3Theme {
        Greeting( name = "Android")
    }
}
```

Jetpack Compose

- MainActivity.kt

The setContent block defines the activity's layout where composable functions are called. Composable functions can only be called from other composable functions.

```
class MainActivity : ComponentActivity() {
    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        enableEdgeToEdge()
        setContent {
            Lec3Theme {
                Scaffold(modifier = Modifier.fillMaxSize()) { innerPadding ->
                    Greeting(
                        name = "Android",
                        modifier = Modifier.padding( paddingValues = innerPadding)
                    )
                }
            }
        }
    }
}
```

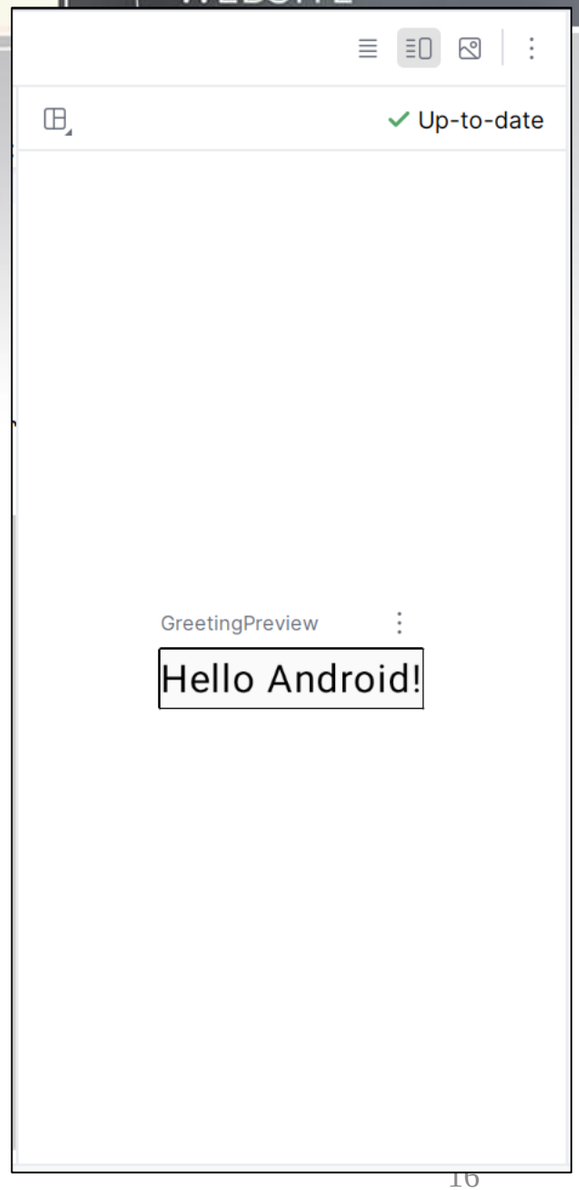
Jetpack Compose

- MainActivity.kt

@Composable — a special annotation class. Any function annotated this way is also called a composable function

@Preview — a special annotation class. this composable should be shown in the design view of this file.

```
@Composable
fun Greeting(name: String, modifier: Modifier = Modifier) {
    Text(
        text = "Hello $name!",
        modifier = modifier
    )
}

@Preview(showBackground = true)
@Composable
fun GreetingPreview() {
    Lec3Theme {
        Greeting( name = "Android")
    }
}
```



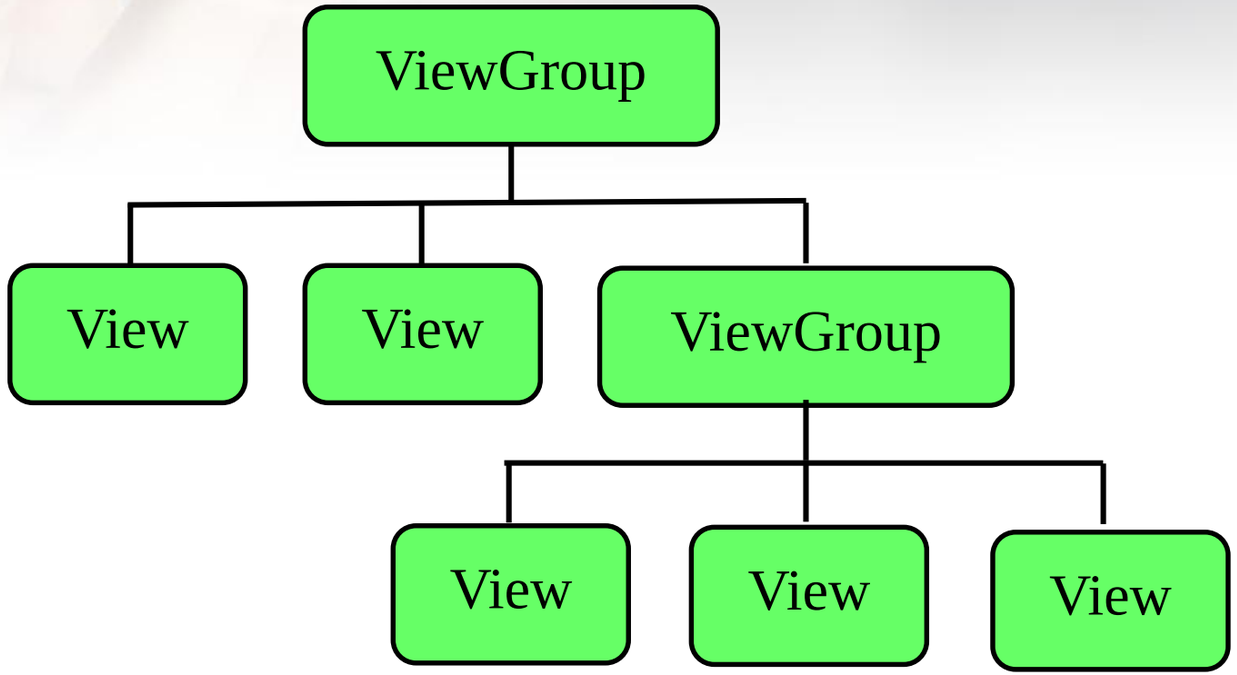
Jetpack Compose

UI Hierarchy

- The UI hierarchy is based on containment, meaning one component can contain one or more components, and the terms parent and child are sometimes used.
- The context is that the parent UI elements contain children UI elements, which in turn can contain children UI elements.

```
// Column คือ Parent
Column {
    // Text และ Button คือ Child
    Text( text = "Header")
    Button(onClick = {}) {
        // Text ภายใน Button คือ Child ของ Button
        Text( text = "Click Me")
    }
}
```

UI Hierarchy



- Each element is either a View or ViewGroup object
- View objects are leaves in the tree
- ViewGroup objects are branches in the tree

Layout

- Layout is the architecture for the user interface in an Activity
- Defines the layout structure and holds all the elements that appear to the user
- Express the view hierarchy

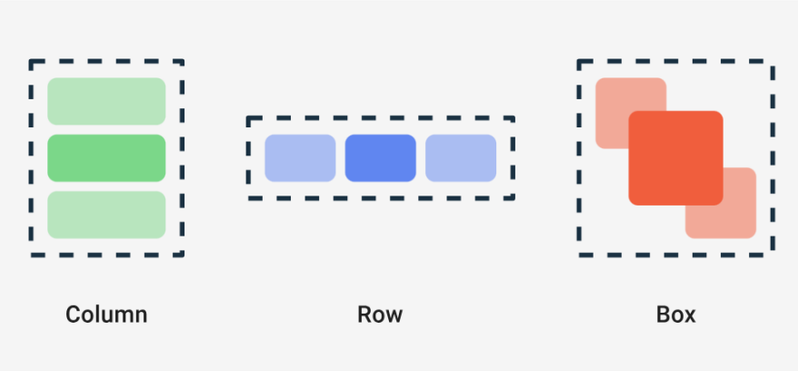
Dimension

- Dimensions in any of the following units:
  - *.dp* (Density-independent pixels): Used for all UI sizing and layout (e.g., width, padding, margin). It automatically scales with screen density to maintain a consistent physical size.
  - *.sp* (Scale-independent pixels): Used exclusively for font sizes. It scales with screen density and respects the user's system font size preference for accessibility

Jetpack Compose

The three basic, standard layout elements in Compose, used for sequential or layered arrangement, are:

- Column
- Row
- Box

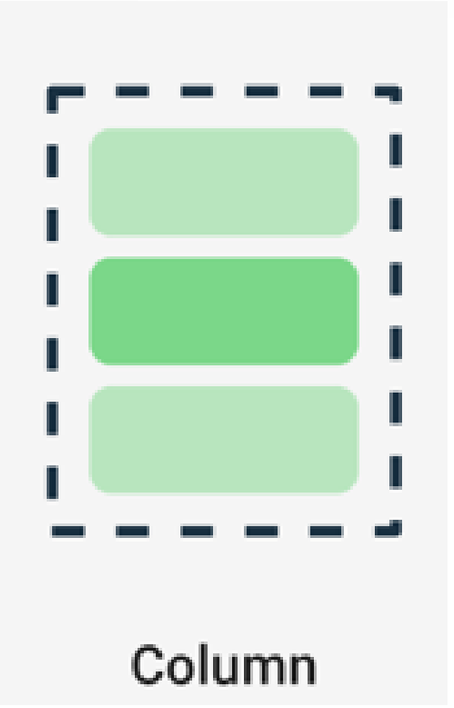


ConstraintLayout is also a key layout element but is generally categorized as an advanced layout used for complex UI structures that require referencing and constraining elements relative to one another.

Column Layout

- A layout composable that places its children in a vertical sequence.

```
@Composable
fun ColumnLayoutText() {
    Column (){
        ..........
    }
}
```



Column Layout

```
@Composable
fun ColumnLayoutText(modifier: Modifier = Modifier) {
    Column {
        Text(
            text = "Hello Text1",
            style = TextStyle(background = Color.Yellow),
            fontWeight = FontWeight.Bold,
            fontSize = 30.sp,
            modifier = modifier
                .padding(10.dp)     )
        Text(
            text = "Hello Text2",
            style = TextStyle(background = Color( red: 100,  green: 100,  blue: 255)),
            fontSize = 20.sp,
            fontWeight = FontWeight.Bold,
            modifier = modifier
                .padding(5.dp)
        )
        Text(
            text = "Hello Text3",
            fontSize = 20.sp,
            modifier = modifier
                .padding(5.dp)
        ) }
}
```

```
@Preview(showBackground = true)
@Composable
fun GreetingPreview() {
    Lab3Layout2023Theme {
        ColumnLayoutText()
    }
}
```

GreetingPreview

Hello Text1

Hello Text2

Hello Text3

```
class MainActivity : ComponentActivity() {
    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        enableEdgeToEdge()
        setContent {
            Lec3Theme {
                Scaffold(modifier = Modifier.fillMaxSize()) { innerPadding ->

                    ColumnLayoutText(modifier = Modifier.padding(innerPadding))

                }
            }
        }
    }
}
```

Column Layout

fun ColumnLayoutText()

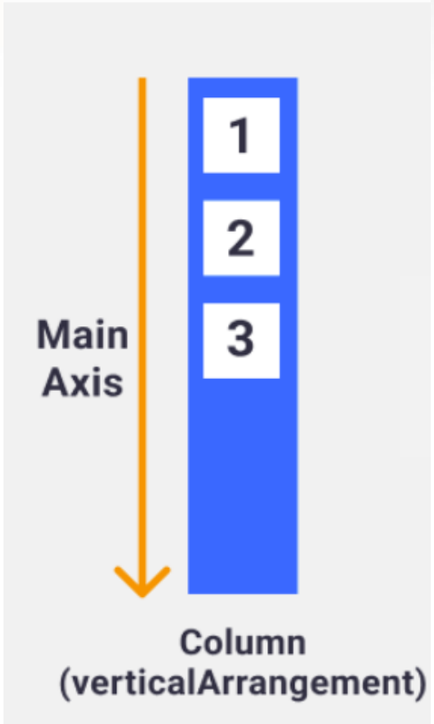

```
@Composable
fun ColumnLayoutText(modifier: Modifier = Modifier) {
    Column {
        Text(
            text = "Hello Text1",
            style = TextStyle(background = Color.Yellow),
            fontWeight = FontWeight.Bold,
            fontSize = 30.sp,
            modifier = modifier.padding(10.dp)
           )

        Text(
            text = "Hello Text2",
            style = TextStyle(background = Color(100, 100, 255)),
            fontSize = 20.sp,
            fontWeight = FontWeight.Bold,
            modifier = modifier.padding(5.dp)
          )

        Text(
            text = "Hello Text3",
            fontSize = 20.sp,
            modifier = modifier.padding(5.dp)
        )
    }
}
```

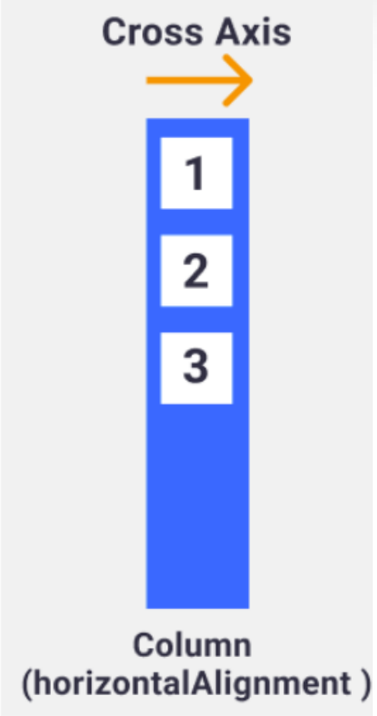
Column Layout

- Arrangement object and Alignment object

verticalArrangement = Arrangement.**

**: Top
Center
Bottom
SpaceEvenly
SpaceBetween
SpaceAround





horizontalAlignment= Alignment.**

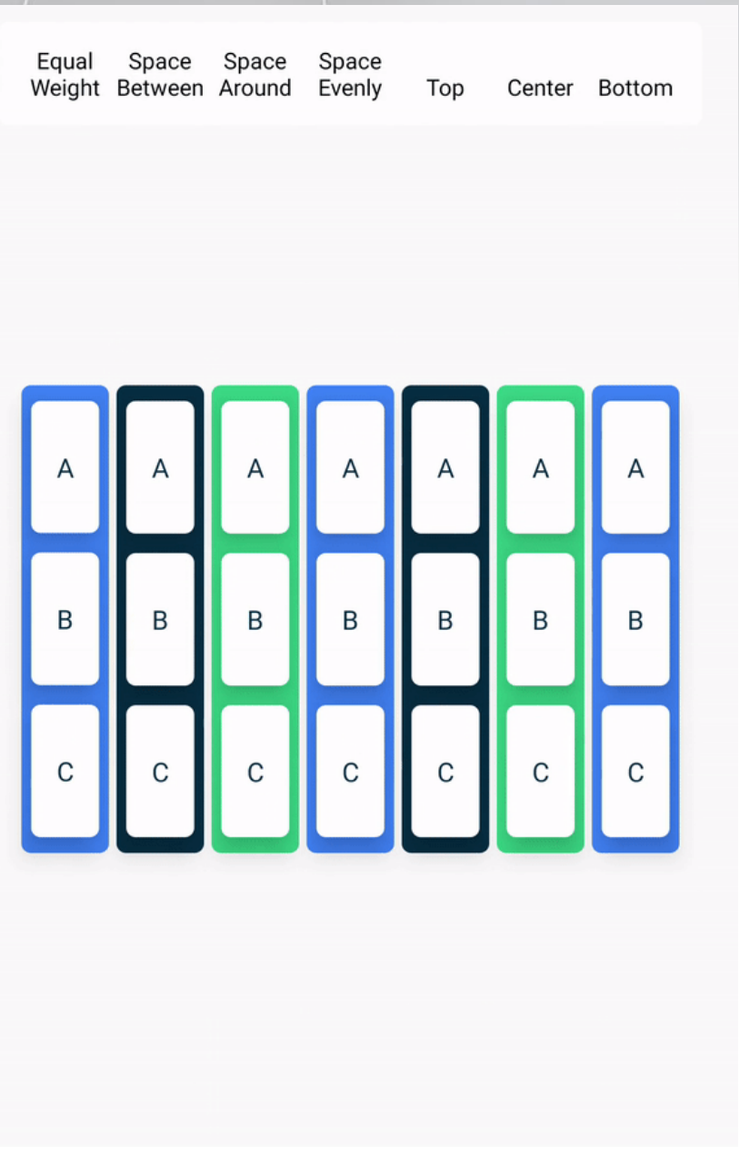
**: Strat
End
Center
CenterHorizontally

https://semicolonspace.com/jetpack-compose-alignment-arrangement/

Column Layout

- The arrangement property is used to arrange the child elements when the size of the layout is larger than the sum of its children.

- For example: when the size of the Column is larger than the sum of its children sizes, a verticalArrangement can be specified to define the positioning of the children inside the Column.



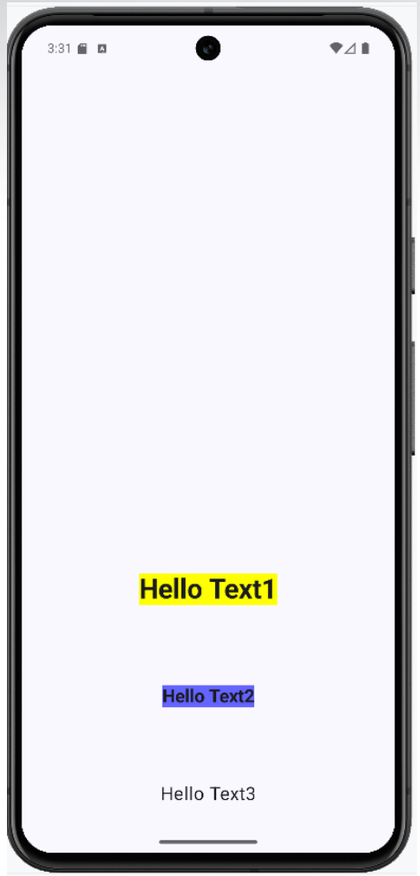
Column Layout

Example:

```
@Composable
fun ColumnLayoutText(modifier: Modifier = Modifier) {
    Column(modifier = modifier.fillMaxSize(),
           verticalArrangement= Arrangement.Bottom,
           horizontalAlignment= Alignment.CenterHorizontally)
     {
       Text(
           text = "Hello Text1",
           style = TextStyle(background = Color.Yellow),
           fontWeight = FontWeight.Bold,
           fontSize = 30.sp,
           modifier = modifier.padding(10.dp)
         )
       Text(
           text = "Hello Text2",
           style = TextStyle(background = Color(100, 100, 255)),
           fontSize = 20.sp,
           fontWeight = FontWeight.Bold,
           modifier = modifier.padding(5.dp)
         )
```

```
       Text(
           text = "Hello Text3",
           fontSize = 20.sp,
           modifier = modifier
               .padding(5.dp)
       )
    }
}
```

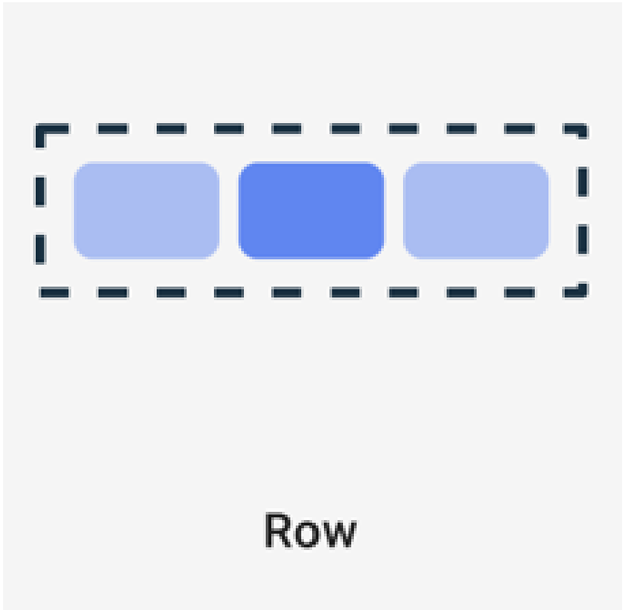
Result



Row Layout

- A layout composable that places its children in a horizontal sequence

```
@Composable
fun RowLayoutText() {
    Row (){
        ..........
    }
}
```

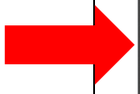


Row Layout

```
@Composable
fun RowLayoutText(modifier: Modifier = Modifier) {
    Row() {
        Text(
            text = "Hello Text1",
            style = TextStyle(background = Color.Yellow),
            fontWeight = FontWeight.Bold,
            fontSize = 30.sp,
            modifier = modifier
                .padding(10.dp)     )
        Text(
            text = "Hello Text2",
            style = TextStyle(background = Color( red: 100,  green: 100,  blue: 255)),
            fontSize = 20.sp,
            fontWeight = FontWeight.Bold,
            modifier = modifier
                .padding(5.dp)
        )
        Text(
            text = "Hello Text3",
            fontSize = 20.sp,
            modifier = modifier
                .padding(5.dp)
        ) }
}
```

```
@Preview(showBackground = true)
@Composable
fun GreetingPreview() {
    Lab3Layout2023Theme {
        RowLayoutText()
    }
}
```


```
class MainActivity : ComponentActivity() {
    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        enableEdgeToEdge()
        setContent {
            Lec3Theme {
                Scaffold(modifier = Modifier.fillMaxSize()) { innerPadding ->

                    RowLayoutText(modifier = Modifier.padding(innerPadding))

                }
            }
        }
    }
}
```



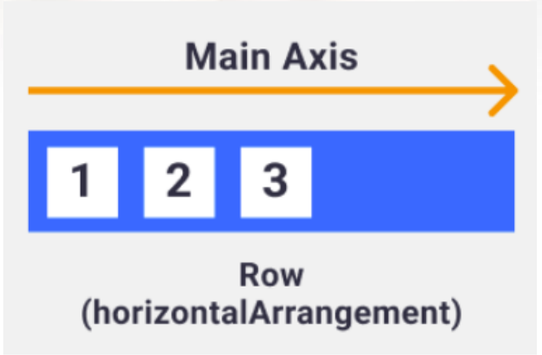
Row Layout

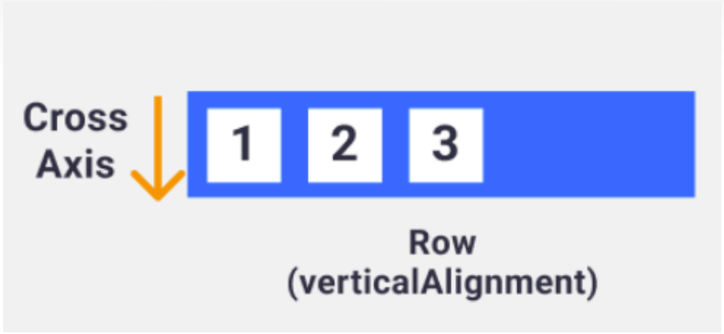
fun RowLayoutText()


```
@Composable
fun RowLayoutText(modifier: Modifier = Modifier) {
    Row() {
        Text(
            text = "Hello Text1",
            style = TextStyle(background = Color.Yellow),
            fontWeight = FontWeight.Bold,
            fontSize = 30.sp,
            modifier = modifier.padding(10.dp)
        )
        Text(
            text = "Hello Text2",
            style = TextStyle(background = Color(100, 100, 255)),
            fontSize = 20.sp,
            fontWeight = FontWeight.Bold,
            modifier = modifier.padding(5.dp)
        )
        Text(
            text = "Hello Text3",
            fontSize = 20.sp,
            modifier = modifier.padding(5.dp)
        )
    }
}
```

Row Layout

- Arrangement object and Alignment object





horizontalArrangement = Arrangement.**

**: Strat
End
Center
SpaceEvenly
SpaceBetween
SpaceAround

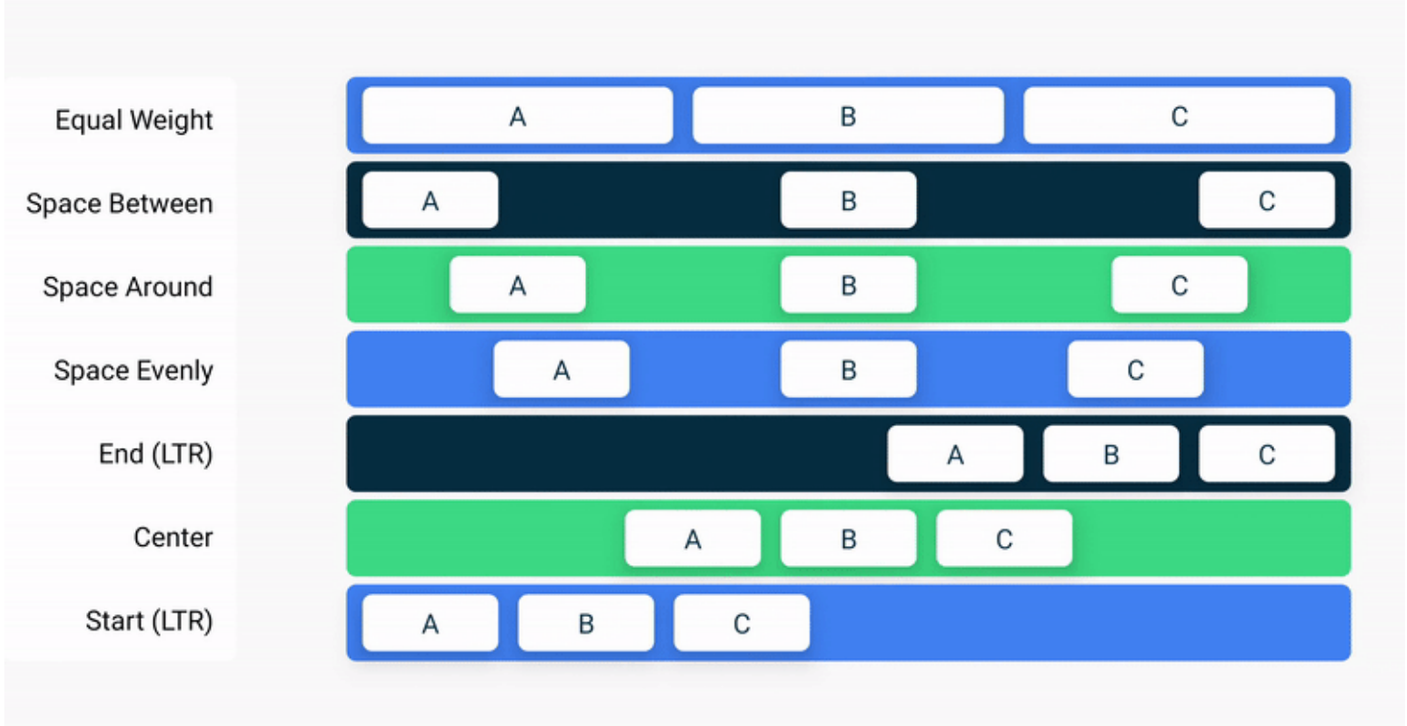
verticalAlignment= Alignment.**

**: Top
Bottom
CenterVertically

https://semicolonspace.com/jetpack-compose-alignment-arrangement/

Row Layout

- When the size of the Row is larger than the sum of its children sizes, a horizontalArrangement can be specified to define the positioning of the children inside the Row.



Row Layout

Example

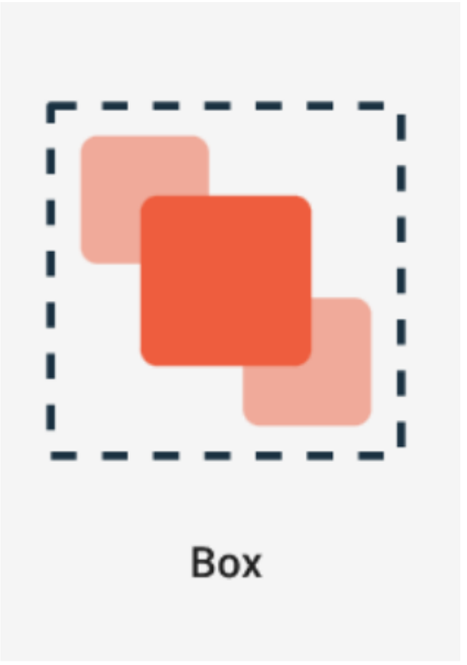
```
@Composable
fun RowLayoutText(modifier: Modifier = Modifier) {
    Row (modifier = modifier.fillMaxSize(),
            horizontalArrangement = Arrangement.End,
            verticalAlignment = Alignment.CenterVertically
        )
    {
        Text(
            text = "Hello Text1",
            style = TextStyle(background = Color.Yellow),
            fontWeight = FontWeight.Bold,
            fontSize = 30.sp,
            modifier = modifier.padding(10.dp)     )
        Text(
            text = "Hello Text2",
            style = TextStyle(background = Color(100, 100, 255)),
            fontSize = 20.sp,
            fontWeight = FontWeight.Bold,
            modifier = modifier.padding(5.dp)
        )
        Text(
            text = "Hello Text3",
            fontSize = 20.sp,
            modifier = Modifier
                .padding(5.dp)
        )
    }
}
```

Result

Box layout

- Box layout is one of the standard layout elements in Compose.
- Use Box layout to stack elements on top of one another.
- Box layout also lets to configure the specific alignment of the elements that it contains.

```
@Composable
fun BoxLayout() {
    Box(
        modifier = Modifier.fillMaxSize()
    ) {
                .....
    }
}
```

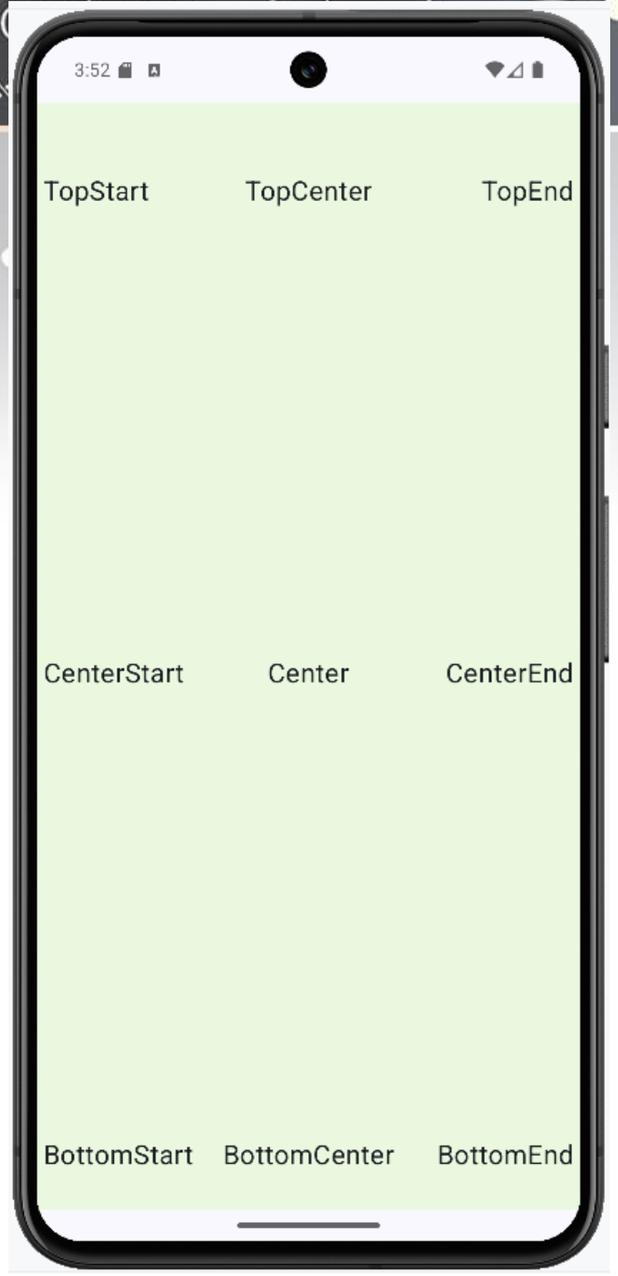


Box layout

- Set the alignment on the children using the Modifier.align() method.

```
Box(
    modifier = Modifier.fillMaxSize()
) {
    Text(
        text = "My text",
        modifier = Modifier.align(Alignment.**)
    )
}
```

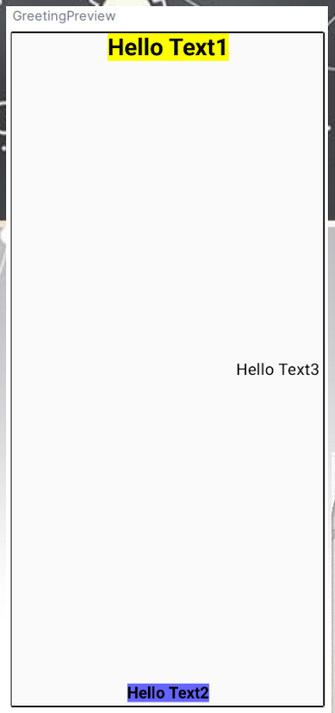
**: TopStart, TopCenter, TopEnd, CenterStart, Center, CenterEnd, BottomStart, BottomCenter, and BottomEnd



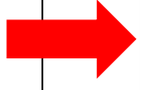
Box Layout

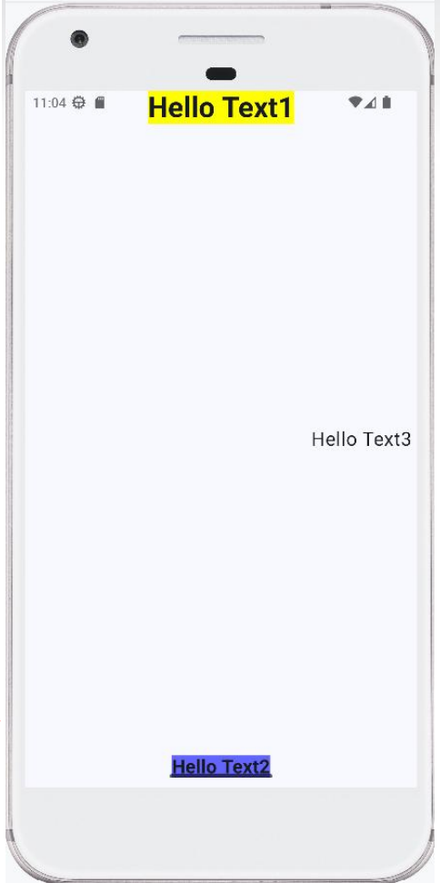
```
fun BoxLayout(modifier: Modifier = Modifier) {
    Box( modifier = Modifier.fillMaxSize()
    ) {
        Text(
            text = "Hello Text1",
            style = TextStyle(background = Color.Yellow),
            fontWeight = FontWeight.Bold,
            fontSize = 30.sp,
            modifier = Modifier.align(Alignment.TopCenter)
        )
        Text(
            text = "Hello Text2",
            style = TextStyle(background = Color( red: 100,  green: 100,  blue: 255)),
            fontSize = 20.sp,
            fontWeight = FontWeight.Bold,
            modifier = Modifier.padding(5.dp)
                .align(Alignment.BottomCenter)
        )
        Text(
            text = "Hello Text3",
            fontSize = 20.sp,
            modifier = Modifier.padding(5.dp)
                .align(Alignment.CenterEnd)
        )
    }
}
```

```
@Preview(showBackground = true)
@Composable
fun GreetingPreview() {
    Lab3Layout2023Theme {
      BoxLayout()
    }
}
```




```
class MainActivity : ComponentActivity() {
    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        enableEdgeToEdge()
        setContent {
            Lec3Theme {
                Scaffold(modifier = Modifier.fillMaxSize()) { innerPadding ->

                    BoxLayout(modifier = Modifier.padding(innerPadding))

                }
            }
        }
    }
}
```





Box Layout

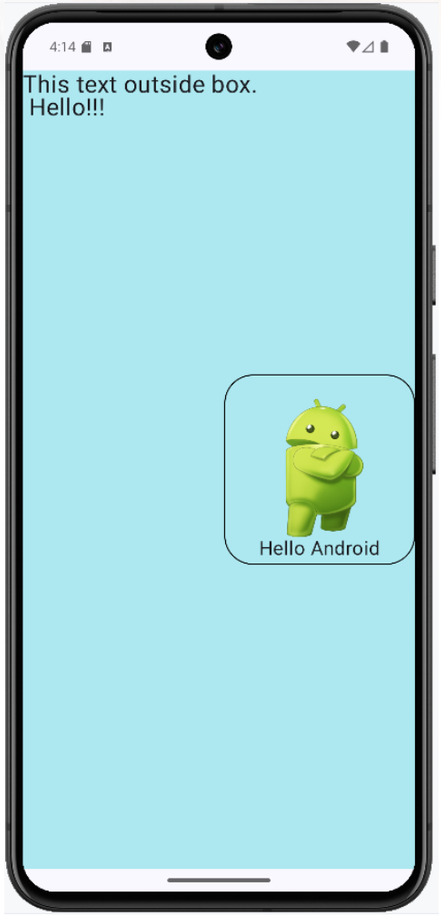
fun BoxLayout()


```
@Composable
fun BoxLayout(modifier: Modifier = Modifier) {
    Box( modifier = Modifier.fillMaxSize()
    ) {
        Text(
            text = "Hello Text1",
            style = TextStyle(background = Color.Yellow),
            fontWeight = FontWeight.Bold,
            fontSize = 30.sp,
            modifier = Modifier.align(Alignment.TopCenter)
        )
        Text(
            text = "Hello Text2",
            style = TextStyle(background = Color(100, 100, 255)),
            fontSize = 20.sp,
            fontWeight = FontWeight.Bold,
            modifier = Modifier.padding(5.dp)
                .align(Alignment.BottomCenter)
        )
        Text(
            text = "Hello Text3",
            fontSize = 20.sp,
            modifier = Modifier.padding(5.dp)
                .align(Alignment.CenterEnd)
        )
    }
}
```

Box Layout

Ex2: fun BoxImage()

Result




```
@Composable
fun BoxImage(modifier: Modifier = Modifier) {
    Box(
        modifier = Modifier.fillMaxSize()
            .background(Color(173, 232, 240, 255))
    ){
    Box(
        modifier = Modifier
            .fillMaxSize()
            .wrapContentSize(unbounded = true, align = Alignment.CenterEnd)
            .border(
                width = 1.dp,
                color = Color.Black,
                shape = RoundedCornerShape(30.dp))
        )
    {
       Image(
        painter = painterResource(R.drawable.logoandroid),
        contentDescription = null,
        contentScale = ContentScale.Fit,
        modifier = Modifier.size(200.dp)
                        .padding(20.dp)
    )
        Text(
            text = "Hello Android",
            fontSize = 20.sp,
            modifier = Modifier.padding(5.dp)
              .align(Alignment.BottomCenter)
        )
    }
```

File: logoandroid.png

align = Alignment.**

**: TopStart, TopCenter, TopEnd, CenterStart, Center, CenterEnd, BottomStart BottomCenter, and BottomEnd

```
    Text(
        text = "This text outside box. \n Hello!!!",
        fontSize = 25.sp
    )
  }
}
```

ConstraintLayout

- ConstraintLayout is a layout that allows you to place composables relative to other composables on the screen.
- It is an alternative to using multiple nested Row, Column, and Box.
- ConstraintLayout is useful when implementing larger layouts with more complicated alignment requirements.

ConstraintLayout

First, add this dependency in your build.gradle and then click Sync Now

```
implementation("androidx.constraintlayout:constraintlayout-compose:1.1.1")
```

Constraint Layout

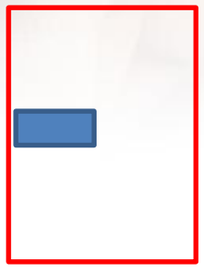
ConstraintLayout in Compose works in the following way

- Create references for each composable in the ConstraintLayout using the createRefs() or createRefFor()
- Constraints are provided using the constrainAs() modifier, which takes the reference as a parameter.
- Constraints are specified using linkTo() or other helpful methods.
- parent is an existing reference that can be used to specify constraints towards the ConstraintLayout composable itself.

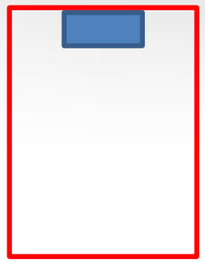
https://developer.android.com/jetpack/compose/layouts/constraintlayout

Constraint Layout

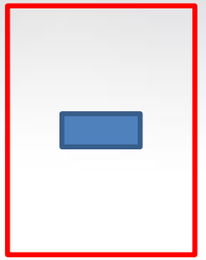
- Position relative to Parent



centerVerticallyTo(parent)



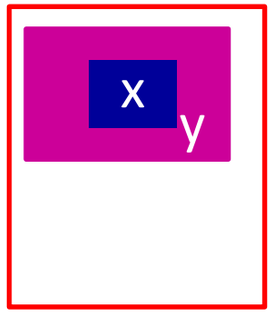
centerHorizontallyTo(parent)



centerVerticallyTo(parent)
centerHorizontallyTo(parent)

- centerTo() method

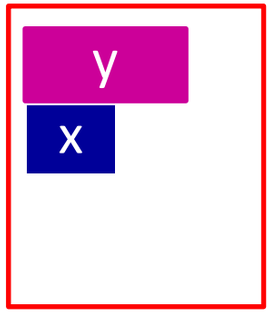
```
modifier = Modifier.constrainAs(x){
    centerTo(y)}
```



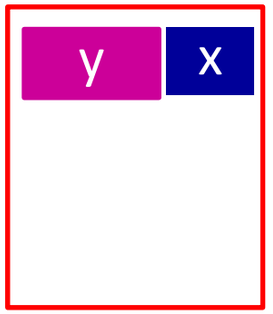
Constraint Layout

- linkTo() methods

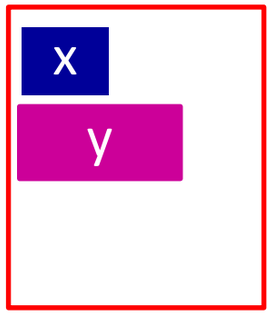
```
modifier = Modifier.constrainAs(x){
    * .linkTo(y.**_y)   }
```



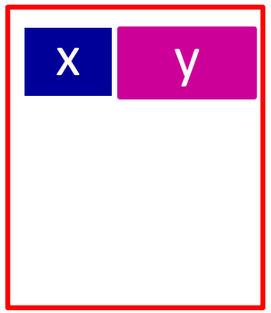
top.linkTo(y.bottom)



start.linkTo(y.end)



bottom.linkTo(y.top)



end.linkTo(y.start)

ConstraintLayout

fun ConstraintLayoutTest()


```
@Composable
fun ConstraintLayoutTest(modifier: Modifier = Modifier) {
    ConstraintLayout(modifier = Modifier.fillMaxSize()){
        val (text1, text2, text3) = createRefs()
        Text(
            text = "Hello Text1",
            style = TextStyle(background = Color.Yellow),
            fontSize = 30.sp,
            modifier = modifier.constrainAs(text1) {
                top.linkTo(parent.top)}
        )
        Text( text = "Hello Text2",
            fontSize = 25.sp,
            fontWeight = FontWeight.Bold,
            modifier = modifier.constrainAs(text2) {
                top.linkTo(text1.bottom)
                centerHorizontallyTo(parent)}
        )
        Text( text = "Hello Text3",
            fontSize = 25.sp,
            modifier = modifier.constrainAs(text3) {
                top.linkTo(text2.bottom)
                start.linkTo(text2.end)}
        )
    }
}
```

References

- https://www.jetpackcompose.net/compose-layout-row-and-column
- https://www.boltuix.com/2021/12/column-layout_25.html
- https://semicolonspace.com/jetpack-compose-alignment-arrangement/
- https://foso.github.io/Jetpack-Compose-Playground/layout/column/