CMPS 312

Navigation

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Navigation

The act of moving between screens of an app to complete tasks

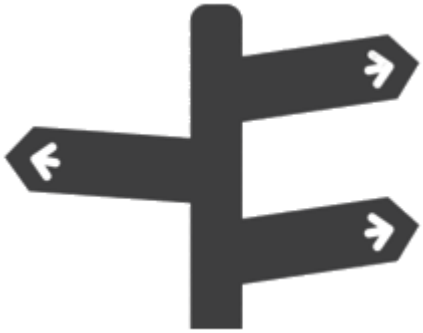
Designing effective navigation = Simplify the user journey

Outline

1. Jetpack Compose Navigation
2. Navigation UI Components
3. Floating Windows
4. Responsive UI

Jetpack Compose Navigation

Used for navigating between destinations within an app



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https://developer.android.com/jetpack/compose/navigation

Single Activity with Multi-Screens

- App UI = { **1 Activity** + Multi-Screens }
  - A Screen is a composable that represents **a portion of the UI**
- The Navigation Component enables implementing Single Activity App with the ability to navigate between the app screens (also called **destinations**)
- Requires the following dependency in app module's *build.gradle* file:

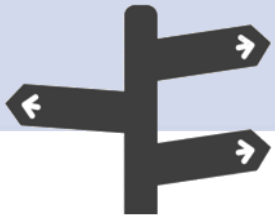
```
implementation "androidx.navigation:navigation-compose::<version>"
```

Navigation uses 2 main Classes

NavHost

- Defines the app **Navigation Graph** = possible **routes** a user can take through the app

- Acts as a **container** to load the screen associated with the **route** requested by the NavController



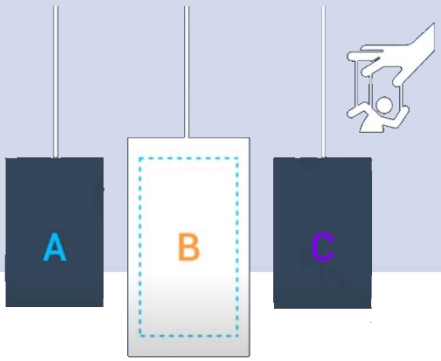
NavController

- Used to request navigating to a particular route

e.g.,

```
navController.navigate("friends")
```

- Keeps track of the **back stack** of visited screens



Creating a NavHost

- **`NavHost`** (typically added to the Main Screen) is used to define a **navigation graph** to specify the possible **routes** within the app
  - A **route** associates a **path** name to a specific screen
    - Each app route should have a unique name
    - One of the route will be used as the start destination
- The Nav Graph is defined using the **`composable`**() function to map each **route** to the associated **screen**

```
NavHost(navController = navController, startDestination = "profile") {
    composable("profile") { ProfileScreen() }
    composable("orders") { OrdersScreen() }
    /*...*/
}
```

Navigate to a destination using NavController

- **navController** object is created in the Main Screen using the **rememberNavController**()

```
val navController = rememberNavController()
```

- navController.**navigate**(***destinationRoute***) method is used to navigate to a specific destination
  - The requested destination screen will be loaded by the **NavHost**
- navController.**navigateUp**() navigates to the previous screen

```
@Composable
fun Profile(navController: NavController) {
    /*...*/
     Button(onClick = {
                navController.navigate("friends")
         })
    {  Text(text = "Show Friends") }
}
```

Navigate with arguments

- To pass arguments to a destination e.g., get the profile for user 123 `navController.navigate("profile/123")`
  - First add the argument placeholder to the destination route

  e.g., The user profile destination takes a *userId* argument to determine which user to display

```
NavHost( ...) {
    composable("profile/{userId}") {...}
}
```

- By default, all arguments are parsed as strings. You can specify another type by using the arguments parameter

```
composable("profile/{userId}",
    arguments = listOf(navArgument("userId") { type = NavType.IntType })
) { ... }
```

Extract the Nav Arguments from the Nav BackStackEntry

- Nav BackStackEntry represent an entry in the back stack
  - The route provides access the current **backStackEntry** to extract the navigation arguments

```
composable("profile/{userId}",
    arguments = listOf(navArgument("userId") { type = NavType.IntType })
) { backStackEntry ->
    // Extract the Nav Arguments from the Nav BackStackEntry
    Profile(navController, backStackEntry.arguments?.getInt("userId"))
}
```

Adding optional arguments

- Optional arguments must be added to the `composable()` as a **query parameter**

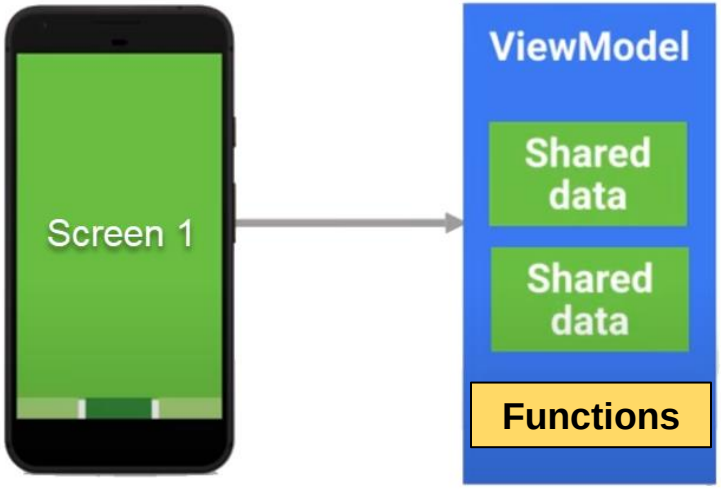
  `?argName={argName}`

  - Optional arguments must have a defaultValue, or set ***`nullable = true`***

```
composable("profile?userId={userId}",
    arguments = listOf(navArgument("userId") {
                        type = NavType.IntType
                        defaultValue = 123 })
) { backStackEntry ->
    Profile(navController, backStackEntry.arguments?.getInt("userId"))
}
```

Shared data/functions between Screens using ViewModel

- Screens can **share** data using a shared **View Model** class that extends `ViewModel()`




```
class UserViewModel : ViewModel() {
    val users = mutableStateListOf(
        User(1, "Ahmed", "Faleh", "ahmed@test.com"),
        User(2, "Fatima", "Faleh", "fatima@test.com"),
        ….
    )
}
```

```
val userViewModel = viewModel<UserViewModel>()
NavHost(
    …
    composable(Screen.Users.route) {
        UsersScreen(userViewModel)
    }
```

NavOptions - popUpTo and popUpTo inclusive

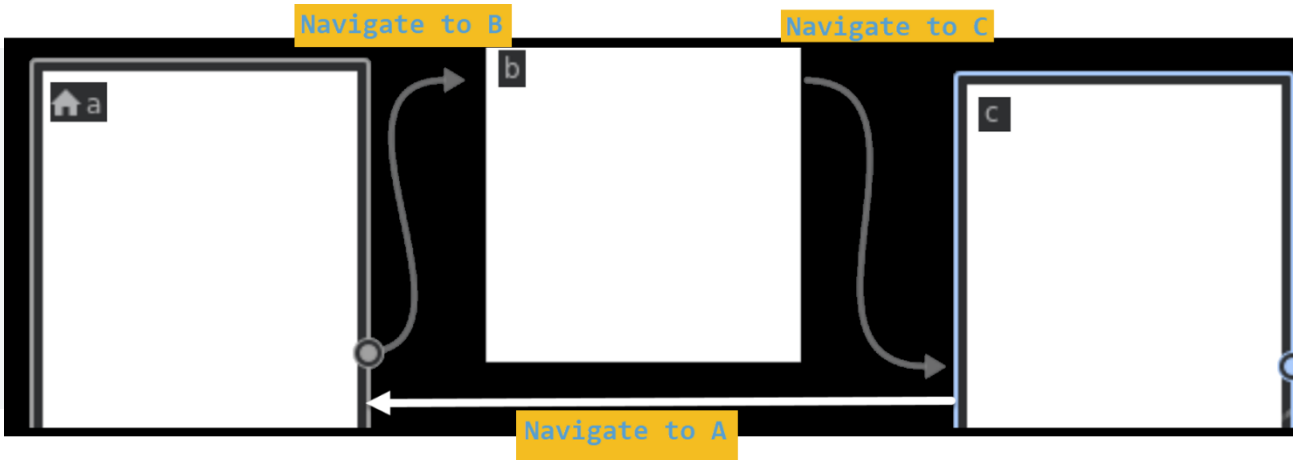
- By default, **`navigate()`** adds the new destination to the back stack (i.e., history of visited screens). To modify this behavior, pass **navigation options** to **`navigate()`** call
  - **`launchSingleTop = true`** : Navigate to the destination only if we're not already on it to avoid multiple copies of the destination screen on the back stack
  - **`popUpTo(route)`** : pop off previously visited destinations from the back stack (up to the specified route)
    - For example, after a login flow, you should **pop off all the login-related destinations** of the back stack so that the Back button doesn't take users back into the login flow
    - It should go back to the Home Screen while removing all visited destinations from the back stack
    - If *`inclusive = true`* the destination specified in **popUpTo** should also be removed from the back stack

Navigation Options: popUpTo & launchSingleTop

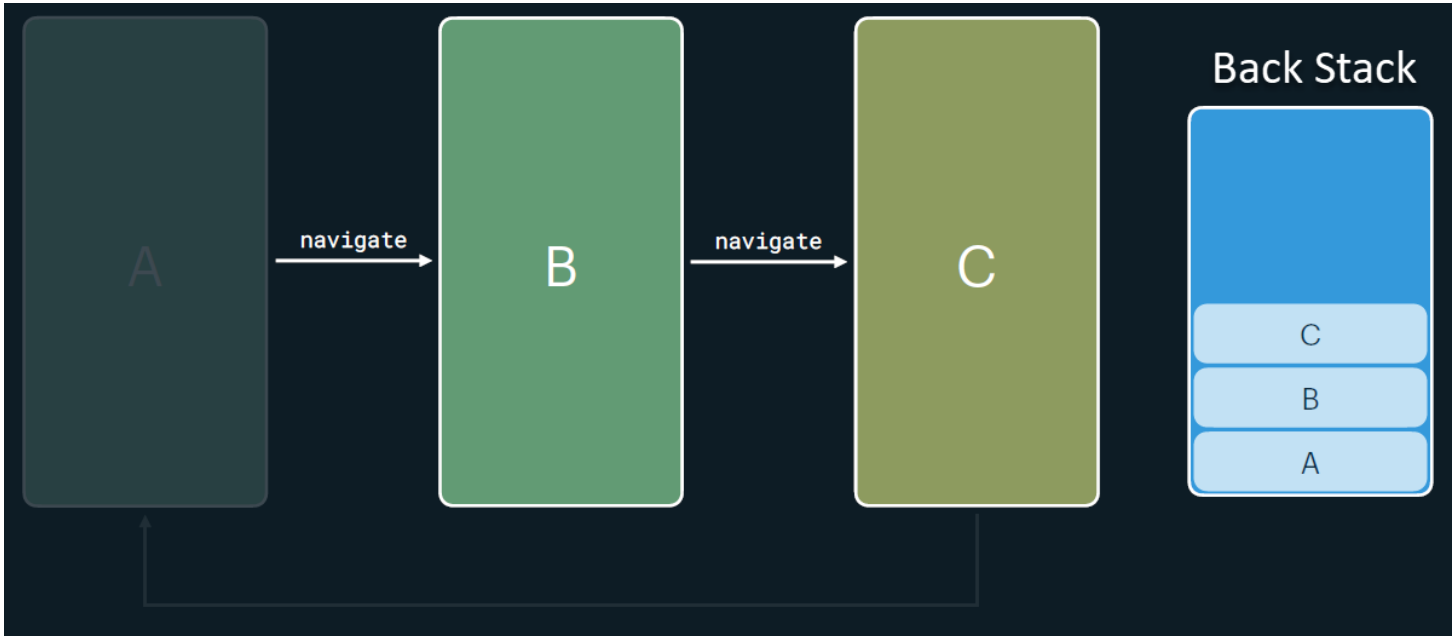
```
/* Pop everything up to the "home" destination off the back stack before
 navigating to the "friends" destination */
navController.navigate("friends") {
    popUpTo("home")
}

/* Pop off from the back stack up to and including the "home" destination
 before navigating to the "friends" destination */
navController.navigate("friends") {
    popUpTo("home") { inclusive = true }
}

/* Navigate to the "search” destination only if we’re not already on
 the "search" destination, avoiding multiple copies of the search screen
 on the back stack */
navController.navigate("search") {
    launchSingleTop = true
}
```

popUpTo Example

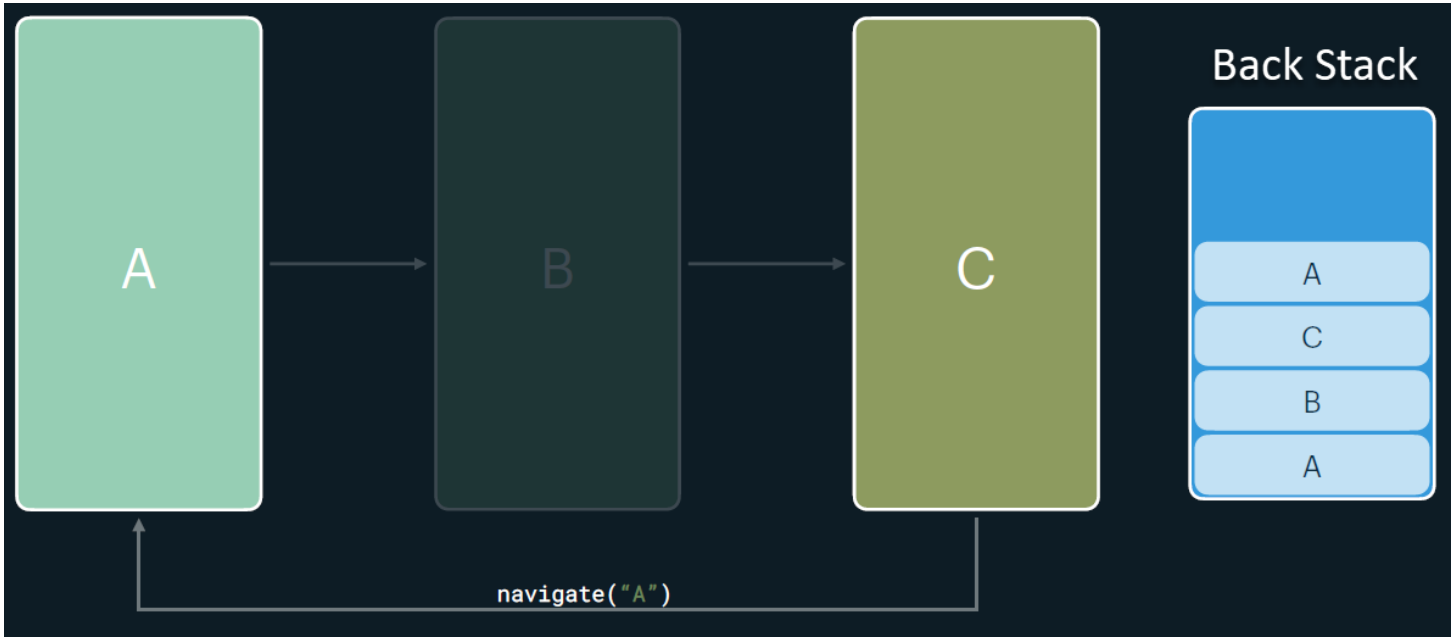
```
navController.navigate("A") {
    popUpTo("A") {
        inclusive = true
    }
}
```

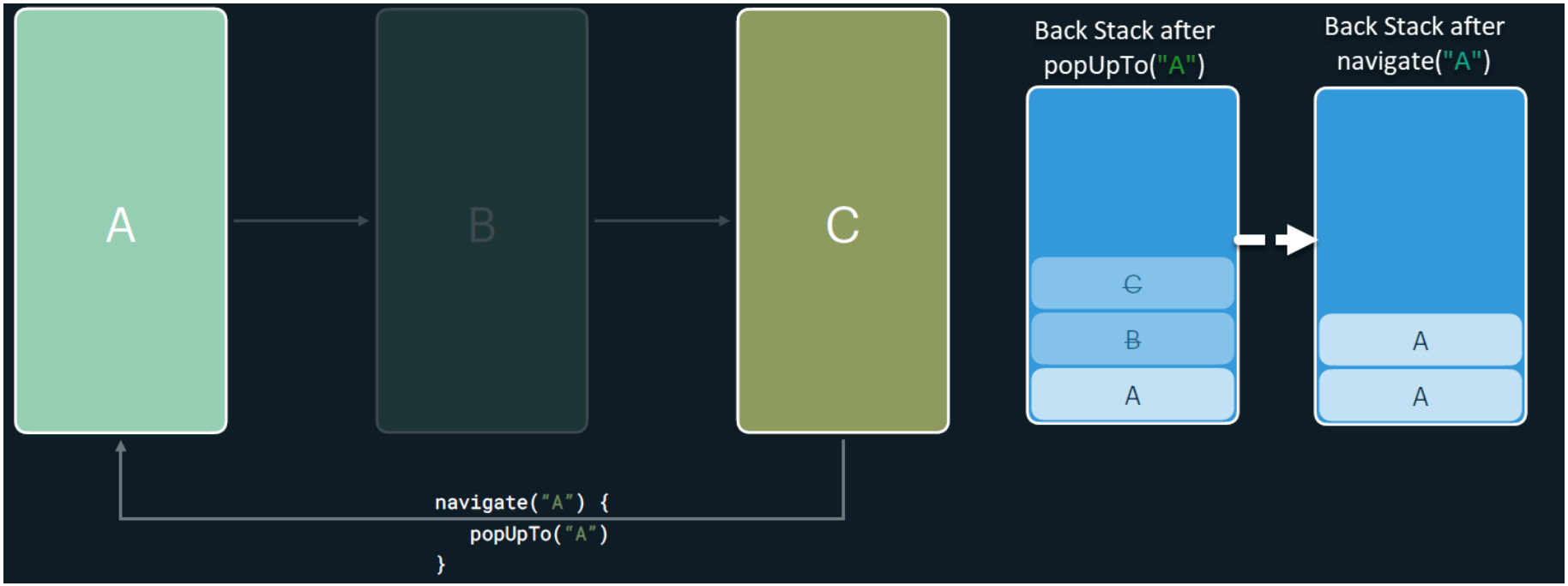


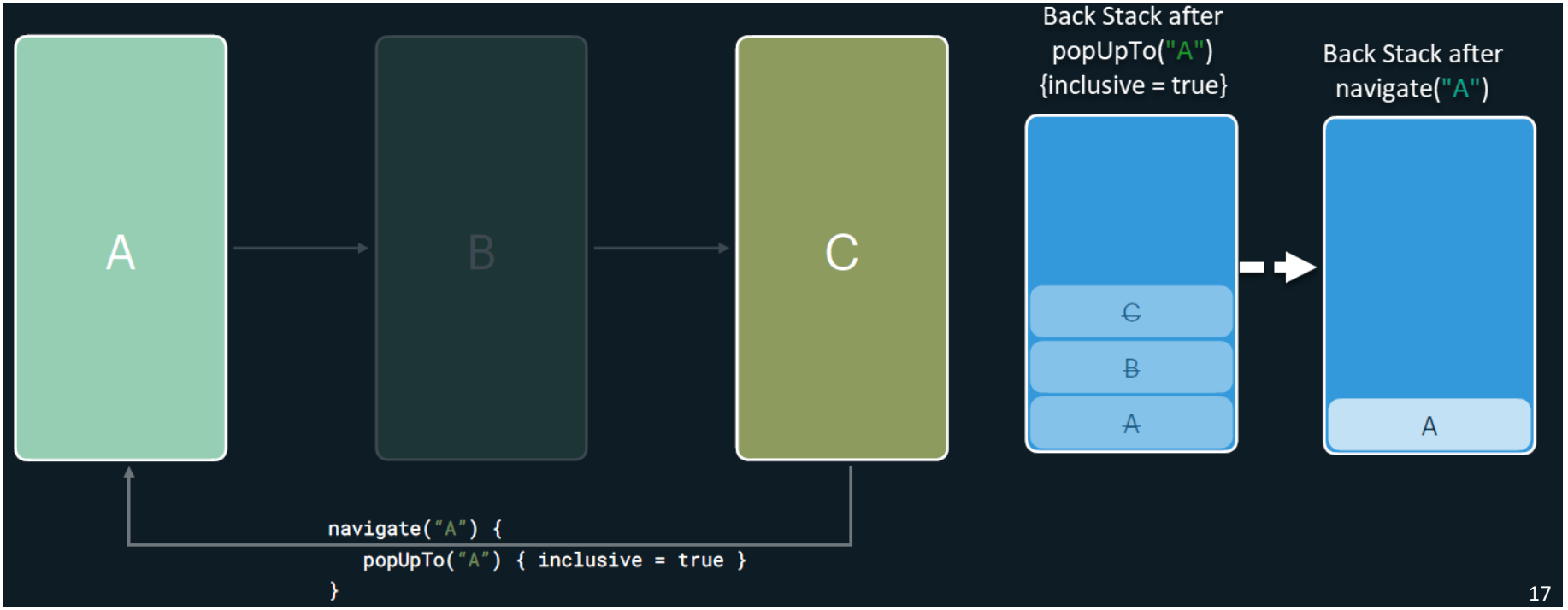
- After reaching C, the back stack contains (A, B, C). When navigating back to A, we also **popUpTo A**, which means that we remove B and C from the stack as part of the call to **navigate**(**"A"**)
  - With inclusive= true, we also pop off that first A of the stack to avoid having two instances of A




```
navController.navigate("A")
```




A
B
C
Back Stack after popUpTo("A")
C
B
A
Back Stack after navigate("A")
A
A
navigate("A") {
popUpTo("A")
}


A
B
C
Back Stack after popUpTo("A") {inclusive = true}
C
B
A
Back Stack after navigate("A")
A
navigate("A") {
popUpTo("A") { inclusive = true }
}

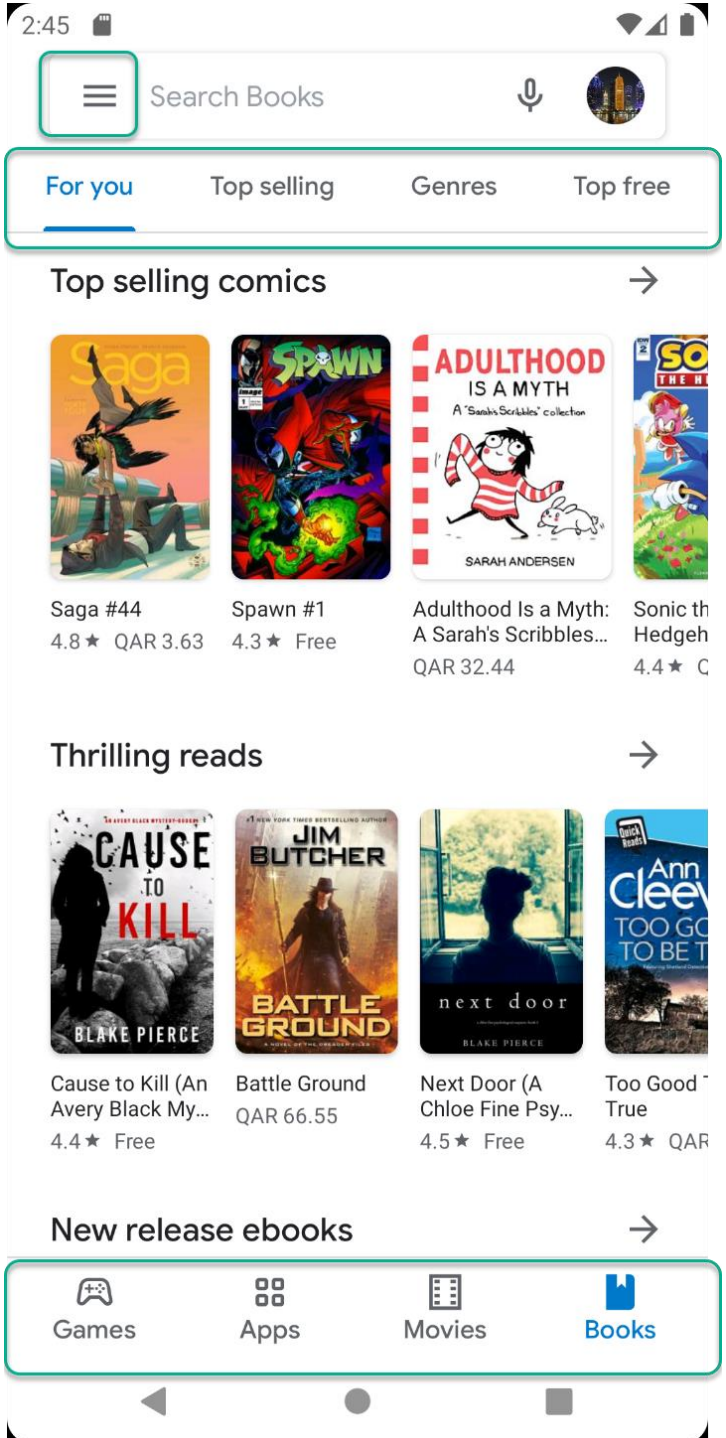
Navigation UI Components:

App Bars

Navigation Rail

Floating Action Button

Navigation Drawer



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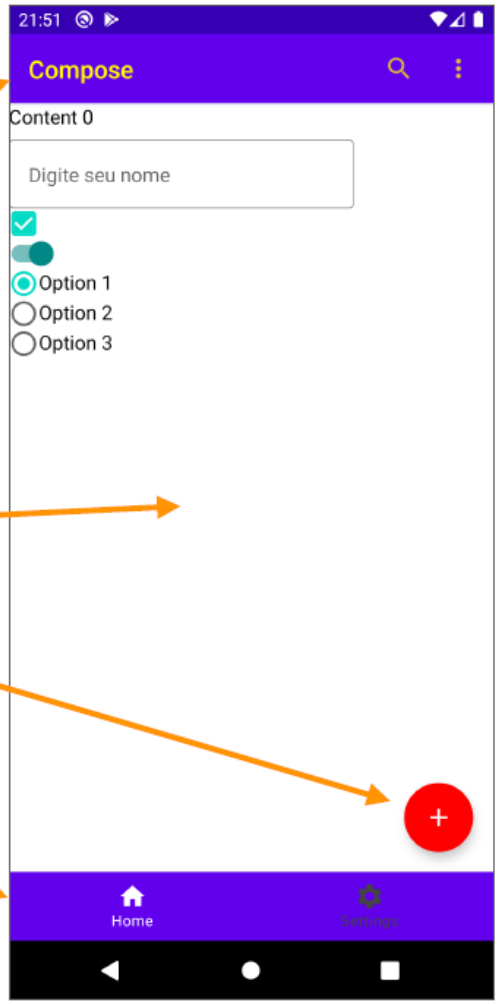
Scaffold

- **Scaffold** is a **Slot-based** layout
- Scaffold is **template** to build the entire screen by adding different UI Navigation components (e.g., *topBar*, *bottomBar*, *floatingActionButton*)

```
Scaffold(
    topBar = {...},
    floatingActionButton = {...},
    bottomBar = {...}
) {...}
```

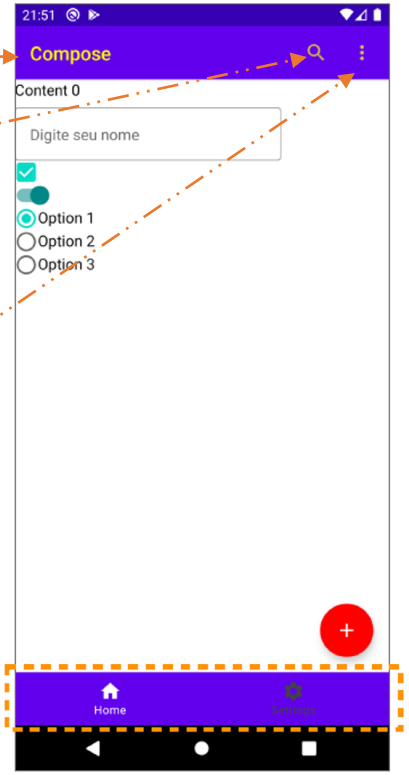


TopAppBar

- Info and actions **related to the current screen**
- Typically has Title, Drawer button / Back button, Menu items

```
TopAppBar(
    title = {
        Text(text = "Compose")
    },
    navigationIcon = {
        IconButton(onClick = { }) {
            Icon(
                imageVector = Icons.Default.Search,
                contentDescription = "Search"
            )
        }
    }

    navigationIcon = {
        IconButton(onClick = { }) {
            Icon(
                imageVector = Icons.Default.MoreVert,
                contentDescription = "More"
            )
        }
    }
)
```

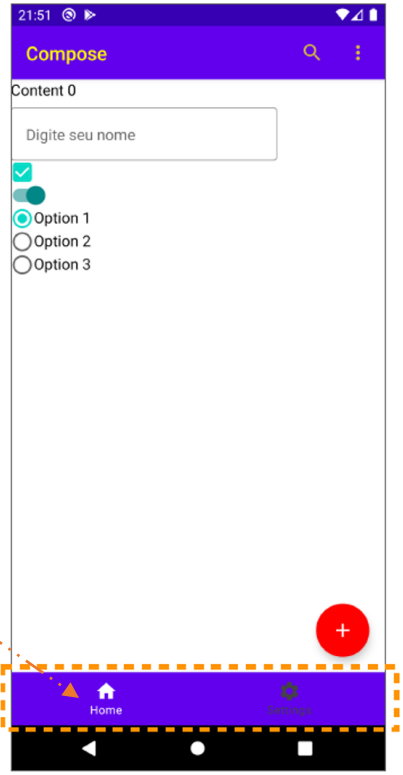


Bottom Navigation Bar

- Allow movement between the app's primary **top-level destinations** (3 to 5 options)
- Each destination is represented by an icon and an optional text label. May have notification badges

- Recommended for **compact screen**

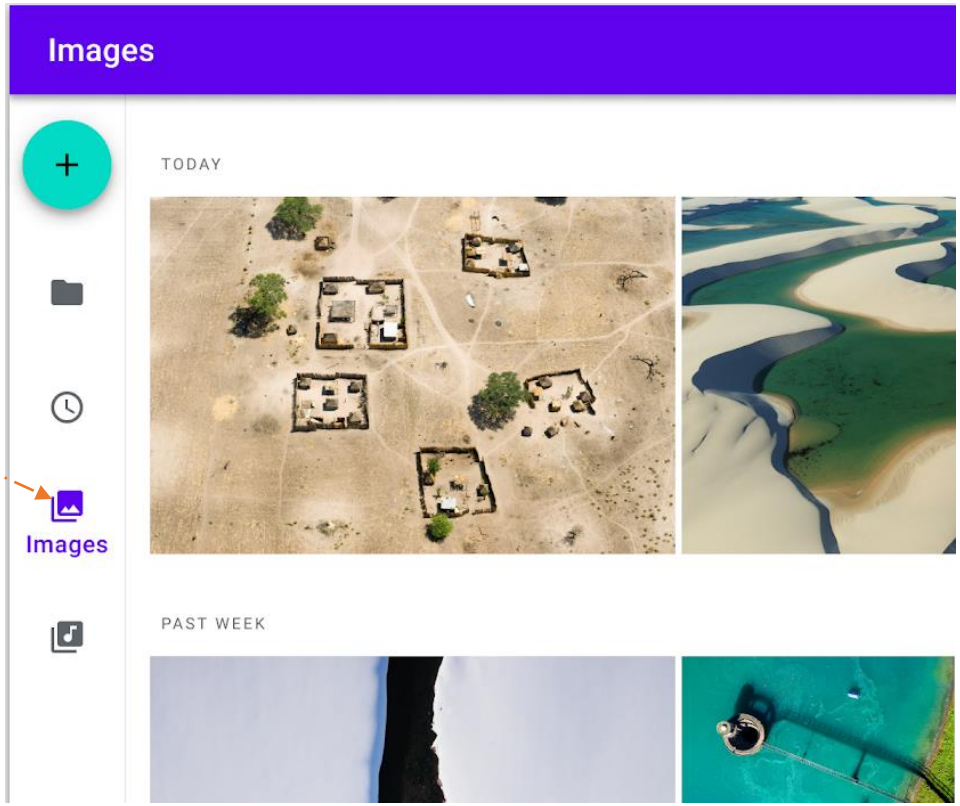
```
NavigationBar {
   NavigationBarItem(
     icon = {Icon(Icons.Default.Home,
                  contentDescription = "Home")},
     label = { Text( "Home" ) }
     onClick = { },
   )
   ...
   NavigationBarItem(
     icon = { },
     label = { }
     onClick = { },
   )
}
```



Navigation Rail

- Can contain 3-7 destinations plus an optional FAB
- Recommended for for **medium** or **expanded** screens

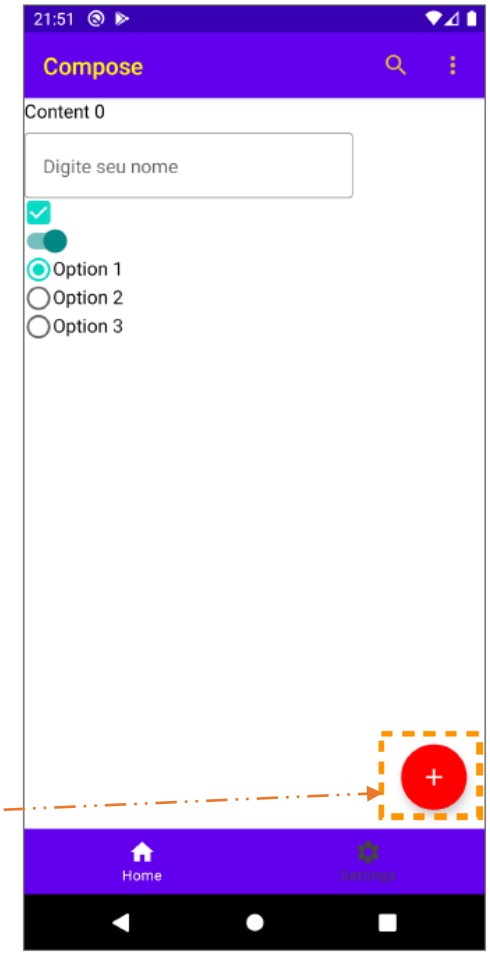
```
NavigationRail {
    ...
    NavigationRailItem(
      icon = {Icon(Icons.Default.Image,
             contentDescription = "Images")},
      label = { Text( "Images" ) }
      onClick = { },
    )
    ...
    NavigationRailItem(
      icon = { },
      label = { }
      onClick = { },
    )
}
```



Floating Action Button (FAB)

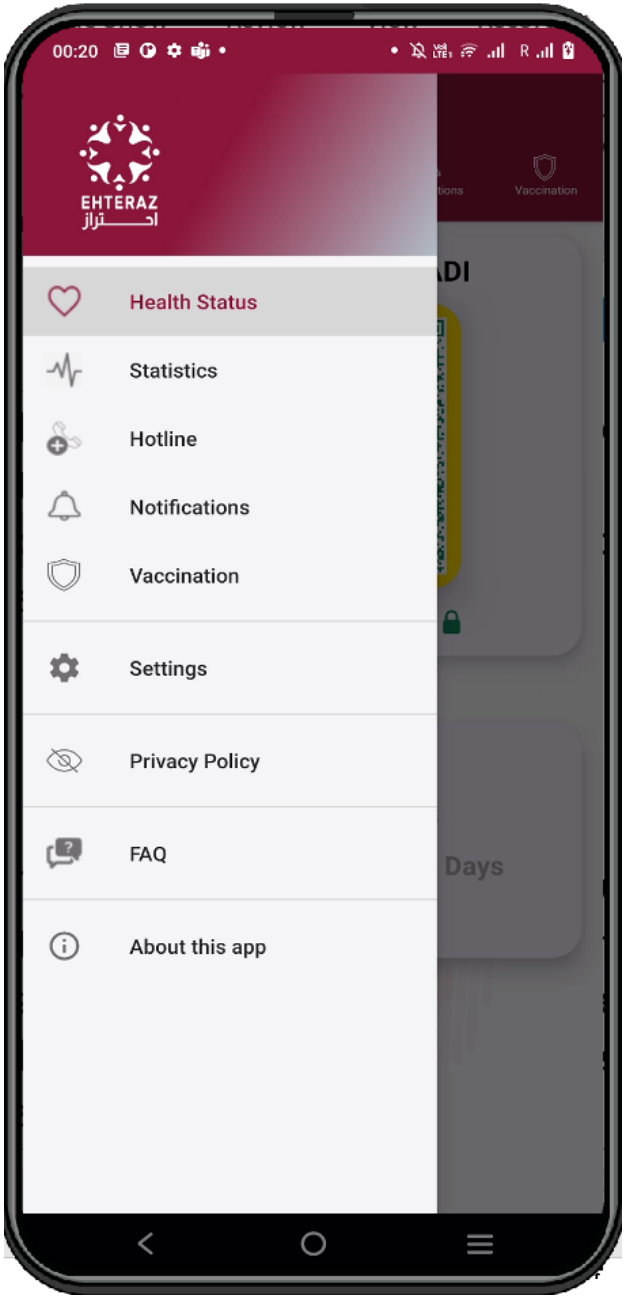
- A FAB performs the primary, or most common, action on a screen, such as drafting a new email
  - It appears in front of all screen content, typically as a circular shape with an icon in its center.
  - FAB is typically placed at the bottom right

```
FloatingActionButton(
    onClick = { … },
    backgroundColor = Color.Red,
    contentColor = Color.White
) {
    Icon(Icons.Filled.Add, "Add")
}
```



Navigation Drawer

- Navigation Drawer provides access to app **destinations** that cannot fit on the Bottom Bar , such as settings screen
  - Recommended for five or more top-level destinations
  - Quick navigation between unrelated destinations
- The drawer appears when the user touches the drawer icon ☰ in the app bar or when the user swipes a finger from the left edge of the screen



Navigation Drawer - Example

```
ModalNavigationDrawer(
    drawerContent = {
        ModalDrawerSheet {
            NavigationDrawerItem(
               label = { Text(text = "Settings" ) },
               icon = { Icon(Icons.Default.Settings,
                                  contentDescription = "Settings")
                      },
               onClick = { }
            )
           ...
        }
})
```

- See more details in the posted example

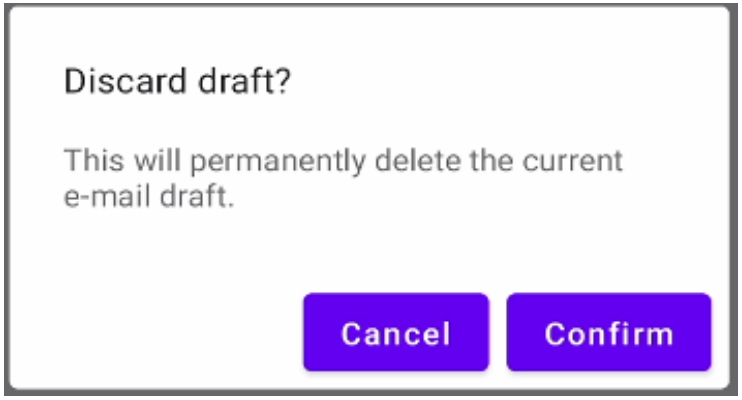
Floating Windows

Alert Dialog

- Alert dialog is a Dialog which interrupts the user with urgent information, details or actions
- Dialogs are displayed in front of app content
  - Inform users about a task that may contain **critical information** and/or **require a decision**
  - Interrupt the current flow and remain on screen until dismissed or action taken. Hence, they should be used sparingly
- 3 Common Usage:
  - **Alert dialog**: request user action/confirmation. Has a title, optional supporting text and action buttons
  - **Simple dialog:** Used to present the user with a list of actions that, when tapped, take immediate effect.
  - **Confirmation dialog:** Used to present a list of single- or multi-select choices to a user. Action buttons serve to confirm the choice(s)

Alert Dialog

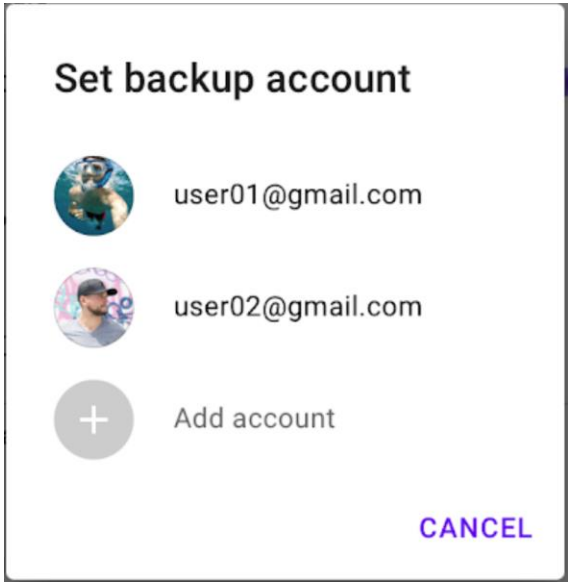
- Commonly used to **confirm high-risk actions** like deleting progress



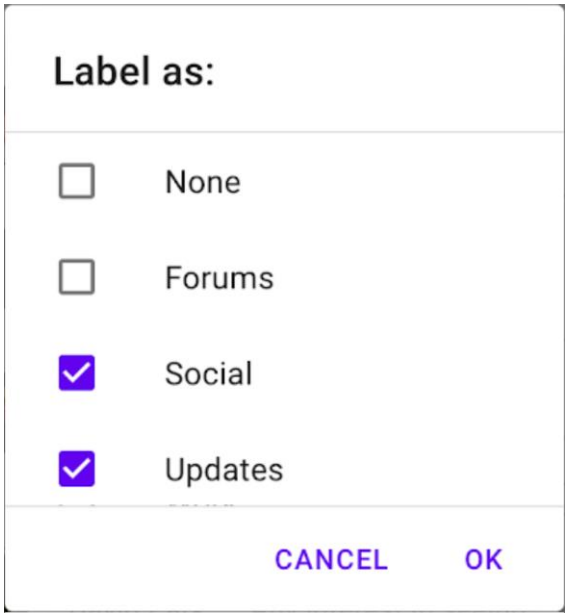

```
AlertDialog(
        onDismissRequest = {
           // Dismiss the dialog when the user clicks outside the dialog
           // or on the back button
             onDialogOpenChange(false)
        },
        title = { Text(text = title) },
        text = { Text(text = message) },
        confirmButton = {
            Button(
                onClick = {  onDialogResult(true) }) {
                Text(text = "Confirm")
            }
        },
        dismissButton = {
            Button(
                onClick = {  onDialogResult(false) }) {
                Text("Cancel")
            }
        }
    )
}
```

Simple dialog:

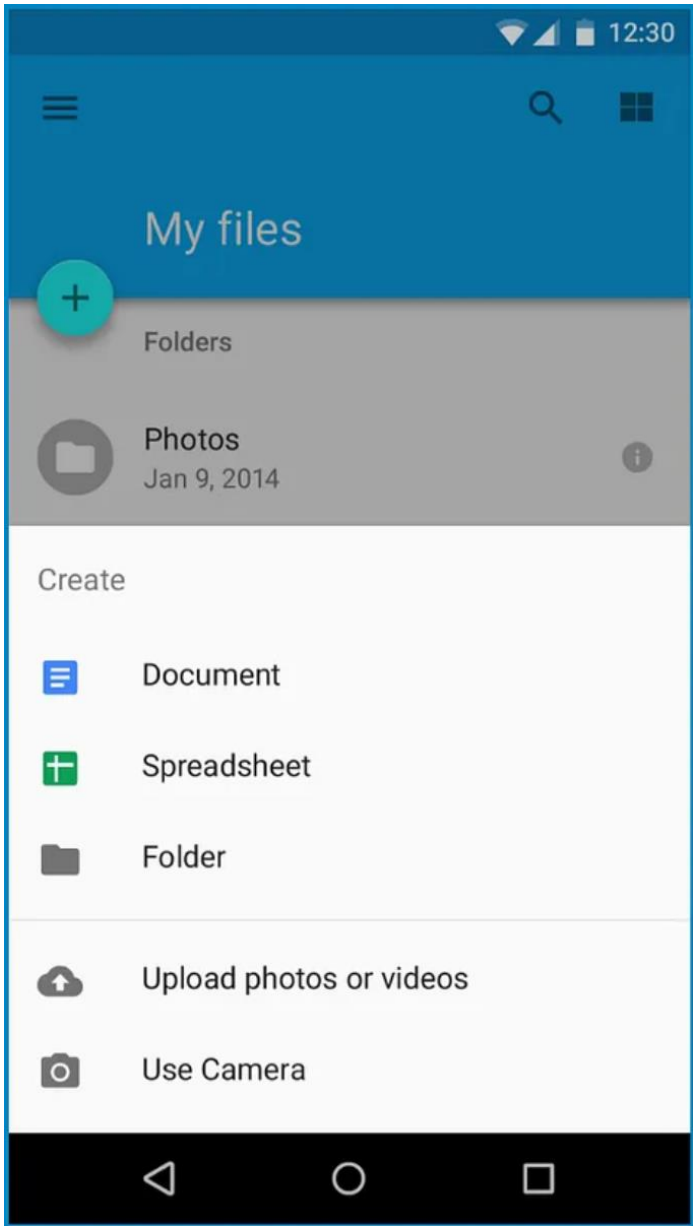
present the user with a list of actions that, when tapped, take immediate effect



Confirmation dialog (multi choice)



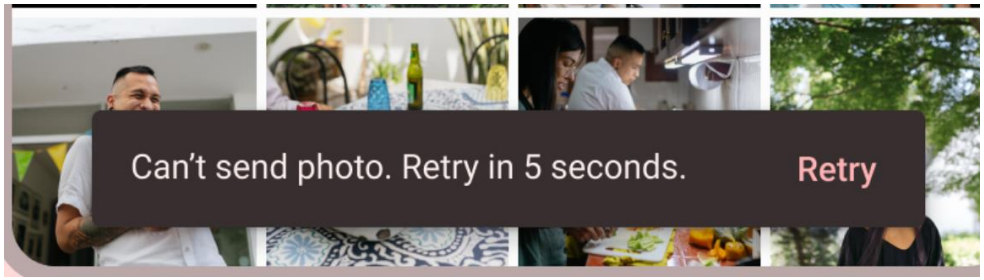
Bottom Sheets



- Bottom sheets show secondary content / actions anchored to the bottom of the screen
- Content should be additional or secondary (not the app's main content)
- Bottom sheets can be dismissed in order to interact with the main content
- See more details in the posted example

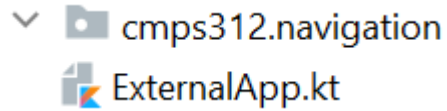
Snackbar

- Snackbars show **short updates** about app processes at the bottom of the screen



- Do not interrupt the user’s experience
- Can disappear on their own or remain on screen until the user takes action
- See more details in the posted example

Routing to External App



- **Intent** can be used to route a request to another app
  - Specify an **Action** and the **Parameters** expected by the action
  - Implicit intents can be handled by **a component in an installed app** registered to handle that intent type

- **Dial a number:**

```
val intent = Intent(Intent.ACTION_DIAL).apply {
    data = Uri.parse("tel:$phoneNumber")
}
context.startActivity(intent)
```

- **Open a Uri**

```
val intent = Intent(Intent.ACTION_VIEW,
Uri.parse("https://www.qu.edu.qa"))
startActivity(intent)
```

- **Share content**

```
val intent = Intent(Intent.ACTION_SEND).apply {
    putExtra(Intent.EXTRA_TEXT, content)
    type = "text/plain"
}
context.startActivity(Intent.createChooser(intent, "Share via"))
```

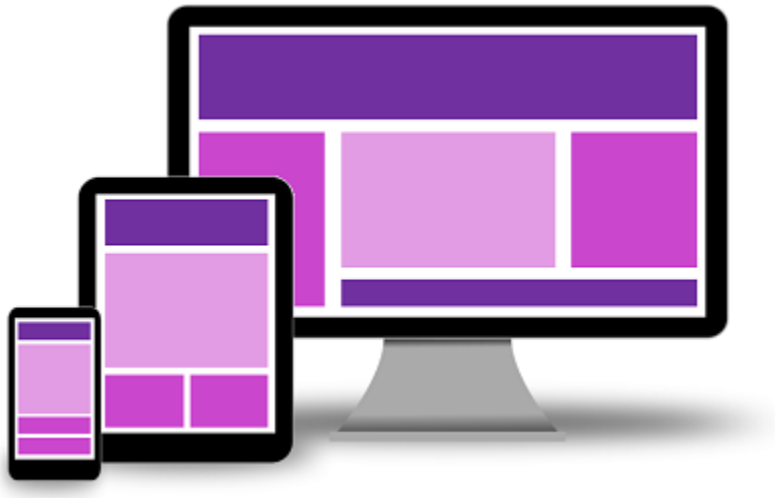
- Other common intents discussed here

Using Sealed Class to Enumerate the App Destinations

- A sealed class allows defining subclasses, but they must be in the same file as the sealed class
  - It is like enum class but more flexible as it allows subclasses to have different properties and methods
  - A sealed class cannot be instantiated directly
- A sealed class is often used to enumerate the app destination as shown in the example below

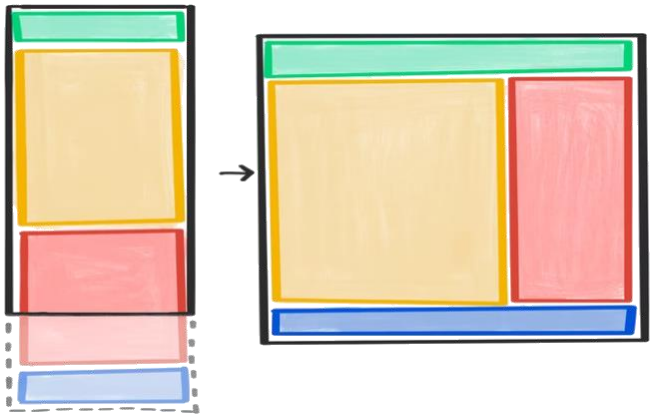
```
sealed class NavDestination(val route: String, val title: String, val icon: ImageVector? = null,
            val iconResourceId:Int? = null) {
    object Quran : NavDestination(route = "quran", title = "Quran", iconResourceId = R.drawable.ic_quran)
    object Verses : NavDestination(route = "verses", title = "Surah Verses", iconResourceId = R.drawable.ic_quran)
    object Search : NavDestination(route = "search", title = "Search", icon = Icons.Outlined.Search)
    object Settings : NavDestination(route = "settings", title = "Settings", icon = Icons.Outlined.Settings)
}
```

Responsive UI



Responsive UI

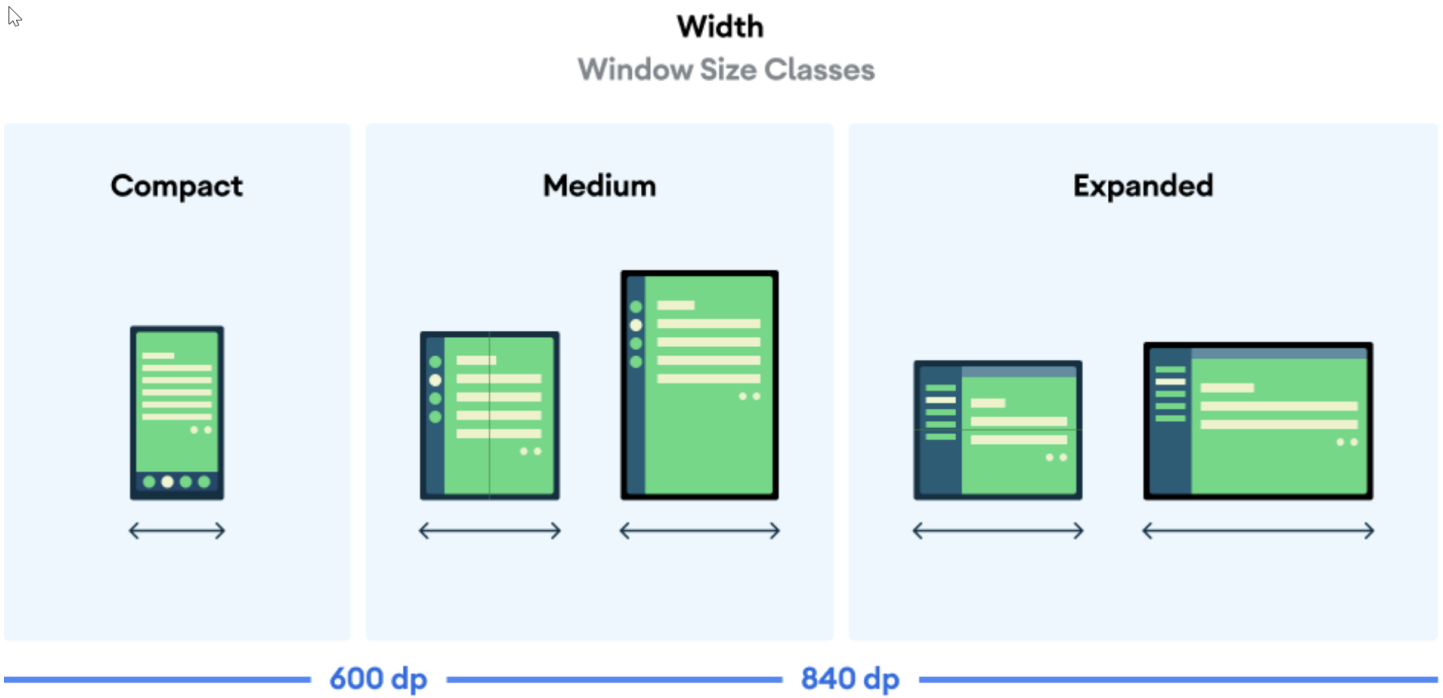
- Responsive UI = **serve different layouts for different screen sizes and orientations**
  - **Optimize the viewing experience on range of devices**: mobile, desktop, tablet, TV…
- For example, a newspaper app might have a single column of text on a mobile device, but display several columns on a larger tablet/desktop device



windowSizeClass

- `calculateWindowSizeClass` return a window size class. It can be either **compact**, **medium**, or **expanded**.

```
val context = LocalContext.current as Activity
val windowSizeClass =
      calculateWindowSizeClass(context)
```



Design for window size classes instead of specific devices

- Devices fall into different window size classes based on orientation and user behavior, such as multi-window modes or unfolding a foldable device
- Start by designing for compact window class size and then adjust your layout for the next class size

Window class (width)	Breakpoint (dp)	Common devices
Compact	Width < 600	Phone in portrait
Medium	600 <= width < 840	Tablet in portrait Foldable in portrait (unfolded)
Expanded	Width >= 840	Phone in landscape Tablet in landscape Foldable in landscape (unfolded) Desktop

Responsive UI - Example

- A bottom navigation bar in a compact layout can be swapped with a navigation rail in a medium layout, and a navigation drawer in an expanded layout

Responsive UI - Example

```
val context = LocalContext.current as Activity
val windowSizeClass = calculateWindowSizeClass(context)

val shouldShowBottomBar =  windowSizeClass.widthSizeClass
       == WindowWidthSizeClass.Compact
val shouldShowNavRail = !shouldShowBottomBar
...
Scaffold(
    bottomBar = {
        if (shouldShowBottomBar)
            BottomNavBar(navController)
    }
) {
    padding -> Row(...) {
        if (shouldShowNavRail) {
            AppNavigationRail(navController)
        }
        AppNavigator(navController = navController)
     }
}
```

Resources

- Jetpack Compose Navigation
  - https://developer.android.com/jetpack/compose/navigation
- Jetpack Compose Navigation codelab
  - https://developer.android.com/codelabs/jetpack-compose-navigation
- Responsive UI
  - https://m3.material.io/foundations/layout/applying-layout/window-size-classes