CP3406_CP5307 Codelab 4.3: Start an External Activity

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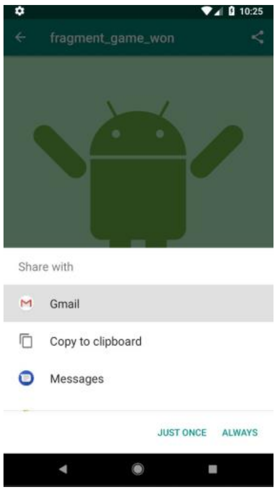
1. Welcome

In the previous codelab, you modified the AndroidTrivia app to add navigation to the app. In this codelab, you modify the app so that the user can share their game-play results. The user can initiate an email or text, or they can copy their game-play results to the clipboard.

2. App overview

The AndroidTrivia app, which you worked on in the previous two codelabs, is a game in which users answer questions about Android development. If the user answers three questions correctly, they win the game.

In this codelab, you update the AndroidTrivia app so that users can send their game results to other apps and share their results with friends.



3. Set up and use the Safe Args plugin

Before users can share their game results from within the AndroidTrivia app, your code needs to pass parameters from one Fragment to another. To prevent bugs in these transactions and make them type-safe, you use a Gradle plugin called *Safe Args*. The plugin generates `NavDirection` classes, and you add these classes to your code.

In later tasks in this codelab, you use the generated `NavDirection` classes to pass arguments between fragments.

Why you need the Safe Args plugin

Often your app will need to pass data between fragments. One way to pass data from one Fragment to another is to use an instance of the `Bundle` class. An Android `Bundle` is a key-value store.

A *key-value store*, also known as a *dictionary* or *associative array*, is a data structure where you use a unique key (a string) to fetch the value associated with that key. For example:

Key	**Value**
"name"	"Anika"
"favorite_weather"	"sunny"
"favorite_color"	"blue"

Your app could use a `Bundle` to pass data from Fragment A to Fragment B. For example, Fragment A creates a bundle and saves the information as key-value pairs, then passes the `Bundle` to Fragment B. Then Fragment B uses a key to fetch a key-value pair from the `Bundle`. This technique works, but it can result in code that compiles, but then has the potential to cause errors when the app runs.

The kinds of errors that can occur are:

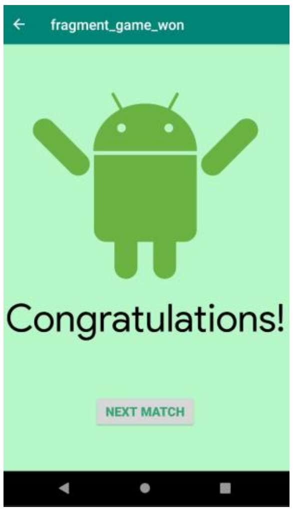
- **Type mismatch errors**. For example, if Fragment A sends a string but Fragment B requests an integer from the bundle, the request returns the default value of zero. Since zero is a valid value, this kind of type mismatch problem does not throw an error when the app is compiled. However, when the user runs the app, the error might make the app misbehave or crash.
- **Missing key errors**. If Fragment B requests an argument that isn't set in the bundle, the operation returns `null`. Again, this doesn't throw an error when the app is compiled but could cause severe problems when the user runs the app.

You want to catch these errors when you compile the app in Android Studio, so that you catch these errors before deploying the app into production. In other words, you want to catch the errors during app development so that your users don't encounter them.

To help with these problems, Android's Navigation Architecture Component includes a feature called *Safe Args*. Safe Args is a Gradle plugin that generates code and classes that help detect errors at compile-time that might not otherwise be surfaced until the app runs.

Step 1: Open the app and run it

1. If it’s not already opened, open up your AndroidTrivia project from the previous codelabs (make sure you’ve completed those codelabs before you begin this one).
2. Run the app on an Android-powered device or on an emulator. At this point, the app is a trivia game with a navigation drawer, an options menu on the title screen, and an Up button at the top of most of thescreens.
3. Explore the app and play the game. When you win the game by answering three questions correctly, you see the **Congratulations** screen.



In this codelab, you add a **share** icon to the top of the **Congratulations** screen. The **share** icon lets the user share their results in an email or text message.

Step 2: Add Safe Args to the project

1. In Android Studio, open the project-level `build.gradle` file.
2. Add the `navigation-safe-args-gradle-plugin` dependency, above the existing plugins code, as shown below:

```
// Adding the safe-args dependency to the project Gradle file
buildscript {
    repositories {
        google()
    }
    dependencies {
        classpath("androidx.navigation:navigation-safe-args-gradle-
plugin:2.7.7")
    }
}

plugins {
    alias(libs.plugins.androidApplication) apply false
    alias(libs.plugins.jetbrainsKotlinAndroid) apply false
}
```

3. Open the app-level `build.gradle` file.
4. At the top of the file, within the braces of plugins, after the other listed plugins, add the following statement with the `androidx.navigation.safeargs` plugin:

```
// Adding the apply plugin statement for safeargs
id("androidx.navigation.safeargs.kotlin")
```

5. Re-build the project. If you are prompted to install additional build tools, install them.

The app project now includes generated `NavDirection` classes.

The Safe Args plugin generates a `NavDirection` class for each Fragment. These classes represent navigation from all the app's actions.

For example, `GameFragment` now has a generated `GameFragmentDirections` class. You use the `GameFragmentDirections` class to pass type-safe arguments between the game Fragment and other fragments in the app.

Step 3: Add a NavDirection class to the game Fragment

In this step, you add the `GameFragmentDirections` class to the game Fragment. You'll use this code later to pass arguments between the `GameFragment` and the game-state fragments (`GameWonFragment` and `GameOverFragment`).

1. Open the `GameFragment.kt` Kotlin file that's in the **java** folder.
2. Inside the `onCreateView()` method, locate the game-won conditional statement ("We've won!"). Change the parameter that's passed into the `NavController.navigate()` method: Replace the action ID for the game-won state with an ID that uses the `actionGameFragmentToGameWonFragment()` method from the `GameFragmentDirections` class.

The conditional statement now looks like the following code. You'll add parameters to the `actionGameFragmentToGameWonFragment()` method in the next task.

```
// Using directions to navigate to the GameWonFragment
view.findNavController()

.navigate(GameFragmentDirections.actionGameFragmentToGameWonFragment())
```

3. Likewise, locate the game-over conditional statement ("Game over!"). Replace the action ID for the game-over state with an ID that uses the game-over method from the `GameFragmentDirections` class:

```
// Using directions to navigate to the GameOverFragment
view.findNavController()

.navigate(GameFragmentDirections.actionGameFragmentToGameOverFragment())
```

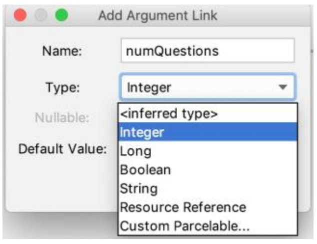
4. Add and pass arguments

In this task, you add type-safe arguments to the `gameWonFragment` and pass the arguments safely into a `GameFragmentDirections` method. Similarly you then will replace the other Fragment classes with their equivalent `NavDirection` classes.

Step 1: Add arguments to the game-won Fragment

1. Open the `navigation.xml` file, which is in the **res > navigation** folder. Click the **Design** tab to open the navigation graph, which is where you'll set the arguments in the fragments.
2. In the preview, select the **gameWonFragment**.
3. In the **Attributes** pane, expand the **Arguments** section.

4. Click the + icon to add an argument. Name the argument `numQuestions` and set the type to **Integer**, then click **Add**. This argument represents the number of questions the user answered.


Add Argument Link

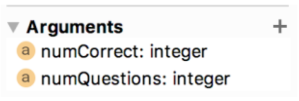
Name: numQuestions

Type: Integer

Nullable:

Default Value:

5. Still with the **gameWonFragment** selected, add a second argument. Name this argument **numCorrect** and set its type to **Integer**. This argument represents the number of questions the user answered correctly.


Arguments
numCorrect: integer
numQuestions: integer

If you try to build the app now, you will likely get two compile errors.

```
No value passed for parameter 'numQuestions'
No value passed for parameter 'numCorrect'
```

You fix this error in the coming steps.

Note: If you're using Android Studio 3.2 or lower, you might have to change `app:type = "integer"` to `app:argType = "integer"` in the `navigation.xml` file.

Step 2: Pass the arguments

In this step, you pass the `numQuestions` and `questionIndex` arguments into the `actionGameFragmentToGameWonFragment()` method from the `GameFragmentDirections` class.

1. Open the `GameFragment.kt` Kotlin file and locate the game-won conditional statement:

```
else {
 // We've won! Navigate to the gameWonFragment.
 view.findNavController()
       .navigate(GameFragmentDirections
             .actionGameFragmentToGameWonFragment())
}
```

2. Pass the `numQuestions` and `questionIndex` parameters to the `actionGameFragmentToGameWonFragment()` method:

```
// Adding the parameters to the Action
view.findNavController()
      .navigate(GameFragmentDirections
            .actionGameFragmentToGameWonFragment(numQuestions,
questionIndex))
```

You pass the total number of questions as `numQuestions` and the current question being attempted as `questionIndex`. The app is designed in such a way that the user can only share their data if they answer all the questions correctly—the number of correct questions always equals the number of questions answered. (You can change this game logic later, if you want.)

3. In `GameWonFragment.kt`, extract the arguments from the bundle, then use a `Toast` to display the arguments. Put the following code in the `onCreateView()` method, before the `return` statement:

```
val args = GameWonFragmentArgs.fromBundle(requireArguments())
Toast.makeText(context, "NumCorrect: ${args.numCorrect}, NumQuestions:
${args.numQuestions}", Toast.LENGTH_LONG).show()
```

4. Run the app and play the game to make sure that the arguments are passed successfully to the `GameWonFragment`. The toast message appears on the **Congratulations** screen, saying "NumCorrect: 3, NumQuestions: 3".

You do have to win the trivia game first, though. To make the game easier, you can change it to a single-question game by setting the value of `numQuestions` to `1` in the `GameFragment.kt` Kotlin file (or better still, take this opportunity to brush up on your Android/Kotlin knowledge!).

Step 3: Replace Fragment classes with NavDirection classes

When you use "safe arguments," you can replace Fragment classes that are used in navigation code with `NavDirection` classes. You do this so that you can use type-safe arguments with other fragments in the app.

In `TitleFragment`, `GameOverFragment`, and `GameWonFragment`, change the action ID that's passed into the `navigate()` method. Replace the action ID with the equivalent method from the appropriate `NavDirection` class:

1. Open the `TitleFragment.kt` Kotlin file. In `onCreateView()`, locate the `navigate()` method in the **Play** button's click handler. Pass `TitleFragmentDirections.actionTitleFragmentToGameFragment()` as the method's argument:

```
binding.playButton.setOnClickListener { view: View ->
    view?.findNavController()?

.navigate(TitleFragmentDirections.actionTitleFragmentToGameFragment())
}
```

2. In the `GameOverFragment.kt` file, in the **Try Again** button's click handler, pass `GameOverFragmentDirections.actionGameOverFragmentToGameFragment()` as the `navigate()` method's argument:

```
binding.tryAgainButton.setOnClickListener { view: View ->
    view.findNavController()

.navigate(GameOverFragmentDirections.actionGameOverFragmentToGameFragment())
}
```

3. In the `GameWonFragment.kt` file, in the **Next Match** button's click handler, pass `GameWonFragmentDirections.actionGameWonFragmentToGameFragment()` as the `navigate()` method's argument:

```
binding.nextMatchButton.setOnClickListener { view: View ->
    view.findNavController()

.navigate(GameWonFragmentDirections.actionGameWonFragmentToGameFragment())
}
```

4. Run the app.

You won't find any changes to the app's output, but now the app is set up so that you can easily pass arguments using `NavDirection` classes whenever needed.

5. Sharing game results

In this task, you add a sharing feature to the app so that the user can share their game results. This is implemented by using an Android Intent, specifically an implicit intent. The sharing feature will be accessible via an options menu inside the `GameWonFragment` class. In the app's UI, the menu item will appear as a **share** icon at the top of the **Congratulations** screen.

Implicit intents

Up until now, you've used navigation components to navigate among fragments within your Activity. Android also allows you to use *intents* to navigate to activities that other apps provide. You use this functionality in the AndroidTrivia app to let the user share their game-play results with friends.

An `Intent` is a simple message object that's used to communicate between Android components. There are two types of intents: explicit and implicit. You can send a message to a specific target using an *explicit intent*. With an *implicit intent*, you initiate an Activity without knowing which app or Activity will handle the task. For example, if you want your app to take a photo, you typically don't care which app or Activity performs the task. When multiple Android apps can handle the same implicit intent, Android shows the user a chooser, so that the user can select an app to handle the request.

Each implicit intent must have an `ACTION` that describes the type of thing that is to be done. Common actions, such as `ACTION_VIEW`, `ACTION_EDIT`, and `ACTION_DIAL`, are defined in the `Intent` class.

Terminology alert! `Intent` actions are unrelated to actions shown in the app's navigation graph

Step 1: Add an options menu to the Congratulations screen

1. Open the `GameWonFragment.kt` Kotlin file.
2. Inside the `onCreateView()` method, before the `return`, copy and paste the code we used last codelab to create the menu from TitleFragment:

```
val menuHost: MenuHost = requireActivity()
menuHost.addMenuProvider(object : MenuProvider {
    override fun onCreateMenu(menu: Menu, menuInflater: MenuInflater) {
        // Add menu items here
        menuInflater.inflate(R.menu.options_menu, menu)
    }

    override fun onMenuItemSelected(menuItem: MenuItem): Boolean {
        // Handle the menu selection
        when (menuItem.itemId) {
            R.id.aboutFragment ->
                          view?.findNavController()?.navigate(R.id.action_title
                          Fragment_to_aboutFragment)
            else -> return false
        }
        return true
      }
    }, viewLifecycleOwner, Lifecycle.State.RESUMED)
```

Step 2: Build and call an implicit intent

Modify your code to build and call an `Intent` that sends the message about the user's game data. Because several different apps can handle an `ACTION_SEND` intent, the user will see a chooser that lets them select how they want to send their information.

1. Inside the `GameWonFragment` class, after the `onCreateView()` method, create a private method called `getShareIntent()`, as shown below. The line of code that sets a value for `args` is identical to the line of code used in the class's `onCreateView()`.

In the rest of the method's code, you build an `ACTION_SEND` intent to deliver the message that the user wants to share. The data's MIME type is specified by the `setType()` method. The actual data to be delivered is specified in the `EXTRA_TEXT`. (The `share_success_text` string is defined in the `strings.xml` resource file.)

```
// Creating our Share Intent
private fun getShareIntent() : Intent {
   val args = GameWonFragmentArgs.fromBundle(requireArguments())
   val shareIntent = Intent(Intent.ACTION_SEND)
   shareIntent.setType("text/plain")
            .putExtra(Intent.EXTRA_TEXT,
getString(R.string.share_success_text, args.numCorrect, args.numQuestions))
   return shareIntent
}
```

2. Below the `getShareIntent()` method, create a `shareSuccess()` method. This method gets the `Intent` from `getShareIntent()` and calls `startActivity()` to begin sharing.

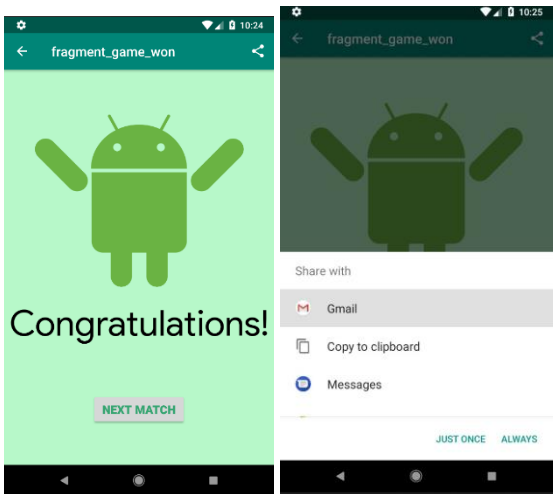
```
// Starting an Activity with our new Intent
private fun shareSuccess() {
   startActivity(getShareIntent())
}
```

3. The starter code already contains a `winner_menu.xml` menu file. Override `onCreateMenu()` in the `GameWonFragment` class to inflate `winner_menu`.

4. To handle the menu item, override `onMenuItemSelected()` in the `GameWonFragment` **class**. Call the `shareSuccess()` method when the menu item `R.id.share` is clicked:

```
override fun onMenuItemSelected(menuItem: MenuItem): Boolean {
    // Handle the menu selection
    when (menuItem.itemId) {
        R.id.share -> shareSuccess()
        else -> return false
    }
    return true
}
…
```

5. Now run your app. (You might need to import some packages into `GameWonFragment.kt` before the code will run.) After you win the game, notice the **share** icon that appears at the top right of theapp bar. Click the share icon to share a message about your victory.



6. Summary

Safe Args:

- To help catch errors caused by missing keys or mismatched types when you pass data from one Fragment to another, use a Gradle plugin called *Safe Args*.
- For each Fragment in your app, the Safe Args plugin generates a corresponding `NavDirection` class. You add the `NavDirection` class to the Fragment code, then use the class to pass arguments between the Fragment and other fragments.
- The `NavDirection` classes represent navigation from all the app's actions.

Implicit intents:

- An *implicit intent* declares an action that your app wants some other app (such as a camera app or email app) to perform on its behalf.
- If several Android apps could handle an implicit intent, Android shows the user a chooser. For example, when the user taps the **share** icon in the AndroidTrivia app, the user can select which app they want to use to share their game results.
- To build an intent, you declare an action to perform, for example `ACTION_SEND`.
- Several `Intent()` constructors are available to help you build intents.

Sharing functionality:

- In the case of sharing your success with your friends, the `Intent` action would be `Intent.ACTION_SEND`.