# Save preferences locally with DataStore

## 1. Before you begin

### Introduction

In this unit, you have learned how to use SQL and Room to save data locally on a device. SQL and Room are powerful tools. However, in cases where you don't need to store relational data, DataStore can provide a simple solution. The DataStore Jetpack Component is a great way to store small and simple data sets with low overhead. DataStore has two different implementations, `Preferences DataStore` and `Proto DataStore`.

- `Preferences DataStore` stores key-value pairs. The values can be Kotlin's basic data types, such as `String`, `Boolean`, and `Integer`. It does not store complex datasets. It does not require a predefined schema. The primary use case of the `Preferences Datastore` is to store user preferences on their device.
- `Proto DataStore` stores custom data types. It requires a predefined schema that maps proto definitions with object structures.

Only `Preferences DataStore` is covered in this codelab, but you can read more about `Proto DataStore` in the DataStore documentation.

Preferences DataStore is a great way to store user-controlled settings, and in this codelab, you learn how to implement DataStore (https://developer.android.com/topic/libraries/architecture/datastore) to do exactly that!

### Prerequisites:

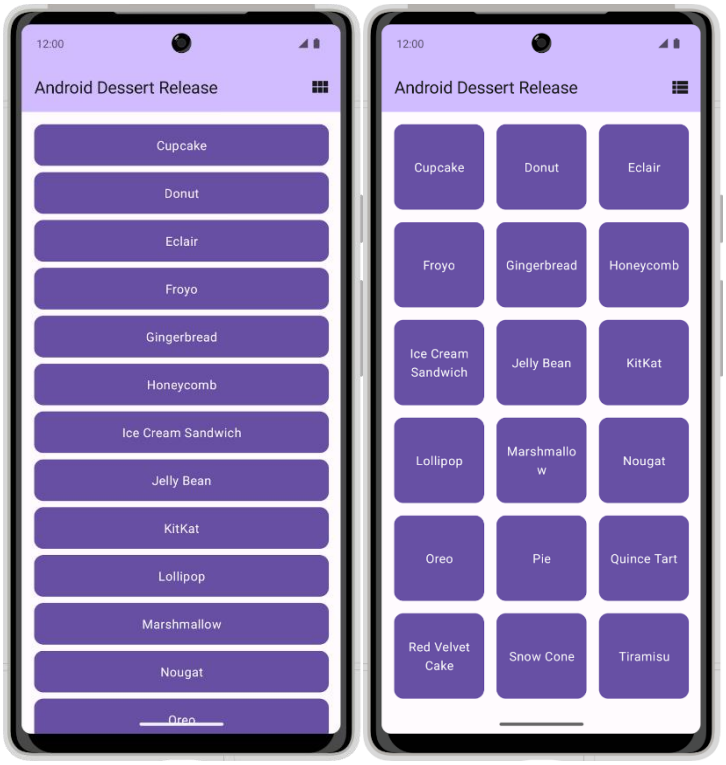
- Complete the Android Basics with Compose coursework through the Read and Update Data with Room codelab.

### What you'll need

- A computer with internet access and Android Studio
- A device or emulator
- The starter code for the Dessert Release app

### What you'll build

The Dessert Release app shows a list of Android releases. The icon in the app bar toggles the layout between a grid view and a list view.




In its current state, the app does not persist the layout selection. When you close the app, your layout selection does not save and the setting returns to the default selection. In this codelab, you add `DataStore` to the Dessert Release app and use it to store a layout selection preference.

## 2. Download the starter code

Click the following link to download all the code for this codelab:

https://github.com/google-developer-training/basic-android-kotlin-compose-training-dessert-release/archive/refs/heads/starter.zip

Or if you prefer, you can clone the Dessert Release code from GitHub:

**Starter code URL**:

https://github.com/google-developer-training/basic-android-kotlin-compose-training-dessert-release

**Branch name with starter code**: `starter`

```
$ git clone https://github.com/google-developer-
training/basic-android-kotlin-compose-training-dessert-
release.git
$ cd basic-android-kotlin-compose-training-dessert-release
$ git checkout starter
```

1. In Android Studio, open the `basic-android-kotlin-compose-training-dessert-release` folder.
2. Open the Dessert Release app code in Android Studio.

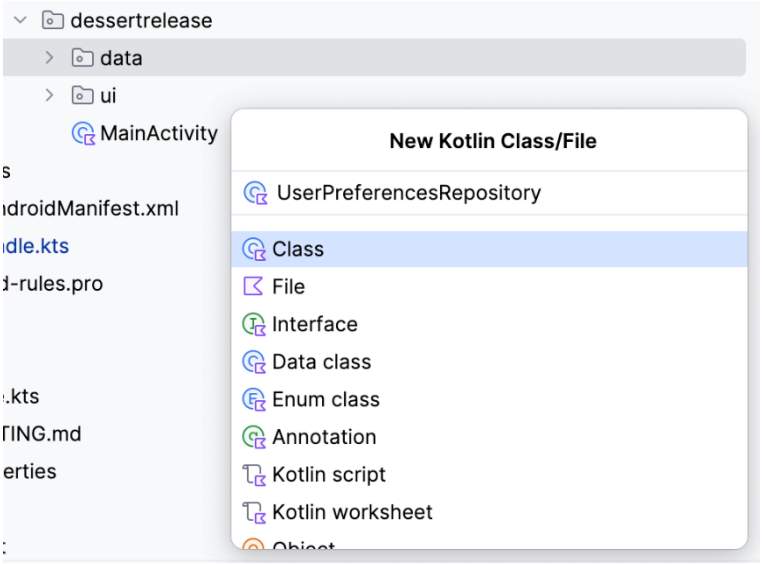
## 3. Set up dependencies

Add the following to `dependencies` in the `app/build.gradle.kts` file:

```
implementation("androidx.datastore:datastore-
preferences:1.0.0")
```

## 4. Implement the user preferences repository

1. In the `data` package, create a new class called `UserPreferencesRepository`.




2. In the `UserPreferencesRepository` constructor, define a private value property to represent a `DataStore` object instance with a `Preferences` type.

```
class UserPreferencesRepository(
    private val dataStore: DataStore<Preferences>
){
}
```

**Note**: Make sure to use the `androidx.datastore.preferences.core.Preferences` import for the Preferences class.

`DataStore` stores key-value pairs. To access a value you must define a key.

3. Create a `companion object` inside the `UserPreferencesRepository` class.
4. Use `the booleanPreferencesKey()` function to define a key and pass it the name `is_linear_layout`. Similar to SQL table names, the key needs to use an underscore format. This key is used to access a boolean value indicating whether the linear layout should be shown.

```
class UserPreferencesRepository(
    private val dataStore: DataStore<Preferences>
){
    private companion object {
        val IS_LINEAR_LAYOUT =
booleanPreferencesKey("is_linear_layout")
    }
    ...
}
```

## Write to the DataStore

You create and modify the values within a `DataStore` by passing a lambda to the `edit()` method. The lambda is passed an instance of `MutablePreferences`, which you can use to update values in the `DataStore`. All the updates inside this lambda are executed as a single transaction. Put another way, the update is *atomic* — it happens all at one time. This type of update prevents a situation in which some values update but others do not.

1. Create a suspend function and call it `saveLayoutPreference()`.
2. In the `saveLayoutPreference()` function, call the `edit()` method on the `dataStore` object.

```
suspend fun saveLayoutPreference(isLinearLayout: Boolean) {
    dataStore.edit {

    }
}
```

3. To make your code more readable, define a name for the `MutablePreferences` provided in the lambda body. Use that property to set a value with the key you defined and the boolean passed to the `saveLayoutPreference()` function.

```
suspend fun saveLayoutPreference(isLinearLayout: Boolean) {
    dataStore.edit { preferences ->
        preferences[IS_LINEAR_LAYOUT] = isLinearLayout
    }
}
```

**Note**: The value does not exist in DataStore until this function is called and the value is set. By setting up the key-value pair in the `edit()` method, the value is defined and initialized until the app's cache or data is cleared.

## Read from the DataStore

Now that you have created a way to write `isLinearLayout` into `dataStore`, take the following steps to read it:

1. Create a property in `UserPreferencesRepository` of type `Flow<Boolean>` called `isLinearLayout`.

```
val isLinearLayout: Flow<Boolean> =
```

2. You can use the `DataStore.data` property to expose `DataStore` values. Set `isLinearLayout` to the `data` property of the `DataStore` object.

```
val isLinearLayout: Flow<Boolean> = dataStore.data
```

**Note**: This code does not compile and the `dataStore.data` instruction is underlined in red. This outcome is expected, as the implementation is not yet complete.

The `data` property is a `Flow` of `Preferences` objects. The `Preferences` object contains all the key-value pairs in the DataStore. Each time the data in the DataStore is updated, a new `Preferences` object is emitted into the `Flow`.

3. Use the map function to convert the `Flow<Preferences>` into a `Flow<Boolean>`.

This function accepts a lambda with the current `Preferences` object as a parameter. You can specify the key you previously defined to obtain the layout preference. Bear in mind that the value might not exist if `saveLayoutPreference` hasn't been called yet, so you must also supply a default value.

4. Specify `true` to default to the linear layout view.

**Note**: Remember that until the preference is defined and initialized, it does not exist in the `DataStore`. That is why you must programmatically confirm that the preference exists and provide a default value if it does not.

```
val isLinearLayout: Flow<Boolean> = dataStore.data.map {
preferences ->
    preferences[IS_LINEAR_LAYOUT] ?: true
}
```

## Exception handling

Any time you interact with the file system on a device, it's possible that something can fail. For example, a file might not exist, or the disk could be full or unmounted. As `DataStore` reads and writes data from files, `IOExceptions` can occur when accessing the `DataStore`. You use the `catch{}` operator to catch exceptions and handle these failures.

1. In the companion object, implement an immutable `TAG` string property to use for logging.

```
private companion object {
    val IS_LINEAR_LAYOUT =
booleanPreferencesKey("is_linear_layout")
    const val TAG = "UserPreferencesRepo"
}
```

2. `Preferences DataStore` throws an `IOException` when an error is encountered while reading data. In the `isLinearLayout` initialization block, before `map()`, use the `catch{}` operator to catch the `IOException`.

```
val isLinearLayout: Flow<Boolean> = dataStore.data
    .catch {}
    .map { preferences ->
        preferences[IS_LINEAR_LAYOUT] ?: true
    }
```

3. In the catch block, if there is an `IOexception`, log the error and emit `emptyPreferences()`. If a different type of exception is thrown, prefer re-throwing that exception. By emitting `emptyPreferences()` if there is an error, the map function can still map to the default value.

```
val isLinearLayout: Flow<Boolean> = dataStore.data
    .catch {
        if(it is IOException) {
            Log.e(TAG, "Error reading preferences.", it)
            emit(emptyPreferences())
        } else {
            throw it
        }
    }
    .map { preferences ->
```

```
        preferences[IS_LINEAR_LAYOUT] ?: true
    }
```

## 5. Initialize the DataStore

In this codelab, you must handle the dependency injection manually. Therefore, you must manually provide the `UserPreferencesRepository` class with a `Preferences DataStore`. Follow these steps to inject `DataStore` into the `UserPreferencesRepository`.

1. Find the `dessertrelease` package.
2. Within this directory, create a new class called `DessertReleaseApplication` and implement the `Application` class. This is the container for your DataStore.

```
class DessertReleaseApplication: Application() {
}
```

3. Inside of the `DessertReleaseApplication.kt` file, but outside the `DessertReleaseApplication` class, declare a `private const val` called `LAYOUT_PREFERENCE_NAME`.
4. Assign the `LAYOUT_PREFERENCE_NAME` variable the string value `layout_preferences`, which you can then use as the name of the `Preferences Datastore` that you instantiate in the next step.

```
private const val LAYOUT_PREFERENCE_NAME =
"layout_preferences"
```

5. Still outside the `DessertReleaseApplication` class body but in the `DessertReleaseApplication.kt` file, create a private value property of type `DataStore<Preferences>` called `Context.dataStore` using the `preferencesDataStore` delegate. Pass `LAYOUT_PREFERENCE_NAME` for the `name` parameter of the `preferencesDataStore` delegate.

```
private const val LAYOUT_PREFERENCE_NAME =
"layout_preferences"
private val Context.dataStore: DataStore<Preferences> by
preferencesDataStore(
    name = LAYOUT_PREFERENCE_NAME
)
```

6. Inside the `DessertReleaseApplication` class body, create a `lateinit var` instance of the `UserPreferencesRepository`.

```
private const val LAYOUT_PREFERENCE_NAME =
"layout_preferences"
private val Context.dataStore: DataStore<Preferences> by
preferencesDataStore(
    name = LAYOUT_PREFERENCE_NAME
)

class DessertReleaseApplication: Application() {
    lateinit var userPreferencesRepository:
UserPreferencesRepository
}
```

7. Override the `onCreate()` method.

```
private const val LAYOUT_PREFERENCE_NAME =
"layout_preferences"
private val Context.dataStore: DataStore<Preferences> by
preferencesDataStore(
    name = LAYOUT_PREFERENCE_NAME
)

class DessertReleaseApplication: Application() {
    lateinit var userPreferencesRepository:
UserPreferencesRepository

    override fun onCreate() {
        super.onCreate()
    }
}
```

8. Inside the `onCreate()` method, initialize `userPreferencesRepository` by constructing a `UserPreferencesRepository` with `dataStore` as its parameter.

```
private const val LAYOUT_PREFERENCE_NAME =
"layout_preferences"
private val Context.dataStore: DataStore<Preferences> by
preferencesDataStore(
    name = LAYOUT_PREFERENCE_NAME
)

class DessertReleaseApplication: Application() {
    lateinit var userPreferencesRepository:
UserPreferencesRepository

    override fun onCreate() {
        super.onCreate()
        userPreferencesRepository =
```

```
UserPreferencesRepository(dataStore)
    }
}
```

9. Add the following line inside the `<application>` tag in the `AndroidManifest.xml` file.

```
<application
    android:name=".DessertReleaseApplication"
    ...
</application>
```

This approach defines `DessertReleaseApplication` class as the entry point of the app. The purpose of this code is to initialize the dependencies defined in the `DessertReleaseApplication` class before launching the `MainActivity`.

## 6. Use the UserPreferencesRepository

### Provide the repository to the ViewModel

Now that the `UserPreferencesRepository` is available through dependency injection, you can use it in `DessertReleaseViewModel`.

1. In the `DessertReleaseViewModel`, create a `UserPreferencesRepository` property as a constructor parameter.

```
class DessertReleaseViewModel(
    private val userPreferencesRepository:
UserPreferencesRepository
) : ViewModel() {
    ...
}
```

2. Within the `ViewModel`'s companion object, in the `viewModelFactory` `initializer` block, obtain an instance of the `DessertReleaseApplication` using the following code.

```
  companion object {
    val Factory: ViewModelProvider.Factory = viewModelFactory {
      initializer {
        val application = (this[APPLICATION_KEY] as DessertReleaseApplication)
        ...
      }
    }
```

```
    }
}
```

3. Create an instance of the `DessertReleaseViewModel` and pass the `userPreferencesRepository`.

```
    companion object {
        val Factory: ViewModelProvider.Factory = viewModelFactory {
            initializer {
                val application = (this[APPLICATION_KEY] as DessertReleaseApplication)
                DessertReleaseViewModel(application.userPreferencesRepository)
            }
        }
    }
}
```

The `UserPreferencesRepository` is now accessible by the ViewModel. The next steps are to use the read and write capabilities of the `UserPreferencesRepository` that you implemented previously.

## Store the layout preference

1. Edit the `selectLayout()` function in the `DessertReleaseViewModel` to access the preferences repository and update the layout preference.
2. Recall that writing to the `DataStore` is done asynchronously with a `suspend` function. Start a new Coroutine to call the preference repository's `saveLayoutPreference()` function.

```
fun selectLayout(isLinearLayout: Boolean) {
    viewModelScope.launch {
        userPreferencesRepository.saveLayoutPreference(isLinea
rLayout)
    }
}
```

## Read the layout preference

In this section, you refactor the existing `uiState: StateFlow` in the `ViewModel` to reflect the `isLinearLayout: Flow` from the repository.

1. Delete the code that initializes the `uiState` property to `MutableStateFlow(DessertReleaseUiState)`.

```
val uiState: StateFlow<DessertReleaseUiState> =
```

The linear layout preference from the repository has two possible values, true or false, in the form of a `Flow<Boolean>`. This value must map to a UI state.

2. Set the `StateFlow` to the result of the `map()` collection transformation called on the `isLinearLayout Flow`.

```
val uiState: StateFlow<DessertReleaseUiState> =
    userPreferencesRepository.isLinearLayout.map {
isLinearLayout ->
}
```

3. Return an instance of the `DessertReleaseUiState` data class, passing the `isLinearLayout Boolean`. The screen uses this UI state to determine the correct strings and icons to display.

```
val uiState: StateFlow<DessertReleaseUiState> =
    userPreferencesRepository.isLinearLayout.map {
isLinearLayout ->
        DessertReleaseUiState(isLinearLayout)
    }
```

`UserPreferencesRepository.isLinearLayout` is a `Flow` which is *cold* (https://developer.android.com/kotlin/flow/stateflow-and-sharedflow#sharein). However, for providing state to the UI, it's better to use a *hot flow*, like `StateFlow`, so that the state is always available immediately to the UI.

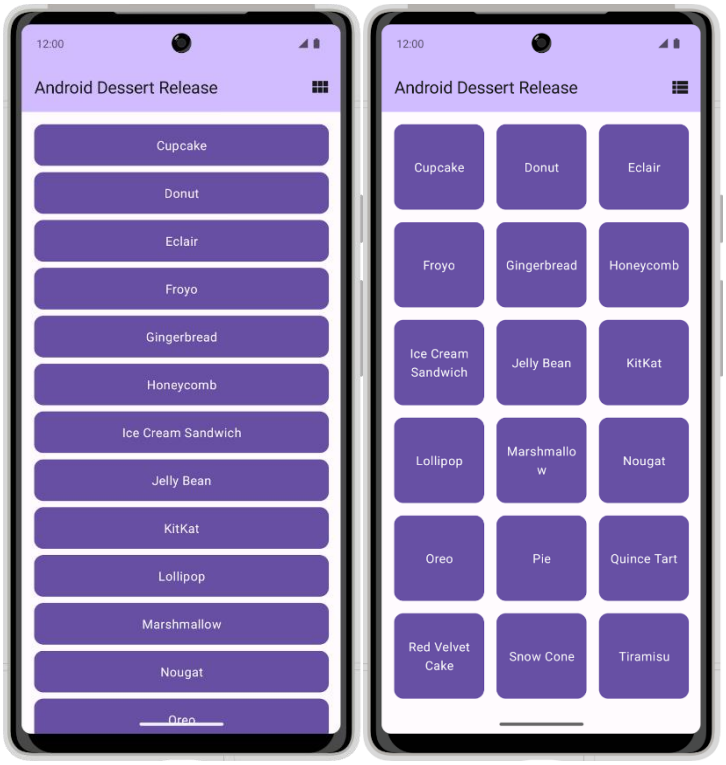
4. Use the `stateIn()` function to convert a `Flow` to a `StateFlow`.
5. The `stateIn()` function accepts three parameters: `scope`, `started`, and `initialValue`. Pass in `viewModelScope`, `SharingStarted.WhileSubscribed(5_000)` and `DessertReleaseUiState()` for these parameters, respectively.

```
val uiState: StateFlow<DessertReleaseUiState> =
    userPreferencesRepository.isLinearLayout.map {
isLinearLayout ->
        DessertReleaseUiState(isLinearLayout)
    }
.stateIn(
        scope = viewModelScope,
        started = SharingStarted.WhileSubscribed(5_000),
        initialValue = DessertReleaseUiState()
    )
```

**Note**: Please read Migrating from LiveData to Kotlin's Flow (https://medium.com/androiddevelopers/migrating-from-livedata-to-kotlins-flow-379292f419fb) to learn more about the `started` parameter and why `SharingStarted.WhileSubscribed(5_000)` is passed to it.

6. Launch the app. Notice that you can click on the toggle icon to toggle between a grid layout and a linear layout.

**Note**: Try toggling the layout and closing the app. Reopen the app and notice that your layout preference was saved.




Congratulations! You successfully added `Preferences DataStore` to your app to save the user's layout preference.

## 7. Get the solution code

To download the code for the finished codelab, you can use these git commands:

```
$ git clone https://github.com/google-developer-training/basic-android-kotlin-compose-training-dessert-release.git
$ cd basic-android-kotlin-compose-training-dessert-release
$ git checkout main
```

Alternatively, you can download the repository as a zip file, unzip it, and open it in Android Studio.

https://github.com/google-developer-training/basic-android-kotlin-compose-training-dessert-release/archive/refs/heads/main.zip

**Note**: The solution code is in the main branch of the downloaded repository.

If you want to see the solution code, view it on GitHub.

https://github.com/google-developer-training/basic-android-kotlin-compose-training-dessert-release/tree/main