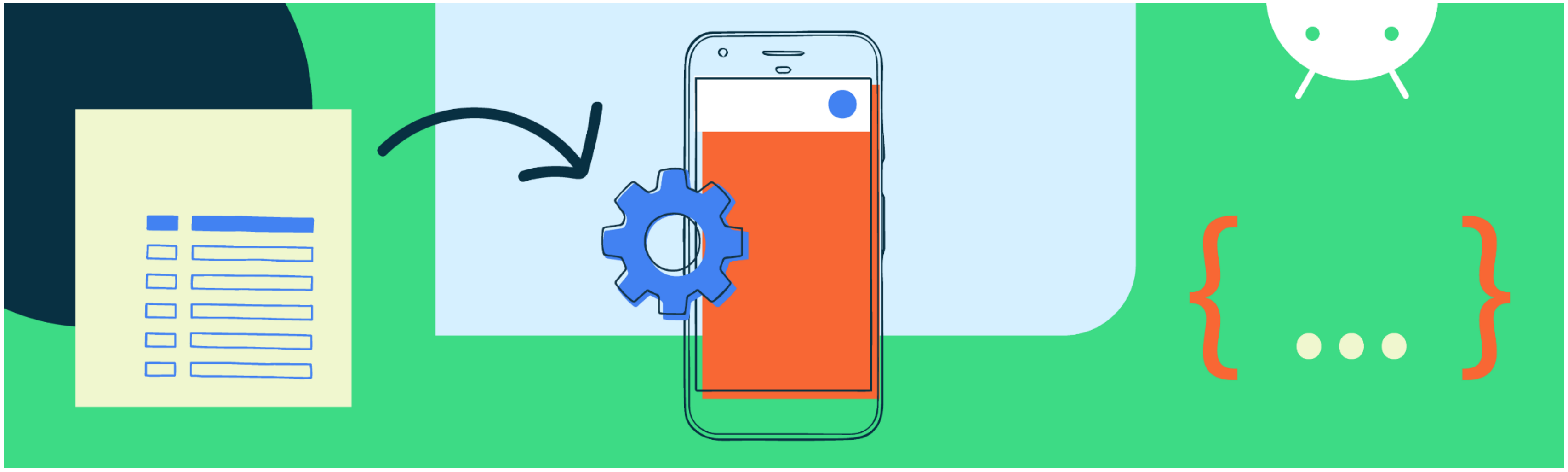
Background processing using WorkManager



WorkManager

- WorkManager is an Android library to **schedule** & **execute** **deferrable** background work
  - Intended for tasks that require a **guarantee** that the system will run them even if the app exits (app inactive)
- Can specify **constraints** that must be satisfied before the work is executed (e.g., only upload images to Cloud Storage when Wi-Fi collection is available)
- Can configure **retries** if the job fails

Implementing Work Manager

- Add Dependency

```
def work_version = "2.4.0"
implementation "androidx.work:work-runtime-ktx:$work_version"
```

- Extend **Worker** class
- Override **doWork** method
  - Return result: SUCCESS, FAILURE, RETRY
- Schedule Work: immediate execution, execute after initial delay, execute periodically

Define work to do using Worker

- Define a unit of work to perform in the background using class that extends **Worker** class and implements

```
name -> value

object Constants {
const val COUNT_VALUE = “Count_Value"
}
class UploadWorker(context: Context, params:WorkerParameters) : Worker(context, params) {
    override fun doWork(): Result {
        return try {
            val count = inputData.getInt(Constants.COUNT_VALUE , 0)
            for (i in 0 until count) {
                Log.i("UploadWorker", "Uploading $i")
            }
            val dateFormat = SimpleDateFormat("dd/M/yyyy hh:mm:ss aa")
            val currentDate = dateFormat.format(Date())

            val outputData = workDataOf(Constants.CURRENT_DATE to currentDate)
            Result.success(outputData)
        } catch (e: Exception) {
            Result.failure()
        }
    }
```

One Time Work Request

- Create a **`OneTimeWorkRequest,`** pass parameters. Then **enqueue** the request
- Can start immediately or after an **`Initial Delay`**
- **.addTag** is used to assign a Human Readable identifier or create logical groups of work requests

```
val inputData = workDataOf(Constants.COUNT_VALUE to 125)
val downloadRequest = OneTimeWorkRequestBuilder<DownloadWorker>()
                                .setInitialDelay(10, TimeUnit.Minutes)
                                .setInputData(inputData)
                                .addTag(Constants.TAG_DOWNLOAD)
                                .build()


WorkManager.getInstance(applicationContext)
            .enqueue(downloadRequest)
```

Schedule Period Work Request

- Use **`PeriodicWorkRequest`** to schedule a work to repeat periodically

```
// Create a periodic work request with 15 mins as repeat interval
val repeatInterval = 15

val periodicWorkRequest = PeriodicWorkRequestBuilder<DownloadWorker>
                                    (repeatInterval, TimeUnit.MINUTES).build()

WorkManager.getInstance(applicationContext).enqueue(periodicWorkRequest)
```

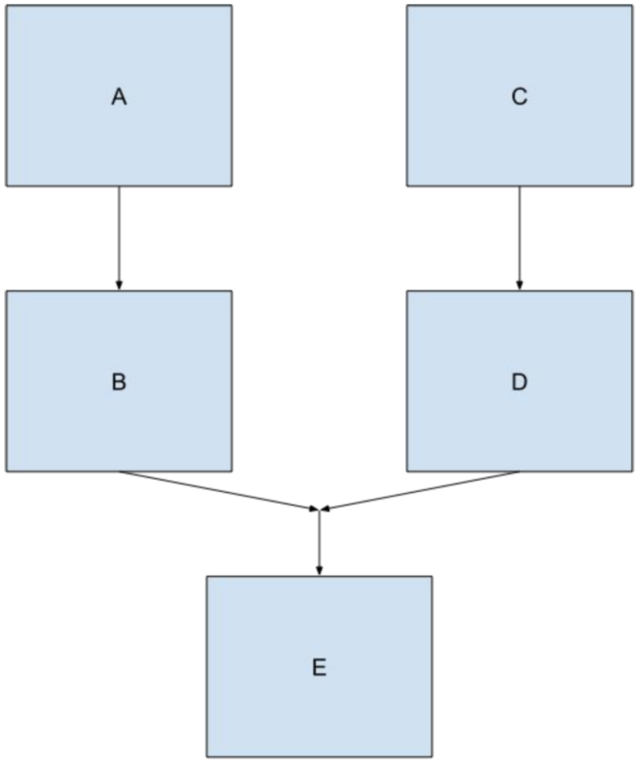
Define Constraints

- You can define constraints that must be met before the work starts:
  - Network connectivity
  - Battery
  - Storage
  - Device State: device charging, device idle

```
val constraints = Constraints.Builder()
            .setRequiredNetworkType(NetworkType.CONNECTED)
            .setRequiresBatteryNotLow(true)
            .setRequiresCharging(true)
            .setRequiresDeviceIdle(false)
            .setRequiresStorageNotLow(false)
            .build()
val uploadRequest = OneTimeWorkRequestBuilder<UploadWorker>()
                                        .setConstraints(constraints)
                                        .build()
```

Work Chaining

- Orchestration of multiple jobs. E.g.,
  - B runs after A
  - D runs after C
  - E runs after B and D are completed



```
val parallelWorks = listOf(downloadRequest, filterRequest)
workManager.beginWith(parallelWorks)
           .then(compressRequest)
           .then(uploadRequest)
           .enqueue()
```

Configure retries

- If you require that WorkManager retry failed work, you can return **Result.retry()** from your worker. Your work is then rescheduled according to a **backoff delay** and **backoff policy**.

```
val uploadRequest = OneTimeWorkRequestBuilder<UploadWorker>()
                    .setBackoffCriteria(
                        BackoffPolicy.LINEAR,
                        OneTimeWorkRequest.MIN_BACKOFF_MILLIS,
                        TimeUnit.MILLISECONDS)
                    .build()
```

Unique Work

- Three possible policies for **OneTimeWorker**: KEEP, REPLACE, APPEND
- Two possible policies for **PeriodicWorker**: KEEP, REPLACE

```
class MyApp: Application() {
override fun onCreate() {
    super.onCreate()
    val backupWorkRequest =
       PeriodicWorkRequestBuilder<BackupWorker>(8, TimeUnit.HOURS).build()
       WorkManager.getInstance(applicationContext).enqueueUniquePeriodicWork(
               "BackupWork",
               ExistingPeriodicWorkPolicy.REPLACE,
               backupWorkRequest)
    }
}
```

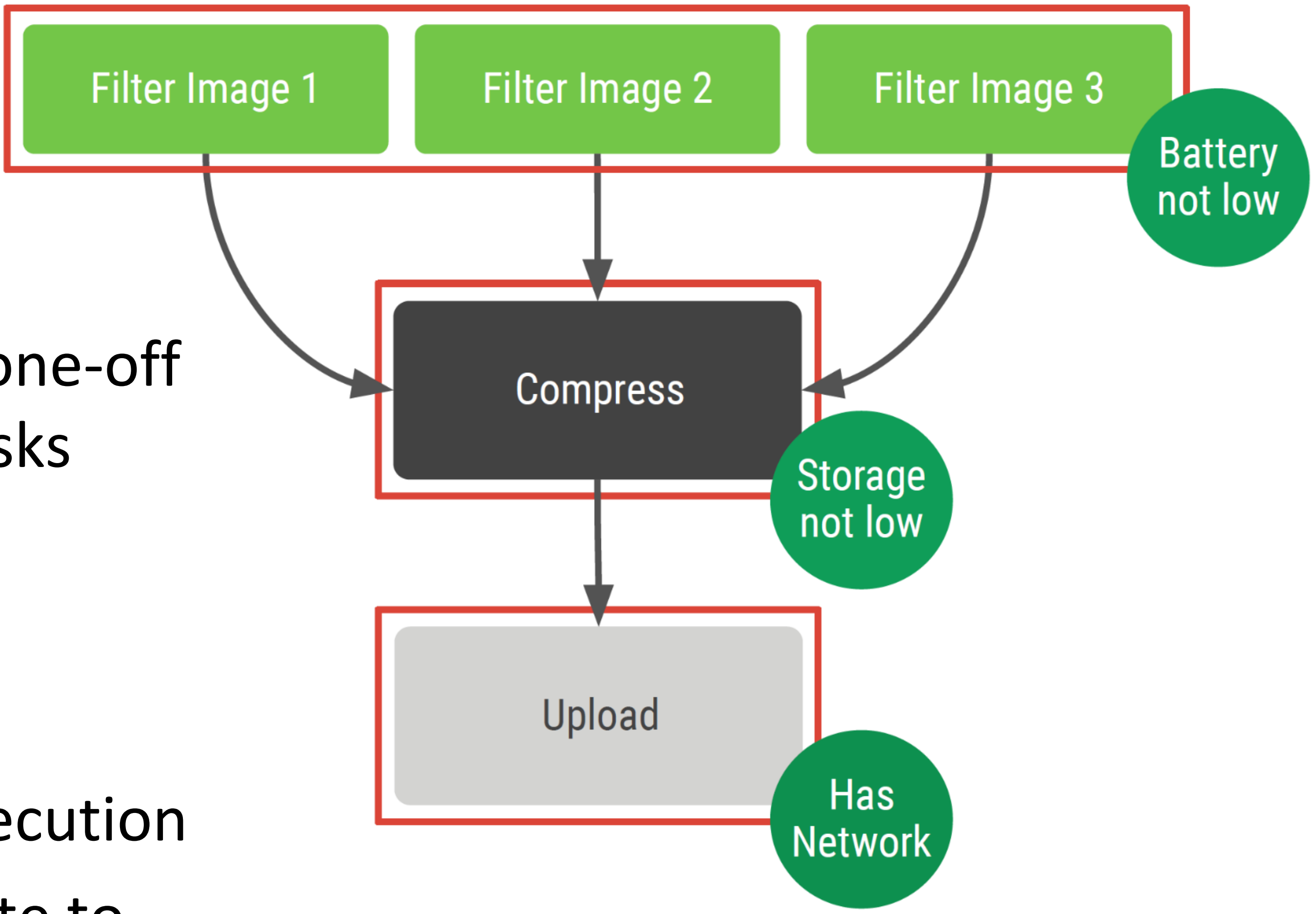
Coroutines + WorkManager

- Use **CoroutineWorker** to call coroutines in **doWork**
- You can specify a Dispatcher to use otherwise **Dispatchers.Default** is used by default

```
class AsyncWorker(context : Context, params: WorkerParameters)
        : CoroutineWorker(context, params) {
    override suspend fun doWork(): Result = withContext(Dispatchers.IO) {
        try {
            // Do async tasks
            Result.success()
        } catch (error: Throwable) {
            Result.failure()
        }
    }
}
```

Summary of features

- Asynchronous one-off and periodic tasks
- Chaining with Input/Output
- Constraints
- Guaranteed execution
- Query work state to display on UI



Monitor work execution

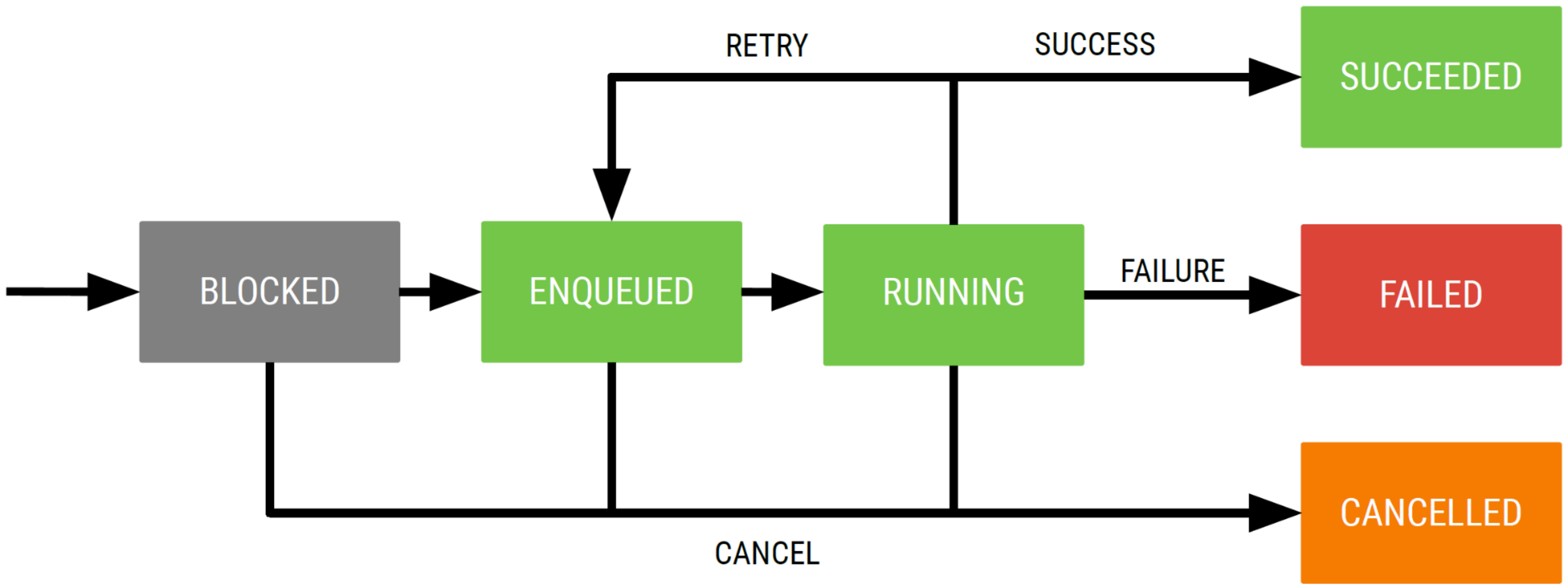
- Query status by ID, Tag or Unique Name

```
workManager.getWorkInfoById(requestId)
workManager.getWorkInfosByTag("Sync")
```

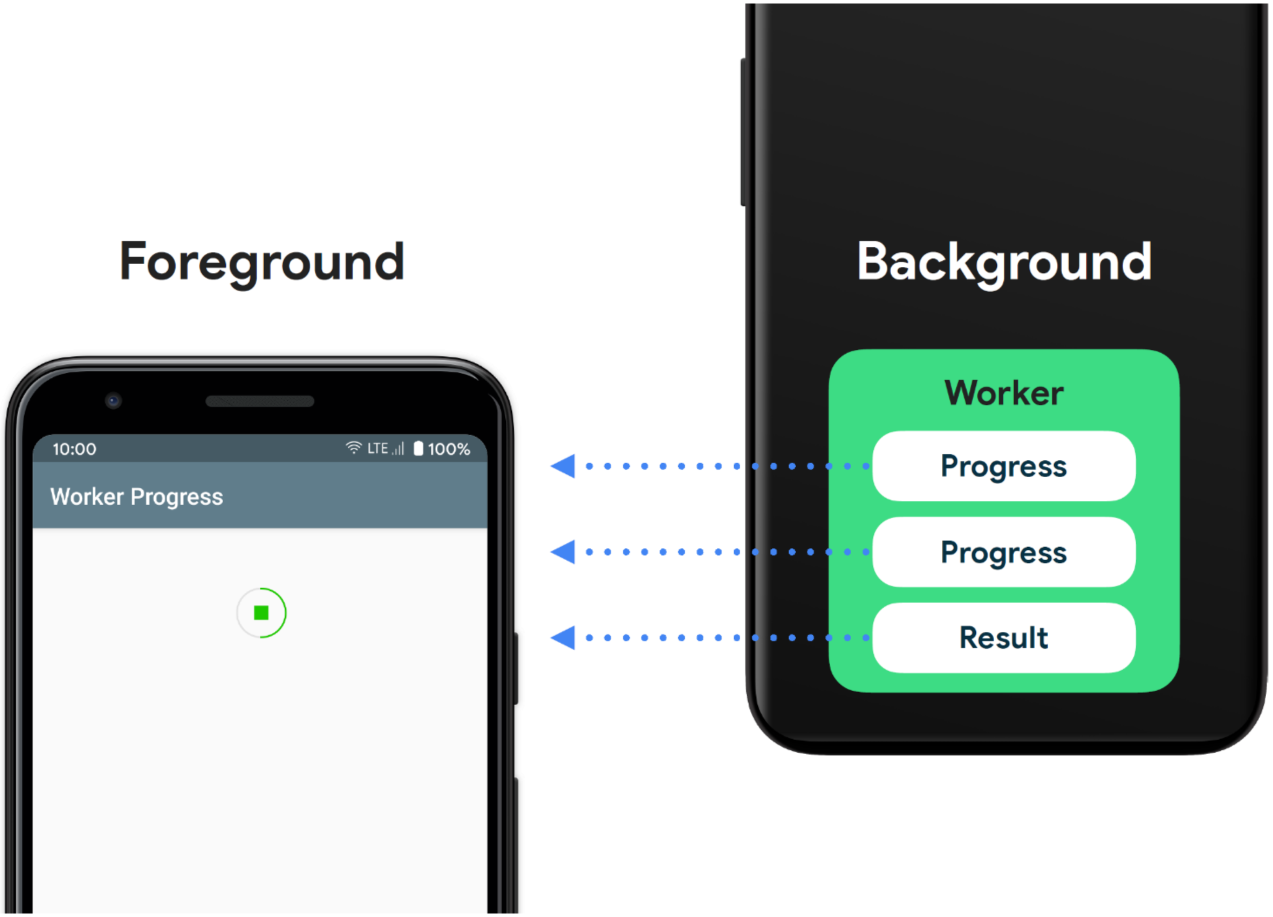
- Monitor status → LiveData providing job status
  - Use **.getWorkInfoByIdLiveData** to observe the work progress

```
workManager.getWorkInfoByIdLiveData(uploadRequest.id)
        .observe(this, Observer {
            textView.text = it.state.name
            if(it.state.isFinished){
                val data = it.outputData
                val message = data.getString(Constants.CURRENT_DATE)
                Toast.makeText(applicationContext, message, Toast.LENGTH_LONG).show()
            }
        })
```

Life of OneTime Work



Worker Progress



Reporting Worker Progress

```
class ProgressWorker(context: Context, parameters: WorkerParameters) :
        CoroutineWorker(context, parameters) {
    override suspend fun doWork(): Result {
        setProgress(workDataOf(Constants.PROGRESS to 25))
        ...
        setProgress(workDataOf(Constants.PROGRESS to 50))
        ...
        return Result.success()
    }
}
```

Observing Worker Progress

```
val request = OneTimeWorkRequestBuilder<ProgressWorker>().build()
workManager.
        .getWorkInfoByIdLiveData(request.id)
        .observe(this, Observer { workInfo: WorkInfo? ->
            if (workInfo != null) {
                val progress = workInfo.progress
                val value = progress.getInt(Constants.PROGRESS, 0)
                    // Do something with progress information
            }
        })
```

Cancel Work

- Can cancel work using the work request id or the associated tag

```
val saveImageWorkRequest = OneTimeWorkRequestBuilder<SaveImageWorker>()
        .addTag(TAG_SAVE_IMAGE)
        .build()

WorkManager.getInstance(applicationContext).cancelWorkById(saveImageWorkRequest.id)
WorkManager.getInstance(applicationContext).cancelAllWorkByTag(TAG_SAVE_IMAGE)

// Or cancel all work
WorkManager.getInstance(applicationContext).cancelAllWork()
```

Summary

- Schedule & execute deferrable background work
- Guarantees execution across system reboots
- Could be one-time or periodic work
- Cancellable work
- Can query the work state

Resources

- Getting started with WorkManager
    - https://developer.android.com/topic/libraries/architecture/workmanager/basics
    - https://developer.android.com/topic/libraries/architecture/workmanager

- WorkManager codelab
    - https://developer.android.com/codelabs/android-workmanager