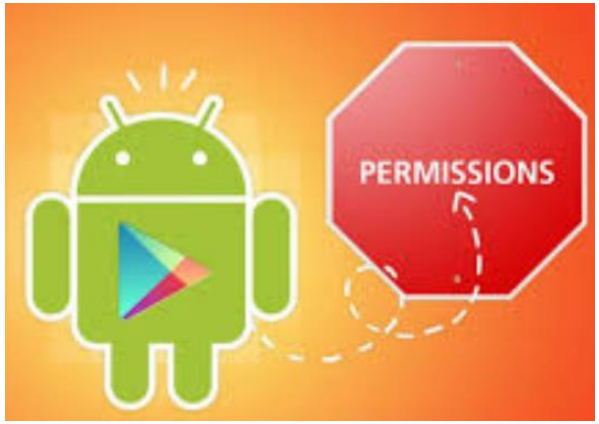
Mobile Application Development

Runtime Permissions

System Permissions

- In an attempt to maintain security (system integrity, user privacy) on Android devices …
- … run each app in a limited sandbox
- If app wants to use resources (e.g. camera, storage, network) or information (e.g. contacts info) outside of sandbox, must request permission.
- List of permissions: https://developer.android.com/reference/android/Manifest.permission.html



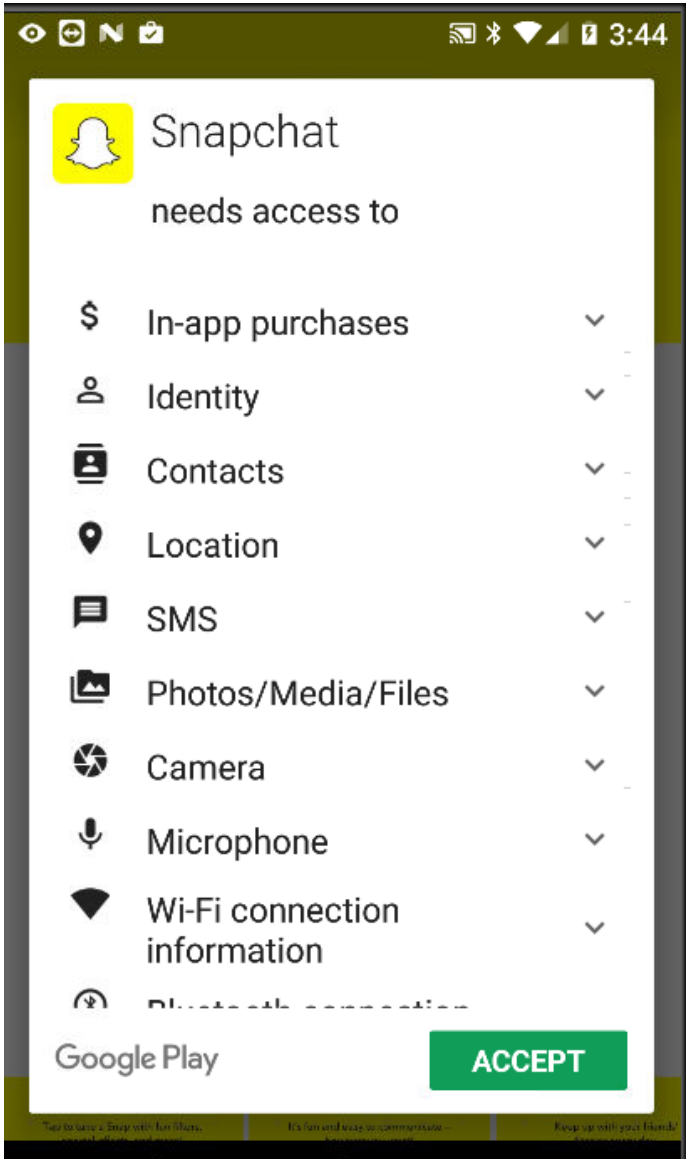
History of Permissions

- Prior to Android version 6.0, Marshmallow…
- Apps requested permission at install time
- Permissions Listed in the AndroidManifest.xml File

```
<uses-permission android:name=
    "android.permission.WRITE_EXTERNAL_STORAGE" />
<uses-permission android:name=
    "android.permission.READ_EXTERNAL_STORAGE" />
```

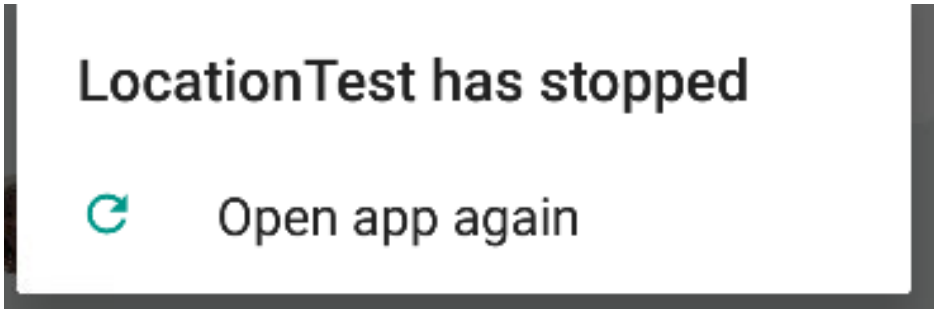
Install Time Permissions

- Pre 6.0 / Marshmallow user granted permission at *install time.*
- Google Play listed permissions for app when install selected
- Based on permissions listed in manifest
- Some apps … “we own you”



Lacks Permission

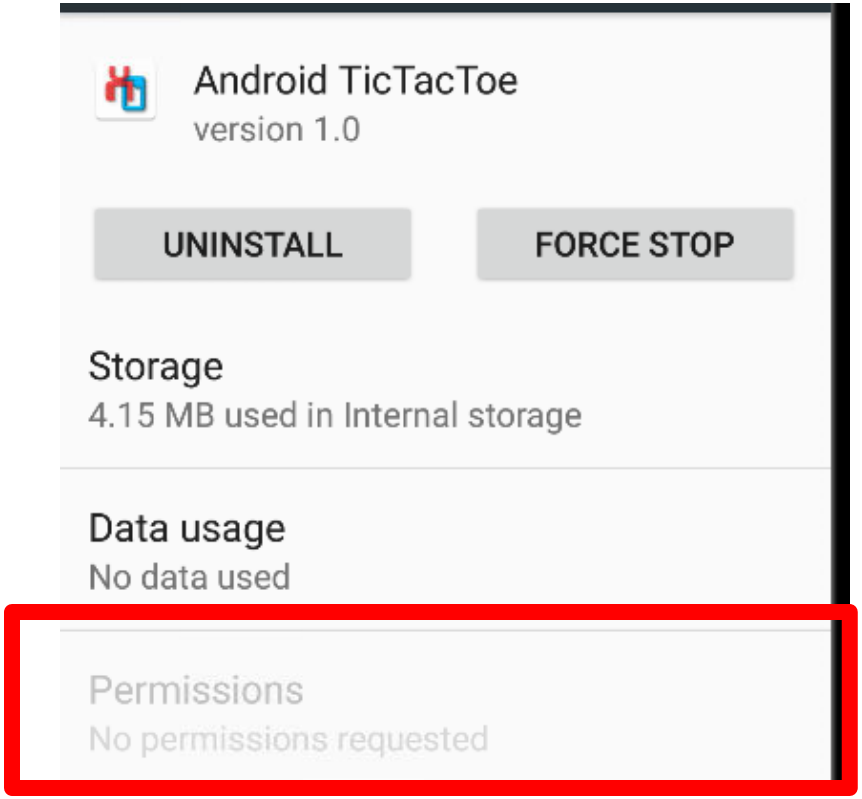
- App stopped by system as soon as it tries to perform operation it doesn't have permission for

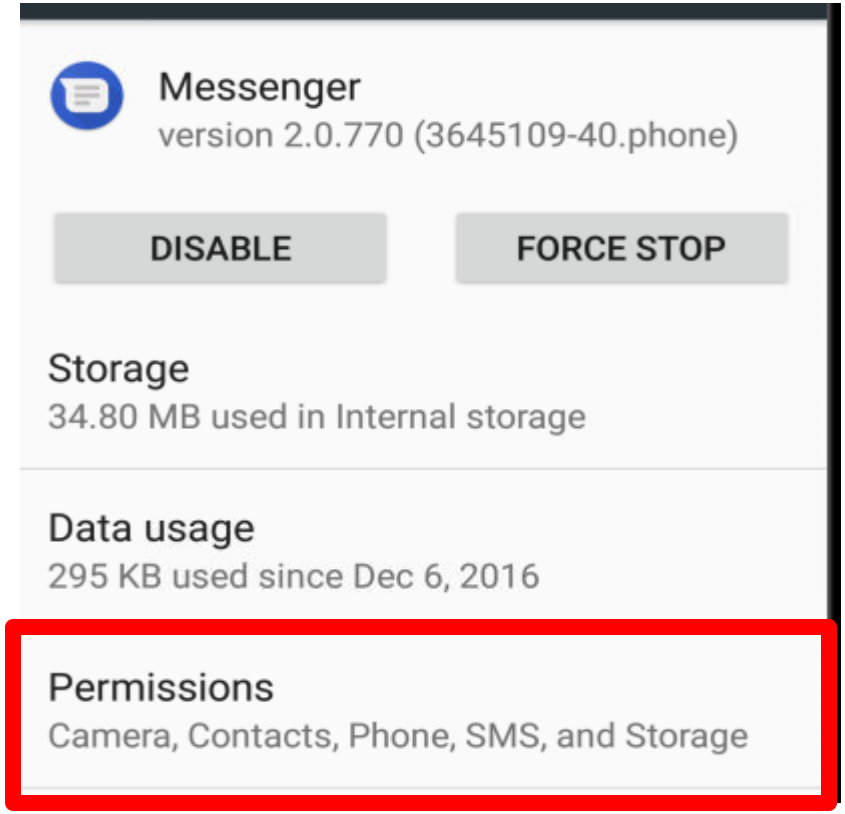


02-09 16:03:39.857 26846-26846/**org.example.locationtest**
E/AndroidRuntime: FATAL EXCEPTION: main
Process: org.example.locationtest, PID: 26846
java.lang.RuntimeException: Unable to start activity
ComponentInfo
{org.example.locationtest/org.example.locationtest.LocationTest}:
java.lang.SecurityException: "passive" location provider requires ACCESS_FINE_LOCATION permission.
at android.location.LocationManager.getProvider(LocationManager.java:383)
at org.example.locationtest.LocationTest.dumpProvider(LocationTest.java:372)
at org.example.locationtest.LocationTest.dumpProviders(LocationTest.java:364)
at org.example.locationtest.LocationTest.onCreate(LocationTest.java:80)

Viewing Permissions

- A user can see what permissions an app has in Settings -> Apps





- Developers can see device permissions via adb: $ adb shell pm list permissions -s

Changes to Permissions

- Android 6.0 / Marshmallow introduced changes to permissions
- Introduced Permission Groups
- Introduced Normal and Dangerous Permissions
  - “Dangerous Permissions cover areas where the app wants data or resources that involve the user's private information, or could potentially affect the user's stored data or the operation of other apps.”

Normal Permissions – API 23

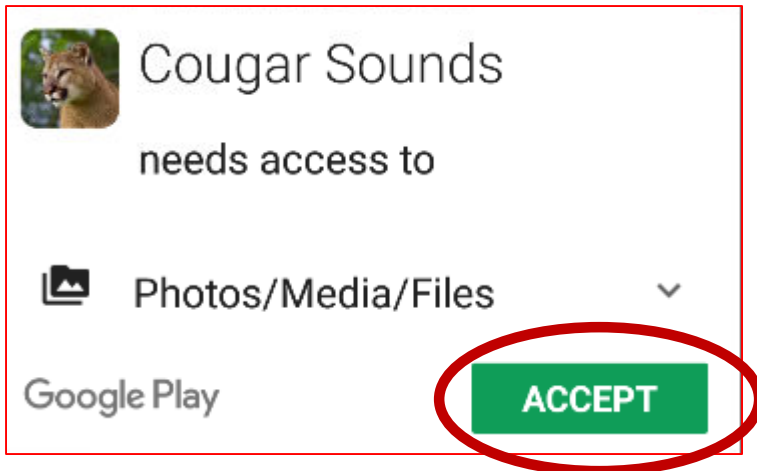
- ACCESS_LOCATION_EXTRA_COMMANDS
- ACCESS_NETWORK_STATE
- ACCESS_NOTIFICATION_POLICY
- ACCESS_WIFI_STATE
- **BLUETOOTH**
- BLUETOOTH_ADMIN
- BROADCAST_STICKY
- CHANGE_NETWORK_STATE
- CHANGE_WIFI_MULTICAST_STATE
- CHANGE_WIFI_STATE
- DISABLE_KEYGUARD
- EXPAND_STATUS_BAR
- GET_PACKAGE_SIZE
- INSTALL_SHORTCUT
- **INTERNET**
- KILL_BACKGROUND_PROCESSES
- MODIFY_AUDIO_SETTINGS
- NFC
- READ_SYNC_SETTINGS
- READ_SYNC_STATS
- RECEIVE_BOOT_COMPLETED
- REORDER_TASKS
- REQUEST_IGNORE_BATTERY_OPTIMIZATIONS
- REQUEST_INSTALL_PACKAGES
- **SET_ALARM**
- SET_TIME_ZONE
- SET_WALLPAPER
- SET_WALLPAPER_HINTS
- TRANSMIT_IR
- UNINSTALL_SHORTCUT
- USE_FINGERPRINT
- **VIBRATE**
- **WAKE_LOCK**
- WRITE_SYNC_SETTINGS

Dangerous Permissions

- Dangerous Permissions Organized into Permission Groups:
- **CALENDAR**: READ_CALENDAR, WRITE_CALENDAR
- **CAMERA**: CAMERA
- **CONTACTS**: READ_CONTACTS, WRITE_CONTACTS, GET_ACCOUNTS
- **LOCATION**: ACCESS_FINE_LOCATION, ACCESS_COARSE_LOCATION
- **MICROPHONE**: RECORD_AUDIO
- **PHONE**: READ_PHONE_STATE, CALL_PHONE, READ_CALL_LOG, WRITE_CALL_LOG, ADD_VOICEMAIL, USE_SIP, PROCESS_OUTGOING_CALLS
- **SENSORS**: BODY_SENSORS
- **SMS**: SEND_SMS, RECEIVE_SMS, READ_SMS, RECEIVE_WAP_PUSH, RECEIVE_MMS
- **STORAGE**: READ_EXTERNAL_STORAGE, WRITE_EXTERNAL_STORAGE

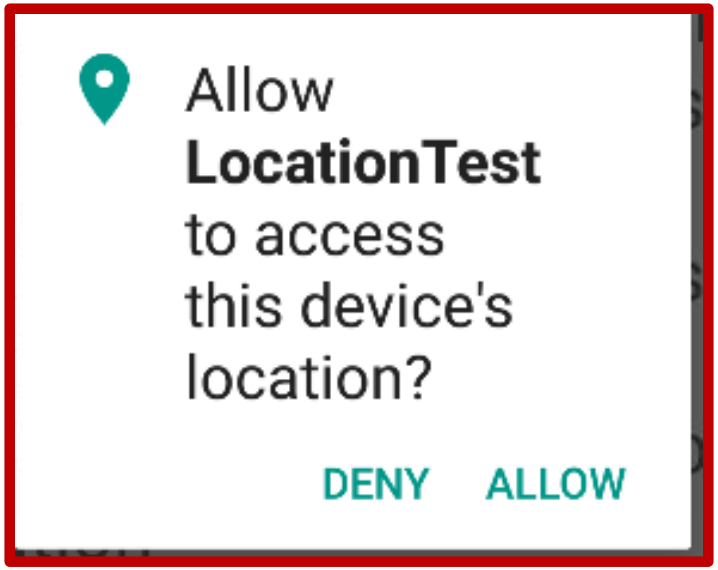
Runtime Permissions

- Post Android 6.0 / Marhsmallow
- All Normal and Dangerous Permissions **still** placed in app Manifest
- If Device is Android 5.1 or lower OR app targets API level 22 or lower …
- … then user must grant Dangerous Permissions at install time
- Or app doesn't install



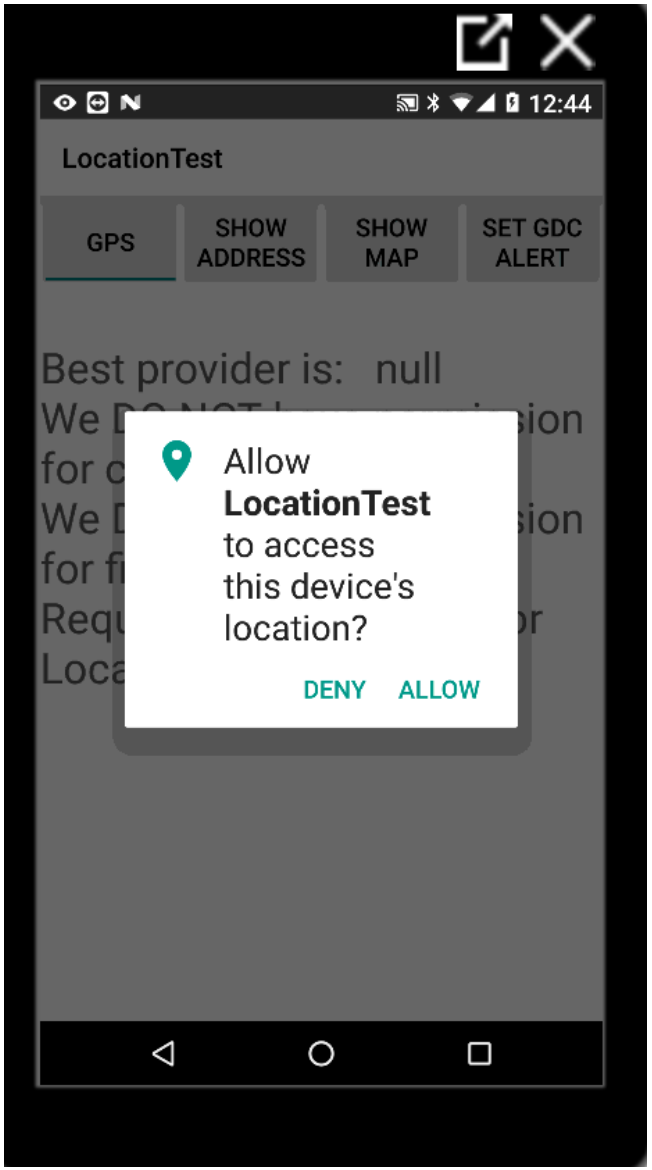
Runtime Permissions

- If device is Android 6.0 or higher AND app targets API level 23 or higher
- Must still list all permissions in manifest
- App must request each dangerous permission in needs **while the app is running**



Requesting Permission at Runtime

- When app needs dangerous permission:
- Check to see if you already have permission
- If not call one of the requestPermission methods with desired permissions and request code
- requestPermission shows a standard, non modifiable dialog box to the user



Checking Permissions

- Before Requesting a Permission Check to see if you already have it.

```
int permissionCoarse
        = ContextCompat.checkSelfPermission(this,
        Manifest.permission.ACCESS_COARSE_LOCATION);
int permissionFine
        = ContextCompat.checkSelfPermission(this,
        Manifest.permission.ACCESS_FINE_LOCATION);
if (permissionCoarse == PackageManager.PERMISSION_GRANTED) {
```

Requesting Permission

- If you do not have a permission you must request it

```
if (ActivityCompat.shouldShowRequestPermissionRationale(this,
        Manifest.permission.READ_CONTACTS)) {

    // Show an explanation to the user (likely with a
    // dialog) *asynchronously* -- don't block
    // this thread waiting for the user's response! After the user
    // sees the explanation, try again to request the permission.
```

- shouldShowRequestPermissionRationale returns true if the app previously requested the permission and the user denied it

Requesting Permission

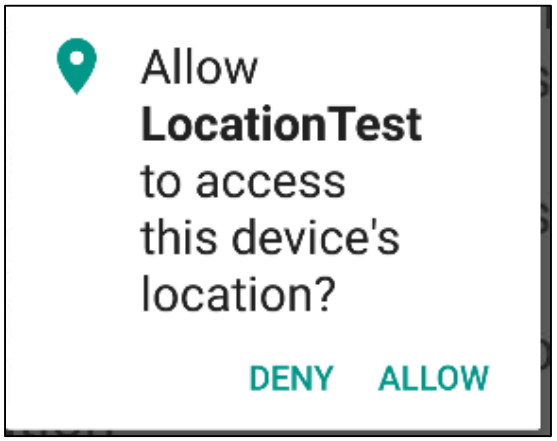
- If user has not previously denied permission

```
} else {
    // No explanation needed, we can request the permission.
    ActivityCompat.requestPermissions(this,
            new String[]{
                    Manifest.permission.ACCESS_COARSE_LOCATION,
                    Manifest.permission.ACCESS_FINE_LOCATION},
            MY_PERMISSIONS_REQUEST_GET_LOCATION);

    // MY_PERMISSIONS_REQUEST_GET_LOCATION is an
    // app-defined int constant. The callback method gets the
    // result of the request.
}
```

Dialog Result

- Dialog displayed to user. Lists permission group, not individual permissions
- Will lead to call back



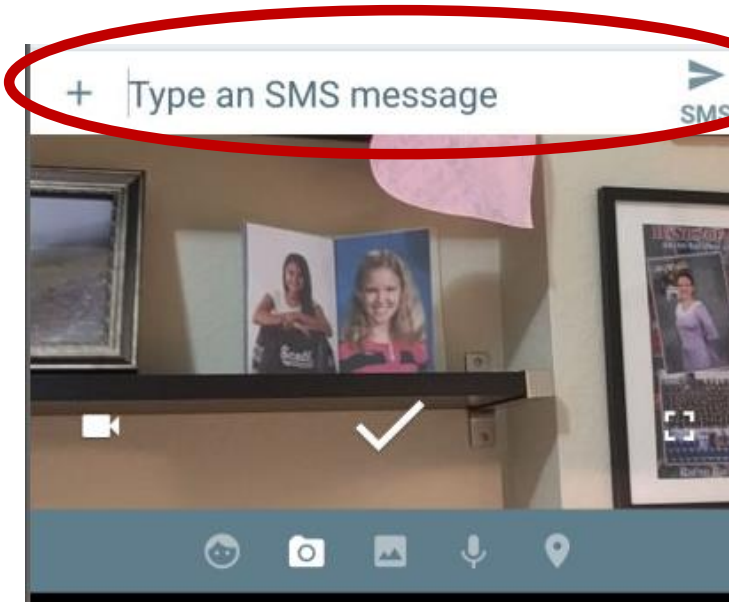

```
public void onRequestPermissionsResult(int requestCode,
                                       String permissions[],
                                       int[] grantResults) {
    log("onRequestPermissionsResult");
    Log.d(TAG, "onRequestPermissionsResult");
    Log.d(TAG, "permissions: " + Arrays.toString(permissions));
    Log.d(TAG, "results: " + Arrays.toString(grantResults));
    switch (requestCode) {
        case MY_PERMISSIONS_REQUEST_GET_LOCATION: {
            // If request is cancelled, the result arrays are empty.
            locationPermissionsGranted =
                    (grantResults.length > 0)
                            && (grantResults[0]
                            == PackageManager.PERMISSION_GRANTED);
```

Permission Groups

- Dialog shows Permission Group based on requested permission
- If user grants permission for one permission in group …
- … app now has all permission in that group.
- If you check on different permission in group after one granted, it will be granted as well

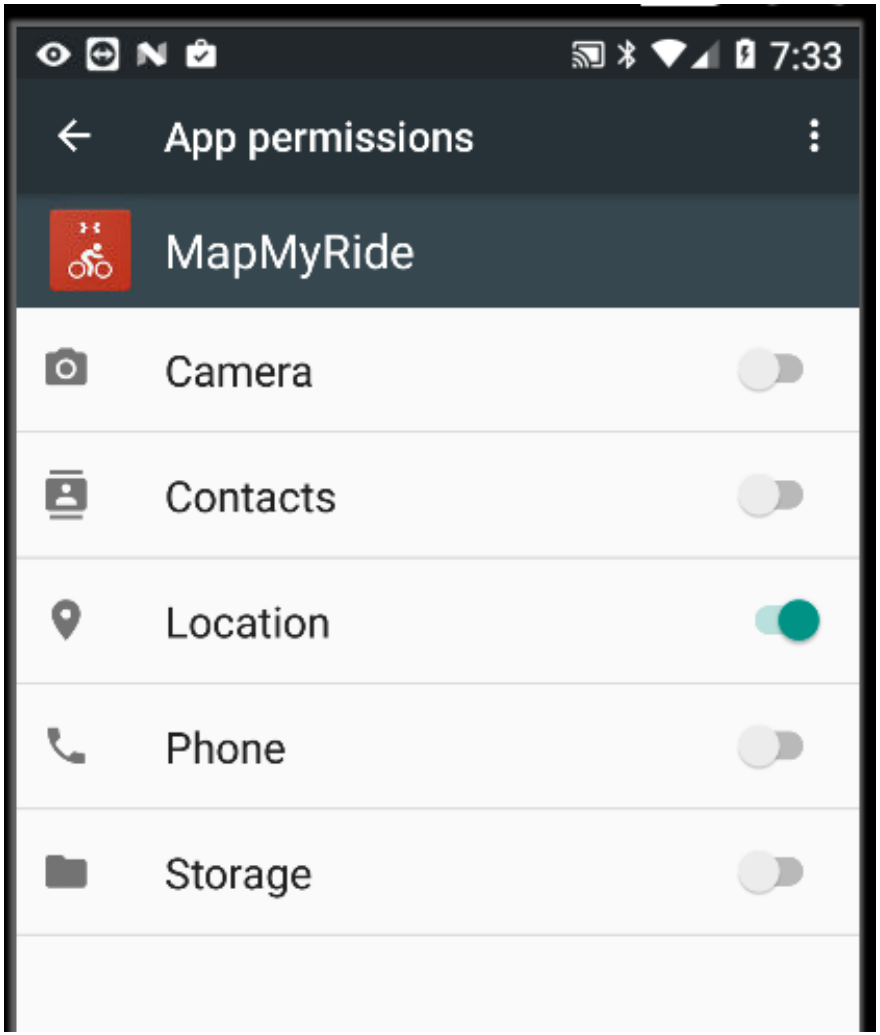
Permission Notes

- If you use an intent to accomplish something, then your app does not usually have to request permission.
- For example, if you use an Intent to take a picture, you DO NOT need CAMERA permission.
- Only if you want to access camera directly in your app.
- Example, messenger ->



Permission Notes

- A user can also alter permissions in the Settings app
- Settings -> app
- Toggle Switches to grant and deny permissions



Permission Notes

- Only Ask for Permissions You Need
- Don't Overwhelm the User
- Explain Why You Need Permissions
- Test for Both Permissions Models Reference

https://developer.android.com/training/permissions/index.html
https://developer.android.com/training/permissions/usage-notes
https://developer.android.com/distribute/best-practices/develop/runtime-permissions
https://developer.android.com/guide/topics/permissions/overview.html