Permission model in Android >= 6

- If your app targets SDK 23 or higher, it prompts users to grant permissions at runtime, instead of install time
  - Your app **must** use the new permissions model!
- Users can revoke permissions at any time from the app Settings screen
- Your app needs to check that it has the permissions it needs every time it runs
- If your app runs on a device that has API 22 or lower, the app uses the old permissions model
  - When the user installs the app, they are prompted to grant all the permissions your app requests in its manifest
- **Note!** You can use the GitHub Google Samples EasyPermissons (or other more advanced/better libraries) which is a wrapper library to simplify basic system permissions logic when targeting SDK 23 or higher
  - https://github.com/googlesamples/easypermissions

Permission overview

- Declaring Permissions
  - The app declares all the permissions it needs in the manifest, as in earlier Android platforms
- Dangerous Permissions belong to Permission Groups
  - Permissions are divided into permission groups, based on their functionality
- Normal Permissions are Granted at Install Time
  - When the user installs or updates the app, the system grants the app all permissions listed in the manifest that fall under PROTECTION_NORMAL
  - For example, alarm clock and internet permissions fall under PROTECTION_NORMAL, so they are automatically granted at install time
- User Grants Permissions at Run-Time
  - When the app requests a permission, the system shows a dialog to the user, then calls the app's callback function to notify it whether the user granted the permission

Permission groups

- Related permissions are divided into permission groups to allow users to grant related permissions to an app in a single action
- The user only has to grant permission once per app for each permission group. If the app subsequently requests a permission from the same permission group, the system automatically grants the permission without any action from the user
- The system calls your app's onRequestPermissionsResult() method just as if the user had granted permission through the dialog box
- See the permissions and permission groups table at: https://developer.android.com/training/permissions/index.html > System Permissions

Table 1. Dangerous permissions and permission groups.

Permission Group	Permissions
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

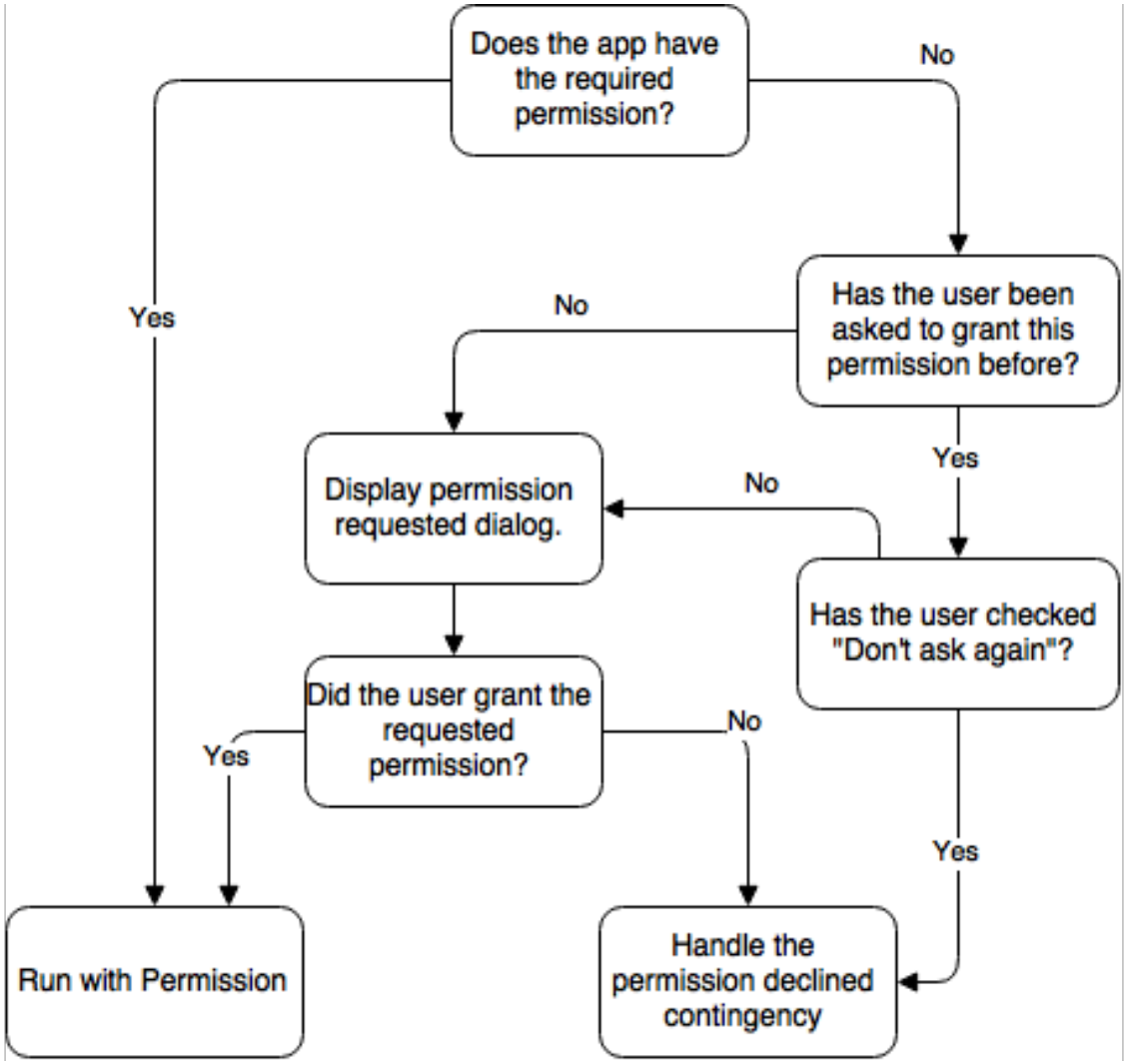
As of API level 23, the following permissions are classified as `PROTECTION_NORMAL`:

- 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

Permission development practices to follow

- Always Check for Permissions
  - When the app needs to perform any action that requires a permission, it should first check whether it has that permission
- Handle Lack of Permissions Gracefully
  - If the app is not granted an appropriate permission, it should handle the failure cleanly. For example, if the permission is just needed for an added feature, the app can disable that feature. If the permission is essential for the app to function, the app might disable all its functionality and inform the user that they need to grant that permission
- Permissions are Revocable
  - Users can revoke an app's permissions at any time

Runtime permission steps overview



Source: http://code.tutsplus.com/articles/understanding-permissions-in-android-m--cms-24443

EasyPermissons location and storage example

```
// Add ”compile 'pub.devrel:easypermissions:1.0.0' to dependencies in your build.gradle file
public class MainActivity extends AppCompatActivity implements EasyPermissions.PermissionCallbacks {

    private static final int RC_LOCATION_STORAGE_PERM = 124;
    private static final int RC_SETTINGS_SCREEN = 125;

    @AfterPermissionGranted(RC_LOCATION_STORAGE_PERM)
    public void locationAndStoragesTask() {
        String[] perms = {Manifest.permission.ACCESS_FINE_LOCATION, Manifest.permission.WRITE_EXTERNAL_STORAGE };
        if (EasyPermissions.hasPermissions(this, perms)) {
            // Have permissions, do the thing!
            Toast.makeText(this, "Permitted: Location and Storage!",
                    Toast.LENGTH_LONG).show();
            getCurrentNetworkParametersCellid();
        } else {
            // Ask for both permissions
            EasyPermissions.requestPermissions(this,
                    getString(R.string.rationale_location_storage),
                   RC_LOCATION_STORAGE_PERM, perms);
        }
    }
    @Override
    public void onRequestPermissionsResult(int requestCode, @NonNull String[] permissions, @NonNull int[] grantResults) {
        super.onRequestPermissionsResult(requestCode, permissions, grantResults);
        // EasyPermissions handles the request result.
        EasyPermissions.onRequestPermissionsResult(requestCode, permissions, grantResults, this);
    }
    @Override
    public void onPermissionsGranted(int requestCode, List<String> perms) {
        Log.d(TAG, "onPermissionsGranted:" + requestCode + ":" + perms.size());
    }
    @Override
    public void onPermissionsDenied(int requestCode, List<String> perms) {
        Log.d(TAG, "onPermissionsDenied:" + requestCode + ":" + perms.size());
        // (Optional) Check whether the user denied any permissions and checked "NEVER ASK AGAIN."
        // This will display a dialog directing them to enable the permission in app settings.
        if (EasyPermissions.somePermissionPermanentlyDenied(this, perms)) {
            new AppSettingsDialog.Builder(this).build().show();
        }
    }
```

```
// when accessing the resource handle exception
// in getCurrentNetworkParametersCellid()
try {
    location = (GsmCellLocation)
telephonyManager.getCellLocation();
}
catch(SecurityException se){
    Toast.makeText(this, "SecurityException! "
+ se.getMessage(), Toast.LENGTH_LONG).show();
}
```

Dexter

build passing | maven central 4.1.1 | Android Arsenal Dexter

```
// Add ”compile 'com.karumi:dexter:4.1.0' to dependencies in your build.gradle file
public SampleActivity extends Activity {
    @Override public void onCreate(){
        super.onCreate();
        // create a PermissionListener
        PermissionListener samplePermissionListener = new SamplePermissionListener(this);
        // For each permission, register a PermissionListener implementation to receive the state of the request
        // A MultiplePermissionsListener implementation is also available
        Dexter.withActivity(this)
            .withPermission(Manifest.permission.READ_CONTACTS)
            .withListener(samplePermissionListener)
            .withErrorListener(errorListener)
            .onSameThread()  // receive permission listener callbacks on the same thread that fired the permission request
            .check();
    }
    public void showPermissionGranted(String permission){
        TextView feedbackView = getFeedbackViewForPermission(permission);
        feedbackView.setText(R.string.permission_granted_feedback);
        feedbackView.setTextColor(ContextCompat.getColor(this,R.color.permission_granted));
    }
    public void showPermissionDenied(String permission,boolean isPermanentlyDenied){
        TextView feedbackView=getFeedbackViewForPermission(permission);
        feedbackView.setText(isPermanentlyDenied?R.string.permission_permanently_denied_feedback
        :R.string.permission_denied_feedback);
        feedbackView.setTextColor(ContextCompat.getColor(this,R.color.permission_denied));
    }
    private TextView getFeedbackViewForPermission(String name) {
        // Return the correct TextView if handling more than one permission
    }
}
```

The official API is heavily coupled with the Activity class. Dexter frees your permission code from your activities and lets you write that logic anywhere you want.
https://github.com/Karumi/Dexter

```
public class SamplePermissionListener implements PermissionListener {
    private final SampleActivity activity;
    public SamplePermissionListener(SampleActivity activity) {
        this.activity = activity;
    }
    @Override
    public void onPermissionGranted(PermissionGrantedResponse response) {
        activity.showPermissionGranted(response.getPermissionName());
    }
    @Override
    public void onPermissionDenied(PermissionDeniedResponse response) {
        activity.showPermissionDenied(response.getPermissionName(), response.isPermanentlyDenied());
    }
    @Override
    public void onPermissionRationaleShouldBeShown(PermissionRequest permission,
                                                   PermissionToken token) {
        activity.showPermissionRationale(token);
    }
}
```

Hotchemi

https://github.com/hotchemi/PermissionsDispatcher

build passing

Permissions Dispatcher

- Provides a simple annotation-based API to handle runtime permissions

```
@RuntimePermissions
public class MainActivity extends AppCompatActivity {

    @NeedsPermission(Manifest.permission.CAMERA)
    public void showCamera() {
        getSupportFragmentManager().beginTransaction()
                .replace(R.id.sample_content_fragment,
                    CameraPreviewFragment.newInstance())
                .addToBackStack("camera")
                .commitAllowingStateLoss();
    }

    @OnShowRationale(Manifest.permission.CAMERA)
    public void showRationaleForCamera(PermissionRequest request) {
        new AlertDialog.Builder(this)
            .setMessage(R.string.permission_camera_rationale)
            .setPositiveButton(R.string.button_allow, (dialog, button) -> request.proceed())
            .setNegativeButton(R.string.button_deny, (dialog, button) -> request.cancel())
            .show();
    }

    @OnPermissionDenied(Manifest.permission.CAMERA)
    public void showDeniedForCamera() {
        Toast.makeText(this, R.string.permission_camera_denied, Toast.LENGTH_SHORT).show();
    }

    @OnNeverAskAgain(Manifest.permission.CAMERA)
    public void showNeverAskForCamera() {
        Toast.makeText(this, R.string.permission_camera_neverask, Toast.LENGTH_SHORT).show();
    }
}
```

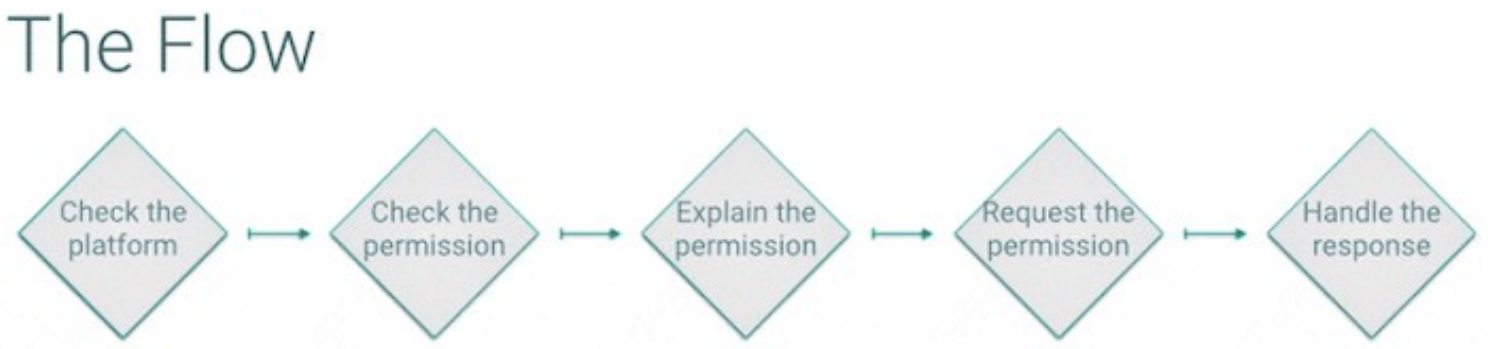
Annotation	Required	Description
`@RuntimePermissions`	✓	Register an `Activity` or `Fragment` to handle permissions
`@NeedsPermission`	✓	Annotate a method which performs the action that requires one or more permissions
`@OnShowRationale`		Annotate a method which explains why the permission/s is/are needed. It passes in a `PermissionRequest` object which can be used to continue or abort the current permission request upon user input
`@OnPermissionDenied`		Annotate a method which is invoked if the user doesn't grant the permissions
`@OnNeverAskAgain`		Annotate a method which is invoked if the user chose to have the device "never ask again" about a permission

NOTE: Annotated methods must NOT be private!

Runtime permission steps explained

(Doing it the API way)

Step 1: check the platform – one line of code
Step 2: check the permission status - checkSelfPermission()
http://goo.gl/T7vE7b
Step 3: explain the permission - shouldShowRequestPermissionRationale()
http://goo.gl/bFyfVj
Step 4: request the permission - requestPermissions() http://goo.gl/yNuizg
Step 5: handle the response - onRequestPermissionResult() callback



Source: https://plus.google.com/+JoannaGSmith/posts/h4DuTT7tDKn

Check if the app has the needed permission (in this case: android.permission-group.LOCATION)

```
// the Mapsproject Android Studio example use the new permission model with real-time permissions
private static final int REQUEST_LOCATION = 10;
private static final String TAG = MainActivity.class.getSimpleName();
private static String[] PERMISSIONS_LOCATION = {Manifest.permission.ACCESS_COARSE_LOCATION,
Manifest.permission.ACCESS_FINE_LOCATION};
// use the LocationManager class to obtain GPS locations
private LocationManager mLM;

public class MainActivity extends AppCompatActivity{
      ...
    /** Initialize locationlistener */
      private void initLocation() {
        // use the LocationManager class to obtain GPS locations
        mLM = (LocationManager) getSystemService(Context.LOCATION_SERVICE);
        Log.d(TAG, "Checking permissions for Location...");

        // Check if the Location permission are already available
        if (ActivityCompat.checkSelfPermission(this, Manifest.permission.ACCESS_FINE_LOCATION) !=
PackageManager.PERMISSION_GRANTED
                || ActivityCompat.checkSelfPermission(this, Manifest.permission.ACCESS_COARSE_LOCATION) !
= PackageManager.PERMISSION_GRANTED) {
            // Location permissions has not been granted
            requestLocationPermission();
        }
        else {
            // Location permissions is already available, show the location
            Log.d(TAG, "Location permissions has already been granted. Requesting location!");
            mLM.requestLocationUpdates(LocationManager.GPS_PROVIDER, 1000, 0, MyLocationListener);
        }
    }
...
```

Request Location permission

```
    /** Request location permissions */
    private void requestLocationPermission() {
        Log.d(TAG, "Location permissions has NOT been granted. Requesting permissions.");

        if (ActivityCompat.shouldShowRequestPermissionRationale(this,
Manifest.permission.ACCESS_FINE_LOCATION)
                || ActivityCompat.shouldShowRequestPermissionRationale(this,
Manifest.permission.ACCESS_COARSE_LOCATION)) {

            // Provide an additional rationale to the user if the permission was not granted
            // and the user would benefit from additional context for the use of the permission.
            // For example, if the request has been denied previously.
            Log.d(TAG, "Displaying location permission rationale to provide additional context");

            // Display a SnackBar with an explanation and a button to trigger the request
            Snackbar.make(mLayout, R.string.permission_location_rationale,
                    Snackbar.LENGTH_INDEFINITE).setAction(R.string.ok, new View.OnClickListener() {
                @Override
                public void onClick(View view) {
                    ActivityCompat.requestPermissions(MainActivity.this, PERMISSIONS_LOCATION,
REQUEST_LOCATION);
                        }
                    }).show();
        }
        else {
            // Location permissions have not been granted yet. Request them directly.
            ActivityCompat.requestPermissions(this, PERMISSIONS_LOCATION, REQUEST_LOCATION);
        }
    }
```

Handle the permissions request response

```
    @Override
    public void onRequestPermissionsResult(int requestCode, @NonNull String[] permissions,
@NonNull int[] grantResults)
    {
        if (requestCode == REQUEST_LOCATION) {
            Log.d(TAG, "Received response for location permissions request!");

     // We have requested multiple permissions for location, so all of them need to be checked.
            if (PermissionUtil.verifyPermissions(grantResults)) {
                // All required permissions have been granted, display location.
                Snackbar.make(mLayout, R.string.permission_available_location,
                        Snackbar.LENGTH_SHORT)
                                .show();
           }
           else {
                Log.d(TAG, "Location permissions were NOT granted.");
                Snackbar.make(mLayout, R.string.permissions_not_granted,
                        Snackbar.LENGTH_SHORT)
                        .show();
            }
        }
        else {
            super.onRequestPermissionsResult(requestCode, permissions, grantResults);
        }
    }
}
```

PermissionUtil class

```
/**
 * Utility class that wraps access to the runtime permissions API in M and provides basic helper
methods.
 */
public abstract class PermissionUtil {
    /**
     * Check that all given permissions have been granted by verifying that each entry in the
     * given array is of the value {@link PackageManager#PERMISSION_GRANTED}.
     *
     * @see Activity#onRequestPermissionsResult(int, String[], int[])
     */
    public static boolean verifyPermissions(int[] grantResults) {
        // At least one result must be checked.
        if(grantResults.length < 1){
            return false;
        }

        // Verify that each required permission has been granted, otherwise return false.
        for (int result : grantResults) {
            if (result != PackageManager.PERMISSION_GRANTED) {
                return false;
            }
        }
        return true;
    }
}
/**
* Full example code
* http://users.du.se/~hjo/cs/common/androidexamples/Mapsproject.7z
* https://developer.android.com/about/versions/marshmallow/samples.html > RuntimePermissions
*/
```