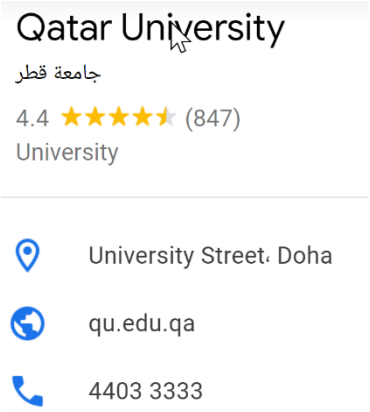

Google Maps

Google Maps Platform Key Services

- **Maps**:
  - Apps can integrate customized and interactive maps, satellite imagery and Street View imagery

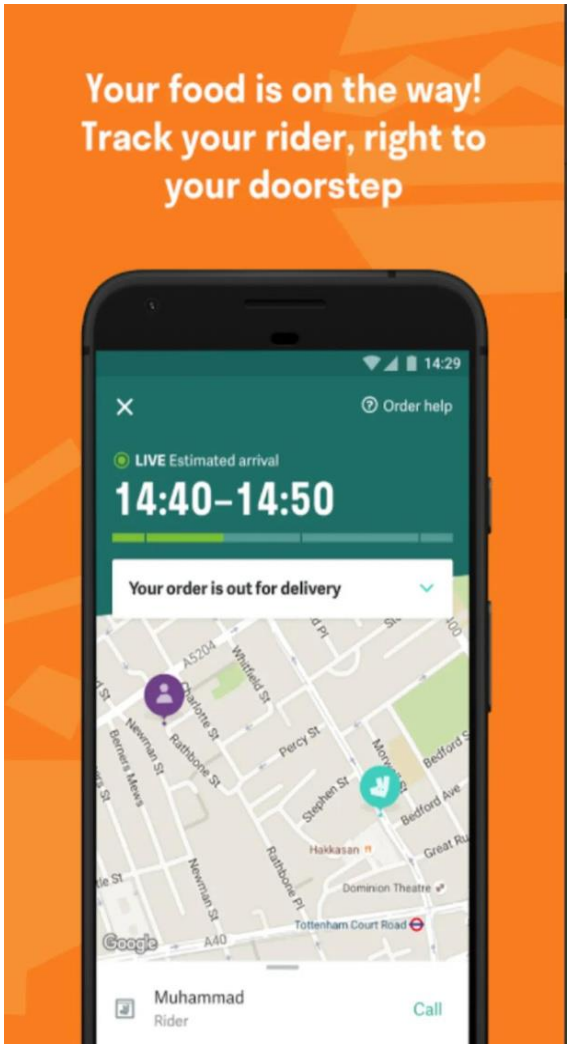
- **Routes**:
  - Allow users to find the best route to get from A to Z using public transport, driving, biking, or walking.
  - Compute travel times and distances
  - Real-time traffic updates about the selected route

- **Places**:
  - Users can search details about million **points of interest** around the world including place names, addresses, images, contact information and reviews

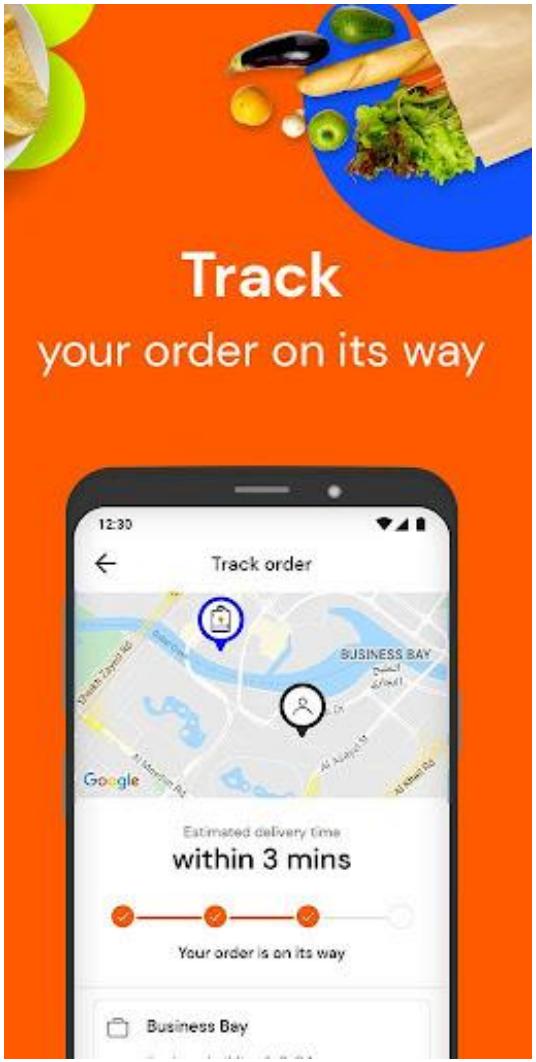


What's driving growth of Map Apps?

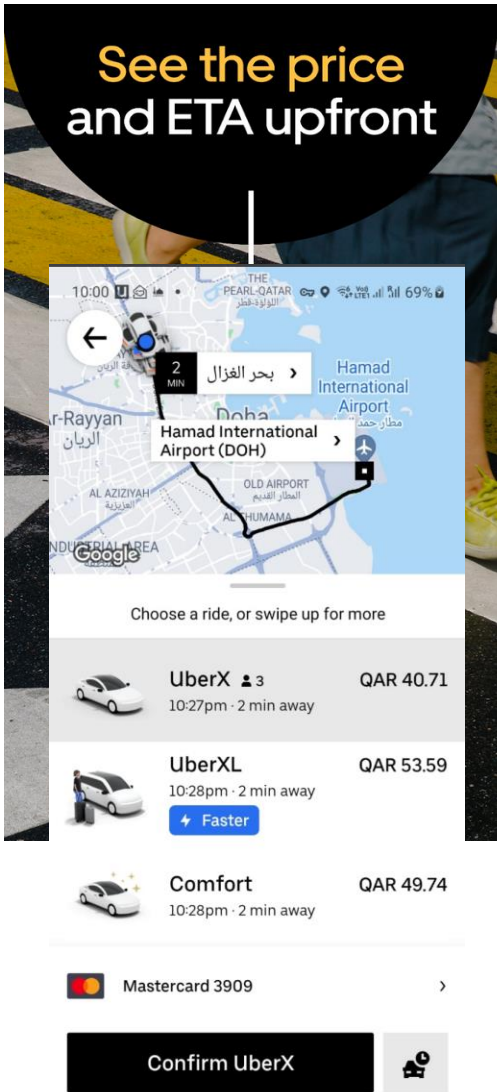
Grocery delivery apps



Food delivery apps



Ride hailing apps



Dependencies

- Add these dependences to build.gradle

```
val mapsComposeVersion = "4.3.0"
implementation("com.google.maps.android:maps-compose:$mapsComposeVersion")

// Optionally, you can include the Compose utils library for Clustering,
// Street View metadata checks, etc.
implementation("com.google.maps.android:maps-compose-utils:$mapsComposeVersion")

// Optionally, you can include the widgets library for ScaleBar, etc.
implementation("com.google.maps.android:maps-compose-widgets:$mapsComposeVersion")
```

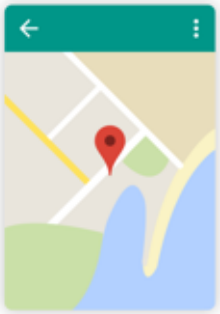
- Need to add Google Maps API key to *AndroidManifest.xml* file

  More details on how to get the API Key
  https://developers.google.com/maps/documentation/android-sdk/get-api-key

Typical Programming Tasks in Location-aware App

- Visualise data in a **custom map**
- Get the device **geolocation** (latitude & longitude)
- **Geocoding**: finding the GPS coordinates of an address
  - E.g., what are coordinates of Qatar University
- **Reverse Geocoding**: finding the address of a GPS coordinates
  - E.g., what is the address at
- **Location tracking** as the user moves
  - Uber track current location during the ride
- **Geofencing**: trigger an action/notification when the device is in area of interest
  - E.g., switch on the corridor light when the user approaches the area of their home

Display a Map



- Use **GoogleMap** component to display an interactive Google Maps

- The displayed map can be **customized** such as:
  - Add marker
  - Add overlay (e.g., image over the map)
  - Change the zoom level
  - Handle events such as Point of Interest (PoI) click event

```
val quPosition = LatLng(25.377, 51.491)
val zoomLevel = 20f // Buildings

val cameraPositionState =
rememberCameraPositionState {
    position = CameraPosition.
           fromLatLngZoom(quPosition,
           zoomLevel)
}

GoogleMap(
    modifier = Modifier.fillMaxSize(),
    cameraPositionState = cameraPositionState
) {
    Marker(
        state = MarkerState(
           position = quLocation),
        title = "QU",
        snippet = "Qatar University"
    )
}
```

Zoom to a Location

- **`GoogleMap`** component a cameraPositionState parameter to know where GoogleMaps should look and the zoom level
  - Look at a particular **geo coordinates** and change the zoom level
- Zoom level values:
  - 1: World
  - 5: Continent
  - 10: City
  - 15: Streets
  - 20: Buildings

```
val quPosition = LatLng(25.377, 51.491)
val zoomLevel = 20f // Buildings
val cameraPositionState =
rememberCameraPositionState {
    position = CameraPosition.fromLatLngZoom(
        quPosition, zoomLevel)
}

GoogleMap(
    cameraPositionState,
    modifier = Modifier.fillMaxSize()
) { }
```

Add Marker

- Marker identify a location on the map at a particular geo coordinates
  - Use the **`Marker`** composable to add a marker containing the coordinates on the map, with a title and small description snippet
  - When the marker is clicked an **info window** displays the marker's title and snippet text

```
// A Snippet is a text displayed below the title
val snippetText = "Lat: ${quLocation.latitude},
        Long: ${quLocation.longitude}"
Marker(
    state = MarkerState(position = quLocation),
    title = "Qatar University",
    snippet = snippetText
)
```

Marker Custom Window

- Use **`MarkerInfoWindowContent`**
- Here we add a column with two text and an Image
- Useful if you want to show more details about the marker


```
MarkerInfoWindow(
    state = MarkerState(position = quLocation),
) {

 Column {
  Image(
    painter = painterResource(
      id = R.drawable.img_qu),
      contentDescription = "QU"),
  Text(text = "My Uni جامعتي" )
  Text(text = snippetText)
 }
}
```

Map Customization

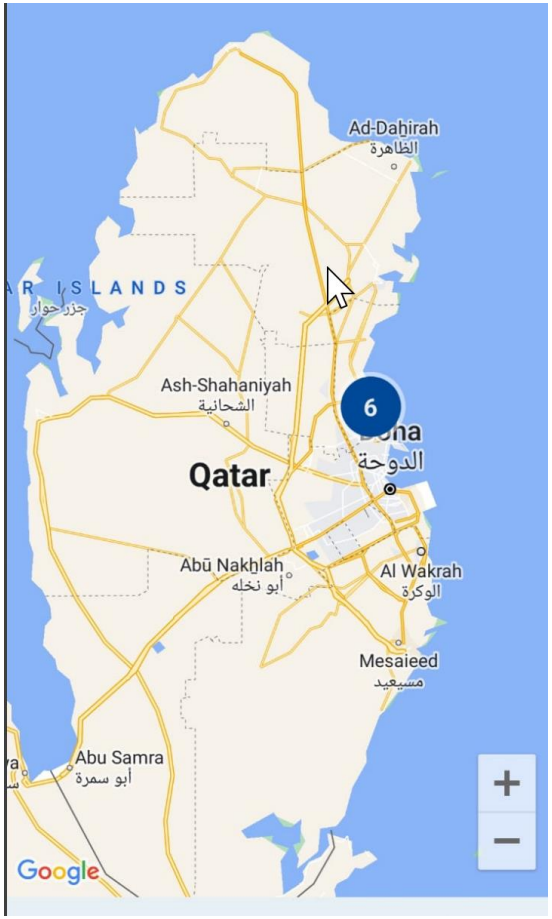
- Configuring the map can be done by passing a **MapProperties** object into the GoogleMap
- For UI-related configurations, use **MapUiSettings**

```
val mapProperties by remember {
    mutableStateOf(
        // Map type could be NORMAL, HYBRID, SATELLITE, TERRAIN
        MapProperties(mapType = MapType.HYBRID, isMyLocationEnabled = true)
    )
}
val mapUiSettings by remember {
    mutableStateOf(
        MapUiSettings(mapToolbarEnabled = true, zoomControlsEnabled = true)
    )
}
GoogleMap(
    cameraPositionState = cameraPositionState,
    properties = mapProperties, uiSettings = mapUiSettings,
    modifier = Modifier.fillMaxSize()
) {}
```

Markers Cluster

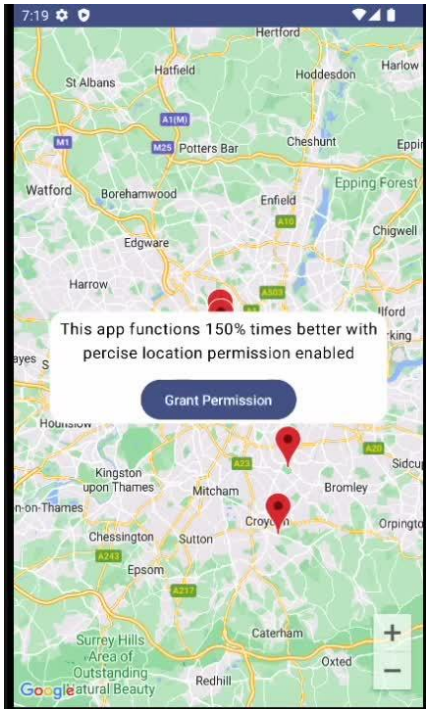
- The marker clustering utility helps manage multiple markers at different zoom levels. When a user views the map at a high zoom level, the individual markers show on the map. When the user zooms out, the markers gather together into clusters, to make viewing the map easier.

```
    val items = remember { mutableStateListOf<MapClusterItem>() }   Out Of Date  ⚠1 ✓1
    LaunchedEffect(Unit) {  this: CoroutineScope
        items.add(MapClusterItem(quPosition,  itemTitle: "Qatar University"))
        items.add(MapClusterItem(hamadAirportPosition,  itemTitle: "Hamad International Airport
        items.add(MapClusterItem(islamicMuseumPosition,  itemTitle: "Museum of Islamic Art"))
        items.add(MapClusterItem(hamadStadiumPosition,  itemTitle: "Hamad bin Khalifa Stadium")
        items.add(MapClusterItem(LatLng( latitude: 25.420738,  longitude: 51.490154),  itemTitle: "Lu
        items.add(MapClusterItem(LatLng( latitude: 25.3607,  longitude: 51.4811),  itemTitle: "Univer
    }
    MapMarkersClustering(items = items)
}

@Composable
fun MapMarkersClustering(items: List<MapClusterItem>) {
    GoogleMap(
        modifier = Modifier.fillMaxSize(),
        cameraPositionState = rememberCameraPositionState {  this: CameraPositionState
            position = CameraPosition.fromLatLngZoom(quPosition,  zoom: 10f)
        }
    ) {
        Clustering(
            items = items,
```



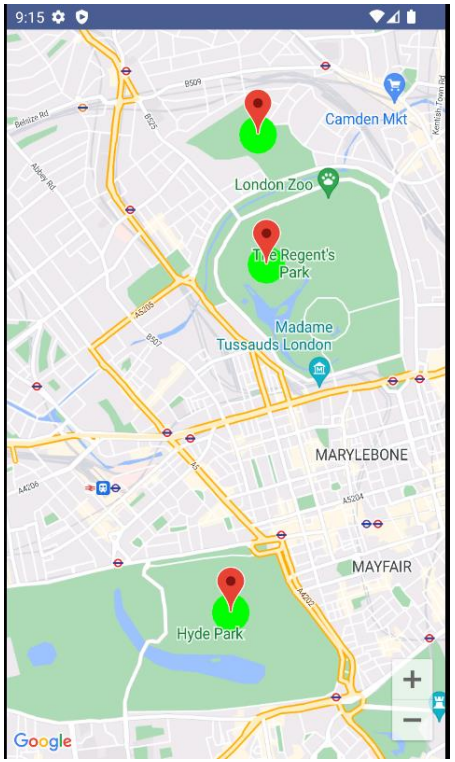
Getting Location Permission

```
// Don't forget to add the permissions to AndroidManifest.xml
val allLocationPermissionsState = rememberMultiplePermissionsState(
    listOf(
        android.Manifest.permission.ACCESS_COARSE_LOCATION,
        android.Manifest.permission.ACCESS_FINE_LOCATION,
    )
)

// Check if we have location permissions
if (!allLocationPermissionsState.allPermissionsGranted) {
  // Show a component to request permission from the user
  Column(
      horizontalAlignment = Alignment.CenterHorizontally,
      verticalArrangement = Arrangement.Center,
      modifier = Modifier
          .padding(horizontal = 36.dp)
          .clip(RoundedCornerShape(16.dp))
          .background(Color.White)
  ) {
      Text(
          modifier = Modifier.padding(top = 6.dp),
          textAlign = TextAlign.Center,
          text = "This app functions 150% times better with percise location permission enabled"
      )
      Button(modifier = Modifier.padding(top = 12.dp), onClick = {
          allLocationPermissionsState.launchMultiplePermissionRequest()
      }) {
          Text(text = "Grant Permission")
      }
  }
}
```



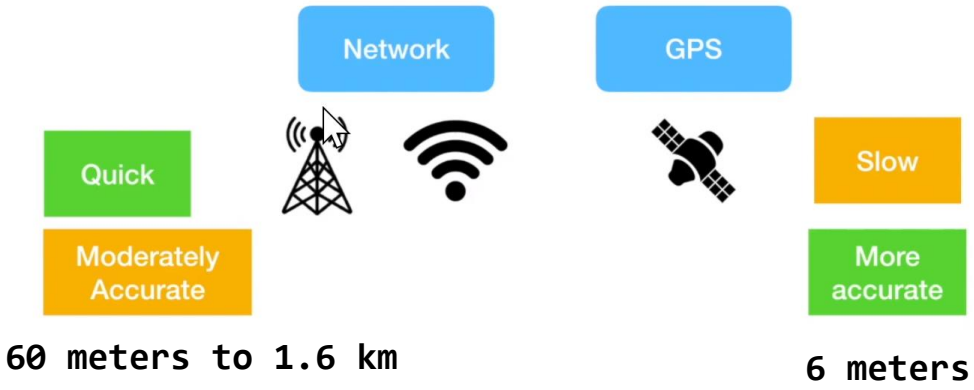
Drawing Shapes

```
Box(contentAlignment = Alignment.Center) {
    GoogleMap(
        modifier = Modifier.fillMaxSize(),
        cameraPositionState = cameraPositionState
    ) {
        Clustering(items = parkMarkers,
            onClusterClick = {
                // Handle when the cluster is tapped
                false
            }, onClusterItemClick = { marker ->
                // Handle when a marker in the cluster is tapped
                selectedMarker = marker
                false
            })

        parkMarkers.forEach {
            Circle(
                center = it.position,
                radius = 120.0,
                fillColor = Color.Green,
                strokeColor = Color.Green
            )
        }
    }
}
```



Get User Location

- Request last known location of the user's device
  - Location is determined by the **LocationServices** using WiFi & Cellular Tower and/or GPS (Global Positioning System)




```
val fusedLocationClient =
    LocationServices.getFusedLocationProviderClient(appContext)
val lastLocation = fusedLocationClient.lastLocation.await()
lastLocation?.let {
        val currentLocation = "Lat: ${it.latitude} & Long: ${it.longitude}"
        println(">> Debug: $currentLocation")
    }
}
```

Request location updates

- To get the location (latitude and longitude) of the device at regular intervals you can use `fusedLocationClient.requestLocationUpdates`
  - The location provider invokes the `LocationCallback.onLocationResult()` on a regular interval. The incoming argument contains a list `Location` object containing the location's latitude and longitude

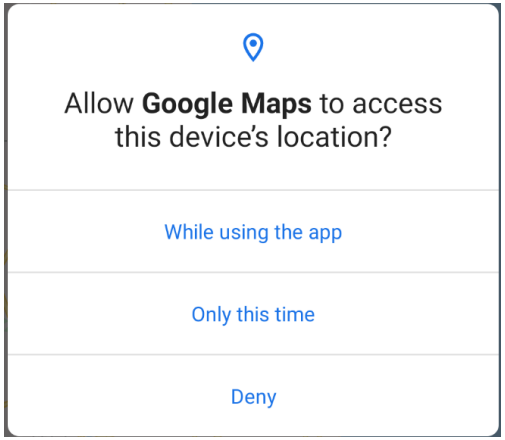
```
fun startLocationUpdates() {
    val locationRequest: LocationRequest = LocationRequest.create().apply {
        interval = 10000 // every 10 seconds
        priority = LocationRequest.PRIORITY_HIGH_ACCURACY
    }
    fusedLocationClient.requestLocationUpdates(
        locationRequest, locationCallback
    )
}
private val locationCallback = object : LocationCallback() {
    override fun onLocationResult(locationResult: LocationResult?) {
        locationResult ?: return
        locationResult.locations.forEach {
            deviceLocation = LatLng(it.latitude, it.longitude)
            println(">> Debug: Lat: ${it.latitude} & Long: ${it.longitude}")
        }
    }
}
```

Request Location Permission

- At runtime must ask for the permission to access the device's location using

```
rememberLauncherForActivityResult(
        ActivityResultContracts.RequestPermission())
```

```
// Register request permission callback, which handles the user's response to the system permission dialog
private val requestPermissionLauncher = rememberLauncherForActivityResult(
        ActivityResultContracts.RequestPermission())
    // Callback for the result from requesting permission
    { isGranted: Boolean ->
        if (isGranted) {
            // Permission is granted. Enable My Location button on the map
            mapViewModel.enableMyLocation()
        }
    }
...
// Ask for the permission to access the user's device location
// The registered call back gets the result of this request
requestPermissionLauncher.launch(Manifest.permission.ACCESS_FINE_LOCATION)
```

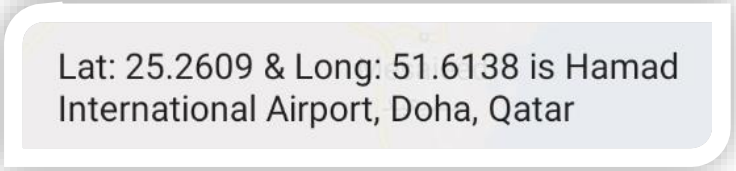


Geocoding

- **Geocoding** is the process of converting an address (e.g., location name or a street address) into geographic coordinates (lat, lng), which you can use to place markers on a map, or zoom to that location on the map


```
/*
    Geocoding = converting an address or location name (like a street address) into
    geographic coordinates (lat, lng)
*/
 private fun getGeoCoordinates(locationAddress: String): GeoLocation? {
    val geocoder = Geocoder(this)
    val coordinates = geocoder.getFromLocationName(locationAddress, 1)
    return if (coordinates != null && coordinates.size > 0) {
         val latitude = coordinates[0].latitude
         val longitude = coordinates[0].longitude
         GeoLocation(latitude, longitude)
    } else {
         null
    }
 }
```

Reverse Geocoding



- **Reverse geocoding** is the process of converting geographic coordinates (lat, lng) into a human-readable location address

```
/*
    Reverse geocoding = converting geographic coordinates (lat, lng)
    into a human-readable location address
*/
fun getLocation(lat: Double, lng: Double): Location? {
    val geocoder = Geocoder(appContext)
    val locations = geocoder.getFromLocation(lat, lng, 1)

    return if (locations!= null && locations.size > 0) {
        val name = locations[0]?.featureName ?: ""
        val city = locations[0]?.locality ?: ""
        val country = locations[0]?.countryName ?: ""
        Location(name, city, country, lat, lng)
    } else {
        null
    }
}
```

Resources

- Android Google Maps Codelab
  - https://developers.google.com/codelabs/maps-platform/maps-platform-101-android
  - https://codelabs.developers.google.com/codelabs/advanced-android-kotlin-training-maps
- Google Maps Android samples
  - https://github.com/googlemaps/android-samples
- Receive location updates in Android with Kotlin Codelab
  - https://codelabs.developers.google.com/codelabs/while-in-use-location/
- Adding geofencing to your map Codelab
  - https://developer.android.com/codelabs/advanced-android-kotlin-training-geofencing