

Lecture #12

Awareness and Nearby

Mobile Applications
Fall 2023

Google Awareness API

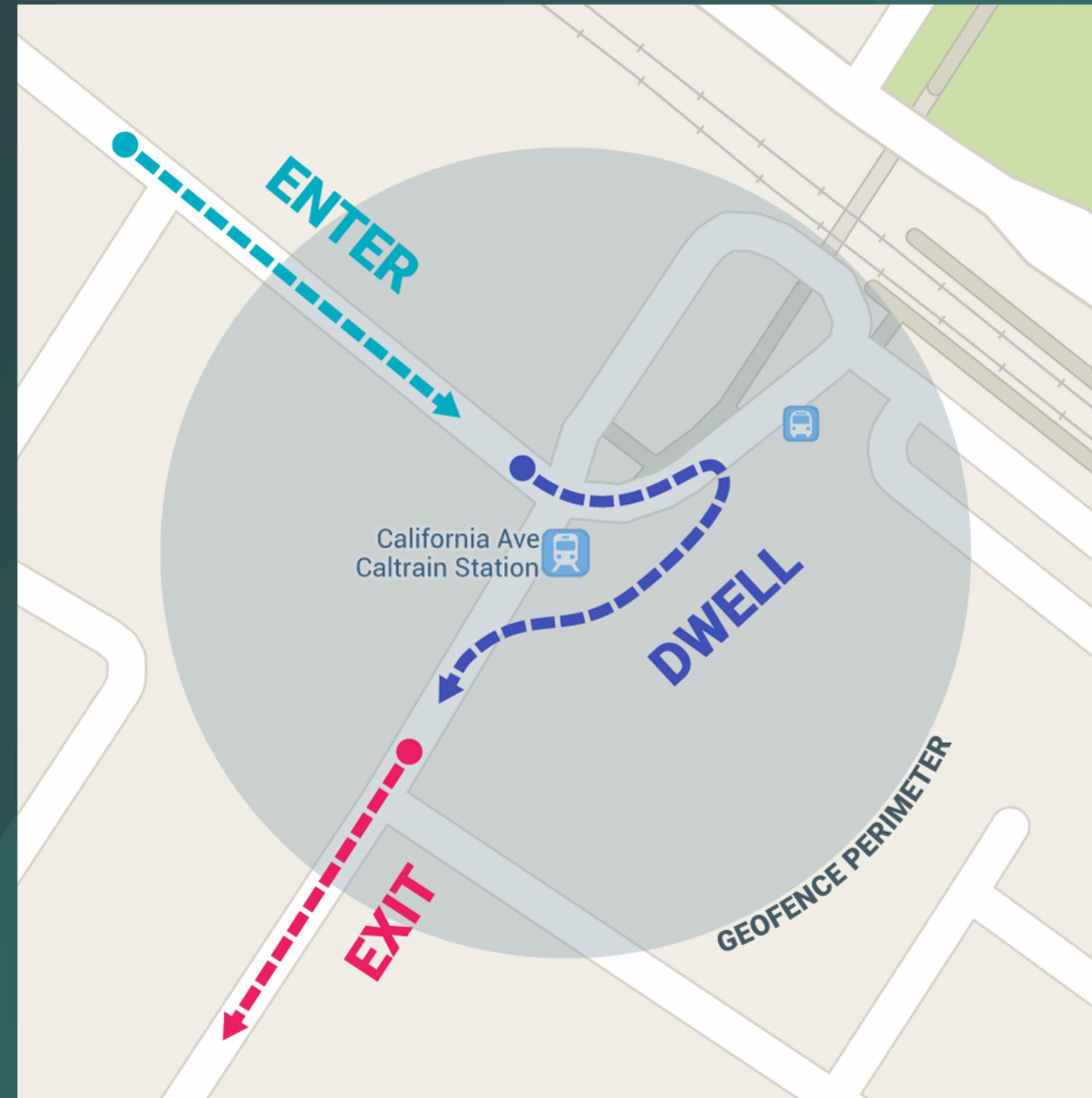
- Part of Google Play Services.
- Many signals, one API.
- High quality data.
- Smart battery savings.



Fence API



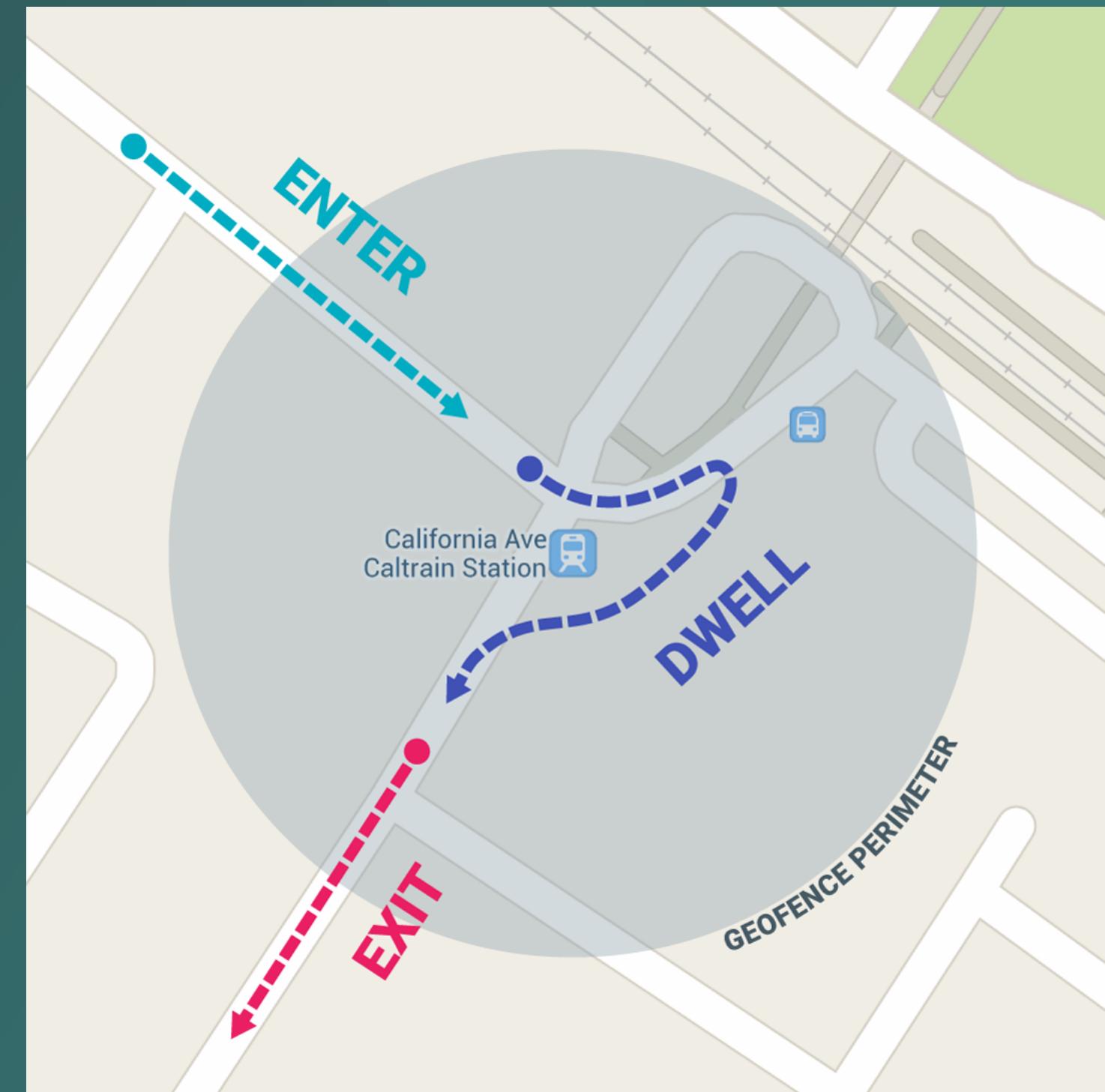
Fence API



Fence API



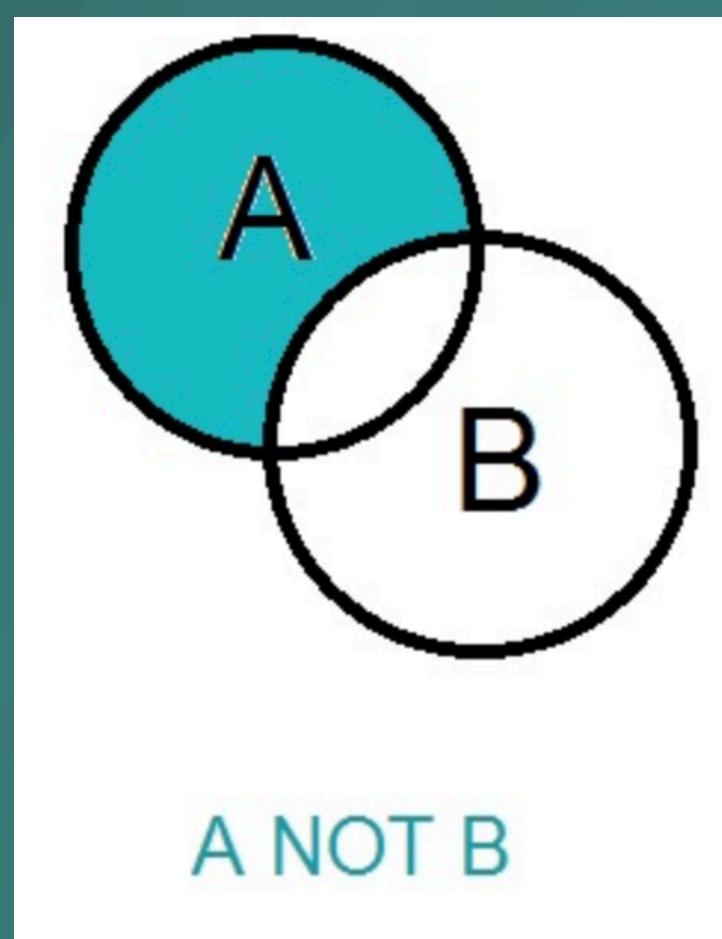
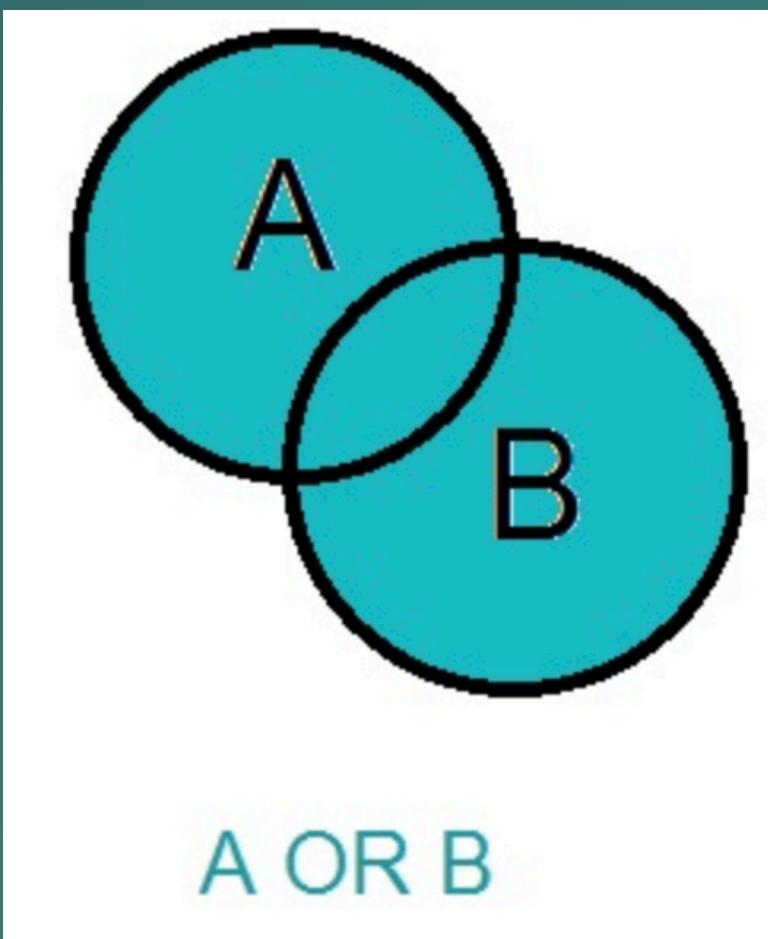
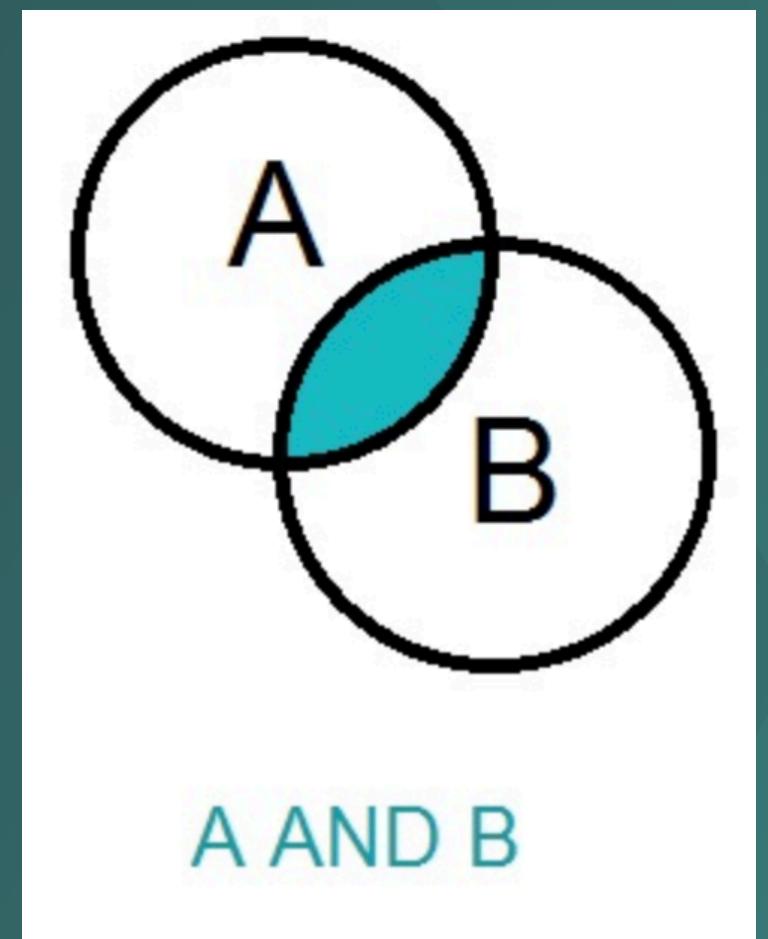
- The user's current location (lat/lng).
- The user's current activity (walking, driving, etc.).
- Device-specific conditions, such as whether the headphones are plugged in.
- Proximity to nearby beacons.



Fence API



- User plugs in headphones and starts walking.
- User enters a 100-meter geofence before 5 p.m. on a weekday.
- User enters range of a specific BLE beacon.



Configuration



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

<!-- Required if your app targets Android 10 (API level 29) or higher -->
<application android:allowBackup="true">
    <uses-permission android:name="android.permission.ACCESS_BACKGROUND_LOCATION"/>
    ...
    <receiver android:name=".GeofenceBroadcastReceiver"/>
</application>
```

Fence API



```
lateinit var geofencingClient: GeofencingClient

override fun onCreate(savedInstanceState: Bundle?) {
    // ...
    geofencingClient = LocationServices.getGeofencingClient(this)
}
```

Fence API



```
geofenceList.add(Geofence.Builder()
    // Set the request ID of the geofence. This is a string to identify this
    // geofence.
    .setRequestId(entry.key)
    // Set the circular region of this geofence.
    .setCircularRegion(
        entry.value.latitude,
        entry.value.longitude,
        Constants.GEOFENCE_RADIUS_IN_METERS
    )
    // Set the expiration duration of the geofence. This geofence gets automatically
    // removed after this period of time.
    .setExpirationDuration(Constants.GEOFENCE_EXPIRATION_IN_MILLISECONDS)
    // Set the transition types of interest. Alerts are only generated for these
    // transition. We track entry and exit transitions in this sample.
    .setTransitionTypes(Geofence.GEOFENCE_TRANSITION_ENTER or Geofence.GEOFENCE_TRANSITION_EXIT)
    // Create the geofence.
    .build())
```



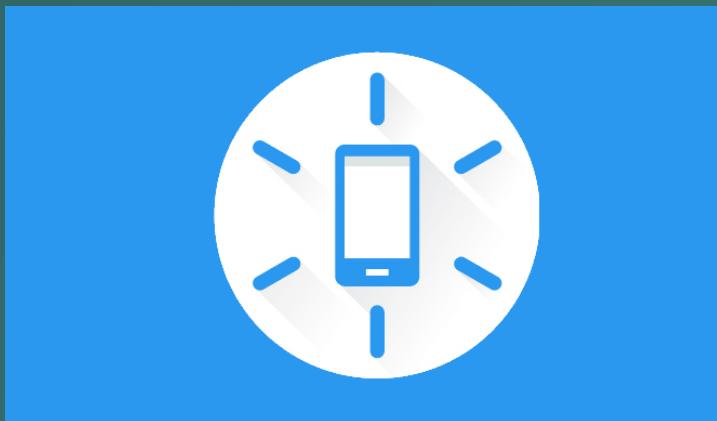
Note: On single-user devices, there is a limit of 100 geofences per app. For multi-user devices, the limit is 100 geofences per app per device user.

Fence API



```
private fun getGeofencingRequest(): GeofencingRequest {  
    return GeofencingRequest.Builder().apply {  
        setInitialTrigger(GeofencingRequest.INITIAL_TRIGGER_ENTER)  
        addGeofences(geofenceList)  
    }.build()  
}
```

Define a broadcast receiver



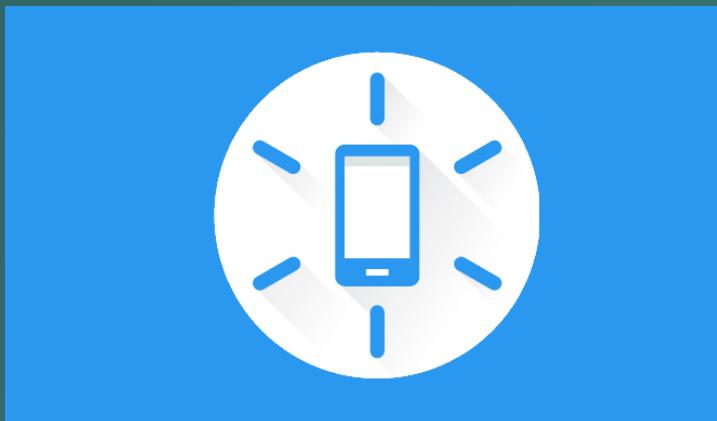
```
class MainActivity : AppCompatActivity() {  
    // ...  
    private val geofencePendingIntent: PendingIntent by lazy {  
        val intent = Intent(this, GeofenceBroadcastReceiver::class.java)  
        // We use FLAG_UPDATE_CURRENT so that we get the same pending intent back when calling  
        // addGeofences() and removeGeofences().  
        PendingIntent.getBroadcast(this, 0, intent, PendingIntent.FLAG_UPDATE_CURRENT)  
    }  
}
```

Connect the Pieces



```
geofencingClient?.addGeofences(getGeofencingRequest(), geofencePendingIntent)?.run {  
    addOnSuccessListener {  
        // Geofences added  
        // ...  
    }  
    addOnFailureListener {  
        // Failed to add geofences  
        // ...  
    }  
}
```

Handle Transitions



```
class GeofenceBroadcastReceiver : BroadcastReceiver() {  
    // ...  
    override fun onReceive(context: Context?, intent: Intent?) {  
        val geofencingEvent = GeofencingEvent.fromIntent(intent)  
        if (geofencingEvent.hasError()) {  
            val errorMessage = GeofenceErrorMessages.getErrorString(this,  
                geofencingEvent.errorCode)  
            Log.e(TAG, errorMessage)  
            return  
        }  
  
        // Get the transition type.  
        val geofenceTransition = geofencingEvent.geofenceTransition  
  
        // Test that the reported transition was of interest.  
        if (geofenceTransition == Geofence.GEOFENCE_TRANSITION_ENTER ||  
            geofenceTransition == Geofence.GEOFENCE_TRANSITION_EXIT) {  
  
            // Get the geofences that were triggered. A single event can trigger  
            // multiple geofences.
```

Stop Monitoring

DEMO

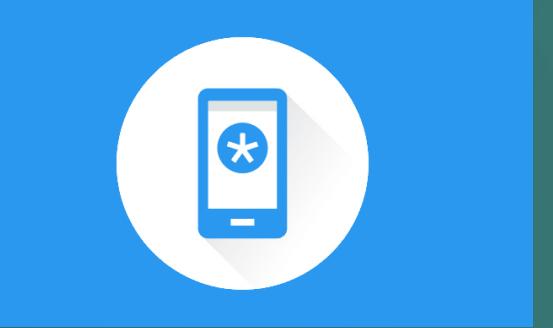


```
geofencingClient?.removeGeofences(geofencePendingIntent)?.run {  
    addOnSuccessListener {  
        // Geofences removed  
        // ...  
    }  
    addOnFailureListener {  
        // Failed to remove geofences  
        // ...  
    }  
}
```

Snapshot API



Snapshot API

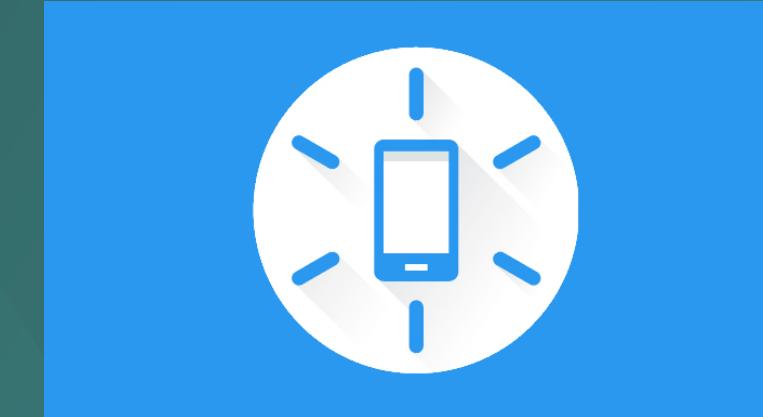


- Detected user activity, such as walking or driving.
- Nearby beacons that you have registered.
- Headphone state (plugged in or not).
- Location, including latitude and longitude.
- Place where the user is currently located.
- Weather conditions in the user's current location.



Get an API key from the Google Developers Console

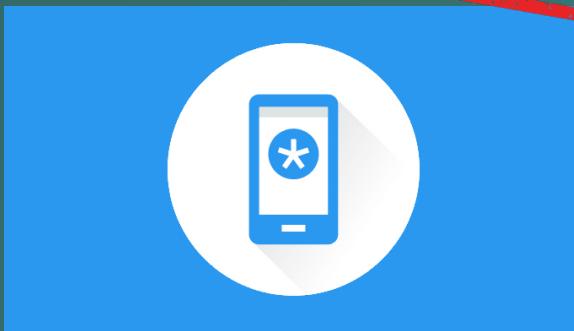
- Go to the Google Developers Console.
- Select a project, or create a new one.
- Click Continue to enable the Awareness API.
- On the Credentials page, create an Android key and set the API credentials.
- In the create key dialog, restrict your usage to Android apps—enter your app's SHA-1 fingerprint and package name.
- Click Create.



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DEMO

Snapshot API



```
Awareness.getSnapshotClient(this).detectedActivity
    .addOnSuccessListener { dar ->
        val arr = dar.activityRecognitionResult
        // getMostProbableActivity() is good enough for basic Activity detection.
        // To work within a threshold of confidence,
        // use ActivityRecognitionResult.getProbableActivities() to get a list of
        // potential current activities, and check the confidence of each one.
        val probableActivity = arr.mostProbableActivity

        val confidence = probableActivity.confidence
        val activityStr = probableActivity.toString()
        mLogFragment.logView.println("Activity: $activityStr,
            Confidence: $confidence/100")
    }
    .addOnFailureListener { e -> Log.e(TAG, "Could not detect activity: $e") }
```

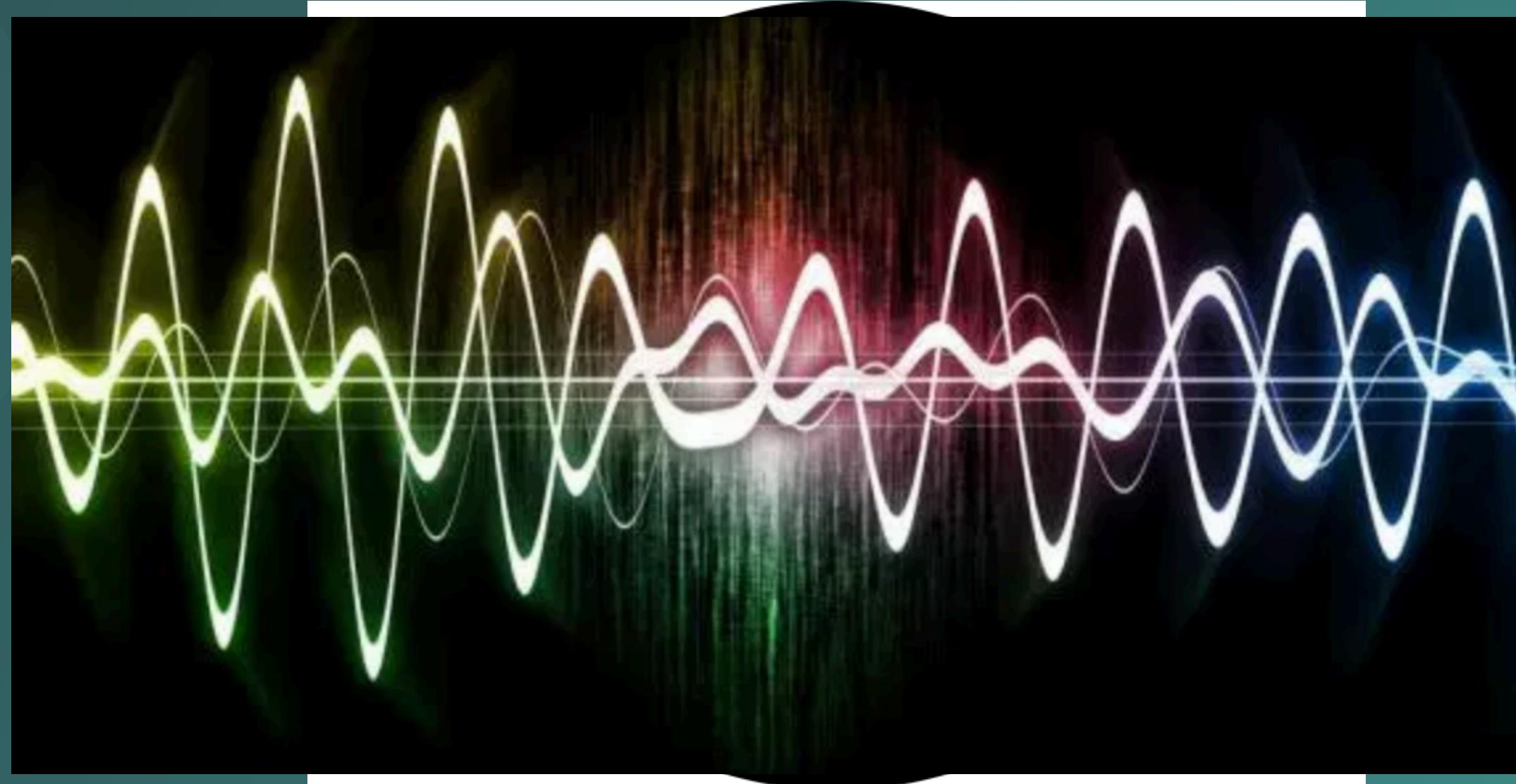
Nearby Messages API

- A Publish-Subscribe API.

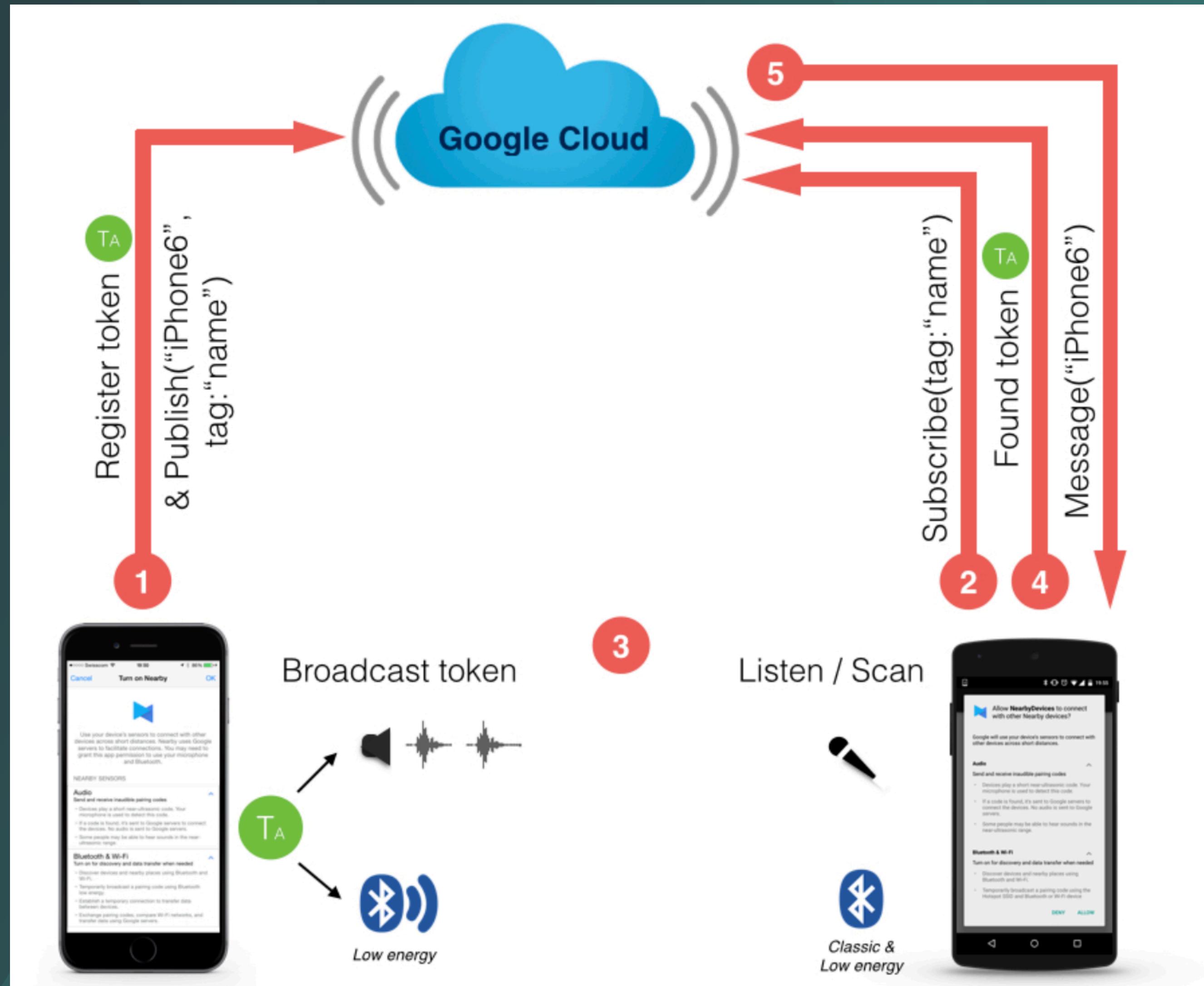


Nearby Messages API

- Bluetooth.
- Bluetooth Low Energy.
- Wi-Fi.
- Near-ultrasonic audio.



Nearby Messages API



Configuration

```
apply plugin: 'android'  
...  
  
dependencies {  
<manifest xmlns:android="http://schemas.android.com/apk/res/android"  
    package="com.google.sample.app" >  
    <application ...>  
        <meta-data  
            android:name="com.google.android.nearby.messages.API_KEY"  
            android:value="API_KEY" />  
        <activity>  
            ...  
        </activity>  
    </application>  
</manifest>
```

Publish and Subscribe

```
@Override  
public void onCreate(Bundle savedInstanceState) {  
    super.onCreate(savedInstanceState);  
    ...  
    mMessageListener = new MessageListener() {  
        @Override  
        public void onFound(Message message) {  
            Log.d(TAG, "Found message: " + new String(message.getContent()));  
        }  
  
        @Override  
        public void onLost(Message message) {  
            Log.d(TAG, "Lost sight of message: " + new String(message.getContent()));  
        }  
    }  
  
    mMessage = new Message("Hello World".getBytes());  
}  
  
@Override  
public void onStart() {
```

Handling User Consent

```
if (ContextCompat.checkSelfPermission(this,  
    Manifest.permission.ACCESS_FINE_LOCATION)  
    == PackageManager.PERMISSION_GRANTED) {  
    mMessagesClient = Nearby.getMessagesClient(this,  
        new MessagesOptions.Builder()  
        .setPermissions(NearbyPermissions.BLE)  
        .build());  
}
```



Bluetooth
SMART

Get Beacon Messages



```
public void onCreate(Bundle savedInstanceState) {  
    super.onCreate(savedInstanceState);  
    ...  
    mMessageListener = new MessageListener() {  
        @Override  
        public void onFound(Message message) {  
            Log.d(TAG, "Found message: " + new String(message.getContent()));  
        }  
        @Override  
        public void onLost(Message message) {  
            Log.d(TAG, "Lost sight of message: " + new String(message.getContent()));  
        }  
    }  
    // Subscribe to receive messages.  
    private void subscribe() {  
        Log.i(TAG, "Subscribing.");  
        SubscribeOptions options = new SubscribeOptions.Builder()  
            .setStrategy(Strategy.BLE_ONLY)  
            .build();  
        Nearby.getMessagesClient(this).subscribe(mMessageListener, options);  
    }  
}
```

Get Beacon Messages



Subscribe in the background

```
// Subscribe to messages in the background.  
private void backgroundSubscribe() {  
    Log.i(TAG, "Subscribing for background updates.");  
    SubscribeOptions options = new SubscribeOptions.Builder()  
        .setStrategy(Strategy.BLE_ONLY)  
        .build();  
    Nearby.getMessagesClient(this).subscribe(getPendingIntent(), options);  
}  
  
private PendingIntent getPendingIntent() {  
    return PendingIntent.getBroadcast(this, 0, new Intent(this,  
        BeaconMessageReceiver.class), PendingIntent.FLAG_UPDATE_CURRENT);  
}
```

DEMO

Get Beacon Messages



Subscribe in the background

```
@Override  
public void onReceive(Context context, Intent intent) {  
    Nearby.getMessagesClient(context).handleIntent(intent, new MessageListener() {  
        @Override  
        public void onFound(Message message) {  
            Log.i(TAG, "Found message via PendingIntent: " + message);  
        }  
  
        @Override  
        public void onLost(Message message) {  
            Log.i(TAG, "Lost message via PendingIntent: " + message);  
        }  
    });  
}
```

Lecture outcomes

- Create applications to be aware of multiple aspects of a user's context, while managing battery and memory health.
- React to changes in the user's environment.
- Get instant details about the user's current environment, by accessing 7 signals from one simple API surface.
- Create nearby notifications to help users discover what's around them.

