

What's new in Android



So... what is new?

What's new about What's New in Android?

Android 11

Tools

Libraries



Android 11 Meetups



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Agenda

1. UI
2. Privacy
3. Developer Goodies
4. Graphics & Media
5. ... more interesting stuff

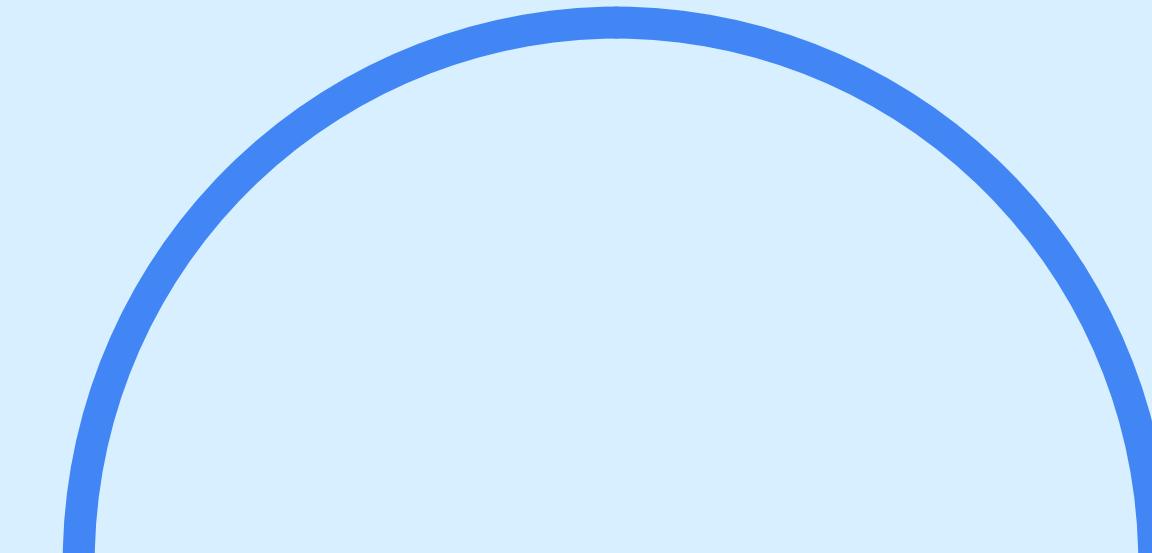


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UI



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Window Insets

- More information about the multiple types of content being displayed
 - Status, navigation, IME, ...

WindowInsets

```
// get WindowInsets object from listener  
view.setOnApplyWindowInsetsListener { view, insets ->  
  
}
```

WindowInsets

```
// get WindowInsets object from listener
view.setOnApplyWindowInsetsListener { view, insets ->

    // See if the IME is visible
    val imeVisible = insets.isVisible(WindowInsets.Type.ime())

}

}
```

WindowInsets

```
// get WindowInsets object from listener
view.setOnApplyWindowInsetsListener { view, insets ->

    // See if the IME is visible
    val imeVisible = insets.isVisible(WindowInsets.Type.ime())

    if (imeVisible) {
        val imeInsets = insets.getInsets(WindowInsets.Type.ime())
        // ...
    }
}
```



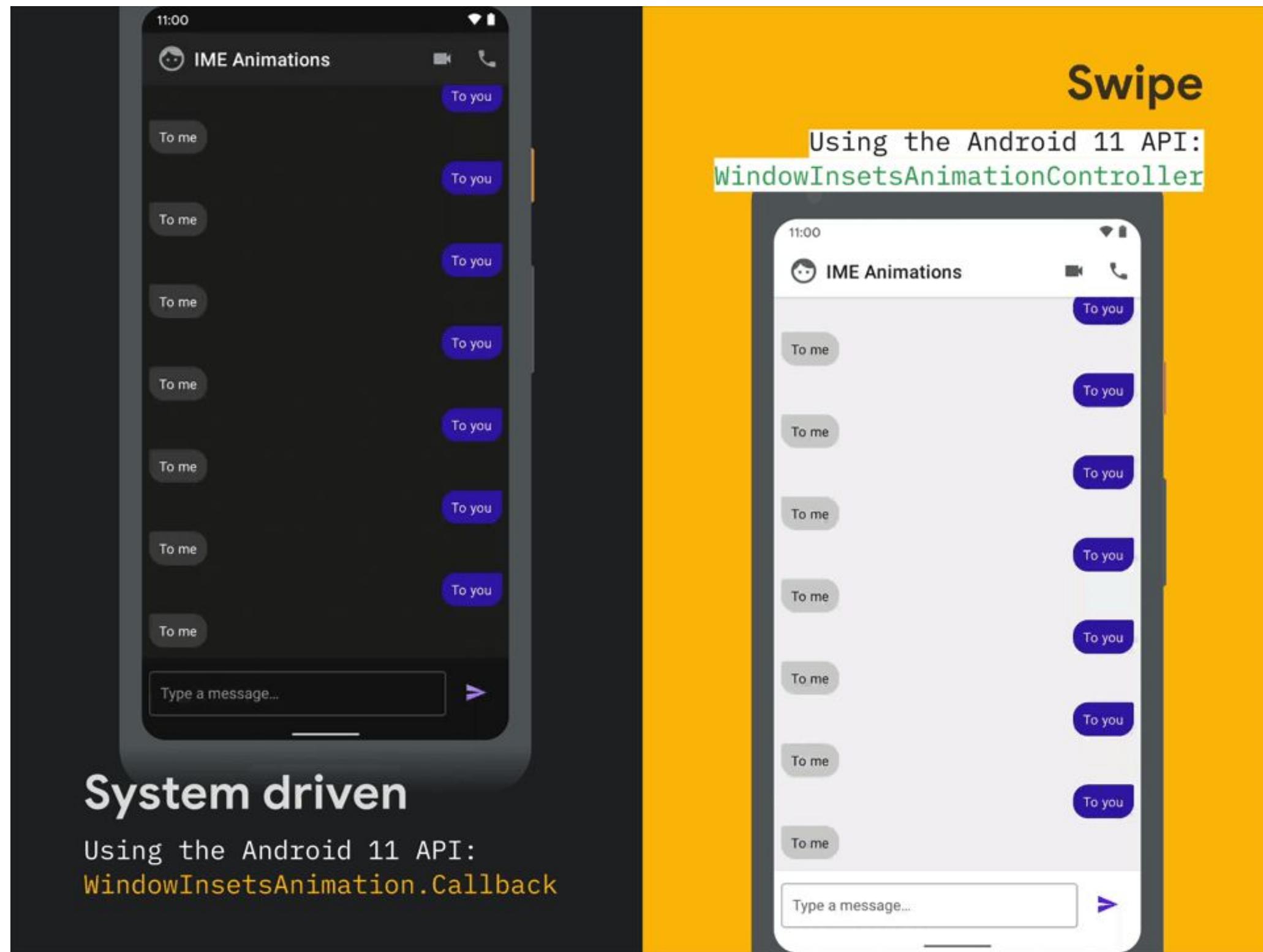
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IME Animations

- Synchronize keyboard animations with app content changes
 - Listen for changes
 - AND/OR
 - Drive keyboard animation directly

IME Animations



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IME Animations

Listening for keyboard changes

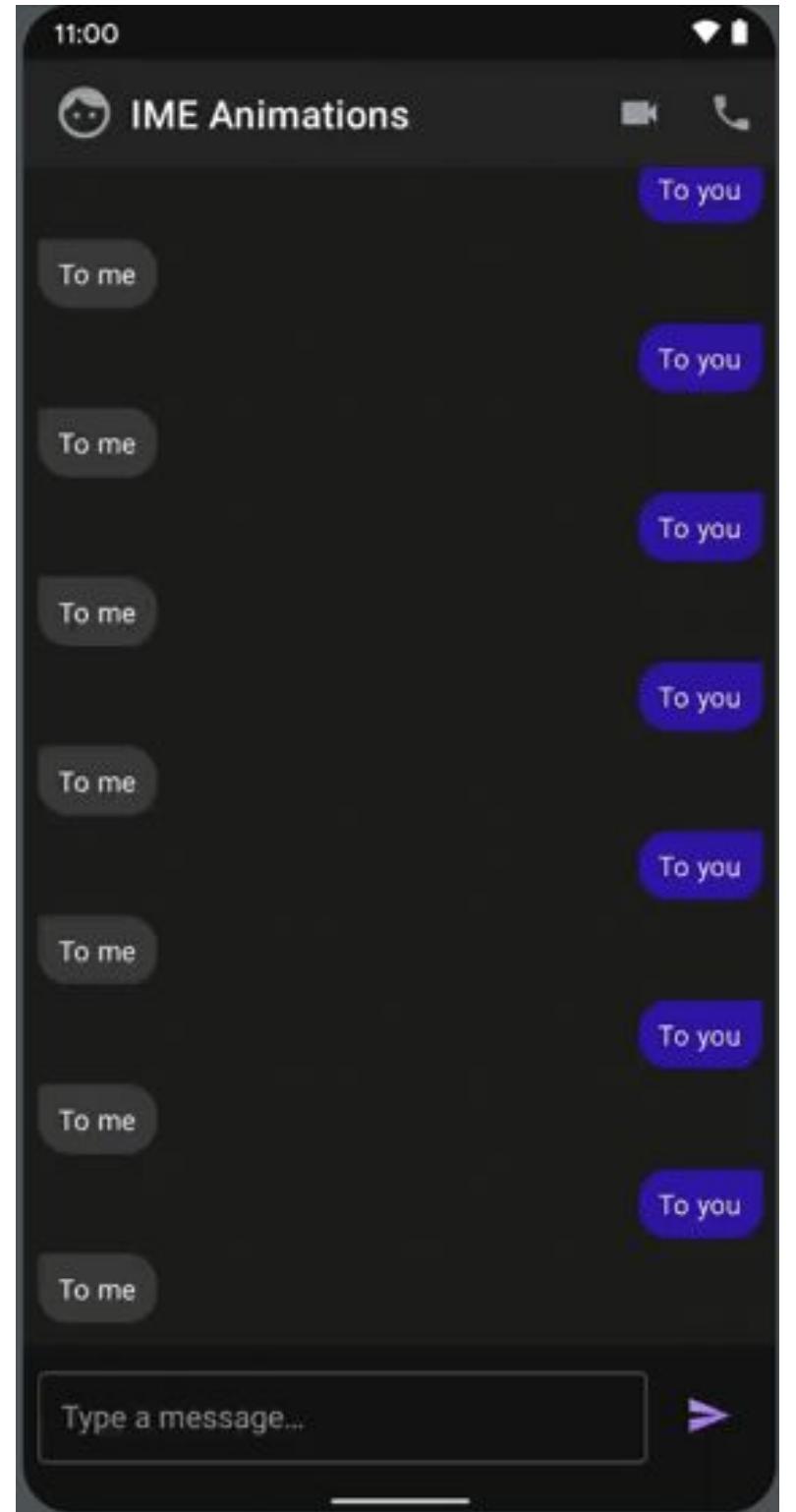
```
editText.setWindowInsetsAnimationCallback(animCallback)

val animCallback = object : WindowInsetsAnimation.Callback(DISPATCH_MODE_STOP) {
    override fun onProgress(p0: WindowInsets, p1: MutableList<WindowInsetsAnimation>)
        : WindowInsets {
        ...
    }

    // Optional overrides
    override fun onPrepare(animation: WindowInsetsAnimation) { ... }

    override fun onEnd(animation: WindowInsetsAnimation) { ... }

    override fun onStart(animation: WindowInsetsAnimation,
        bounds: WindowInsetsAnimation.Bounds
    ): WindowInsetsAnimation.Bounds { ... }
}
```



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IME Animations

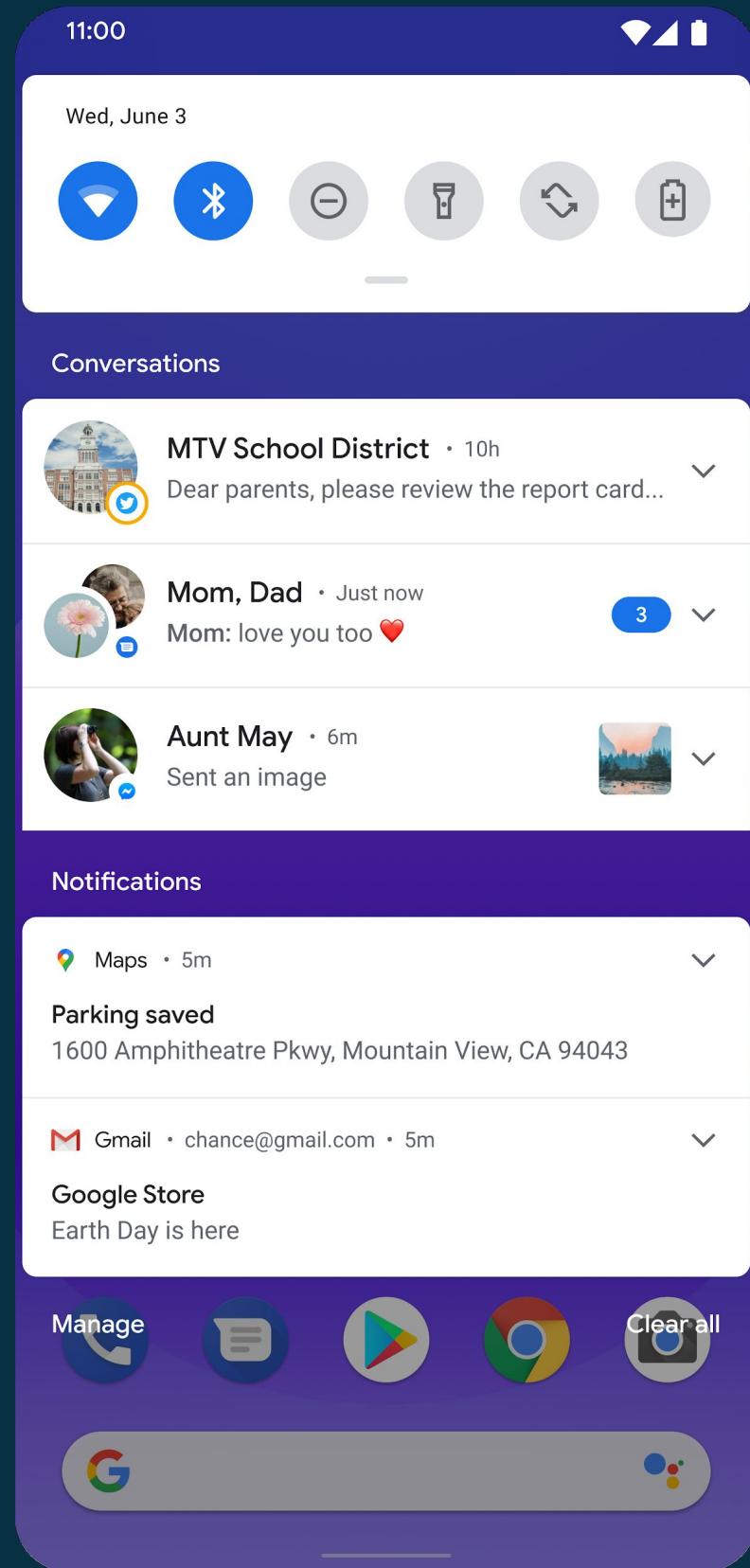
Animating the keyboard directly

```
editText.windowInsetsController?.  
    controlWindowInsetsAnimation(  
        WindowInsets.Type.ime(), /* animate the keyboard */  
        -1, /* infinite duration */  
        linearInterpolator, /* linear motion */  
        cancellationSignal, /* allows cancellation */  
        animationControlListener /* ready/cancelled/finished */  
)
```



WindowInsetsAnimation app:
[goo.gle/insetsanimsample](https://goo.gl/insetsanimsample)

Conversations



Conversations

```
// Create and post shortcut  
  
val person = Person.Builder().build()
```

Conversations

```
// Create and post shortcut

val person = Person.Builder().build()
val shortcutInfo = ShortcutInfoCompat.Builder(this, "sampleShortcut").
    setPerson(person).
    setLongLived(true).
    // ...
    build()
```



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Conversations

```
// Create and post shortcut

val person = Person.Builder().build()
val shortcutInfo = ShortcutInfoCompat.Builder(this, "sampleShortcut") .
    setPerson(person) .
    setLongLived(true) .
    // ...
    build()
ShortcutManagerCompat.pushDynamicShortcut(shortcutInfo)
```

Conversations

```
// Create and post shortcut

val person = Person.Builder().build()
val shortcutInfo = ShortcutInfoCompat.Builder(this, "sampleShortcut") .
    setPerson(person) .
    setLongLived(true) .
    // ...
    build()
ShortcutManagerCompat.pushDynamicShortcut(shortcutInfo)
```

```
// Create notification with shortcut
```

```
val style = NotificationCompat.MessagingStyle(person) .
    addMessage(...) .
    // ...
```



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Conversations

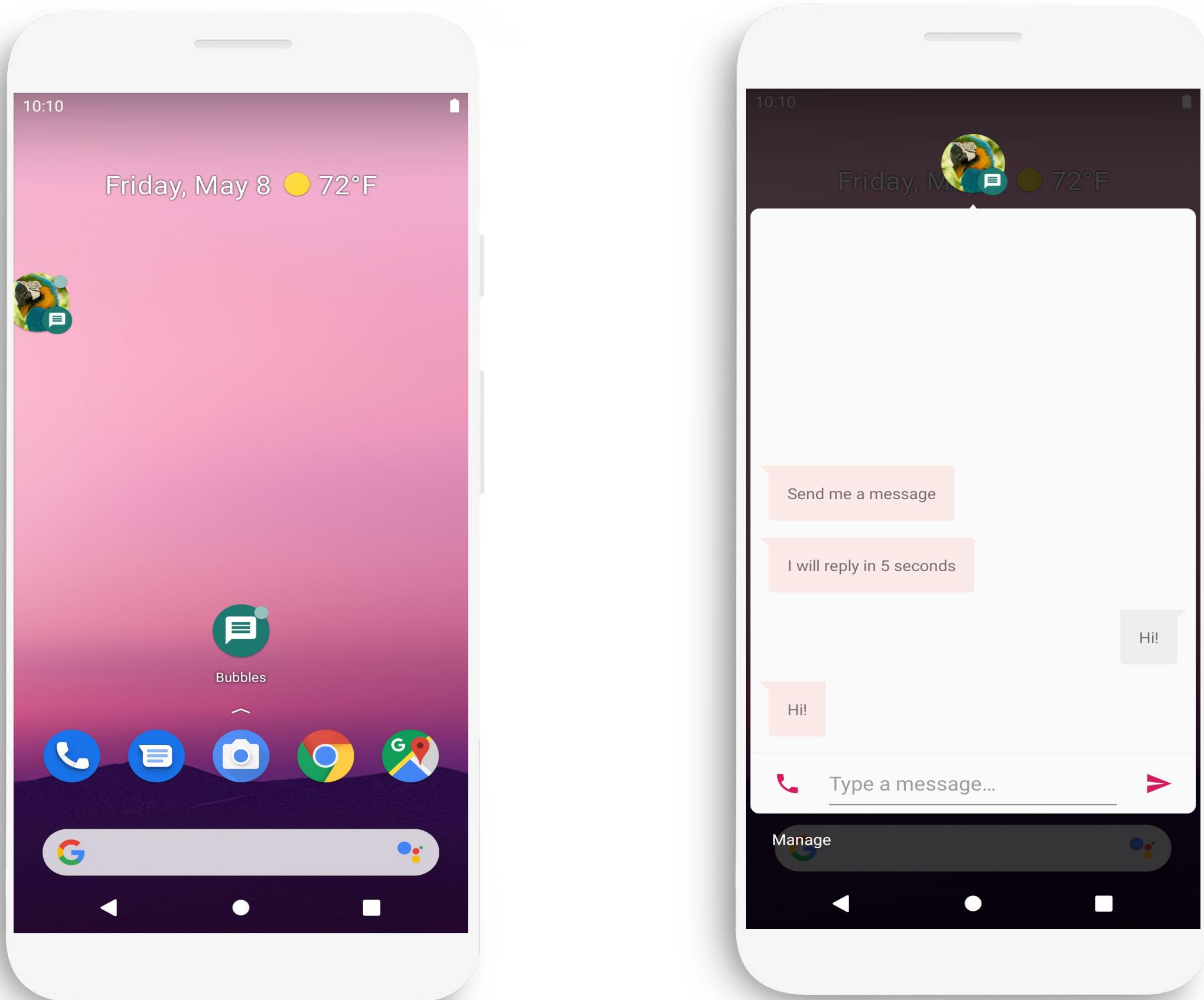
```
// Create and post shortcut

val person = Person.Builder().build()
val shortcutInfo = ShortcutInfoCompat.Builder(this, "sampleShortcut") .
    setPerson(person) .
    setLongLived(true) .
    // ...
    build()
ShortcutManagerCompat.pushDynamicShortcut(shortcutInfo)
```

```
// Create notification with shortcut
```

```
val style = NotificationCompat.MessagingStyle(person) .
    addMessage(...).
    // ...
NotificationCompat.Builder(this, "foo") .
    setShortcutId(shortcutInfo.id) .
    // ...
    build()
```

Bubbles



Bubbles

- Notifications that can *also* show as bubbles
- Android 10: Developer option
 - Android 11: They're here!
- Better than System Alert Window!
- Created with Notification API
 - with more metadata
 - and dedicated activity



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Bubbles: Manifest

Manifest:

```
<activity  
    android:name=".bubbles.BubbleActivity"  
    android:theme="@style/AppTheme.NoActionBar"  
    android:label="@string/title_activity_bubble"  
    android:resizeableActivity="true"  
/>
```

Bubbles: Code

```
// Create Intent to launch  
val intent = Intent(context, BubbleActivity::class.java)  
val bubbleIntent = PendingIntent.getActivity(context, 0, intent, ...)
```

Bubbles: Code

```
// Create Intent to launch  
val intent = Intent(context, BubbleActivity::class.java)  
val bubbleIntent = PendingIntent.getActivity(context, 0, intent, ...)  
  
// Create metadata  
val shortcutInfo = ... /* probably already using for notifications */  
val bubbleMetadata = Notification.BubbleMetadata.Builder(shortcutInfo.id)
```

Bubbles: Code

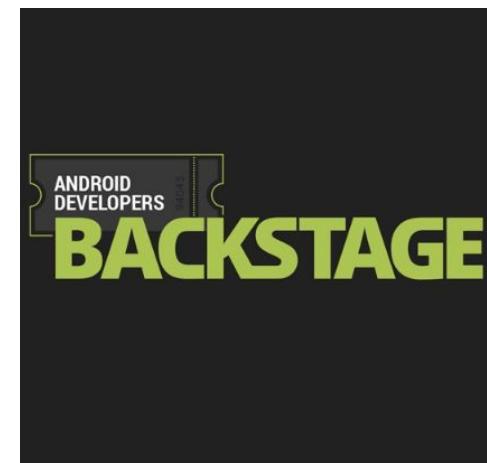
```
// Create Intent to launch
val intent = Intent(context, BubbleActivity::class.java)
val bubbleIntent = PendingIntent.getActivity(context, 0, intent, ...)

// Create metadata
val shortcutInfo = ... /* probably already using for notifications */
val bubbleMetadata = Notification.BubbleMetadata.Builder(shortcutInfo.id)

// Create Notification with metadata
val builder: Notification.Builder =
    Notification.Builder(context, CHANNEL_ID)
    // ...
    .setBubbleMetadata(bubbleMetadata)
    .setCategory(...)
    .setShortcutId(...)
```

What's new in System UI

Android Samples on Github:
[user-interface-samples/ BubblesKotlin](https://github.com/AndroidDeveloperSamples/user-interface-samples/tree/main/BubblesKotlin)



140: Bubbles!



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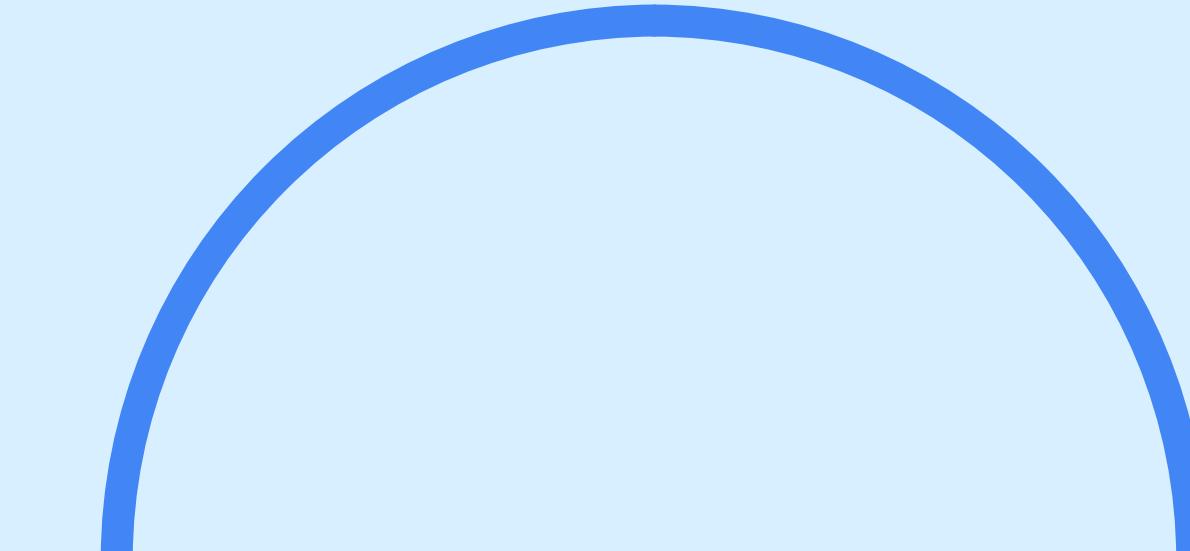


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Privacy

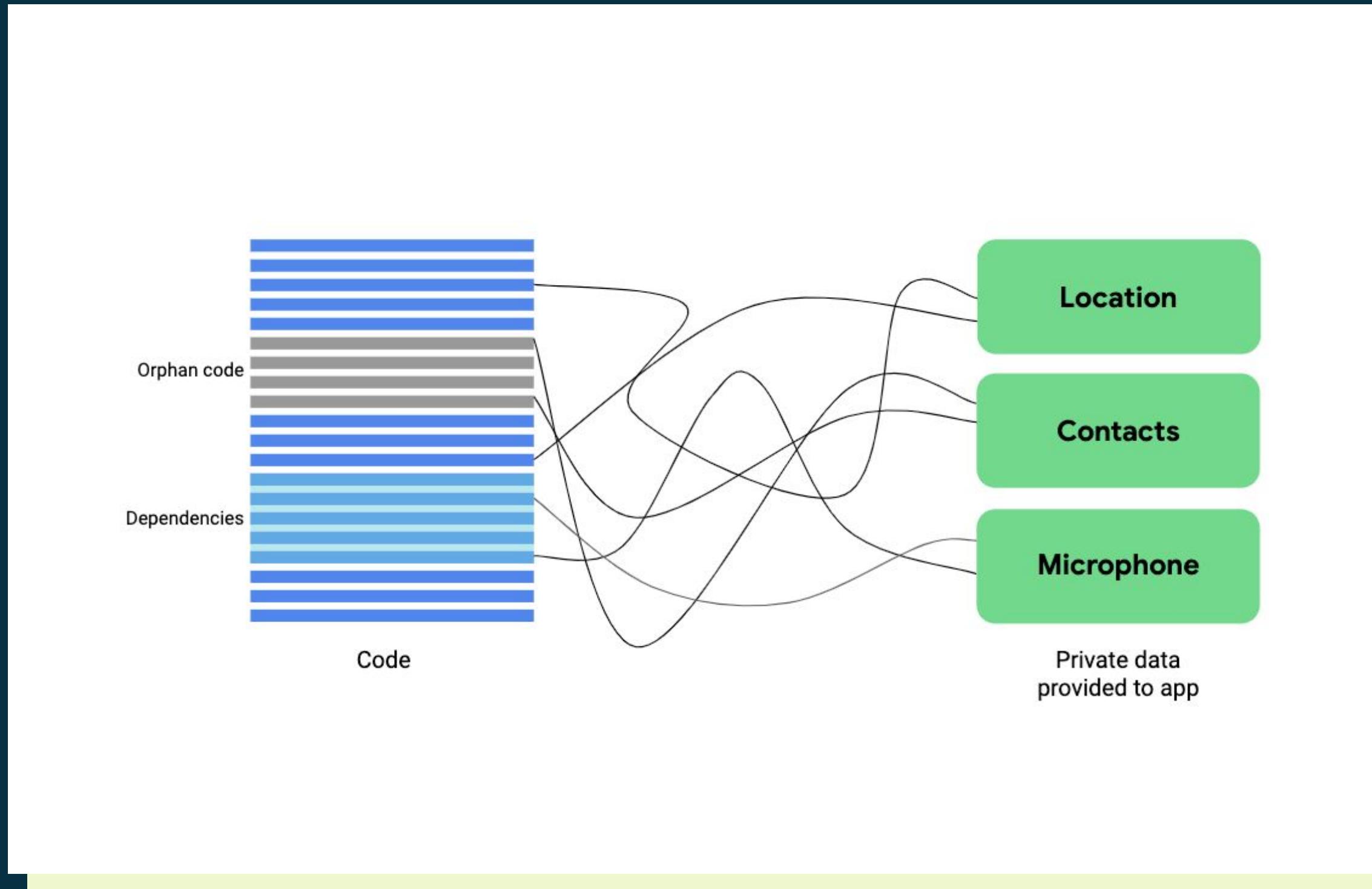
Android 11 [REDACTED] of [REDACTED] and
[REDACTED] features, [REDACTED] and [REDACTED]
[REDACTED] by [REDACTED]
[REDACTED] of [REDACTED] more
[REDACTED] to the [REDACTED]



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Data Access Auditing



Data Access Auditing

- Callbacks invoked when user-permission-required data is accessed

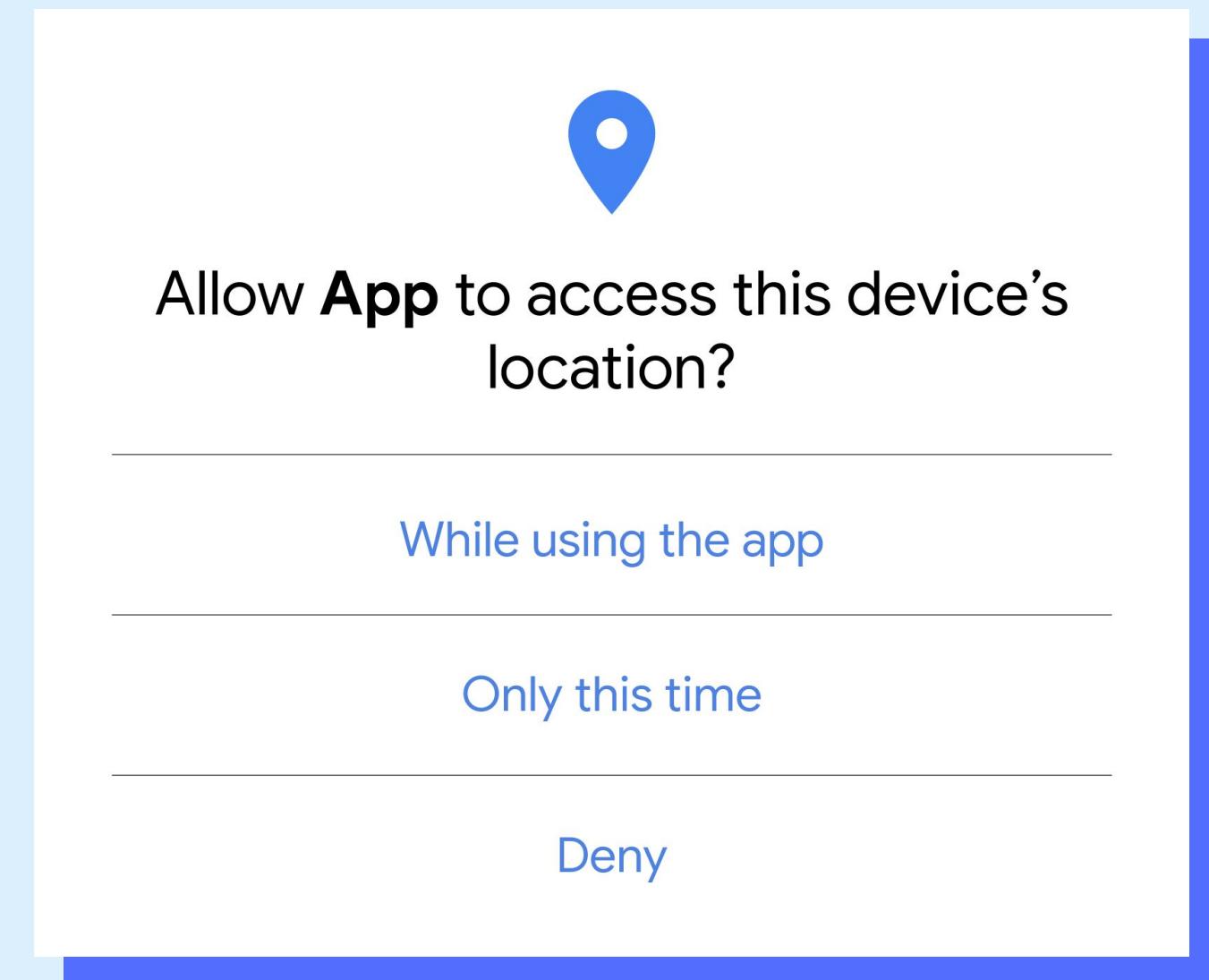
Data Access Auditing

```
val appOpsCallback = object : AppOpsManager.OnOpNotedCallback() {  
    override fun onNoted(syncNotedAppOp: SyncNotedAppOp) { ... }  
    override fun onSelfNoted(syncNotedAppOp: SyncNotedAppOp) { ... }  
    override fun onAsyncNoted(asyncNotedAppOp: AsyncNotedAppOp) { ... }  
}
```

Data Access Auditing

```
val appOpsCallback = object : AppOpsManager.OnOpNotedCallback() {  
  
    override fun onNoted(syncNotedAppOp: SyncNotedAppOp) { ... }  
  
    override fun onSelfNoted(syncNotedAppOp: SyncNotedAppOp) { ... }  
  
    override fun onAsyncNoted(asyncNotedAppOp: AsyncNotedAppOp) { ... }  
}  
  
val appOpsManager =  
    getSystemService(AppOpsManager::class.java) as AppOpsManager  
appOpsManager.setOnOpNotedCallback(mainExecutor, appOpsCallback)
```

One-Time Permissions

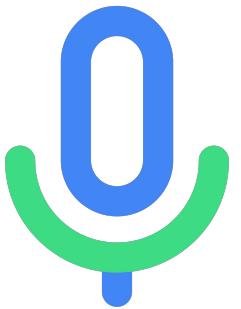


Background Location

- More restrictive in Android 11
- First, request foreground permission
- **Then** request background permission
 - Takes user to Settings

Foreground Services

- Android 10 required manifest attribute for Location
- Android 11 adds
 - Camera
 - Microphone



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Foreground Service Type

```
<manifest>
    ...
    <service ... android:foregroundServiceType="camera|microphone" />
    ...
</manifest>
```



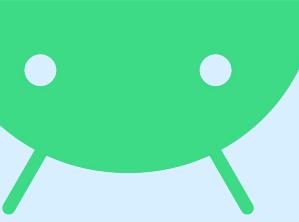
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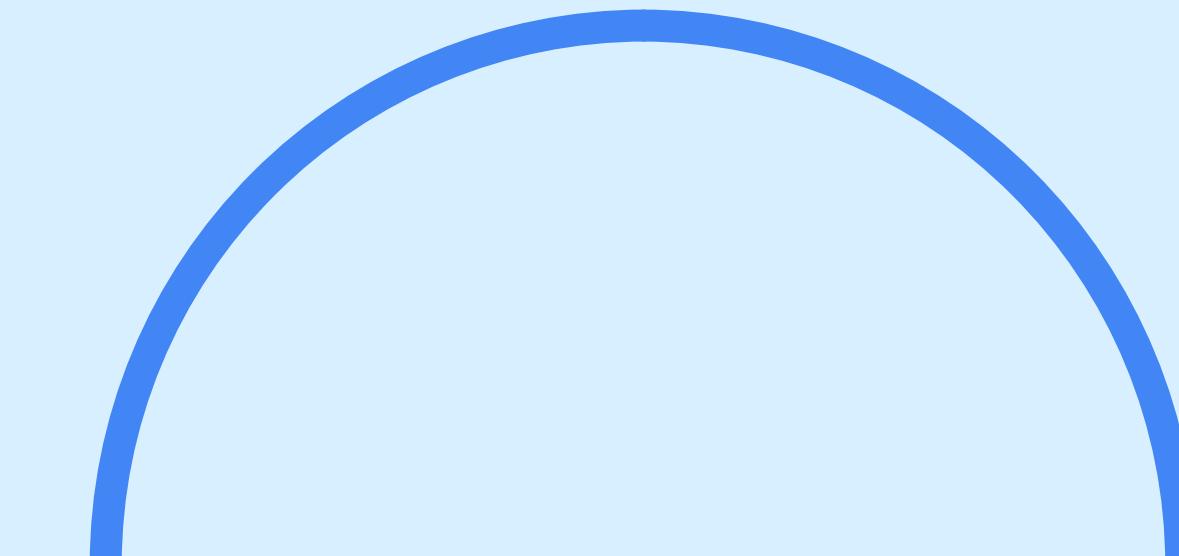
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But Wait, There's More!

- Package visibility restrictions
- Scoped storage
- Auto-reset permissions



Developer Goodies

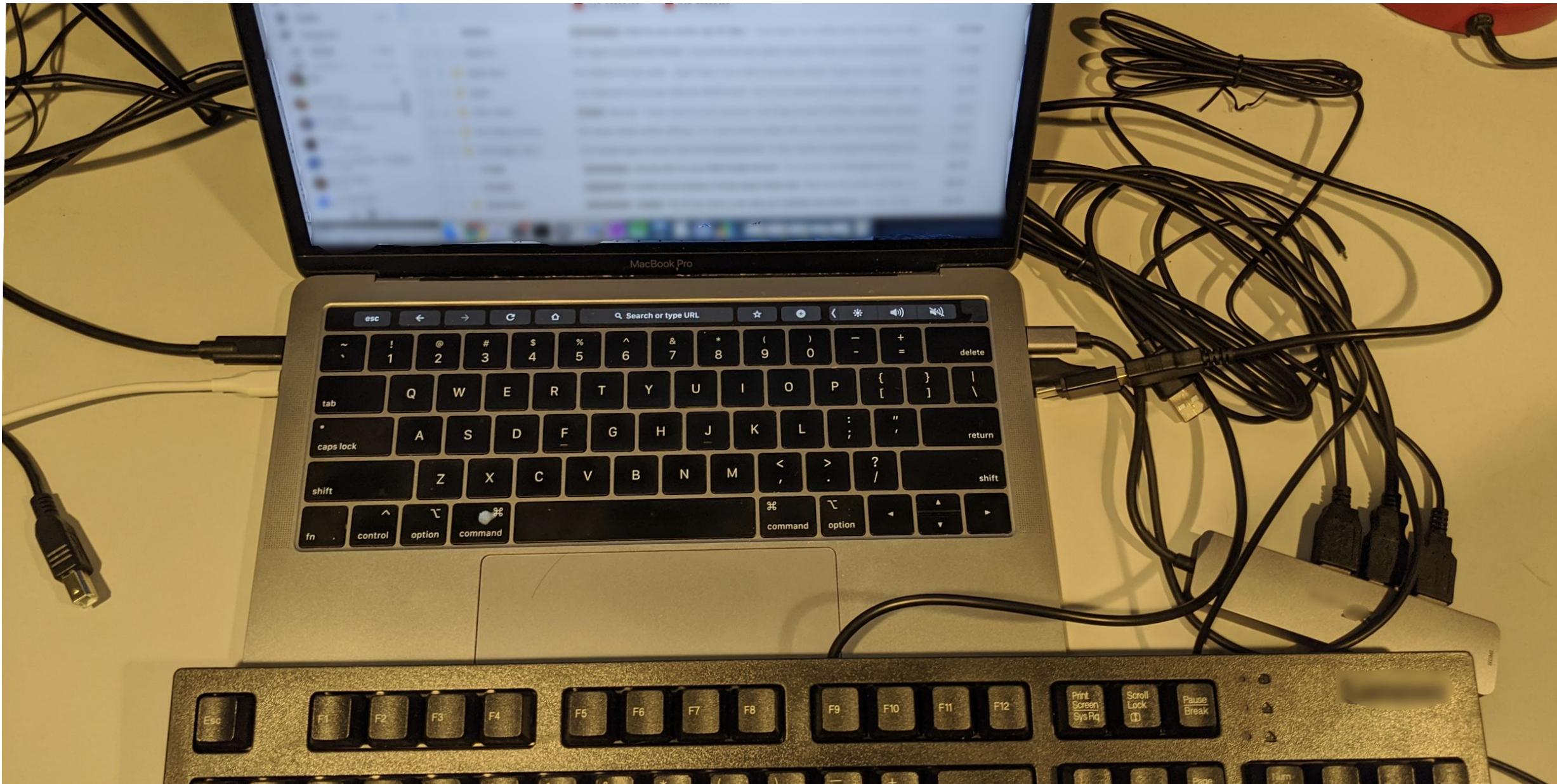


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Wi-Fi Debugging

Because there are *never* enough USB ports

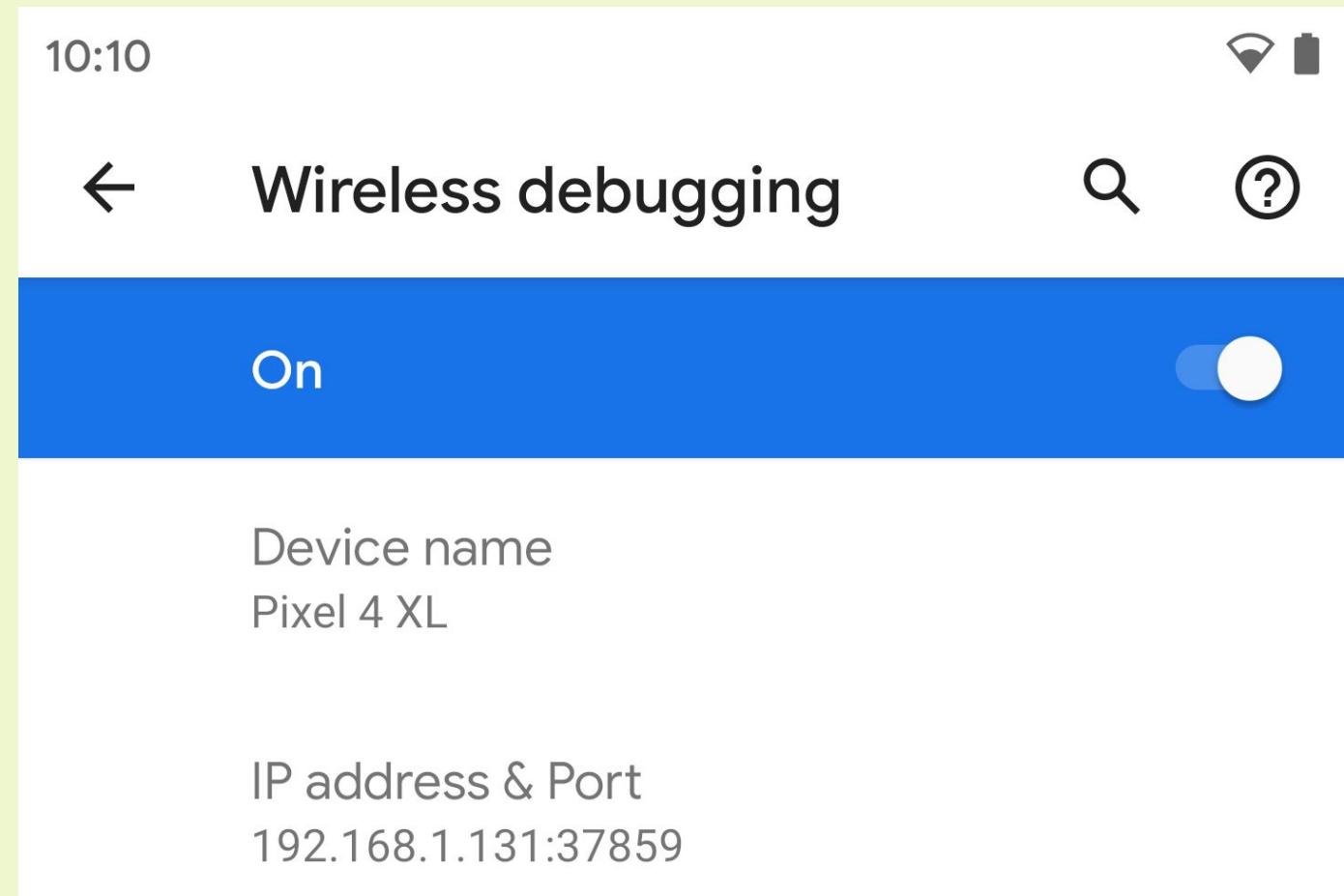


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Wi-Fi Debugging

Because there are *never* enough USB ports



Nullability Annotations

- @RecentlyNullable, @RecentlyNonNull
 - Warnings
- @Nullable, @NonNull
 - Errors

Crash Reasons Reporting

- API to query why your app crashed
 - Upload reports

Crash Reasons Querying

```
// Returns List of ApplicationExitInfo  
val reasonsList = activityManager.getHistoricalProcessExitReasons(  
    packageName, pid /* 0 for all matches */, max /* 0 for all */)
```



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Crash Reasons Querying

```
// Returns List of ApplicationExitInfo
val reasonsList = activityManager.getHistoricalProcessExitReasons(
    packageName, pid /* 0 for all matches */, max /* 0 for all */)

for (info in reasonsList) {
    // Log/store/upload info.reason
    // REASON_LOW_MEMORY, REASON_CRASH, REASON_ANR, etc.
}
```

GWP-ASan

- Android 10: HWASan
 - Memory issue debugging
- GWP-ASan
 - Catches memory issues (for native apps)
 - On user devices in the field
 - Low overhead (runtime and memory)
 - Reports uploaded to Play dashboard

GWP-ASan

```
<application android:gwpAsanMode="always">  
    ...  
</application>
```

GWP-ASan

```
<application android:gwpAsanMode="always">  
    ...  
</application>
```

// Bad memory access caught by GWP-ASan triggers exit + report



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ADB Incremental

- Faster installs via command-line
- For huge APKs (think: games)
- Up to 10x faster

ADB Incremental

```
// First: sign APK, create APK Signature Scheme v4 file  
  
// Then, run ADB incremental  
$ adb install --incremental
```



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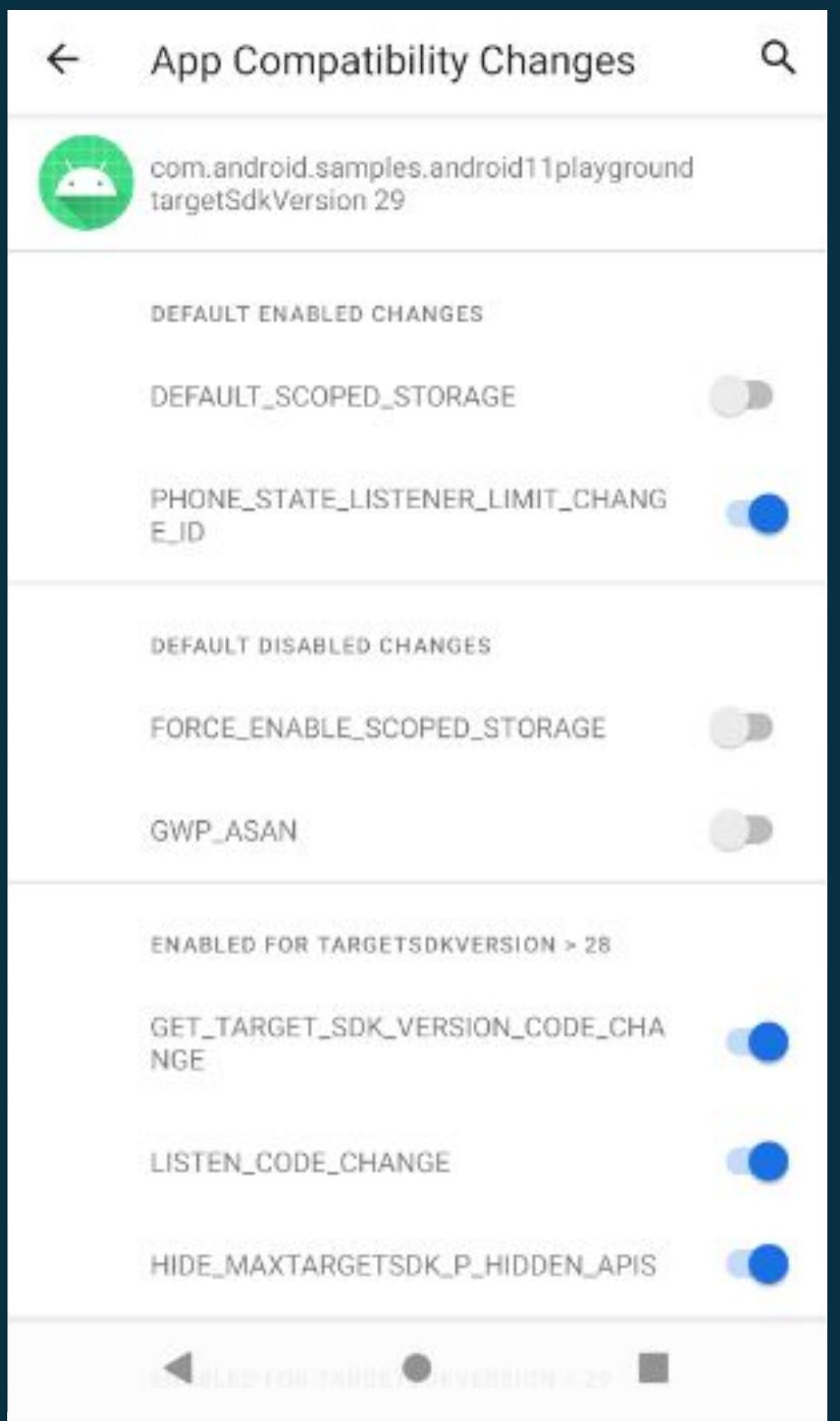
Behavior Changes

- Most changes limited to targetSdk R
- Test changes with behavior toggles
 - Command-line
 - New Developer Options panel

Toggling Behavior Changes

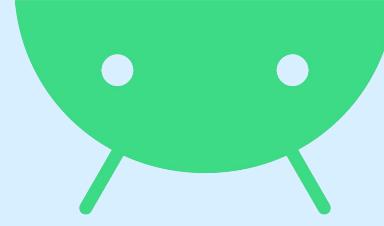
```
// adb shell am compat (enable|disable) (CHANGE_ID|CHANGE_NAME) \
PACKAGE_NAME
```

```
$ adb shell am compat disable DEFAULT_SCOPED_STORAGE \
com.android.samples.android11playground
```

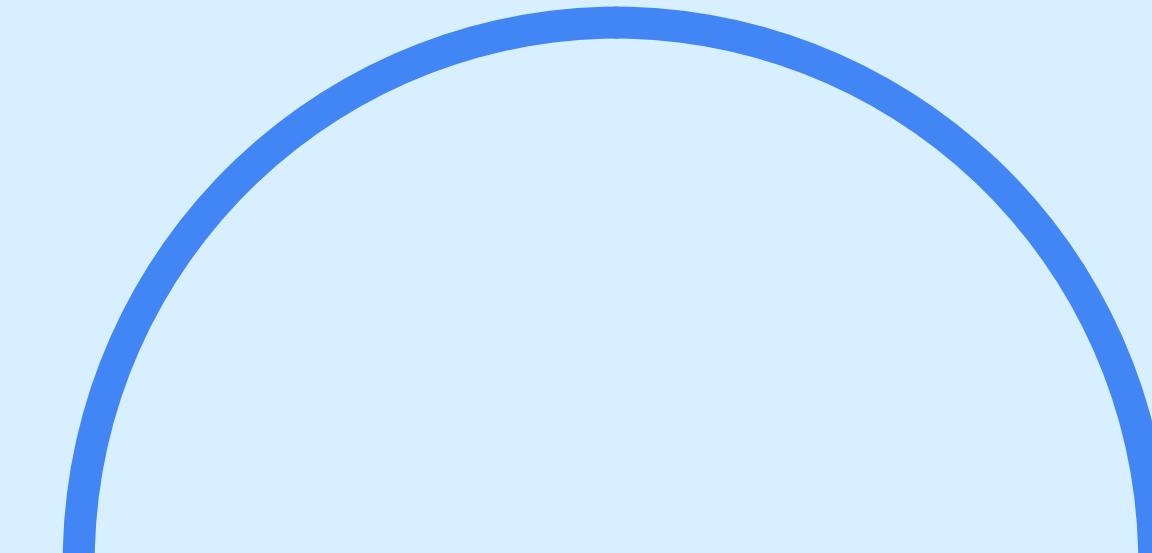


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Graphics & Media



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NDK Image Decoders

- All decoders available from native code
 - JPEG, GIF, PNG, WebP, ...
- No more
 - JNI up-calling
 - Bundling decoder libraries
 - Bulking APK size

NDK ImageDecoder

```
/* Create a decoder. */
AImageDecoder* decoder = nullptr;
AImageDecoder_createFromAAsset(assetDescriptor, &decoder);
```



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NDK ImageDecoder

```
/* Create a decoder. */
AImageDecoder* decoder = nullptr;
AImageDecoder_createFromAAsset(assetDescriptor, &decoder);

/* Set up the target format */
AImageDecoder_setAndroidBitmapFormat(decoder, ANDROID_BITMAP_FORMAT_RGBA_8888);
```

NDK ImageDecoder

```
/* Create a decoder. */
AImageDecoder* decoder = nullptr;
AImageDecoder_createFromAAsset(assetDescriptor, &decoder);

/* Set up the target format */
AImageDecoder_setAndroidBitmapFormat(decoder, ANDROID_BITMAP_FORMAT_RGBA_8888);

/* Create a buffer for the decoded image */
const AImageDecoderHeaderInfo* headerInfo = AImageDecoder_getHeaderInfo(decoder);
int32_t height = AImageDecoderHeaderInfo_getHeight(headerInfo);
size_t stride = AImageDecoder_getMinimumStride(decoder);
std::vector<uint8_t> bits (height * stride);
```

NDK ImageDecoder

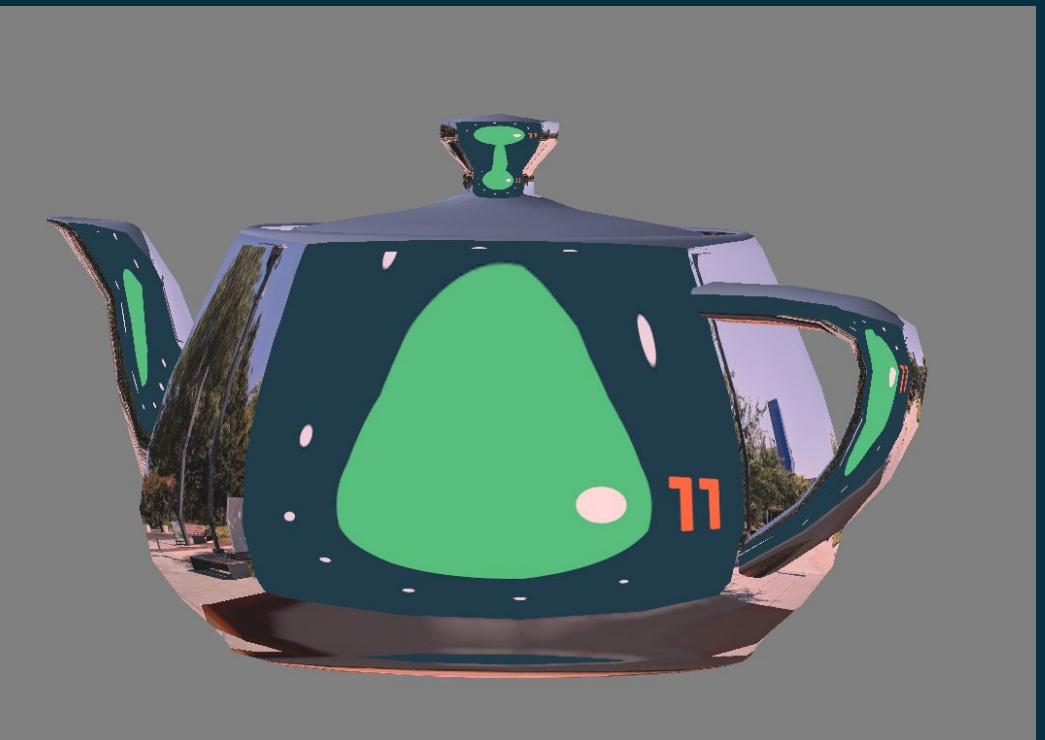
```
/* Create a decoder. */
AImageDecoder* decoder = nullptr;
AImageDecoder_createFromAAsset(assetDescriptor, &decoder);

/* Set up the target format. */
AImageDecoder_setAndroidBitmapFormat(decoder, ANDROID_BITMAP_FORMAT_RGBA_8888);

/* Create a buffer for the decoded image */
const AImageDecoderHeaderInfo* headerInfo = AImageDecoder_getHeaderInfo(decoder);
int32_t height = AImageDecoderHeaderInfo_getHeight(headerInfo);
size_t stride = AImageDecoder_getMinimumStride(decoder);
std::vector<uint8_t> bits (height * stride);

/* Decode! */
AImageDecoder_decodeImage(decoder, bits.data(), stride, bits.size());
```

github.com/android/ndk-samples



Animated HEIF

- Load animated images from HEIF files
- Loaded as AnimatedImageDrawable
 - Like animated GIFs
 - But smaller!

Animated HEIFs

```
val file = File("someHeifFile")
val source = ImageDecoder.createSource(file)
```

Animated HEIFs

```
val file = File("someHeifFile")
val source = ImageDecoder.createSource(file)

// Perform off main thread
val drawable = ImageDecoder.decodeDrawable(source);

if (drawable is AnimatedImageDrawable) {
    drawable.start()
}
```

NDK: OpenSL ES ^{@Deprecated}

- Oboe for the win!
- Unbundled C++ library
 - High-performance audio
 - Works back to API 16
 - Open source

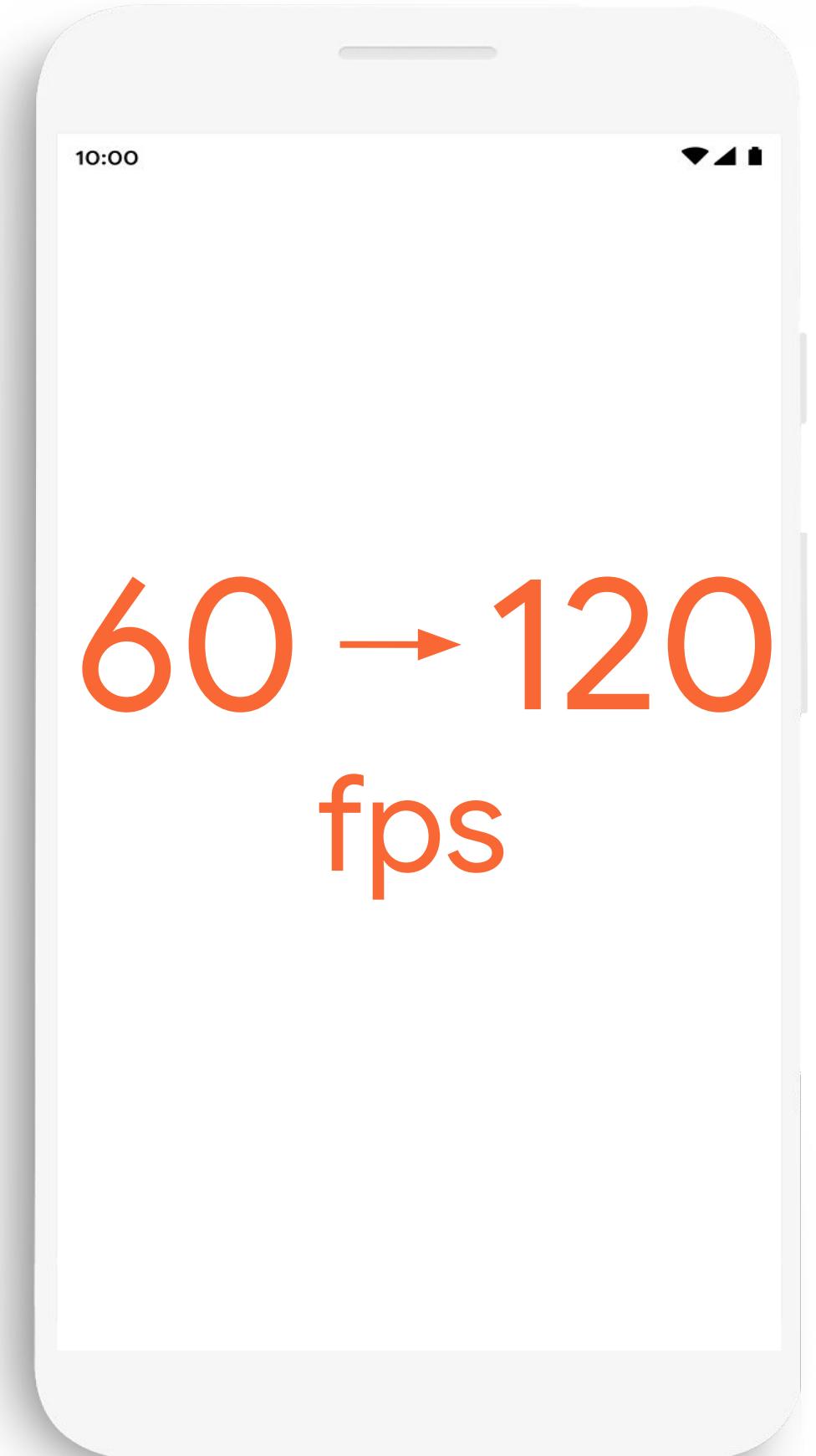
github.com/google/oboe



135: Audio Podcast

Variable refresh rate

- For apps with their own rendering loop
 - e.g., games
- 60 frames per second used to be a given
 - Now some devices support 90, 120 Hz
 - Enables more flexible backoff rates
- `Surface.setFrameRate()`



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NDK Thermal API

- Monitor device thermal status change
 - React to thermal issues
- No need for JNI up-calls

NDK Thermal API

```
// Create a thermal listener
void nativeThermalListener(void *appCtx, AThermalStatus status) {
    ...
    switch (status) {
        case ATHERMAL_STATUS_SHUTDOWN:
            ...
        case ATHERMAL_STATUS_EMERGENCY:
            ...
        case ATHERMAL_STATUS_CRITICAL:
            ...
    ...
}
```

NDK Thermal API

```
// Create a thermal listener
void nativeThermalListener(void *appCtx, AThermalStatus status) {
    ...
    switch (status) {
        case ATHERMAL_STATUS_SHUTDOWN:
            ...
        case ATHERMAL_STATUS_EMERGENCY:
            ...
        case ATHERMAL_STATUS_CRITICAL:
            ...
    }
}

// Register the listener
AThermalManager *manager = ATermal_acquireManager();
AThermal_registerThermalStatusListener(manager, NativeThermalListener, appCtx);
```

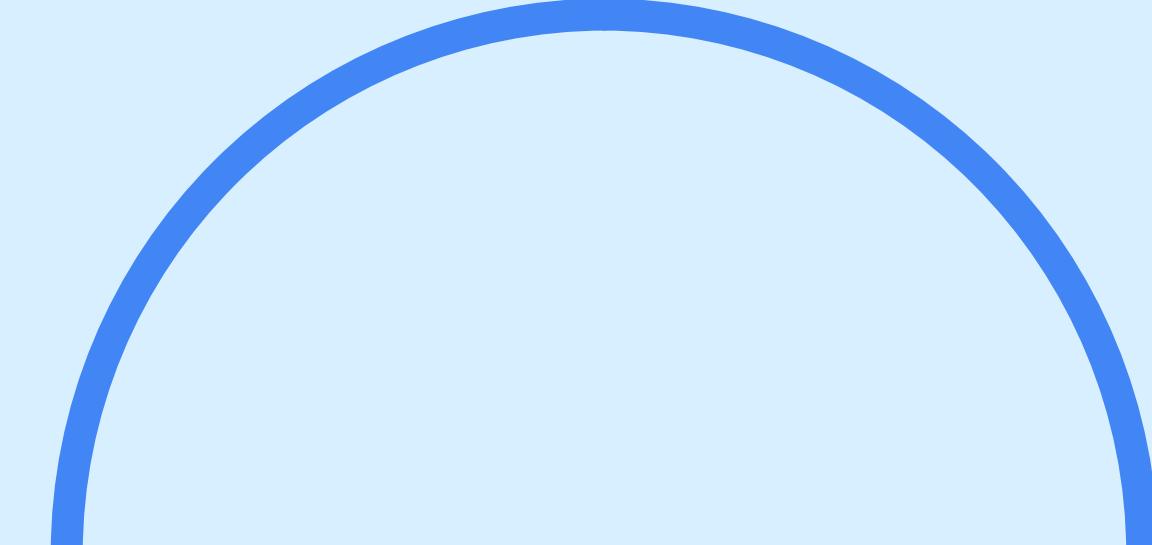
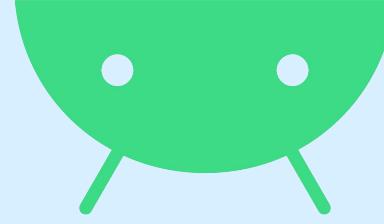
NDK Thermal API

```
// Create a thermal listener
void nativeThermalListener(void *appCtx, AThermalStatus status) {
    ...
    switch (status) {
        case ATHERMAL_STATUS_SHUTDOWN:
            ...
        case ATHERMAL_STATUS_EMERGENCY:
            ...
        case ATHERMAL_STATUS_CRITICAL:
            ...
    }
}

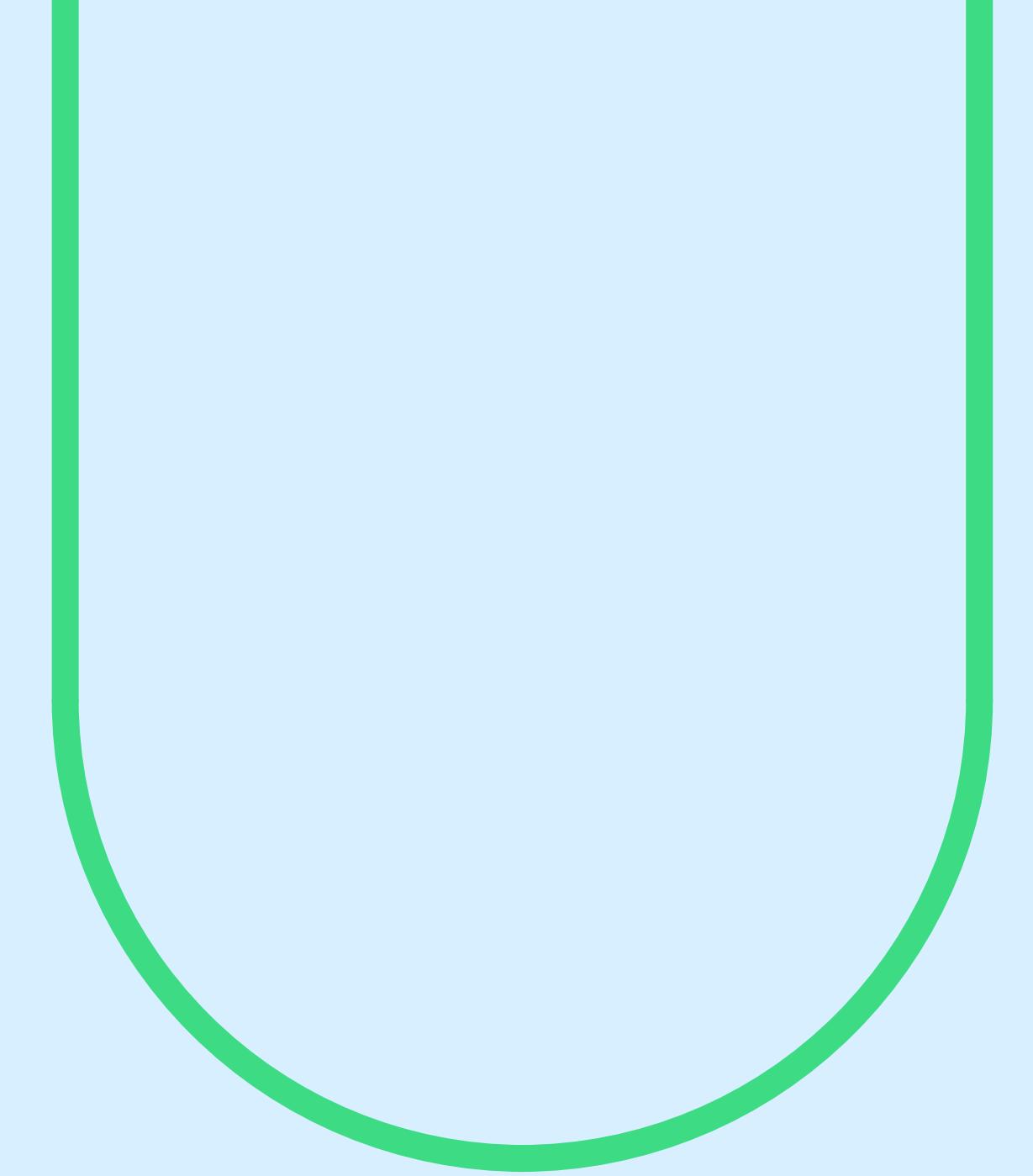
// Register the listener
AThermalManager *manager = ATermal_acquireManager();
AThermal_registerThermalStatusListener(manager, NativeThermalListener, appCtx);

// ...

AThermal_unregisterThermalStatusListener(manager, nativeThermalListener, appCtx);
AThermal_releaseManager(manager);
```

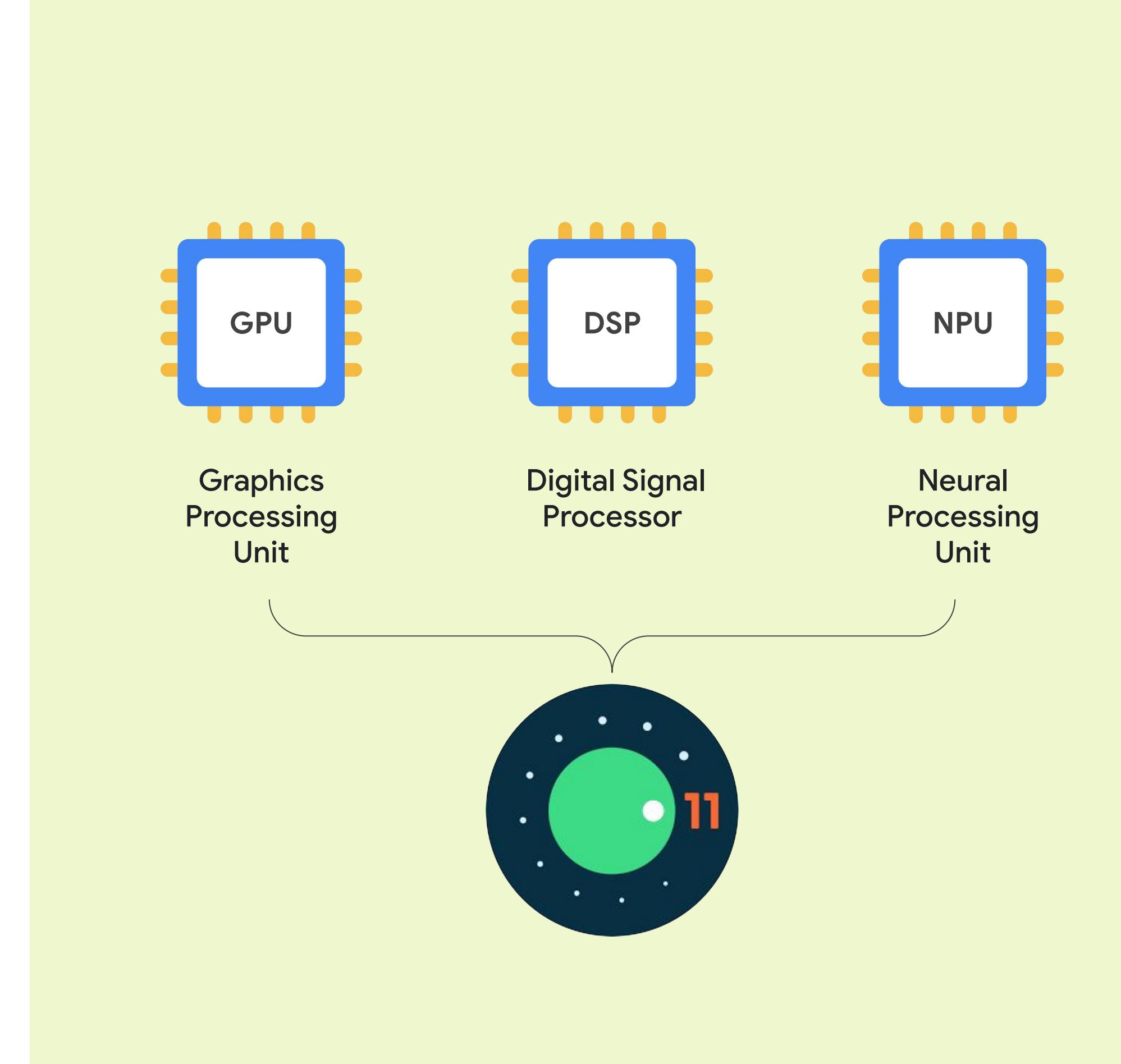


But Wait, There's More!



NNAPI v1.3

- **New** operations
 - IF, WHILE, QUANTIZED_LSTM,
HARD_SWISH
- **New** quantization scheme
- **New** advanced execution control
 - Fenced compute
 - Memory domain input/output
 - Quality of Service(QoS)



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5G

- APIs to optimize 5G experience
 - Metered network state
 - Bandwidth estimates

5G

```
val manager = getSystemService(ConnectivityManager::class.java)
manager.registerDefaultNetworkCallback(object: ConnectivityManager.NetworkCallback() {
    override fun onCapabilitiesChanged(network: Network,
        capabilities: NetworkCapabilities) {
        if (capabilities.hasCapability(
            NetworkCapabilities.NET_CAPABILITY_NOT_METERED)) {...}
        ...
        if (capabilities.linkDownstreamBandwidthKbps > FAST_NETWORK) {...}
    }
})
```

Biometric authenticator strength



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Biometric authenticator strength



```
val manager: BiometricManager? = getSystemService(BiometricManager::class.java)  
val strength = BiometricManager.Authenticators.BIOMETRIC_STRONG  
  
if (manager?.canAuthenticate(strength) != BiometricManager.BIOMETRIC_SUCCESS) {  
    // Takes user to enroll biometrics security.  
    val intent = Intent(Settings.ACTION_BIOMETRIC_ENROLL)  
    intent.putExtra(Settings.EXTRA_BIOMETRIC_AUTHENTICATORS_ALLOWED, strength)  
    startActivity(intent)  
} else {  
    // Authenticate user!  
}
```



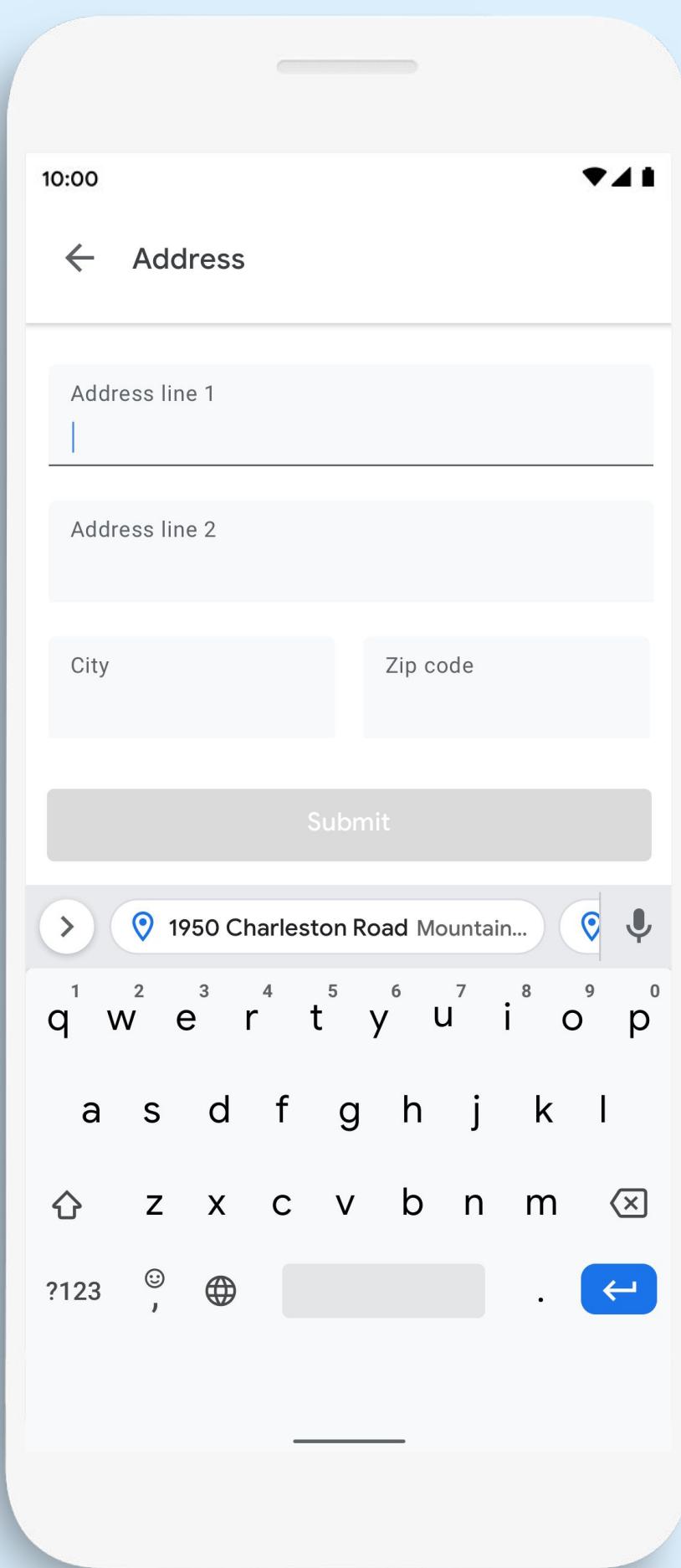
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Autofill/Keyboard Integration

- Autofill content in keyboards, not just drop-down
 - Keyboards
 - Password apps
- Secure - keyboards get UI to *present* data, not data itself

Autofill



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Autofill: Keyboards

```
// Implement InputMethodService methods

// Autofill request from IME
override fun onCreateInlineSuggestionsRequest(uiExtras: Bundle):  
    InlineSuggestionsRequest? {  
    // ...  
}  
}
```

Autofill: Keyboards

```
// Implement InputMethodService methods

// Autofill request from IME
override fun onCreateInlineSuggestionsRequest(uiExtras: Bundle):
    InlineSuggestionsRequest? {
    // ...
}

// Autofill response
override fun onInlineSuggestionsResponse(response: InlineSuggestionsResponse):
    Boolean {
    // ...
}
```

Autofill: Password Apps

```
// AutofillServices handle onFillRequest(), create FillResponse with InlinePresentation  
  
override fun onFillRequest(...) {  
  
}  
}
```

Autofill: Password Apps

```
// AutofillServices handle onFillRequest(), create FillResponse with InlinePresentation  
  
override fun onFillRequest(...) {  
    val datasetBuilder = Dataset.Builder()  
    val inlinePresentation = InlinePresentation(...)  
    datasetBuilder.setValue(..., inlinePresentation, ...)  
  
}
```

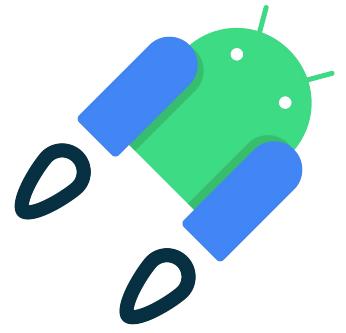
Autofill: Password Apps

```
// AutofillServices handle onFillRequest(), create FillResponse with InlinePresentation

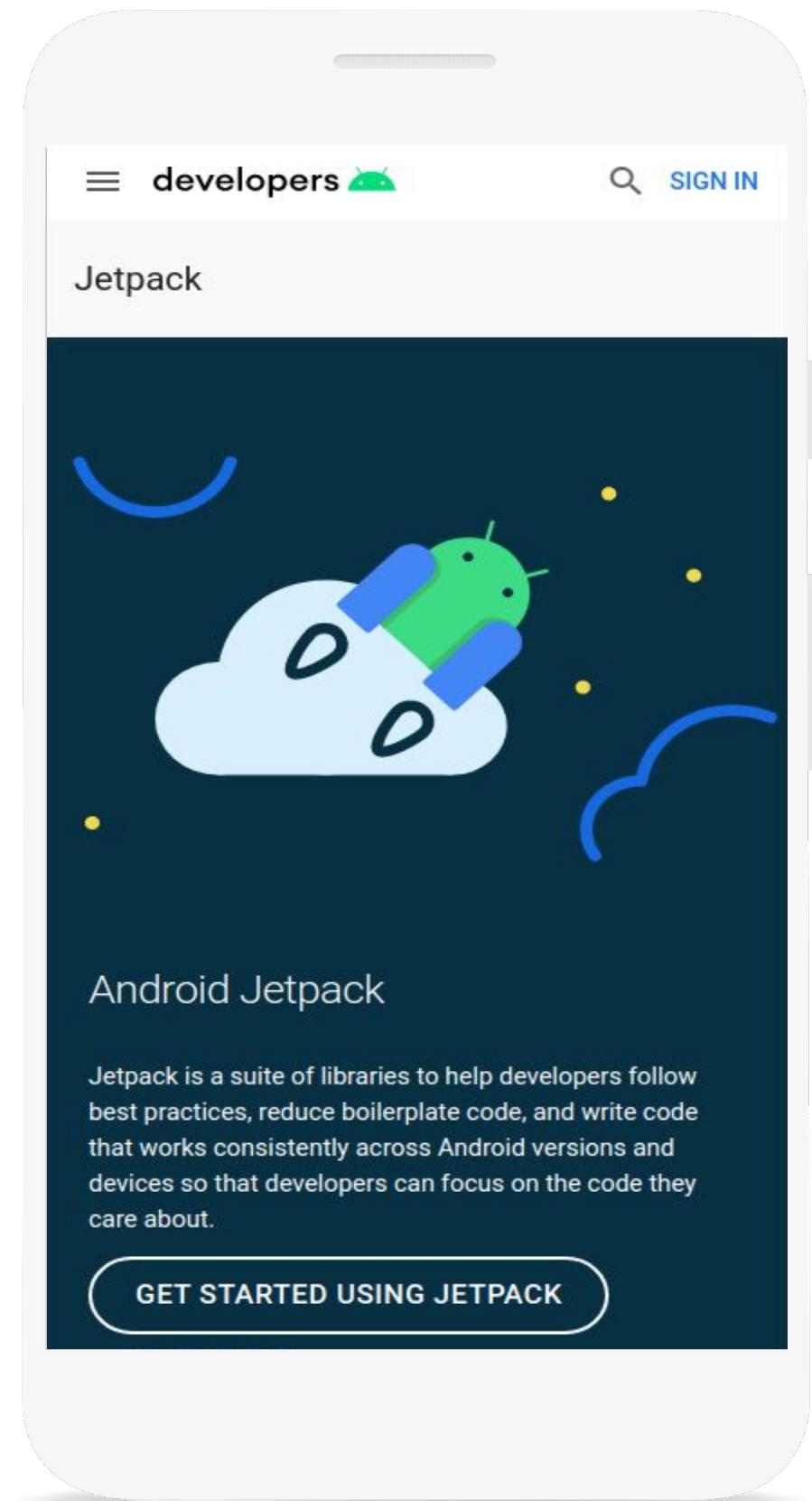
override fun onFillRequest(...) {
    val datasetBuilder = Dataset.Builder()
    val inlinePresentation = InlinePresentation(...)
    datasetBuilder.setValue(..., inlinePresentation, ...)
    responseBuilder = FillResponse.Builder()
    val fillResponse = responseBuilder.addDataset(datasetBuilder.build()).
        // ...
        .build()
    // ...
}
```

Non-Platform

Jetpack



- 70+ libraries, releases every two weeks
- New/Recent
 - Hilt: Dependency injection, built on Dagger
 - Paging 3.0: All-Kotlin, with coroutines
 - CameraX Beta
 - ... and more!



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Jetpack Compose



- New UI Toolkit for Android
- Reactive, Kotlin-based
- Pre-alpha, developed in the open

Android Studio



- 4.0: Stable
 - Motion Editor
 - LayoutInspector
- 4.1: Beta
 - Database Inspector (Room, SQLite)
- 4.2: Canary
 - Wireless debugging with Android 11
 - Jetpack Compose development

Google Play

- New Play console: complete redesign
 - clearer, easier to use
 - policy status section
 - acquisition reports
 - team management
- Now in Beta
 - play.google.com/console

For More Information

Launch videos

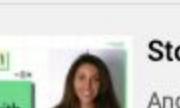
goo.gle/android11

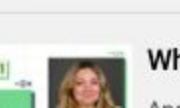
- 

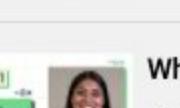
What's new in Android
Android Developers
32:07
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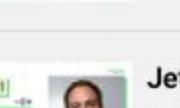
What's new in Android Development Tools
Android Developers
28:26
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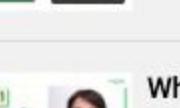
What's new in Android Jetpack
Android Developers
18:25
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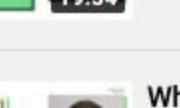
All things privacy in Android 11
Android Developers
15:05
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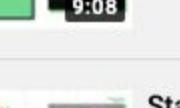
Storage access with Android 11
Android Developers
14:14
- 

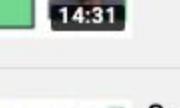
What's new in Google Play
Android Developers
14:12
- 

What's new in Play Commerce
Android Developers
16:04
- 

Jetpack Compose
Android Developers
24:20
- 

What's new in Design Tools
Android Developers
19:34
- 

What's new in System UI
Android Developers
9:08
- 

State of Kotlin on Android
Android Developers
14:31
- 

Screens - large, small and foldable
Android Developers
15:58

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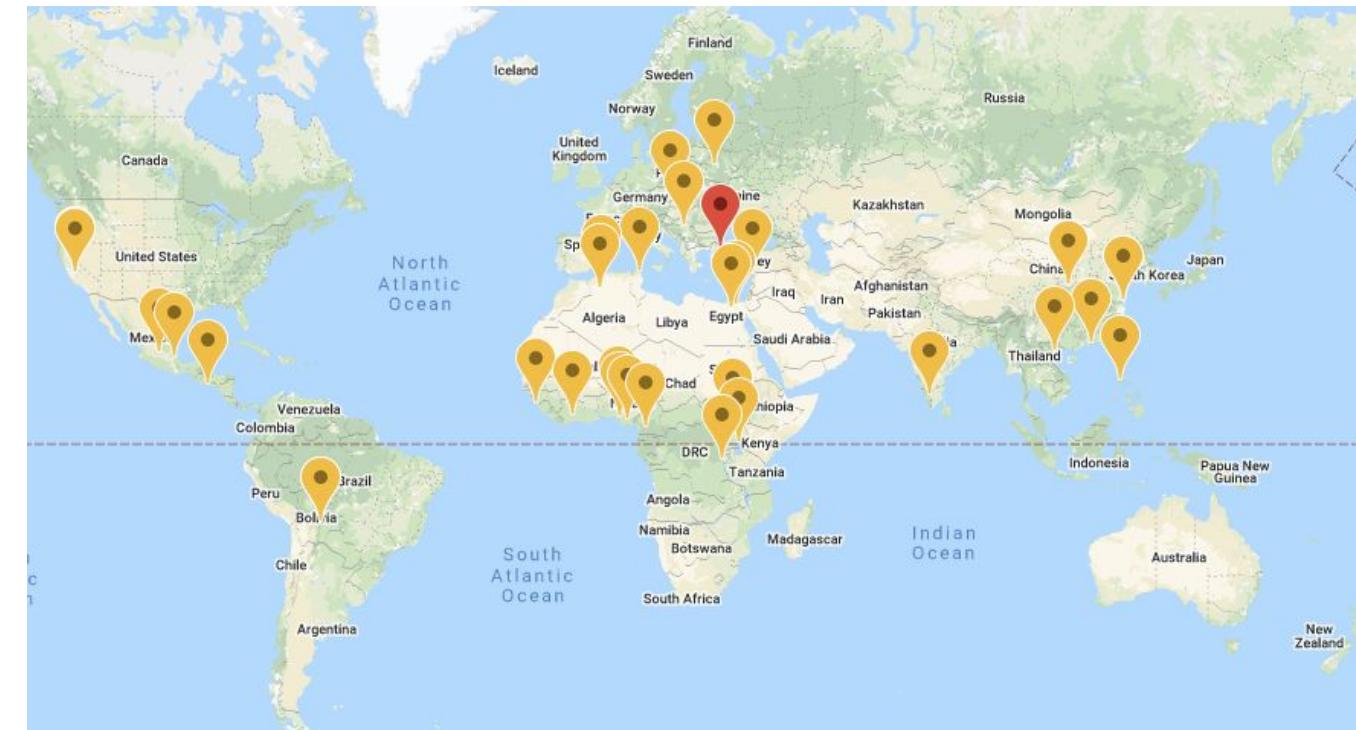
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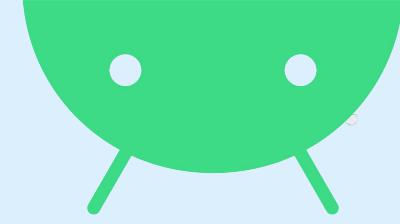
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Thank you!