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Fresco

loading images fast

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Apps using Fresco








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Fresco is an Open source library to fetch and show images in an efficient way

- Fetch images from different sources
- Decoding
- Transcoding
- Rotate and resize
- Progressive JPEG
- Animated GIF and WebP support
- Caching
- Prefetching to memory and disk cache
- Image post processing
- Instrumentation
- Cancellation and Prioritization

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Integrate Fresco using Android Studio or Gradle

```
dependencies {
  // your app's other dependencies
  compile 'com.facebook.fresco:fresco:0.13.0'
}
```

*With ABI splits & ProGuard: 250 ~ 300 KB

```
dependencies {
  // If your app supports Android versions before Ice Cream Sandwich (API level 14)
  compile 'com.facebook.fresco:animated-base-support:0.13.0'

  // For animated GIF support
  compile 'com.facebook.fresco:animated-gif:0.13.0'

  // For WebP support, including animated WebP
  compile 'com.facebook.fresco:animated-webp:0.13.0'
  compile 'com.facebook.fresco:webpsupport:0.13.0'

  // For WebP support, without animations
  compile 'com.facebook.fresco:webpsupport:0.13.0'
}
```

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Simple way to use it: Drawee

```
<com.facebook.drawee.view.SimpleDraweeView
    android:id="@+id/my_image_view"
    android:layout_width="20dp"
    android:layout_height="wrap_content"
    fresco:viewAspectRatio="1.33"
    <!-- other attributes -->
```

```
<com.facebook.drawee.view.SimpleDraweeView
  android:id="@+id/my_image_view"
  android:layout_width="20dp"
  android:layout_height="20dp"
  fresco:fadeDuration="300"
  fresco:actualImageScaleType="focusCrop"
  fresco:placeholderImage="@color/wait_color"
  fresco:placeholderImageScaleType="fitCenter"
  fresco:failureImage="@drawable/error"
  fresco:failureImageScaleType="centerInside"
  fresco:retryImage="@drawable/retrying"
  fresco:retryImageScaleType="centerCrop"
  fresco:progressBarImage="@drawable/progress_bar"
  fresco:progressBarImageScaleType="centerInside"
  fresco:progressBarAutoRotateInterval="1000"
  fresco:backgroundImage="@color/blue"
  fresco:overlayImage="@drawable/watermark"
  fresco:pressedStateOverlayImage="@color/red"
  fresco:roundAsCircle="false"
  fresco:roundedCornerRadius="1dp"
  fresco:roundTopLeft="true"
  fresco:roundTopRight="false"
  fresco:roundBottomLeft="false"
  fresco:roundBottomRight="true"
  fresco:roundWithOverlayColor="@color/corner_color"
  fresco:roundingBorderWidth="2dp"
  fresco:roundingBorderColor="@color/border_color"
/>
```

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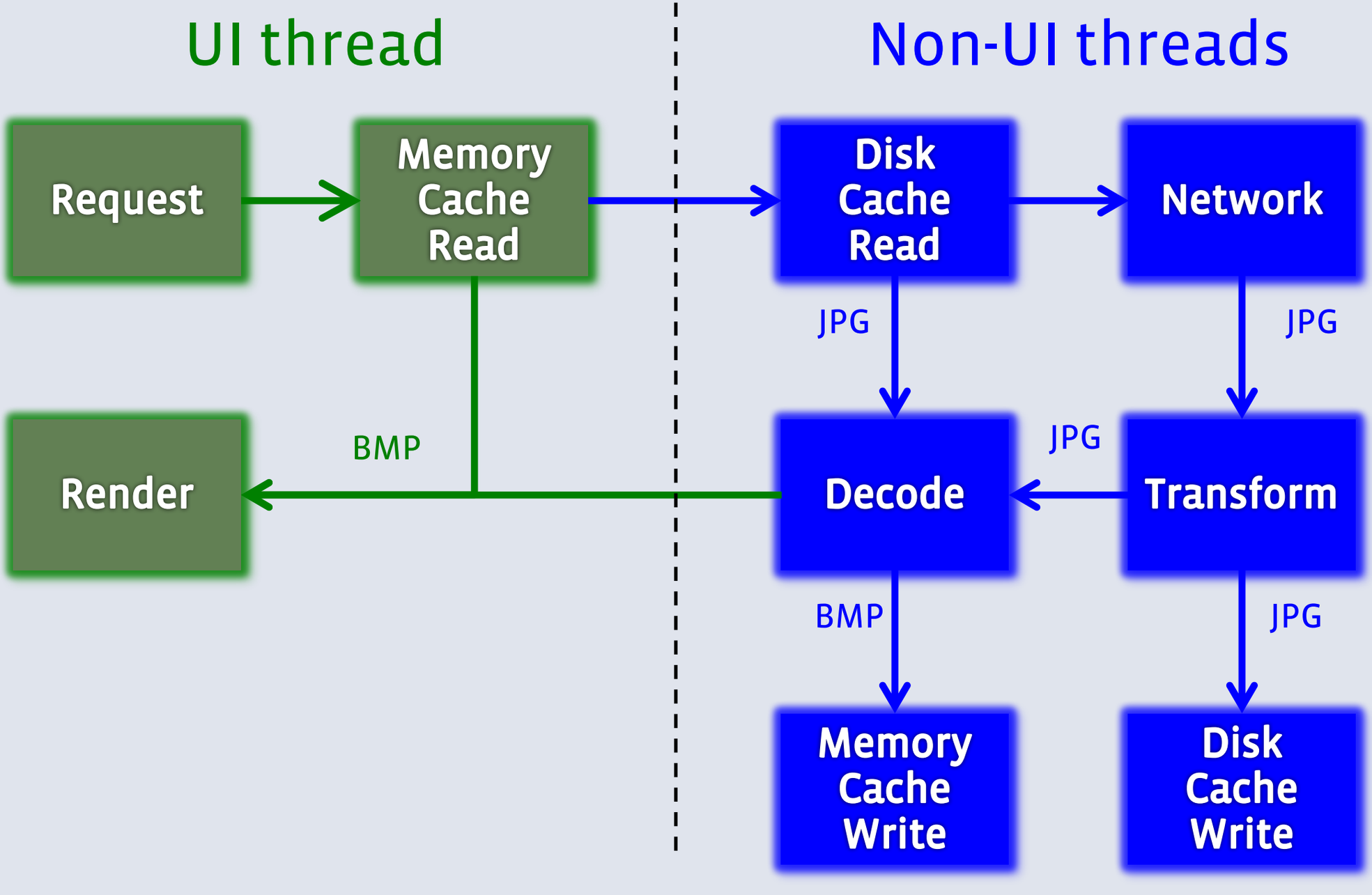
How to use it:

```
// Build image request
ImageRequest imageRequest = ImageRequest.fromUri(myUri);

// To prefetch to disk cache
ImagePipeline imagePipeline = null;
imagePipeline.prefetchToDiskCache(imageRequest, callerContext);

// To prefetch to bitmap cache
DataSource<CloseableReference<CloseableImage>> dataSource =
    imagePipeline.fetchDecodedImage(imageRequest, callerContext);
try {
  CloseableReference<CloseableImage> imageReference = dataSource.getResult();
  if (imageReference != null) {
    try {
      CloseableImage image = imageReference.get();
      // Do something with the image
    } finally {
      imageReference.close();
    }
  }
} finally {
  dataSource.close();
}
```

The Image Pipeline



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Memory is important

- 1/10th for each application
- Images use lots of memory
  - 400x800 pixels = 1536bytes = 1.5MB

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Java has the Garbage Collector

- It removes all the unused object
- But with a price....

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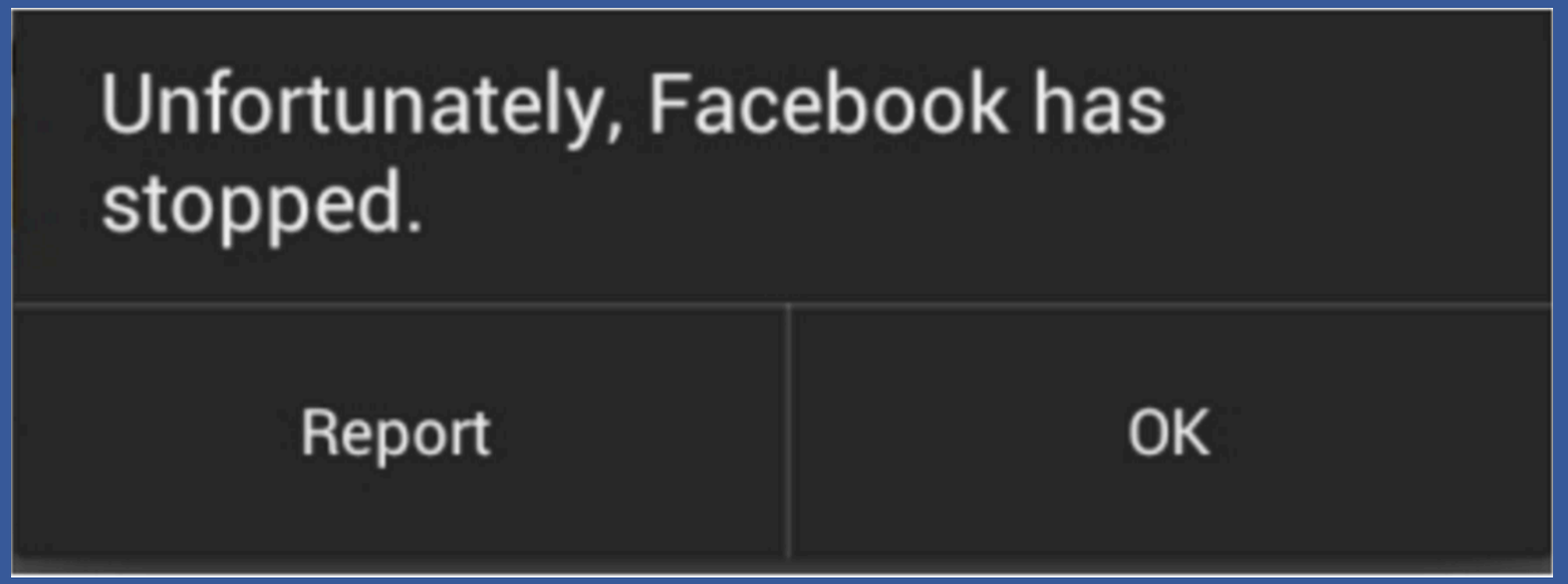

Java.lang.OutOfMemoryError

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Possible solutions to avoid OOM

- Use smaller images
- Use lower resolution

FOR REAL???
NOT GOOD FOR US!!!!

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Different types of Heap

Dalvik Heap

- JDK
- Limited
- Slow
- Safe

Native Heap

- NDK
- Unlimited
- Fast
- Unsafe

Other Heaps

- System calls
- Same advantages of the Native Heap

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Use the Native Heap

```
public final class Bitmap implements Parcelable {
    public final long mNativeBitmap;
    - - -
}
```

```
jobject GraphicsJNI::createBitmap(JNIEnv* env, SkBitmap* bitmap,
    int bitmapCreateFlags, jbyteArray ninePatchChunk, jobject ninePatchInsets,
    int density) {
  bool isMutable = bitmapCreateFlags & kBitmapCreateFlag_Mutable;
  bool isPremultiplied = bitmapCreateFlags & kBitmapCreateFlag_Premultiplied;
  // The caller needs to have already set the alpha type properly, so the
  // native SkBitmap stays in sync with the Java Bitmap.
  assert_premultiplied(bitmap->info(), isPremultiplied);
  jobject obj = env->NewObject(gBitmap_class, gBitmap_constructorMethodID,
      reinterpret_cast<jlong>(bitmap), bitmap->javaByteArray(),
      bitmap->width(), bitmap->height(), density, isMutable, isPremultiplied,
      ninePatchChunk, ninePatchInsets);
  hasException(env);
  return obj;
}
```

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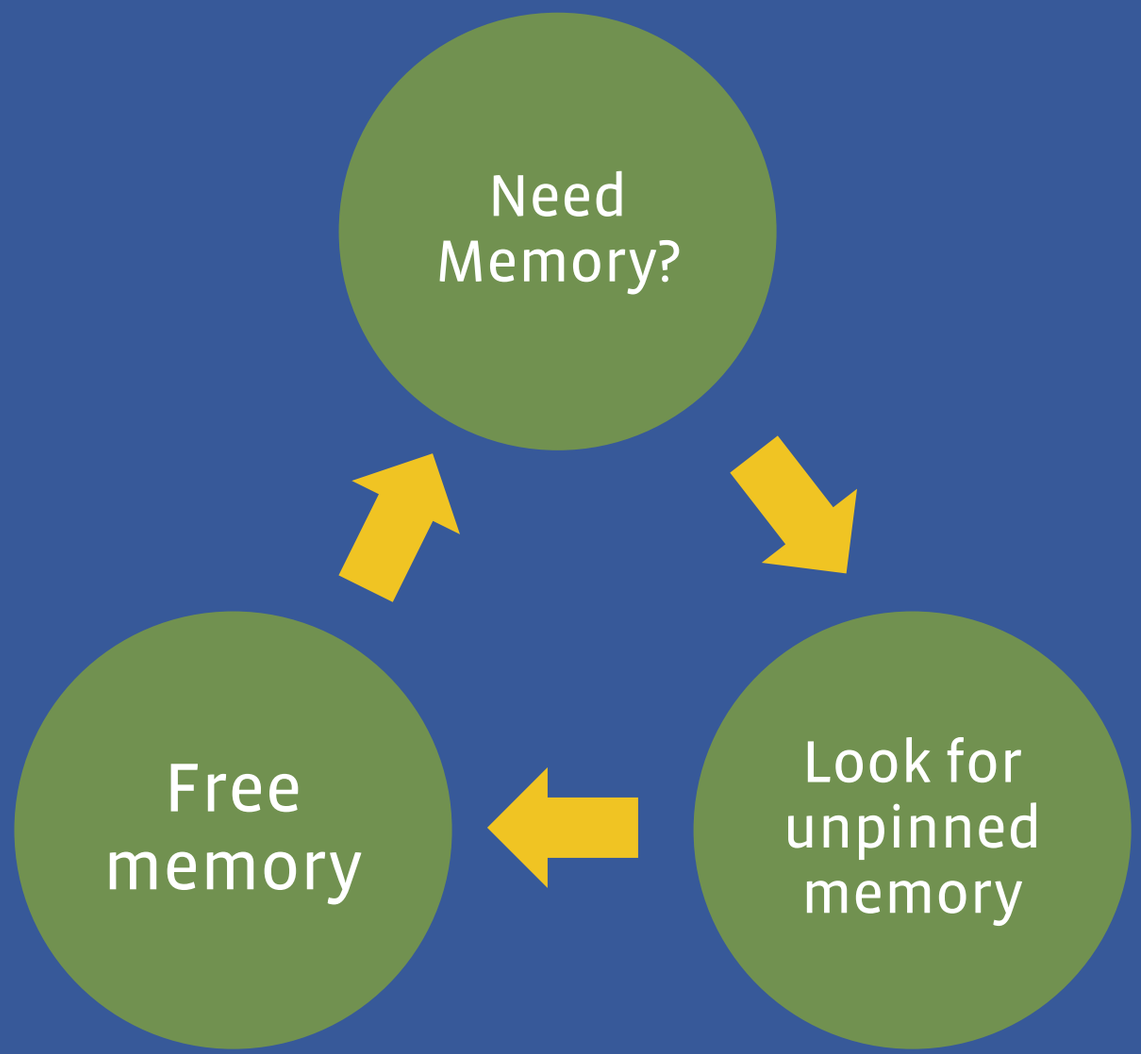
Use the Others Heap: ashmem

- Create region
- Pin region
- Unpin region
- The system frees the memory just if needed



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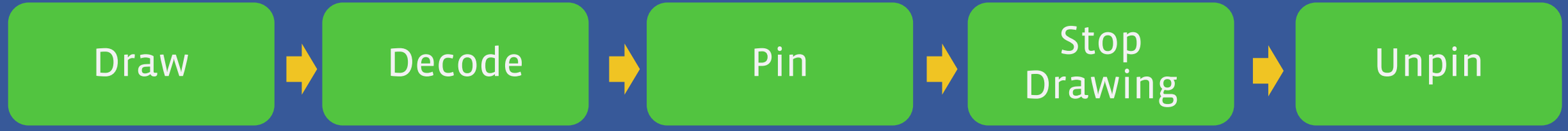
How to use ashmem? Purgeable Bitmap



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Purgeable Bitmap in code

```
BitmapFactory.Options options = new BitmapFactory.Options();
options.inPurgeable = true;
Bitmap bitmap = BitmapFactory.decodeByteArray(jpegData, 0, jpegData.length, options);
```

What is wrong with this?

Decoding is done on the UI Thread!!!

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What's wrong with Purgeable Bitmap

While inPurgeable can help avoid big Dalvik heap allocations (from API level 11 onward), it sacrifices performance predictability since any image that the view system tries to draw may incur a decode delay which can lead to dropped frames. Therefore, most apps should avoid using inPurgeable to allow for a fast and fluid UI. To minimize Dalvik heap allocations use the inBitmap flag instead.

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So what's the inBitmap flag?

```
Bitmap bitmap = Bitmap.createBitmap(width, height, Bitmap.Config.ARGB_8888);
BitmapFactory.Options options = new BitmapFactory.Options();
while (true) {
  // Some code
  options.inBitmap = bitmap;
  Bitmap bitmap = BitmapFactory.decodeByteArray(jpegData, 0, jpegData.length, options)
  // Use the bitmap  - - -
}
```

- It looks perfect!! But....

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In FB we cannot use inBitmap

- Introduced in API Level 11
- Prior to KitKat only JPEG and PNG were supported with the same size
- We need a different solution

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The Facebook Solution

```
int AndroidBitmap_lockPixels(JNIEnv* env, jobject jbitmap, void** addrPtr) {
    if (NULL == env || NULL == jbitmap) {
        return ANDROID_BITMAP_RESULT_BAD_PARAMETER;
    }

    SkBitmap* bm = GraphicsJNI::getNativeBitmap(env, jbitmap);
    if (NULL == bm) {
        return ANDROID_BITMAP_RESULT_JNI_EXCEPTION;
    }

    bm->lockPixels();
    void* addr = bm->getPixels();
    if (NULL == addr) {
        bm->unlockPixels();
        return ANDROID_BITMAP_RESULT_ALLOCATION_FAILED;
    }

    if (addrPtr) {
        *addrPtr = addr;
    }
    return ANDROID_BITMAP_RESUT_SUCCESS;
}
```

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The Facebook Solution: Pin but not Unpin

```
@DoNotStrip
private static native void nativePinBitmap(Bitmap bitmap);
```

```
static void Bitmaps_pinBitmap(
    JNIEnv* env,
    jclass clazz,
    jobject bitmap) {
  UNUSED(clazz);
  int rc = AndroidBitmap_lockPixels(env, bitmap, 0);
  if (rc != ANDROID_BITMAP_RESULT_SUCCESS) {
    safe_throw_exception(env, "Failed to pin Bitmap");
  }
}
```

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It's important to recycle()

void	recycle () Free the native object associated with this bitmap, and clear the reference to the pixel data.

```
BitmapFactory.Options options = new BitmapFactory.Options();
options.inPurgeable = true;
Bitmap bitmap = BitmapFactory.decodeByteArray(jpegData, 0, jpegData.length, options);
lockBitmap(bitmap);
// When done
bitmap.recycle();
```

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Great Power means Great Responsibility

SharedReferences

<<interface>>
CloseableReference

- Deterministic memory management
- Simple and clear rules

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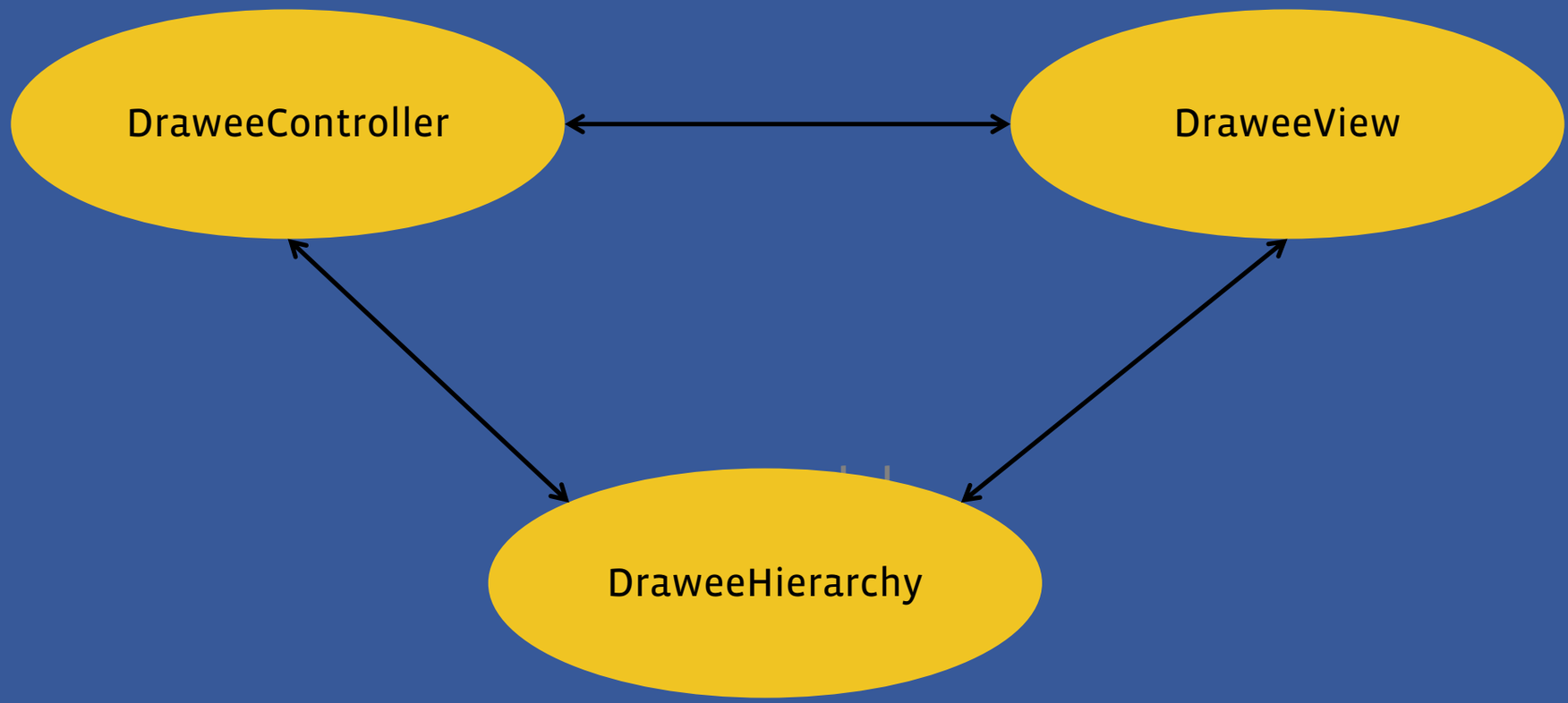
Drawee makes things simple

- MVC like framework to display images



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The future of Fresco

- Smaller libraries and less .SO
    - WebP
    - Animations (GIF and WebP)
- Making Image Pipeline pluggable
- Many other optimizations and extensions

1. http://frescolib.org
   Blog
   http://frescolib.org/blog/2016/09/02/fresco-101.html
2. http://fresco-cn.org
3. Facebook: https://www.facebook.com/frescolib/
4. Twitter: @frescolib