

# ObjC Memory Management and JNI

This page assumes you are already familiar with the following concepts:

- [Allocating objects](#)

There are a few simple rules to follow when writing JNI code that handles Cocoa objects:

## Always use `JNF_COCOA_ENTER()/JNF_COCOA_EXIT()`

- These macros ensure that an autorelease pool is always setup and popped so ObjC objects are not leaked in RR mode.
- They also catch ObjC exceptions that are thrown, and rethrow them as Java exceptions

## As a rule, Java objects should own native objects in jlongs

- The jlong type is used because it is big enough to hold both 32 and 64-bit sized pointers
  - Use the `jlong_to_ptr()` and `ptr_to_jlong()` macros to correctly handle casting and avoid sign-extension problems
- This keeps the number of JNI global refs HotSpot has to manage to a minimum
- Java objects that own native objects have to concretely define the lifecycle of the native objects they hold
  - Do not let native objects hold onto Java objects in JNI global refs, or you can create a cycle across the Java and ObjC reference count, and neither system will realize that they can deallocate their respective objects

## Native objects held by Java objects must have a "hard" CF-retain count of 1 before being passed up to Java

- ObjC objects that are `+alloc'd` or `-retained` are not actually pinned in GC-mode unless they have been `CFRetain()`d
  - As a counterpoint, any `CFRetain()`d ObjC object must be `-released` or `-autorelease`d for its retain count to remain balanced in RR mode
- When the Java object is done with the native object, it must be explicitly `"hard" CFRelease()`d
  - This balances the `"hard" CFRetain()` which occurred before it was passed up to Java
- You need to determine if the object is safe to `CFRelease()` from any thread, or must only be done from the main AppKit thread
  - In some cases, releasing an object may do nothing but decrease its retain count, but in other cases it will cause the object's `-dealloc` or `-finalize` method to be called, and those may not be any-thread safe if they end up releasing AppKit objects

## Don't manage JNI global refs yourself

- If you need to pass a Java object through native (like to the main AppKit thread, or inside of an NSArray), use `JNFJObjectWrapper` or `JNFJObjectWeakWrapper`
  - It handles all the details of managing a JNI global ref in a native ObjC object
- If you have a `JNIEnv` when you are done with the `JNFJObjectWrapper`, pre-clear the reference
  - It is more efficient than the wrapper's `-dealloc`, which may have to connect the current thread to the JVM (possibly a ObjC-GC collector thread), just for the purposes of deleting the ref.

## Don't put ObjC objects into C-structs

- The ObjC garbage collector can't find objects that have been stuffed into C arrays and structs, and it's an assignment error in ARC
- If you **must** use a struct to hold onto a ObjC object (like some pieces of the graphics code currently does), you need to pin the ObjC using `CFRetain()`, just like if you were going to push it up into the JVM heap.
  - Be sure to `CFRelease()` any AppKit objects on the main AppKit thread, so their `-dealloc` methods will be called on the right thread!