

The Decaffeinated Robot

Developing on Android without Java

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Texas Linux Fest

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Android is the pragmatic
choice for open source
mobile development.

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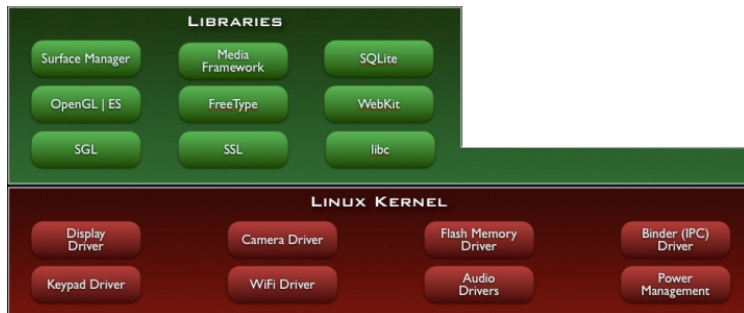
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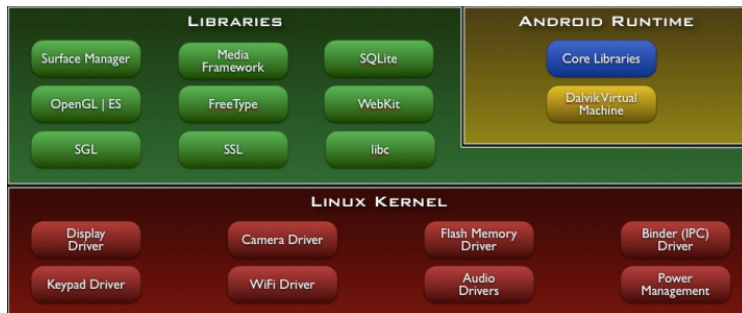
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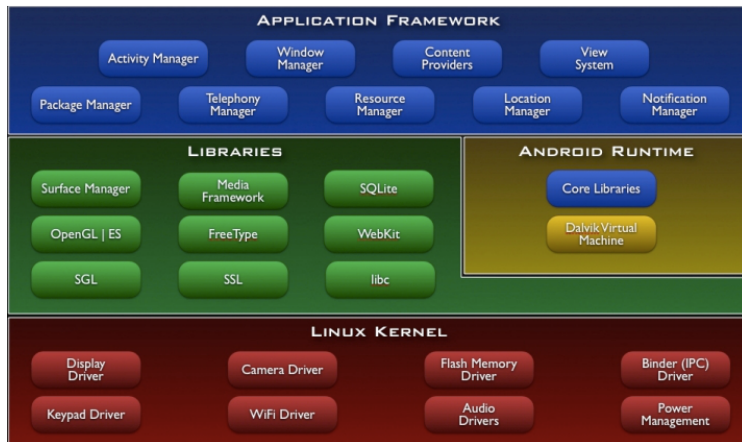
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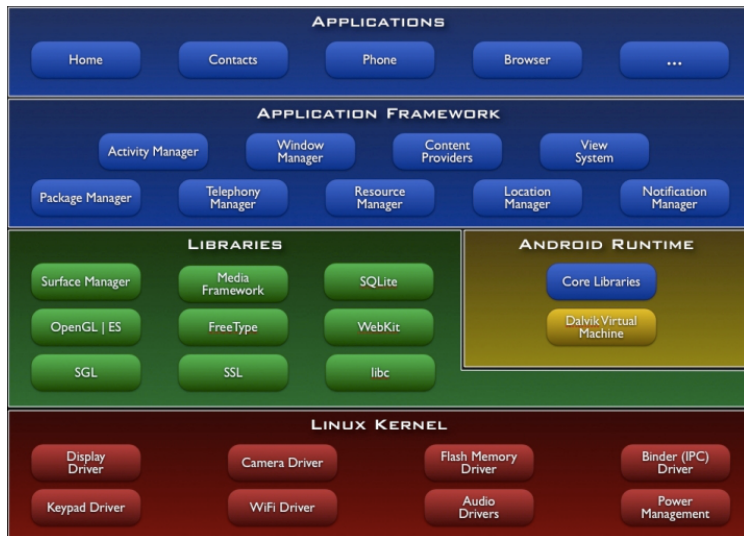
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All apps run in a Dalvik VM

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What does this mean?

In order to write apps for Android, you have to do it within the Java-based environment.

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*What if you do not
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Good question.

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Alternatives to Java

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- ▶ Build a web app
- ▶ Use a cross-platform development tool
- ▶ Use an alternative JVM language
- ▶ Use the Scripting Layer for Android
- ▶ Use the native development tools

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An web app is an application designed to run in a web browser using HTML, CSS, and Javascript.

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What is it?

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An web app is an application designed to run in a web browser using HTML, CSS, and Javascript.

- ▶ Can run in the browser

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An web app is an application designed to run in a web browser using HTML, CSS, and Javascript.

- ▶ Can run in the browser
- ▶ Can run in a browser widget

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Leverage HTML5

- ▶ Cache for off-line use
- ▶ Persistent web storage
- ▶ Video
- ▶ Geolocation

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Advantages

- ▶ Use familiar tools and technologies
- ▶ As close to truly cross-platform as possible
- ▶ Instant updates for all users

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Disadvantages

- ▶ Performance
- ▶ No deep integration with the platform
- ▶ No market visibility
- ▶ Not a 'native experience'

Resources

- ▶ Android-specific web app documentation at <http://developer.android.com/guide/webapps/index.html>
- ▶ Mobile Boilerplate, a 'template for creating rich and performant mobile web apps', at <http://html5boilerplate.com/mobile/>

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PhoneGap

<http://www.phonegap.com>

- ▶ Creates packaged web apps
- ▶ Allows development with JavaScript, HTML5, and CSS3
- ▶ Provides a JavaScript library to expose platform APIs
- ▶ Builds packages for all major platforms
- ▶ MIT license

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Appcelerator Titanium

<http://www.appcelerator.com>

- ▶ Provides a JavaScript library to expose platform APIs
- ▶ Builds as a native app for Android and iOS
- ▶ Interprets app logic at runtime
- ▶ Apache license

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Rhomobile Rhodes

<http://rhomobile.com>

- ▶ Allows development in Ruby with an MVC-style framework
- ▶ Builds native apps for all major platforms
- ▶ Integrates with enterprise features from other Rhomobile products
- ▶ MIT license

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Things to consider

- ▶ Is being dependent on the tool acceptable?
- ▶ What features does your app need?
- ▶ What platforms do you need to support?
- ▶ How important is performance?
- ▶ Is the license compatible with your app?

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The good news

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Java \neq JVM

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The (somewhat) bad news

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JVM \neq Dalvik VM

The Dalvik VM and JVM languages

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- ▶ Incompatible byte codes means no dynamic compilation (no Jython)
- ▶ Staticly compiled and interpreted languages still work
- ▶ Beware of resource limits

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<http://ruboto.org>

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Ruboto (JRuby)

<http://ruboto.org>

- ▶ ruboto-irb
 - ▶ Provides IRB console and runs scripts
 - ▶ Allows Android API exploration
 - ▶ Available from Android Market

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Ruboto (JRuby)

<http://ruboto.org>

- ▶ ruboto-irb
 - ▶ Provides IRB console and runs scripts
 - ▶ Allows Android API exploration
 - ▶ Available from Android Market
- ▶ ruboto-core
 - ▶ Provides a development framework for Android apps
 - ▶ Includes UI setup domain-specific language
 - ▶ Uses familiar Ruby tools
 - ▶ MIT license

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Hello, world!

```
require 'ruboto.rb'

ruboto_import_widgets :TextView

$activity.handle_create do |bundle|
  setup_content do
    text_view :text => "Hello , world!"
  end
end
```

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Ruboto impressions

- ▶ Starts slowly
- ▶ Hogs memory
- ▶ Some JRuby features don't work
- ▶ Weird redeploy cycle

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Mirah

<http://www.mirah.org>

- ▶ Ruby-like syntax
- ▶ No runtime library
- ▶ No performance penalty
- ▶ Metaprogramming and macros
- ▶ Apache license

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Hello, world!

```
import android.app.Activity
import android.widget.TextView

class HelloActivity < Activity
  def onCreate(state)
    super state
    text = TextView.new self
    text.setText "Hello, world!"
    setContentView text
  end
end
```

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Mirah impressions

- ▶ Excellent performance
- ▶ Using Pindah makes it easy to get started
- ▶ Approachable for Ruby programmers
- ▶ Young language, little documentation

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Scala

<http://www.scala-lang.org>

- ▶ Combines functional and object-oriented paradigms
- ▶ Concise syntax
- ▶ Good type inference
- ▶ Used by LinkedIn, Twitter, FourSquare
- ▶ BSD license

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Hello, world!

```
import _root_.android.app.Activity
import _root_.android.os.Bundle
import _root_.android.widget.TextView

class GameChooserActivity extends Activity {
  override def onCreate(savedInstanceState: Bundle) {
    super.onCreate(savedInstanceState)
    val text = new TextView(this)
    text.setText("Hello, world!")
    setContentView(text)
  }
}
```

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Scala impressions

- ▶ Using simple build tool (sbt) with Android plugin makes development a breeze
- ▶ Very good performance
- ▶ Powerful
- ▶ Approachable to Java programmers

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Clojure

<http://www.clojure.org>

- ▶ A Lisp for the JVM
- ▶ Software transactional memory and concurrency primitives
- ▶ Clojure REPL available on Android Market
- ▶ Easy interop with Java
- ▶ EPL license

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```
(ns HelloWorld
  (:gen-class :extends android.app.Activity
               :exposes-methods {onCreate superOnCreate})
  (:import android.widget.TextView))

(defn -onCreate
  [this bundle]
  (doto this
    (.superOnCreate bundle)
    (.setContentView (doto (TextView. this)
                          (.setText "Hello, world!")))))
```

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Clojure impressions

- ▶ Start-up can be slow
- ▶ More memory-intensive than Java, Mirah, and Scala
- ▶ Upcoming leaner runtime should help address performance
- ▶ Neko library should help make Android development faster and more concise

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Kawa

<http://www.gnu.org/software/kawa/>

- ▶ Scheme implementation for the JVM
- ▶ Requires no runtime
- ▶ Includes some Android support built-in
- ▶ MIT license

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Hello, world!

```
(require 'android-libs)

(activity HelloKawa
  (on-create-view
    (android.widget.TextView (this)
      text: "Hello, world!"))))
```

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Kawa impressions

- ▶ Excellent performance
- ▶ Relatively obscure, small community
- ▶ Not much tool support

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Advantages

- ▶ Gives you access to the full API
- ▶ You can use familiar tools
- ▶ Some languages perform as well as Java

Disadvantages

- ▶ Some languages have significant overhead
- ▶ May run into interop corner cases
- ▶ Tool support may be lacking for some languages

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Scripting Layer for Android

<https://code.google.com/p/android-scripting/>

- ▶ Brings scripting languages to Android
- ▶ Loads, edits, and executes scripts
- ▶ Provides interactive consoles
- ▶ Provides access to many Android APIs
- ▶ Runs interactively, in the background, or via Locale

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Supported languages

- ▶ Beanshell
- ▶ JavaScript (Rhino)
- ▶ JRuby
- ▶ Lua
- ▶ Python
- ▶ Perl
- ▶ PHP
- ▶ Shell
- ▶ Tcl

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How SL4A works

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SL4A Service

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How SL4A works



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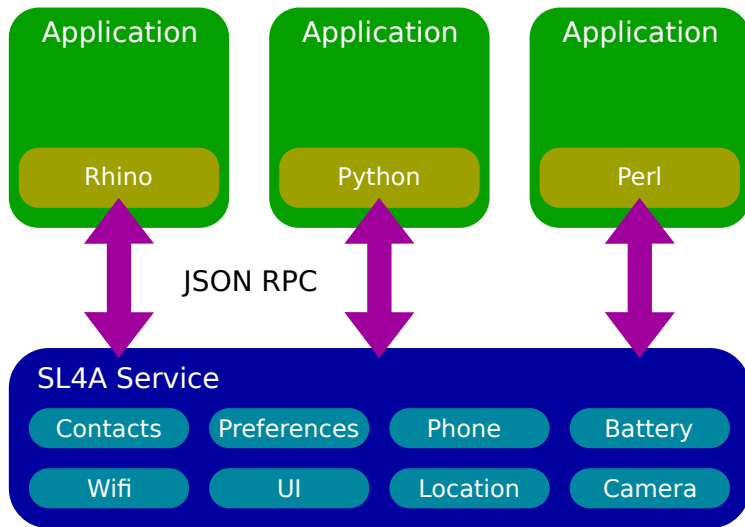
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SL4A limitations

- ▶ Generally, access to API is restricted to exposed façades
- ▶ Languages that can invoke Java directly can access full API
- ▶ Designed for ease of use, not performance

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Writing scripts

- ▶ Use an interactive terminal and save or e-mail the results
- ▶ Use a built-in editor to create scripts
- ▶ Run a server to develop scripts over a network or USB
- ▶ Package script as an app, but still requires separate interpreter installation

Advantages

- ▶ Interactive development from a computer is quick and easy
- ▶ Ideal for scripting a device
- ▶ Use a wide variety of languages

Disadvantages

- ▶ Not ideal for writing applications:
 - ▶ Multistep installation
 - ▶ Limited UI options (dialogs and HTML)
- ▶ Cannot access full platform APIs
- ▶ Performance may not be optimal

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What is it?

- ▶ Designed to allow you to write performance-critical code in C/C++
- ▶ Supplements the SDK
- ▶ Still runs in the Dalvik VM

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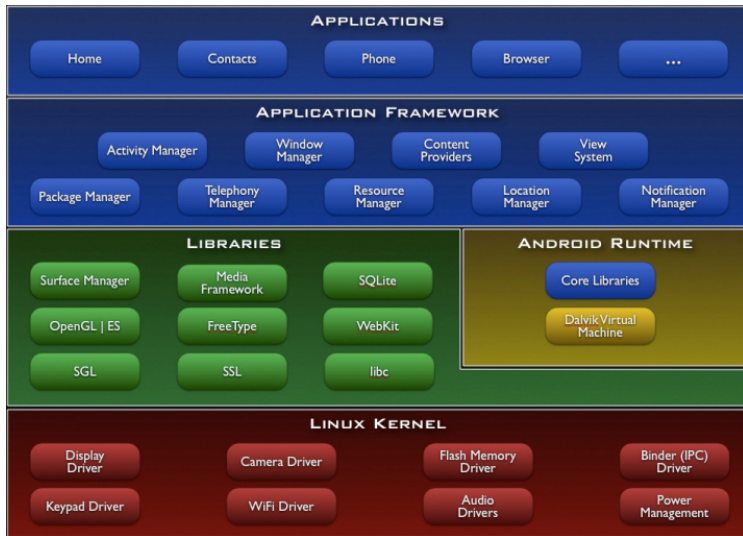
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Where it fits



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Building with the NDK

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- ▶ NDK provides:
 - ▶ Cross-compiler
 - ▶ System libraries and headers
 - ▶ Build tools
 - ▶ Debugger
- ▶ NDK creates shared libraries to be included in an app
- ▶ Still use SDK to build packages

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Using JNI

The Java part

```
public class HelloJni extends Activity {  
    public native String stringFromJNI();  
  
    static {  
        System.loadLibrary("hello-jni");  
    }  
}
```

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Using JNI

The C part

```
#include<string.h>
#include<jni.h>

jstring
Java_com_example_hellojni_HelloJni_stringFromJNI(
    JNIEnv* env, jobject thiz)
{
    return (*env)->NewStringUTF(env, "Hello, from JNI!");
}
```

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Using JNI

The Makefile (Android.mk)

```
LOCAL_PATH := $(call my-dir)

include $(CLEAR_VARS)

LOCAL_MODULE    := hello-jni
LOCAL_SRC_FILES := hello-jni.c

include $(BUILD_SHARED_LIBRARY)
```

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Native activities

- ▶ As of Gingerbread (2.3), it is possible to make 100% native activities
- ▶ Interface with the NDK either through callbacks or an event loop
- ▶ UI restricted to OpenGL

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Use cases

- ▶ Performance critical code
- ▶ Using an existing library
- ▶ Embed an interpreter (Lua and Gambit Scheme have been done)

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About the demo

- ▶ Guess the number with a *WarGames* twist
- ▶ Code available from GitHub:
<https://github.com/sattvik/decafbot>
- ▶ Implementations in:
 - ▶ Ruboto
 - ▶ Mirah
 - ▶ Scala
 - ▶ Clojure
 - ▶ Java with JNI
 - ▶ Python with SL4A
- ▶ Not necessarily the absolute best implementations

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Package size

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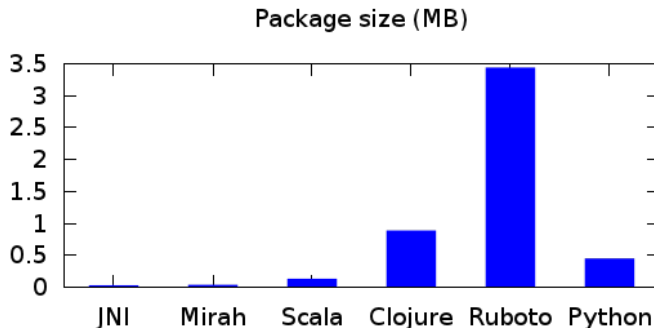
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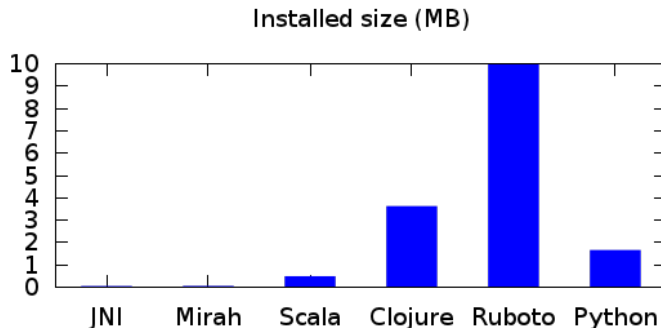


1. Python size does not include interpreter

Installed size

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1. Python size does not include interpreter

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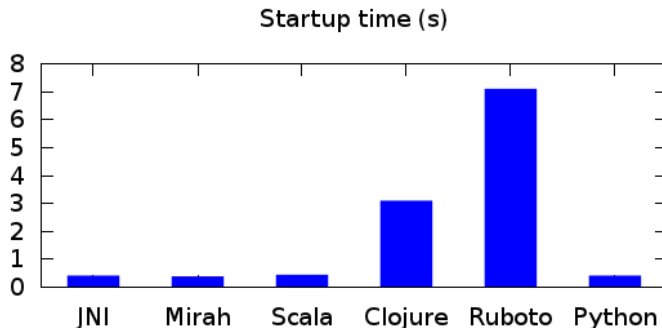
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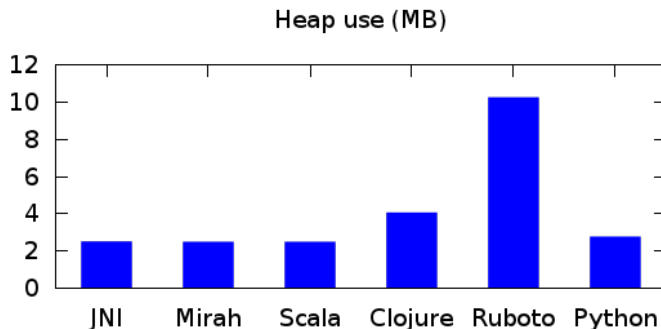


1. Ruboto measurement is approximate

Heap use

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1. Native portions of Python and JNI are not reported

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Lines of code

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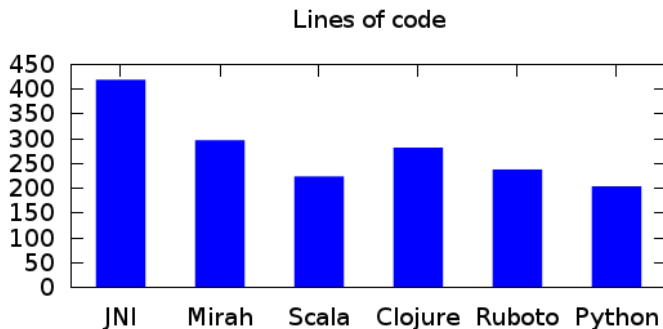
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Yes!

Recommendations

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- ▶ Mature technologies that have worked well for me or others:
 - ▶ Web apps
 - ▶ Cross-platform development tools
 - ▶ Scala
 - ▶ Native development tools
- ▶ Technologies that should run well, but for which development may be trickier:
 - ▶ Mirah
 - ▶ Kawa

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- ▶ Technologies that show promise, but aren't entirely ready yet:
 - ▶ Clojure
 - ▶ Ruboto
- ▶ Technologies that serve a niche:
 - ▶ Scripting layer for Android

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Non-free alternatives

- ▶ MonoDroid
- ▶ Adobe AIR

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Thank you!

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