λNative

Open Source Application Framework

https://github.com/part-cw/lambdanative

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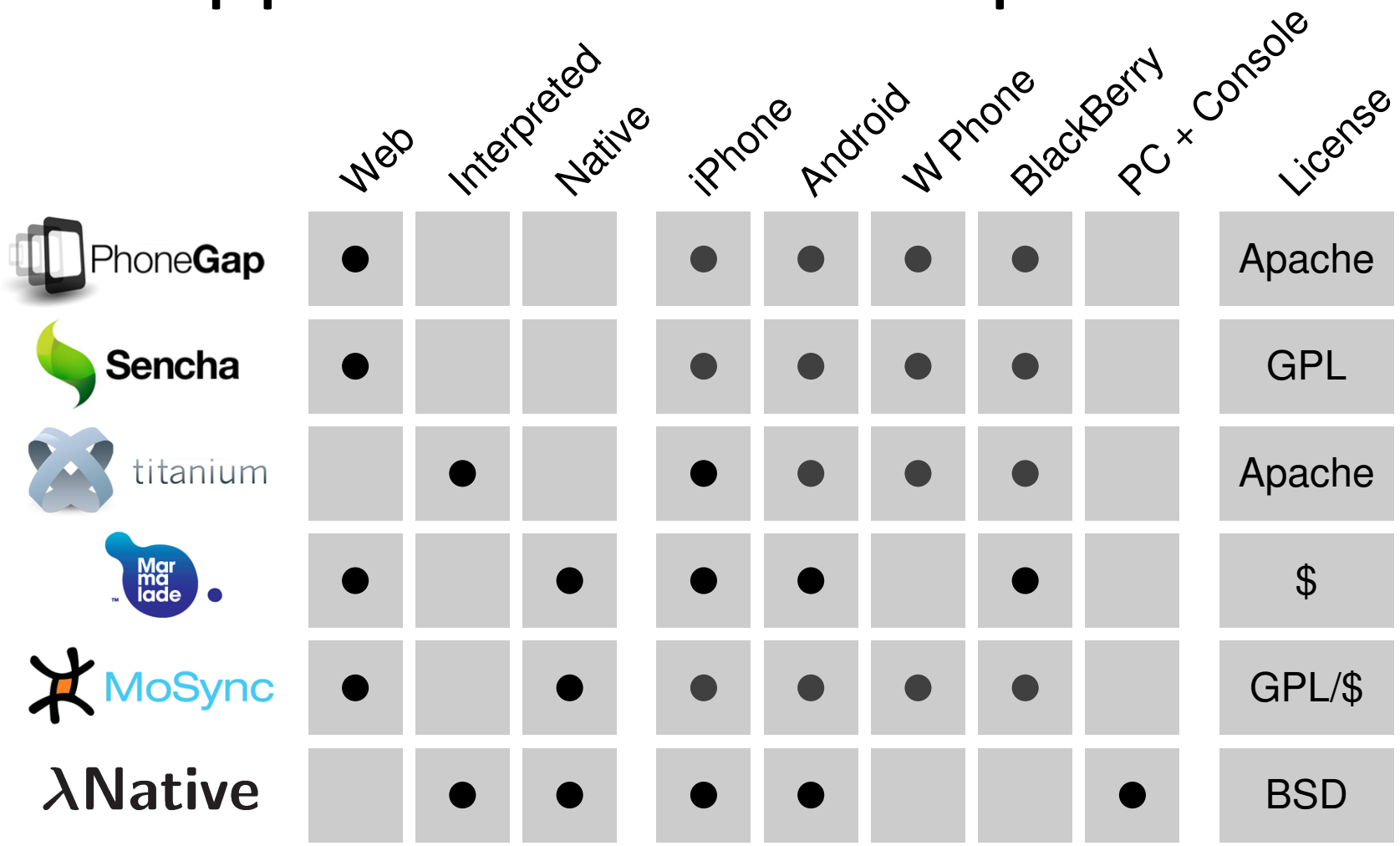
What is λNative?

- Cross-Platform Development Environment
  - Mobile: iOS, Android
  - PC/Embedded: OS X, Linux, Windows, OpenBSD
  - Native binaries from auto-generated C code
  - Scheme + C source
  - IDE independent command line build
- Based on the Gambit-C Scheme compiler
- Open Source (BSD Licensed)

Timeline

Year	Milestone
1975	Scheme (Sussman & Steele @ MIT)
1989	Gambit Scheme (Feeley @ Universite de Montreal)
2009	Cross-platform OpenGL+Scheme framework (OpenBSD/Windows)
2010	OS X (carbon) + iOS + Linux support
2011	OS X (cocoa) + Android support
2013	λNative

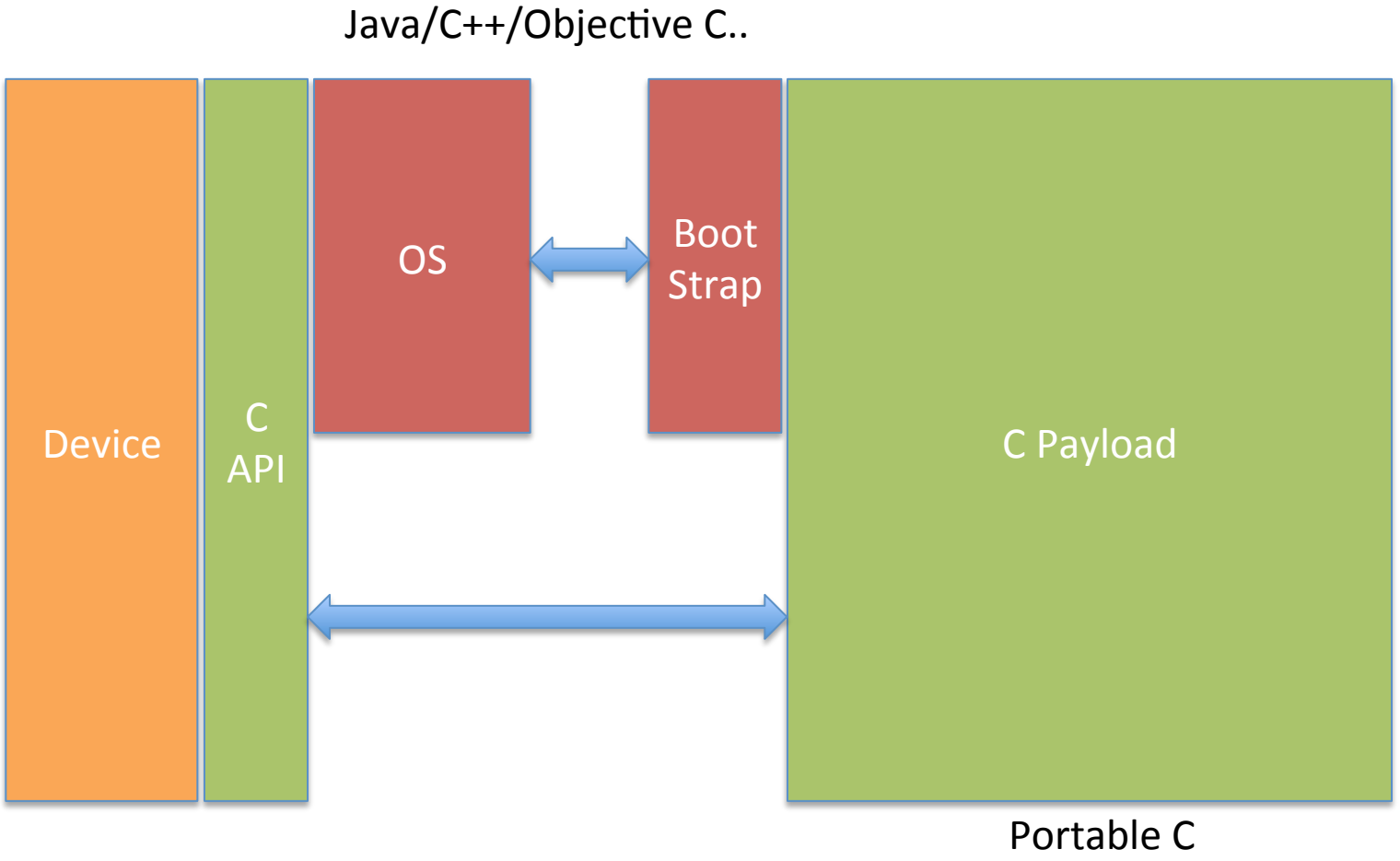
App Framework Comparison



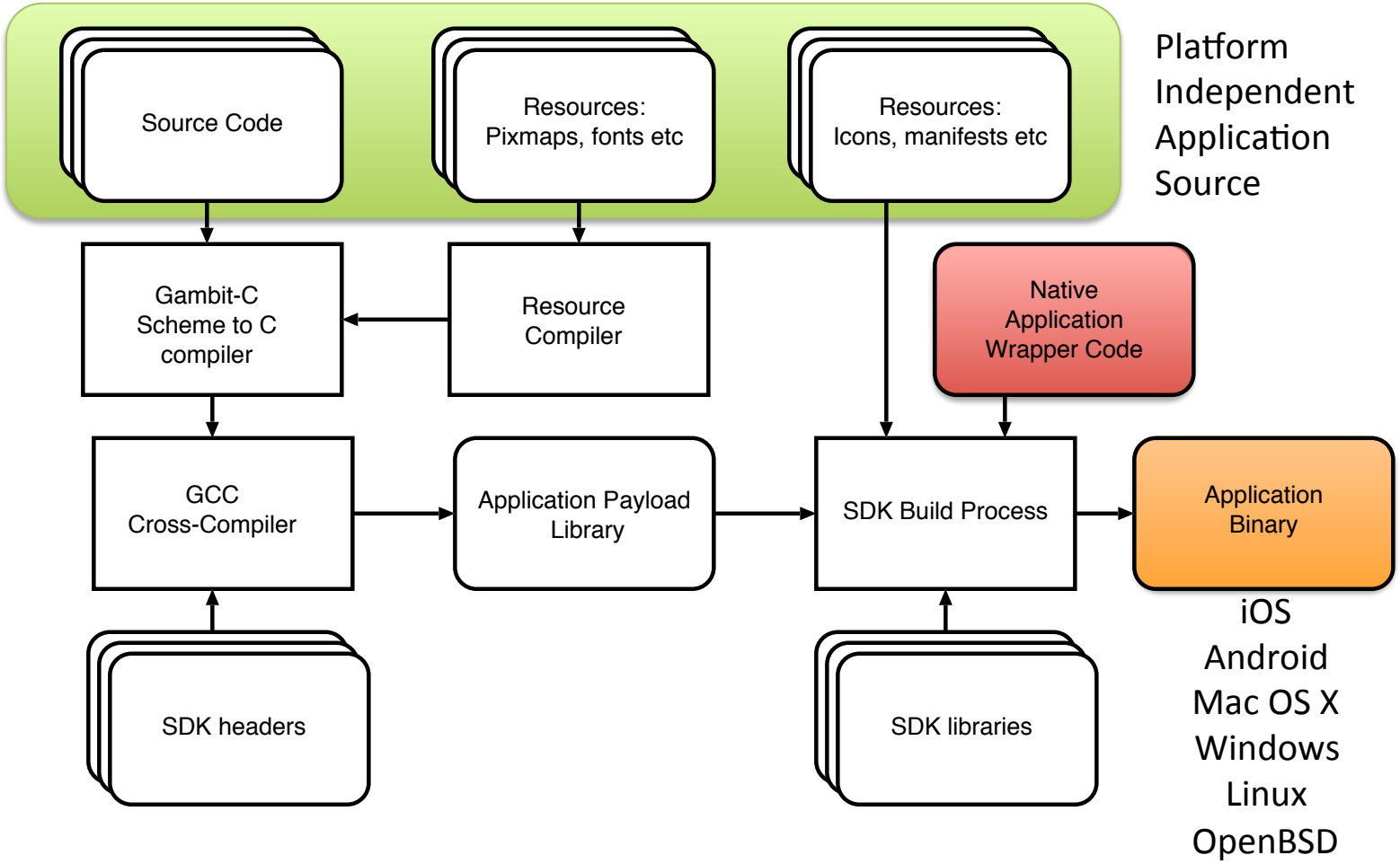
Framework Pros and Cons

- Advantages
  - Reusable portable code base
  - Direct access to existing C based libraries
  - Fast native binaries
  - Brevity and simplicity of code
- Disadvantages
  - Limited access to native GUI elements
    - messaging, camera etc.
  - Limitations of OpenGL GUI (e.g. text handling)
  - Scheme learning curve

Framework Concept



Compilation Diagram



Configuration & Compilation

- Prerequisites:
  - `./PROFILE` developer ID & certificate handling
  - `./SETUP` cross-compiler locations
- `./configure <app> [<platform> [<mode>]]`
  - app
    - Application subdirectory in `./apps`
  - platform
    - `android|ios|macosx|win32|linux`
  - mode
    - `debug|release`
- `make [all|clean|scrub|install]`

Framework File Organization

`PROFILE` `SETUP`	Configuration

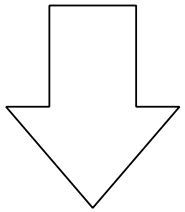
`Makefile`
`configure`
`make.sh`
	Build scripts

`apps/MyApp/*` `modules/MyModule/*`	Scheme/C source code
`libraries/lib*/build.sh.in`	Supporting C libraries
`bootstraps/*/*`	Native platform launchers
`fonts/*.ttf`	Fonts
`tools/*`	Resource compilers etc

Satellite Frameworks

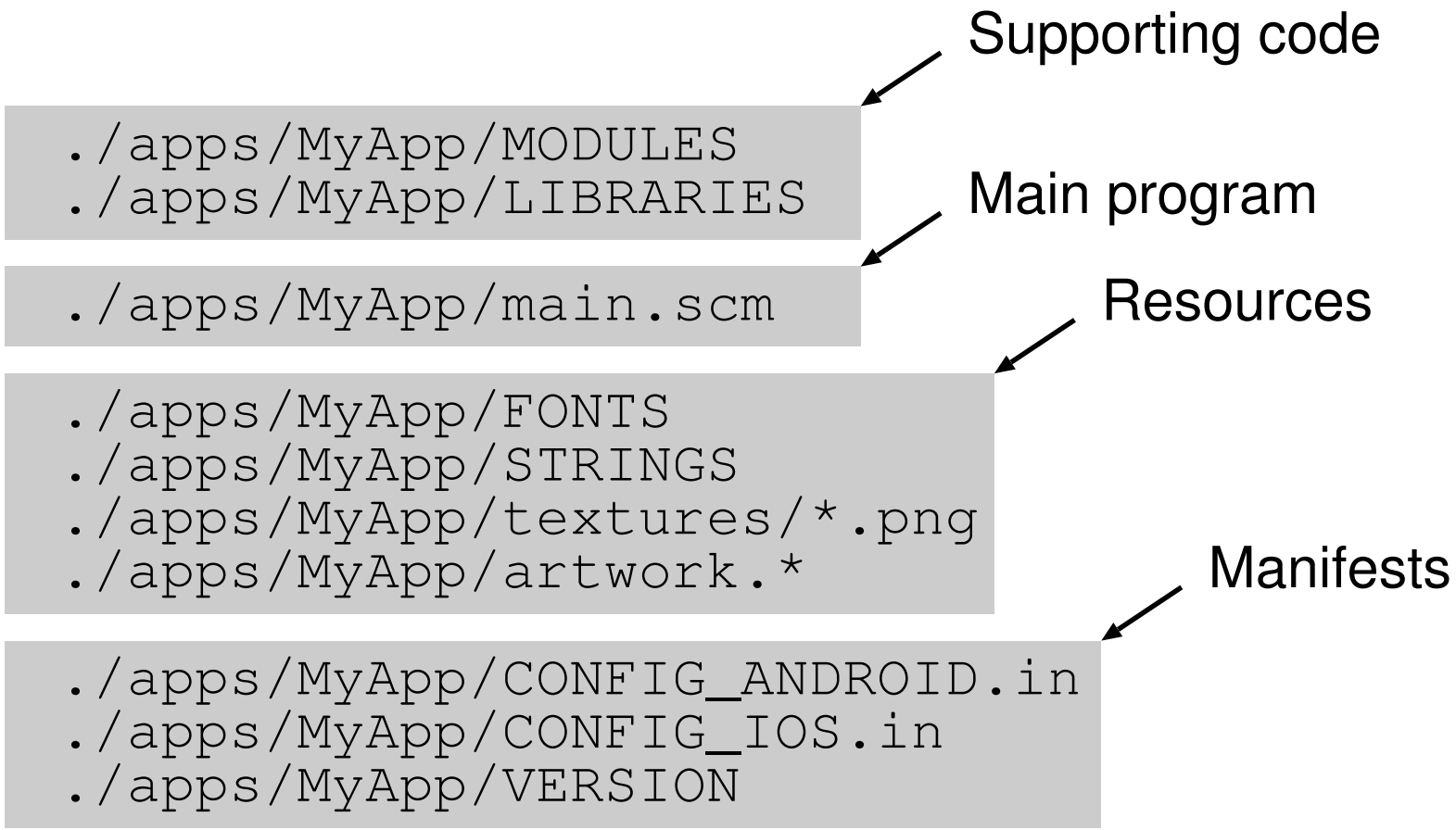
- Shadowing of multiple framework repositories
- Easy code base segmentation
  - E.g. based on projects, organization or privilege

```
/home/satellite_fw/:
 PROFILE
 apps/SatelliteApp/*
 modules/SatelliteModule/*
 libraries/libsatellite/*
 fonts/satfont.ttf
```



```
/home/lambdanative/:
 $ SYS_PATH=/home/satellite_fw ./configure SatelliteApp
   ==> configured to build SatelliteApp for macosx on macosx in normal mode
    == using source in /home/satellite_fw/apps/SatelliteApp
 $ make
   ...
```

Application File Organization



./apps/MyApp/MODULES

- List of all Scheme modules to include
  - Available modules reside in `./modules`
  - `config` module is required for all apps
  - `eventloop` module is required for GUI apps

`ln_core`:	General supporting algos
`ln_glcore`:	OpenGL wrapper
`ln_glgui`:	Widget-based GUI
`ln_audio`:	Cross-platform audio

./apps/MyApp/LIBRARIES

- List of all C libraries to link against
  - Available libraries reside in `./libraries`
  - `libgambc` is minimum requirement
  - Supports conditional linking, e.g.

    `libgambc libportaudio!ios!android`

    -> don't use PortAudio on iOS and Android

./apps/MyApp/FONTS

- <ttf font> <bit depth> <point sizes> <name>

  ```
  helvetica.ttf 7 12,16,24 myfont
  ```

- Truetype fonts reside in `./fonts`
- Bit depth is 7 bits or 8 bits (extended ascii)
- Font texture is accessible as <name>_<size>.fnt in code

  ```
  myfont_16.fnt
  ```

./apps/MyApp/artwork.*

- Vector icon artwork in `artwork.eps`
  - Automatically converted to icon pixmaps
  - Green (#00ff00) is treated as transparent
  - Auto-generated 1024, 512, .., 16 pixel images

`./apps/MyApp/textures/*.png`

- PNG images compile to OpenGL textures
- Automatic padding to powers of two
- Supports RGBA/RGB/Grayscale PNG
  - converts to RGBA/RGB/Alpha textures
- Textures accessible as <png name>.img in program, e.g. `mypixmap.img`

./apps/MyApp/CONFIG_ANDROID.in

C conditional includes
#+ to add

Standard Manifest
to comment out

```
# android manifest
# ----------
#
# enable real-time audio (OpenSL based)
# #define RTAUDIO 1
#
#
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
      package="@SYS_ORGTLD@.@SYS_ORGSLD@.@SYS_LOCASEAPPNAME@"
      android:versionCode="@SYS_APPVERSIONCODE@"
      android:versionName="@SYS_APPVERSION@">
    <uses-sdk android:minSdkVersion="9"/>
    <application android:label="@string/app_name"
                 android:icon="@drawable/icon">
        <activity android:name="@SYS_APPNAME@"
                  android:label="@string/app_name"
                  android:launchMode="standard"
# prevent screen rotations
#                   android:screenOrientation="landscape">
                  android:screenOrientation="portrait">
#                   android:configChanges="orientation|screenSize">
#                   android:configChanges="keyboardHidden|orientation|screenSize">
#                   android:configChanges="keyboardHidden|orientation">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
    </application>
    <uses-permission android:name="android.permission.WRITE_EXTERNAL_STORAGE"/>
#    <uses-permission android:name="android.permission.INTERNET"/>
#    <uses-permission android:name="android.permission.BATTERY_STATS" />
#    <uses-permission android:name="android.permission.WAVE_LOCK" />
#    <uses-permission android:name="android.permission.RECORD_AUDIO" />
</manifest>
# eof
```

./apps/MyApp/CONFIG_IOS.in

```
# ios plist and compile options
#
# don't allow the screen to lock
#+ #define USE_NOLOCK
#
# generate device orientation events
# #define USE_ORIENTATION
#
#
# plist
#
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/DTDs/PropertyList-1.0.d
<plist version="1.0">
<dict>
<key>CFBundleDevelopmentRegion</key>
<string>English</string>
<key>CFBundleExecutable</key>
<string>@SYS_APPNAME@</string>
<key>CFBundleIdentifier</key>
<string>@SYS_ORGTLD@.@SYS_ORGSLD@.@SYS_LOCASEAPPNAME@</string>
<key>CFBundleInfoDictionaryVersion</key>
<string>6.0</string>
<key>CFBundleLongVersionString</key>
<string>@SYS_APPVERSION@</string>
<key>CFBundlePackageType</key>
<string>APPL</string>
<key>CFBundleResourceSpecification</key>
<string>ResourceRules.plist</string>
<key>CFBundleSignature</key>
<string>????</string>
<key>CFBundleSupportedPlatforms</key>
<array>
<string>iPhoneOS</string>
</array>
<key>CFBundleVersion</key>
<string>@SYS_APPVERSION@</string>
<key>CFBundleDisplayName</key>
<string>@SYS_APPNAME@</string>
<key>UIStatusBarHidden</key>
<true/>
</dict>
</plist>
#eof
```

Minimal Console Program

```
(display "DemoConsole\n")

(let loop ()
  (with-exception-catcher (lambda (e)
    (for-each display
      (list (exception->string e) "\n")) #f)
    (lambda () (##repl-debug)))
  (loop))
```

```
$ .../DemoConsole
DemoConsole
> (+ 1 2)
3
>,q
$
```

Minimal GUI program

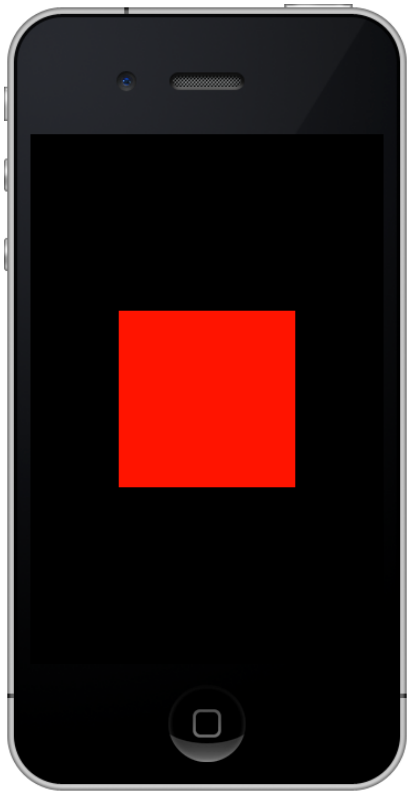
```
(define gui #f)

(main
;; initialization
  (lambda (w h)
    (make-window 320 480)
    (glgui-orientation-set! GUI_PORTRAIT)
    (set! gui (make-glgui))
    (let* ((w (glgui-width-get))
           (h (glgui-height-get))
           (dim (min (/ w 2) (/ h 2))))
      (glgui-box gui (/ (- w dim) 2) (/ (- h dim) 2) dim dim Red)
  )
;; events
  (lambda (t x y)
    (if (= t EVENT_KEYPRESS) (begin
      (if (= x EVENT_KEYESCAPE) (terminate))))
    (glgui-event gui t x y))
;; termination
  (lambda () #t)
;; suspend
  (lambda () (glgui-suspend))
;; resume
  (lambda () (glgui-resume))
)
```

GUI initialization

Event loop

DemoRedSquare

```
$ ./configure DemoRedSquare ios
==> configured to build DemoRedSquare for ios on macosx in normal mode
 == using source in /home/lambdanative/apps/DemoRedSquare
$ make; make install
..
```




235
mcg/kg/min
2.99
mcg/ml
50.1
%
18:40:15 INDUCTIONCOMPLETE:MAIN
18:35:23 PROPOFOLINFUSION:T
18:35:16 HEIGHT:170.000
18:35:16 WEIGHT:99.000
18:35:16 AGE:27.000
18:35:16 SEX:FEMALE
18:35:16 CASESTART:X
Control PIN
Gender
Age [years]
Weight [kg]
Height [cm]
0.552
uSquish
Squish the Animal to Start!
uSquish Ver. 1.0
(c) 2011 University of British Columbia
Animal artwork by Martin Berube
96 SpO2
84 HR
249
mcg/kg/min
1.67
mcg/ml
76.2
%
Infusion Rate Est.
236
ml/h
01:01:47
Time To Empty
Volume [ml]
Qtts [drops/ml]
Tap rate or insert DripRate sensor
06:07:16 TACHYCARDIA
06:07:06 HRMAX:65.000:DRANSERMINO
06:05:48 HRMAX:80.000:DRANSERMINO
06:01:51 INDUCTIONCOMPLETE:MAIN
05:57:22 PROPOFOLINFUSION:T:DRANSERMIN
05:57:15 HEIGHT:170.000
05:57:15 WEIGHT:110.000
05:57:15 AGE:30.000
05:57:15 SEX:MALE
Overview
Location Phase HR SpO2 etCO2 Alert
Dental 0
OR1 122 100 42
OR2 0
OR3 0
OR4 126 100 28
OR5 60 99 43
OR6 132 100 38
OR7 81 99 40
RRate
Respiration Rate Est.
15
breaths/min
Tap Breath Rate
HRate
Heart Rate Est.
53
beats/min
Tap Heart Rate
Sep 25, 2013 13:40
Menu
Measure SpO2
Done
Patient: Jane Doe
49 BPM
98 % SpO2
00:45
Currently measuring...
Sensor Type
Wrap
Phone Oximeter
5 Weight Kg
100 Battery %
100
0.77
0.93
91.1
83 HR bpm
86 SpO2
3. Measure
Audio Thermometer
38.17 TEMP deg
StethoSwirl
43 HR bpm
AudioOx
97
RECORD
72