# Some Experiences With Python For Android (Py4A)

python™

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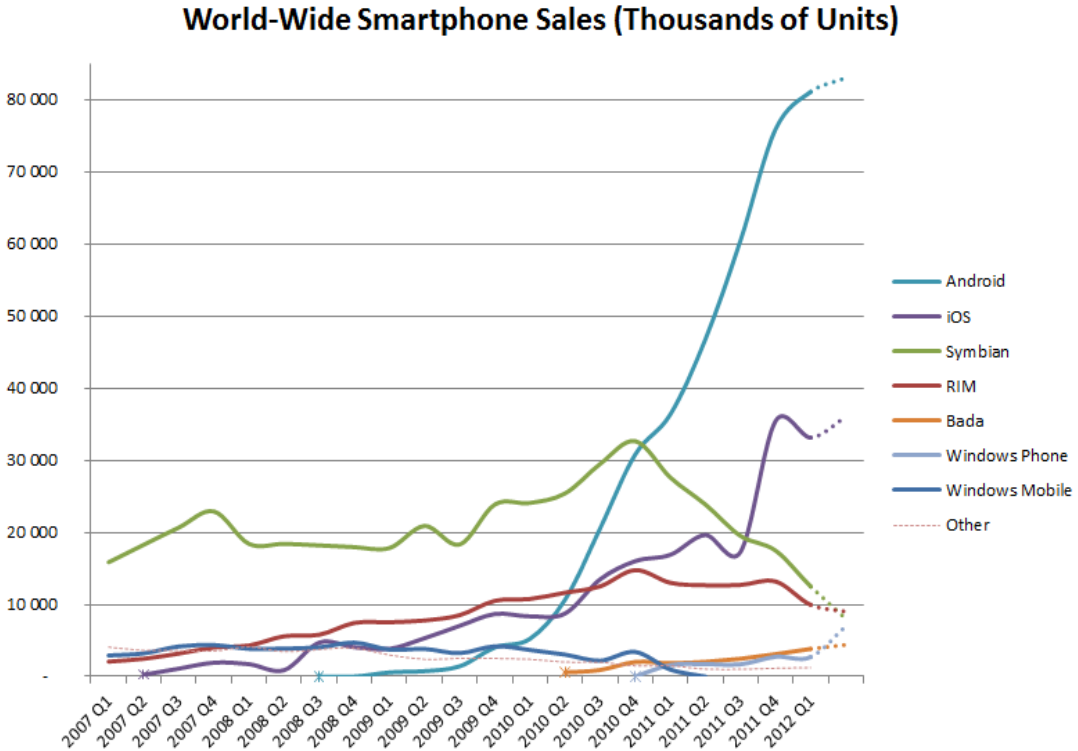
# Motivation and Background


- Teaching since 2001 in our degree program "Interactive Media"
  - "Interactive Media" is a program based on 50% computer science and 50% art design
  - the students are starting to learn programming by a one year java course
  - I try to motivate them using Python in web programming using web2py since 2008
- Research projects *http://www.hs-augsburg.de/~john/mobile-experience/*
  - Java projects on Symbian mobile devices since 2003
  - some projects with Python on S60 in 2007 and 2008
  - but these projects are mostly a single thesis or a single project
  - and none of them could be used for teaching in beginners classes
- Teaching needs
  - ease of use and simplicity
  - fast success stories
  - Open Source and not restricted frameworks

# Changing to Android


- Android as an Operating System for mobiles appeared first in 2008
- increasing mobile smartphone market since 2010 – already all students have now a device, no additional costs for the faculty
- based on Linux Android opens this devices to desktop quality




*Source: http://en.wikipedia.org/wiki/Mobile_operating_system*

# Advantages and Usability


- **Device Driven Development** vs. Emulator Driven Development
  - only a Text Editor is needed
  - no complex Emulator Installation is necessary
- **Why ?**
  - currently more for experienced programmers
  - not for students based on windows-clickable knowledge
- **How ?**

# Beamer Access

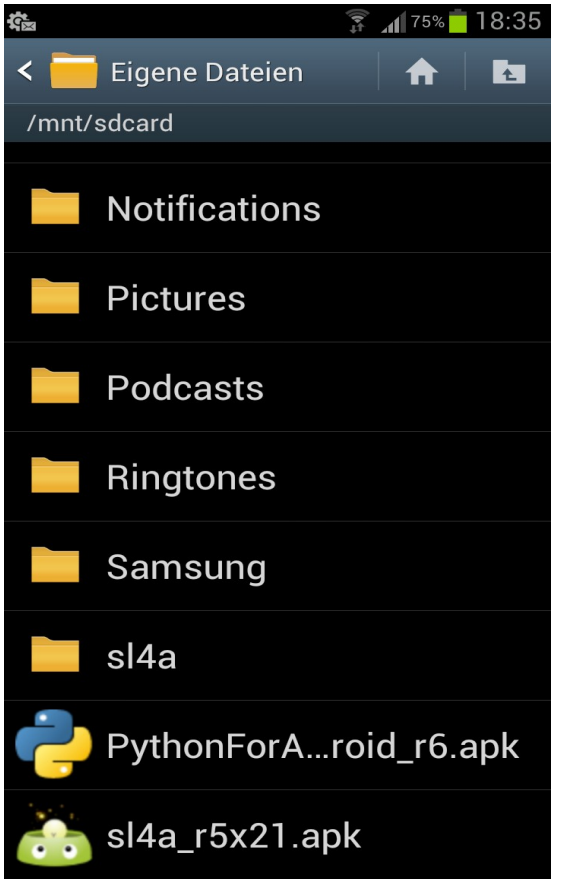
- **MicroUSB – HDMI Adapter**
  - using this adapter (with Android > 4.0) lets you easily output the user interface via modern beamers
- **HDMI – VGA Adapter**
  - for middle-aged beamers like in this room
- be careful and **test it !**
  - there are so many Adapters available, and they are not compatible – even for each smartphone there is a new one !

# WIFI Connection vs. USB Connection


- using the **SwiFTP** Server on the Android and **FileZilla** on the Desktop lets you access the whole root directory and not only the sdcard
- additionally, the sdcard device is not unmounted during transfers as it is using the USB connection
- editing on the PC an testing on the device can by done on-the-fly
- **SwiFTP APK**
  - http://github.com/ppareit/swiftp
- **FileZilla** (or any other FTP-client)
  - http://filezilla-project.org/

# Scripting Layer for Android - SL4A

- SL4A is a wrapper for the Android API via so-called Android Facades using RPC calls
  - code.google.com/p/android-scripting




- Unofficial Release: sl4a_r5x (r5x21 – 4.6.2012)
  - code.google.com/p/android-scripting/wiki/Unofficial

# Scripting Layer for Android - SL4A

- SL4A RPC Server

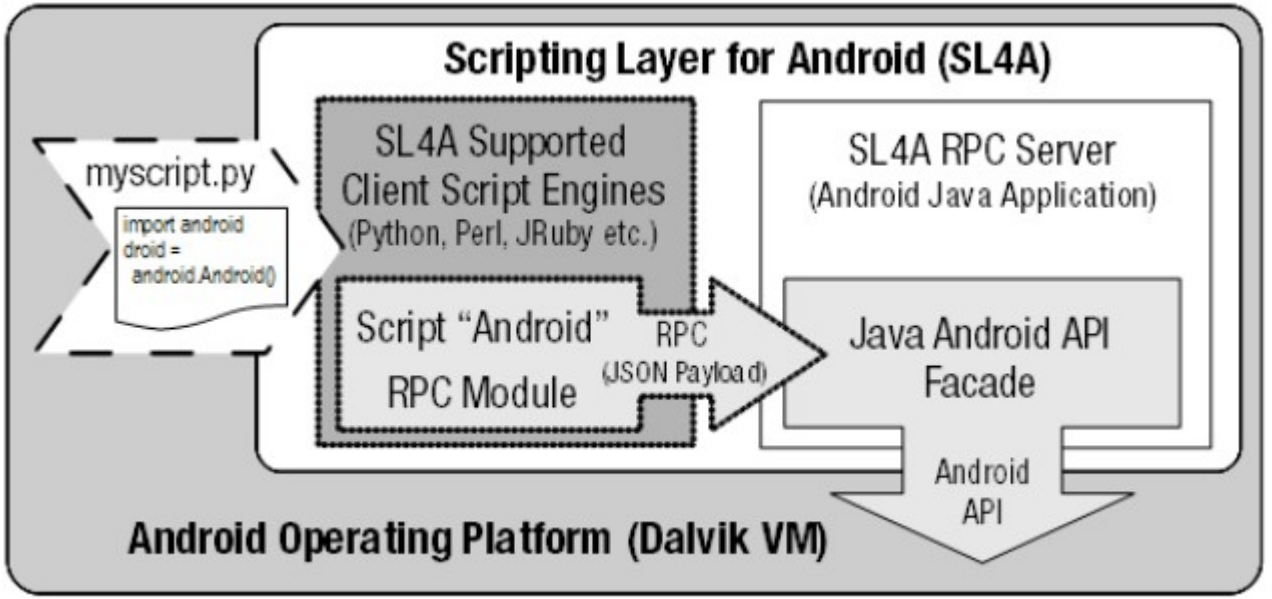



**Figure 5–21.** *SL4A architecture overview*

*Source: Jordan/Greyling, Practical Android Projects*

- SL4A uses JavaScript Object Notation (JSON) for the communication between the SL4A RPC Server and its clients.

# SL4A Features


- SL4A makes it possible to **quickly prototype applications for Android on the device itself** using high-level scripting languages.
- SL4A provides Android facades which make the **Android APIs available via JSON RPC calls**.
- As for the Android facades, the **API is primarily focused on making it easier to write scripts** than on the performance of those scripts.

- Python is actually the cross compiled C binary version running natively.

*Source: see http://code.google.com/p/android-scripting/wiki/FAQ*

# SL4A API


## Dividing the SL4A API into groups of facades:

- Subdevices (BatteryManager, Bluetooth, **Location,** SensorManager, WiFi, SignalStrength)
- Media (MediaPlayer, MediaRecorder, SpeedRecognition, TextToSpeech, Phone, Sms, **Camera**, WebCam, ToneGenerator)
- **UI**
- Contacts
- Intents (e.g. scanBarcode, search, viewHtml, viewMap, ...)
- Others (Android, **Events**, Preferences, Settings, WakeLock, ActivityResult, ApplicationManager)

# SL4A API - List


List of all facades:

http://code.google.com/p/android-scripting/wiki/ApiReference

- enough description for the most methods
- if not, look at the help link at http://www.mithril.com.au/android/doc

# Python for Android - Py4A


- PythonForAndroid-r7b1.apk (Python 2.6.2)
  - http://code.google.com/p/python-for-android/
  - or Python3ForAndroid-r6.apk (Python 3.3)
- Additional you need to install the modules and scripts from the above download area
  - http://python-for-android.googlecode.com/files/python_extras_r13.zip
  - r13 this worked for my devices
  - r14, r15, r16 doesn't – might be because of the r7b1 ?
- additional Documentation:
  - Paul Ferrill: Pro. Android Python with SL4A, 2011, Apress

# SL4A Example: Web2py


- What's Web2py ?
  - modern Python Web Application Framework
  - built originally for teaching students by Massimo di Pierro
  - meanwhile an interesting alternative for Python based Web Application Frameworks
- running out-of-the-box
  - integrated SQLite 3
  - integrated Roxen Webserver
  - integrated jQuery
- nevertheless modular and easily adoptable to all well-known Databases and Webservers

# Web2py Mobile


- using the mobile as a client via jQuery mobile
  - http://jquerymobile.com/
  - http://web2py.com/plugins/plugin_jqmobile/about
- using the mobile as a server via SL4A – Scripting Layer for Android
  - necessary adoption:
    Python module shelve doesn't work correct because of the fallback from anydbm to dumbdbm
    - Workaround: http://klever.hs-augsburg.de/aktuelles#web2pyAndroid
  - disadvantage:
    problems with disk-caching – but only necessary for optimization

# Sensors


code example for a simple sensors function within the web2py framework, running on my mobile and accessed via WLAN http://10.20.x.y:8000/Android/default/sensors :

```
import android
droid = android.Android()

def sensors():
    result = None
    while not result:
        # 1 = all Sensors, 100 ms time between readings
        droid.startSensingTimed(1,100)
        time.sleep(2)
        result = droid.readSensors().result
    return response.render('default/sensors.html',dict(data=result))
```

# Location

code example for a simple gps function within the web2py framework, running on my mobile and accessed via WLAN http://10.20.x.y:8000/Android/default/gps :

```
import android
droid = android.Android()

def gps():
    result = None
    while not result:
        # 2 Minutes as minimum time between updates,
        # 200 m minimum distance between updates
        droid.startLocating(2*60*1000,200)
        time.sleep(2)
        result = droid.readLocation().result
    return response.render('default/sensors.html',dict(data=result))
```

# Camera Picture


code example for a simple camera picture function like before http://10.20.x.y:8000/Android/default/picture :

```
import android, datetime
droid = android.Android()

def picture():
    dt = datetime.datetime.now()
    path = '/mnt/sdcard/sl4a/scripts/web2py/applications/Android/static/'
    PictureName = 'pic_%s.jpg'%dt.strftime('%Y_%m_%d_%H_%M_%S')
    response = droid.cameraCapturePicture(path+PictureName)
    if response.result['takePicture']:
        return dict(data=PictureName)
    else:
        return dict(data=None)
```

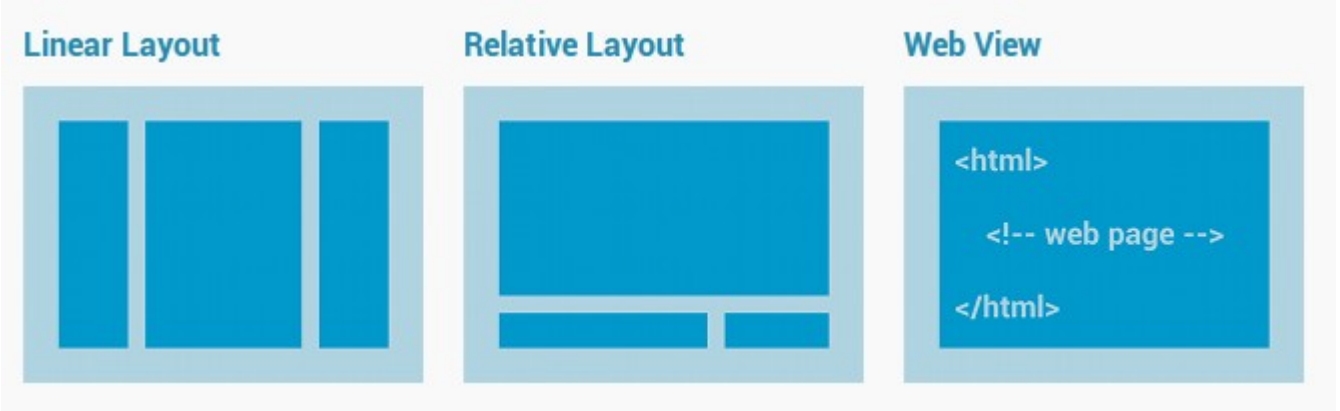
# SL4A Web2py Example


- accessing the Web2py Webserver via WLAN
  - Sensors Example
  - Location Example
  - Picture Example

- changing some layout
  - e.g. in **picture.html** in your preferred editor on the PC
  - transfer it to the device via **ftp**
  - reload the site

# SL4A R5 – Full UI Support


- Support of the Standard Android UI
  - XML Layout Schema as described in
  - http://developer.android.com/guide/topics/ui/overview.html
  - LinearLayout, RelativeLayout



# Full UI Example

- adopted from fulluitest.py

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
              android:id="@+id/background"
              android:orientation="vertical"
              android:layout_width="match_parent"
              android:layout_height="match_parent"
              android:background="#ff000000">
        <TextView android:layout_width="match_parent"
                  android:layout_height="wrap_content"
                  android:text="TextView"
                  android:id="@+id/textView"
                  android:textAppearance="?android:attr/textAppearanceLarge"
                  android:gravity="center_vertical|center_horizontal|center"></TextView>
        <EditText android:layout_width="match_parent"
                  android:layout_height="wrap_content"
                  android:id="@+id/editText"
                  android:tag="Tag Me"
                  android:inputType="textCapWords|textPhonetic|number">
                  <requestFocus></requestFocus></EditText>
        <Button android:id="@+id/button"
                  android:layout_width="wrap_content"
                  android:layout_height="wrap_content"
                  android:text="Ok"></Button>
        <CheckBox android:layout_height="wrap_content"
                  android:id="@+id/checkBox1"
                  android:layout_width="234dp"
                  android:text="Howdy, neighbors."
                  android:checked="true"></CheckBox>
</LinearLayout>
```

# fulluitest.py


```
import android
droid=android.Android()

def eventloop():
  while True:
    event=droid.eventWait().result
    print event

    if event["name"]=="click":
      id=event["data"]["id"]
      if id=="button":
        droid.fullSetProperty("editText","text","OK has been pressed")
      elif id=="checkBox1":
        droid.fullSetProperty("textView","text","Other stuff here")
        if event["data"]["checked"] == "false":
          droid.fullSetProperty("background","backgroundColor","0xff7f0000")
        else:
          droid.fullSetProperty("background","backgroundColor","0xff000000")
    elif event["name"]=="key":
      if event["data"]["key"]=="4":
        return

layout=""" ... """

print droid.fullShow(layout)
eventloop()
print droid.fullQuery()
print "Data entered =",droid.fullQueryDetail("editText").result
droid.fullDismiss()
```

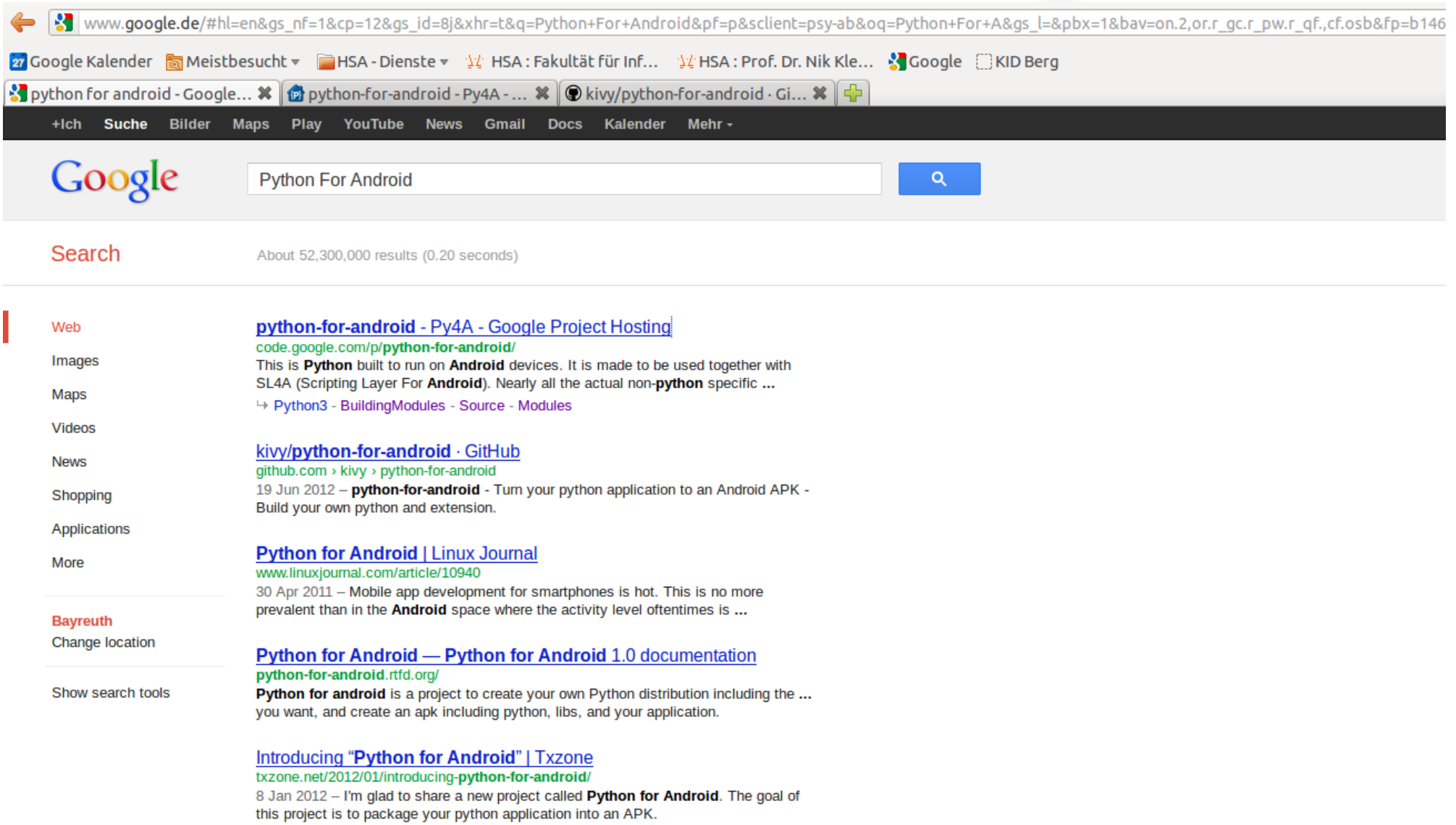
# SL4A Examples on the Mobile


- Accessing the Web2py Webserver on the Device – using the jQuery mobile plugin
  - Sensors Example
  - Location Example
- fulluitest.py
- Full Screen UI Wrapper
  - http://code.google.com/p/python-for-android/downloads/

# Summary and What's Missing ?


- **Summary SL4A**
- tty output and file operations (e.g. logging) as you would expect,
- most Python standard library modules are integrated,
- but no tty input
- simple access to the cool subdevices and media ingredients like Bluetooth, Phone, SMS, Location, Camera, Accelerometer, Magnetic Sensor, ...
- basic UI – adopted to Android UI Design
- **What's missing ?**
- The normal touchable interface is not supported
  - caused by the RPC Architecture
- What's to do ?
  - googling for **Python-For-Android** ?

# Google for „Python for Android“



# Python for Android - Results


- **python-for-android** - Py4A - Google Project Hosting

  code.google.com/p/python-for-android

  „Python for Android“ as Py4A in addition to Scripting Layer for Android (SL4A), as described above

- kivy/**python-for-android –** GitHub

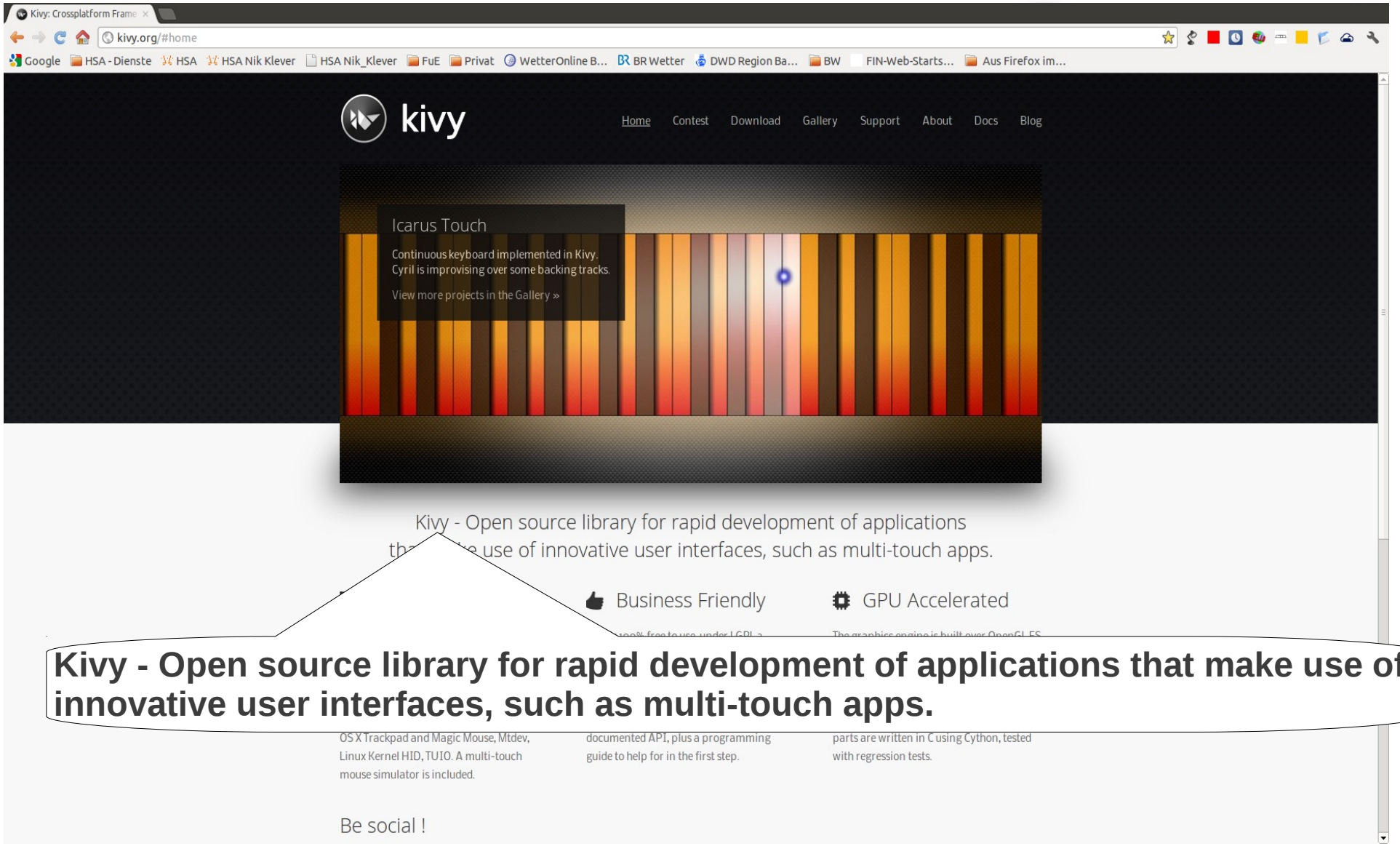
  github.com/kivy/python-for-android

  a second „Python for Android“ exists in addition and combination with Kivy, a Python framework for multi-touch devices

- **Others**

  There are some other Python „on“ Android solutions … (PySide, PyGame, PGS4A, Python-on-a-chip, …) which are discussed by Thomas Perl and Andreas Schreiber earlier in this week

# The Future: Kivy




**Kivy - Open source library for rapid development of applications that make use of innovative user interfaces, such as multi-touch apps.**

# Kivy - http://www.kivy.org


**Cross platform**

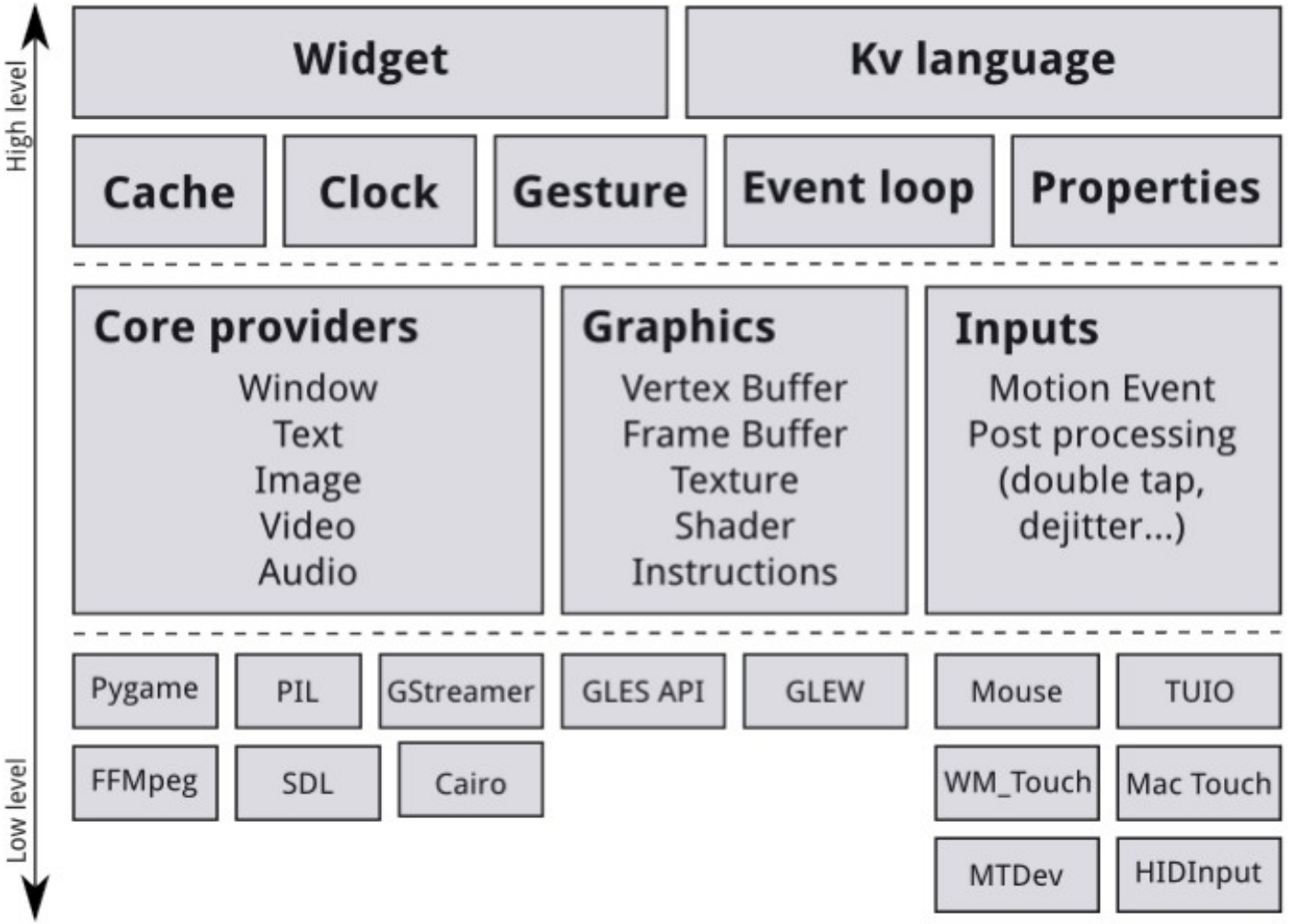
- running on Linux, Windows, MacOSX, Android and IOS
- can use natively most input protocols and devices

**GPU Accelerated**

- graphics engine is built over OpenGL ES 2
- toolkit with more than 20 widgets
- written in C and Cython

*Source: www.kivy.org/#home*

# Kivy - Architecture




*Source: www.kivy.org/docs/guide-index.html*

# Kivy API


- Kivy framework ( …, **App**, ...)
- Core Abstraction (Audio, Camera, Image, Text, ...)
- Extension Support
- Graphics (Basics (…, **Color, Ellipse, Line**, … ), Canvas, ...)
- Input management (Providers, Motion Event, …)
- External libraries (jinja2)
- Modules (Inspector, Monitor, ...)
- Network support (url)
- Widgets (..., **Widget, Button,** ...)

# Kivy on Android


- as stated here:
  - http://python-for-android.readthedocs.org/en/latest/android/
- the Android module of Kivy is written in
  - Cython, transformed to JNI via
  - C JNI, to access the Android Java API via the JNI Layer
- Recipes (additional Python modules) are already available
- all about Python For Android:
  - http://python-for-android.readthedocs.org/en/latest/extend/

# MyPaint Example

```
from random import random
from kivy.app import App
from kivy.uix.widget import Widget
from kivy.uix.button import Button
from kivy.graphics import Color, Ellipse, Line

class MyPaintWidget(Widget):
    def on_touch_down(self, touch):
        userdata = touch.ud
        userdata['color'] = c = (random(), 1, 1)
        with self.canvas:
            Color(*c, mode='hsv')
            d = 30
            Ellipse(pos=(touch.x - d/2, touch.y - d/2), size=(d, d))
            userdata['line'] = Line(points=(touch.x, touch.y))
    def on_touch_move(self, touch):
        touch.ud['line'].points += [touch.x, touch.y]

class MyPaintApp(App):
    def build(self):
        return MyPaintWidget()

if __name__ == '__main__':
    MyPaintApp().run()
```

*Source: http://kivy.org/docs/guide/firstwidget.html*

# Kivy Examples


- MyPaint
- **Touchtracer** from the Kivy Team
- **Showcase** from the Kivy Team

# Thanks


- especially thanks to
- **Massimo Di Pierro**, the creator and maintainer of web2py
- the **Kivy Team**
- **Wyn Williams** and **Sylvio Tomati** from the Wifi-Team here at EuroPython, because of helping to bring up a stable Wifi connection for this talk
- additionally all guys here at the EuroPython behind the scene, they did an excellent work !

# Questions ?


- Questions ?

- http://klever.hs-augsburg.de/aktuelles#EuroPython2012

# Literature and additional Links


- Lucas Jordan & Pieter Greyling „Practical Android Projects“, 2011, Apress
- Chapter 5 „Introducing SL4A: The Scripting Layer for Android“ in Jordan/Greyling „Practical Android Projects“, http://android-scripting.googlecode.com/files/Practical_Android_Projects_Ch05_Introducing_SL4A.pdf
- Paul Ferrill „Pro Android Python with SL4A“, 2011, Apress
- SL4A FAQ, http://code.google.com/p/android-scripting/wiki/FAQ