Importance of Mobile App Testing

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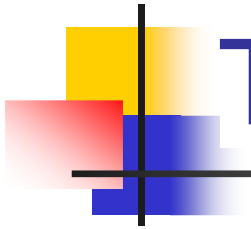
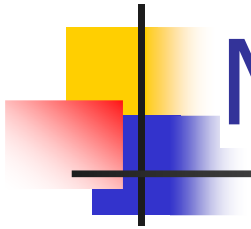


Topics

1. Mobile Apps Testing
2. Mobile Architecture and Mobile Apps Testing
3. Industrial Survey and Analysis
4. Types of Mobile Apps Testing

   15 Minutes Break
5. Testing Tools
6. Government Initiatives

1 Mobile Apps Testing



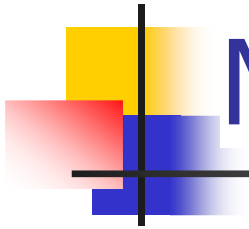
Mobile Application Testing

- Mobile application testing is a process by which application software developed for hand held mobile devices is tested for its functionality, usability and consistency.
- Mobile application testing can be automated or manual type of testing.

Mobile Technology

- Are programming mobile apps typically more difficult than desktop applications?

- People are willing to spend more time to explore these mobile programming techniques
- Mobile programming is often equipped with REST API as far as there are real-time operations and data sharing involved
- Virtually all people will carry mobile/wearable devices at all time

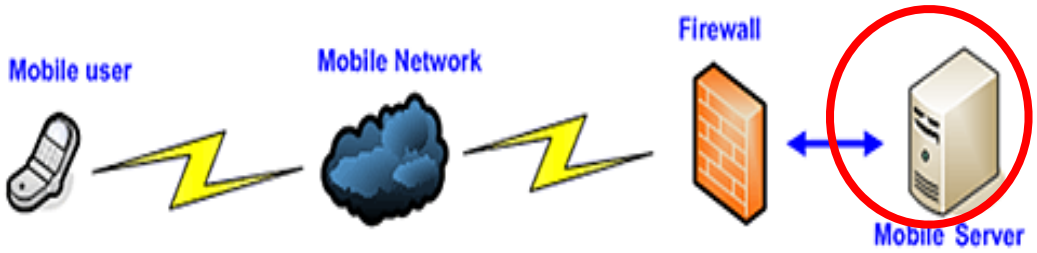


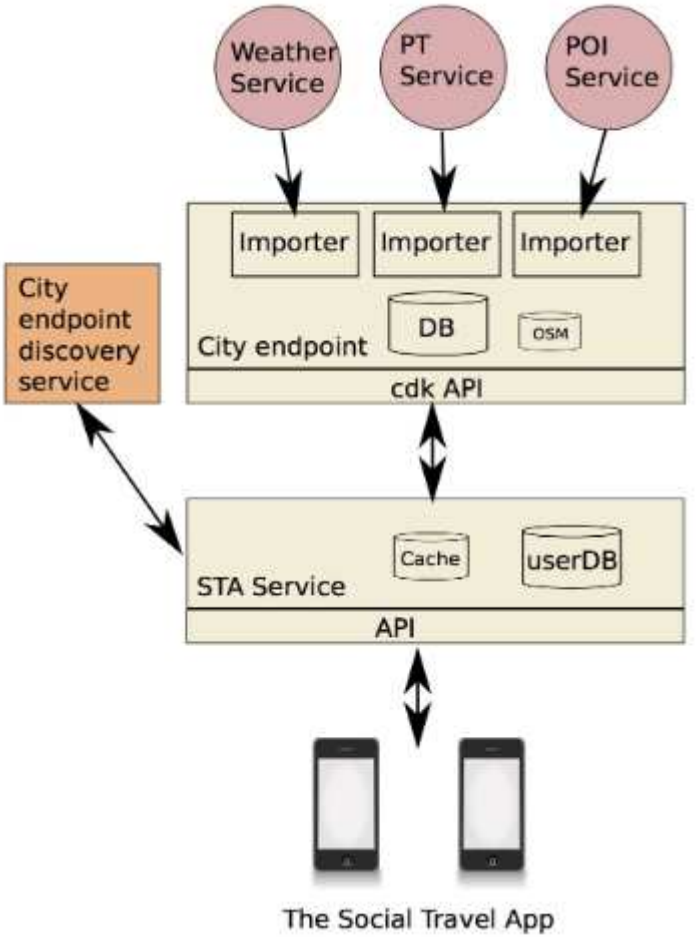
Mobile Apps Testing

- Testing mobile apps is complex
- There are numerous platforms and OS's (think fragmentation)
- numerous devices
- numerous types of testing scenarios
- a variety of network connections and carriers (Wifi, 3G, 4G …)

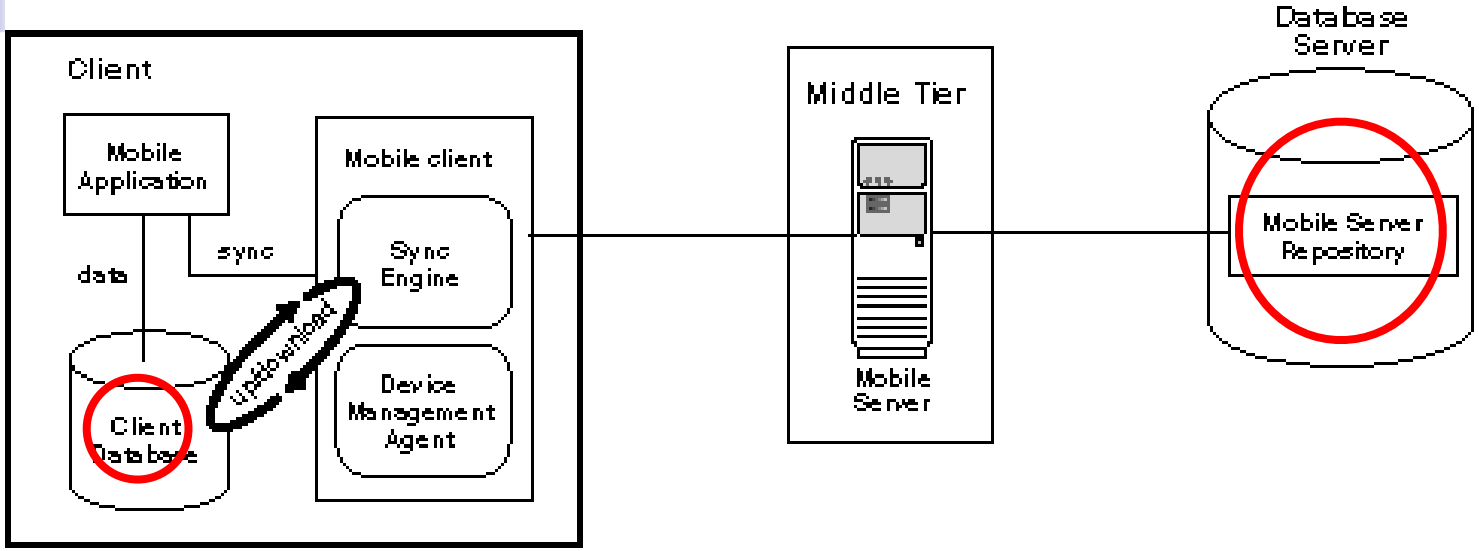
2 Mobile Apps Architecture and Testing

Overview Architecture (I)





Overview Architecture (II)



Example:

Always work with local data on device

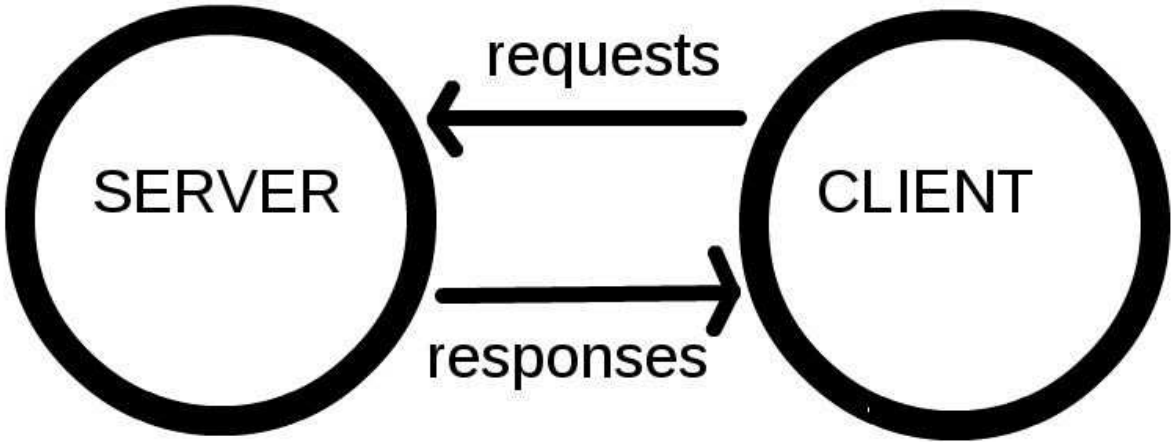
When connected: Create new date and change documents they sync automatically

When not connected: work with solid local NoSQL Database

Couchbase [Lite]

http://db-engines.com/en/ranking

Client - Server



Logic

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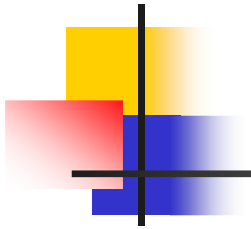


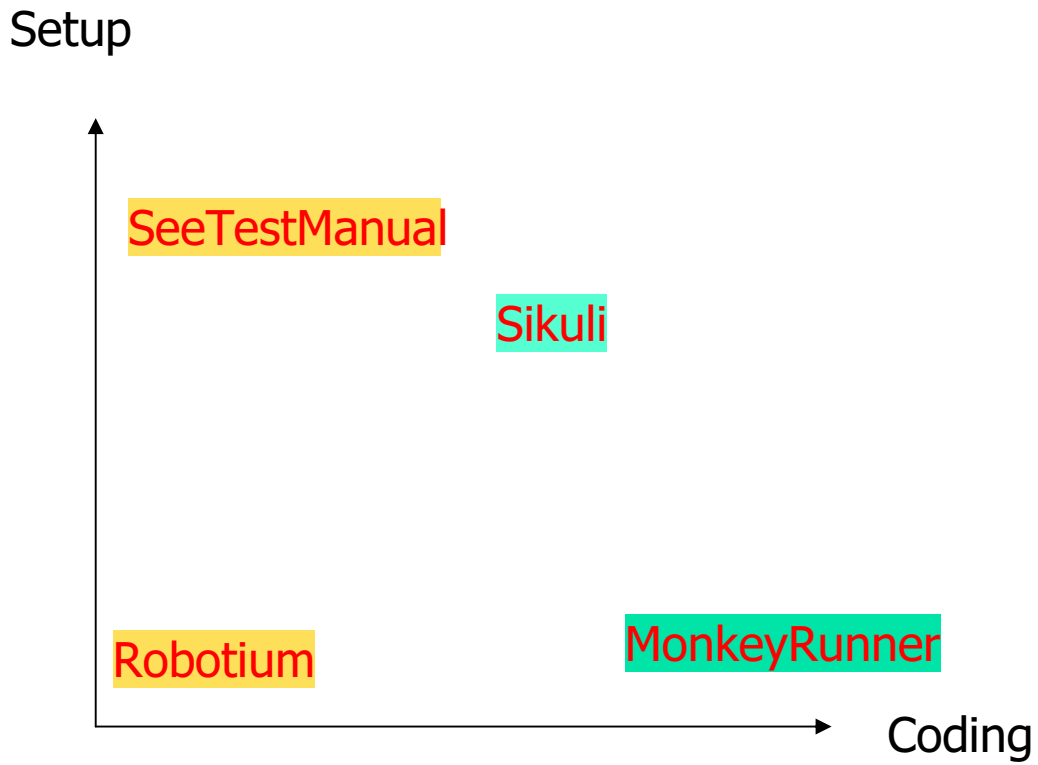
Rest API

- Due to the fact that 3G/4G are less stable than Wifi, the "normal" way to access a database would be to put a Restful server in front of it and use the HTTP/HTTPS protocol to connect to the Restful front end.

Mobile Back-end Communication

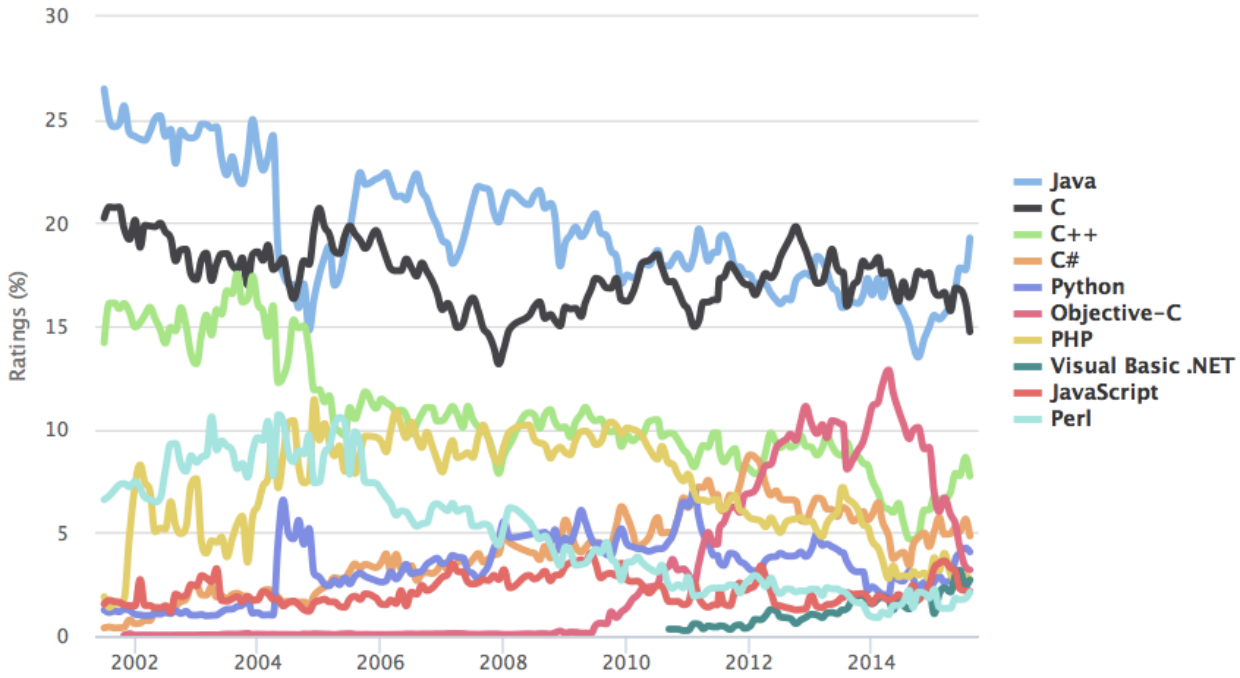
- JDBC is designed for high-bandwidth, low-latency, highly-reliable network connections (e.g., desktop to database server, web application server to database server).
- Mobile devices offer little of these, and none of them consistently.
- Mobile apps do not connect directly to the database server.
- We need to create a simple HTTP service that will pass the requests to the database and will return the response.

Setup vs Coding Effort



Coding

- Recording
- Java
- Python
- Jython
- Ruby



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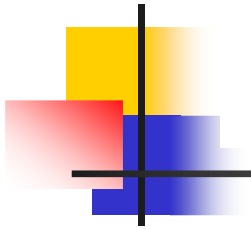
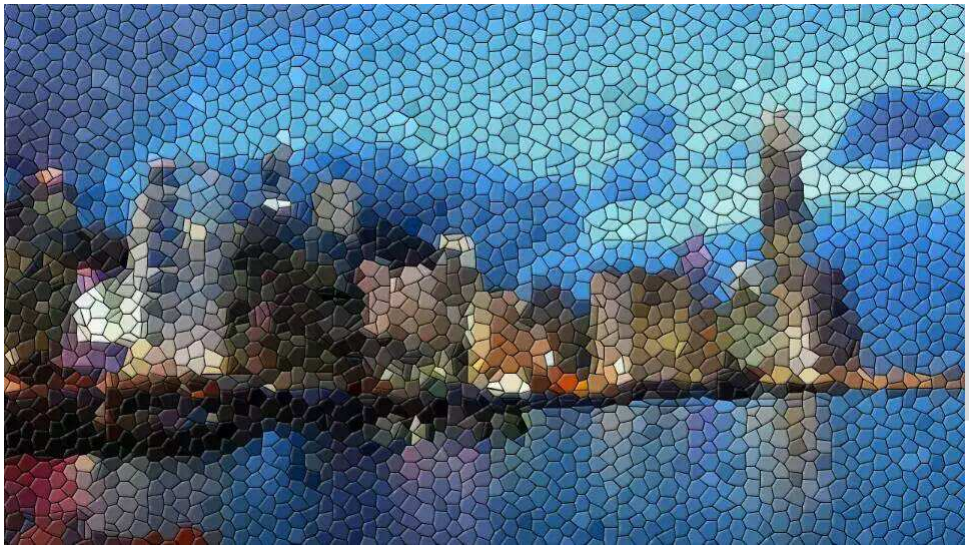
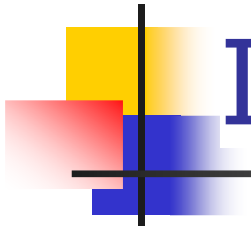


Setup

- Bundled with the sdk
  - E.g. MonkeyRunner
  - Unit testing
- Need to set up an external testing environment

3 Industrial Survey and Analysis



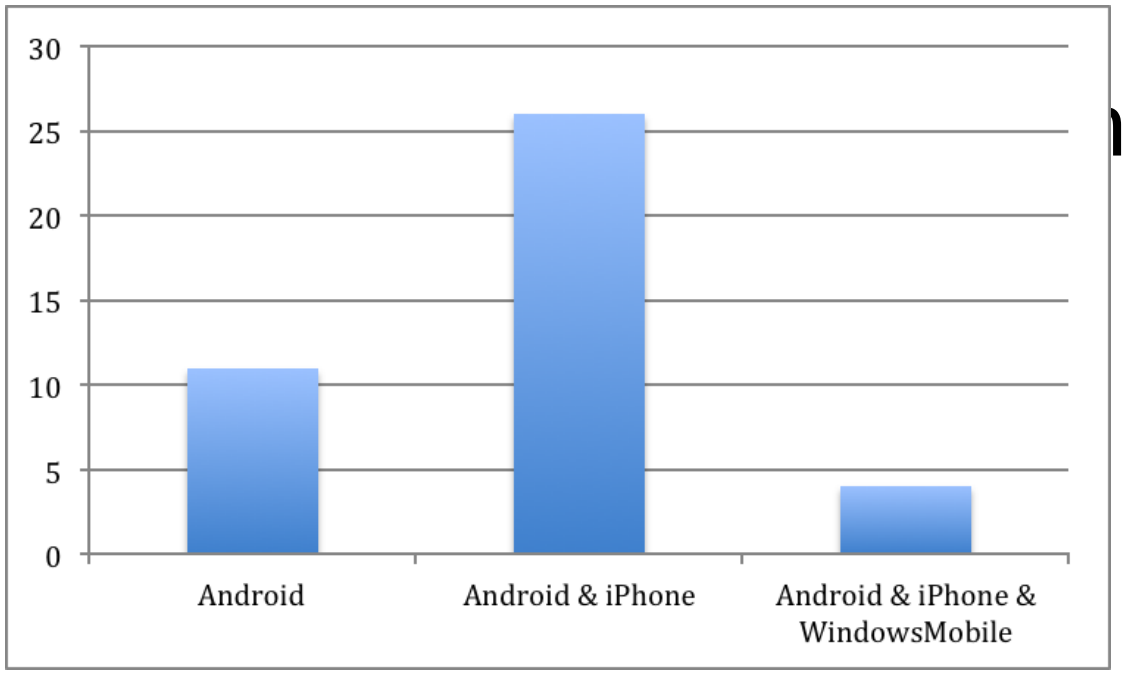


Industrial Survey

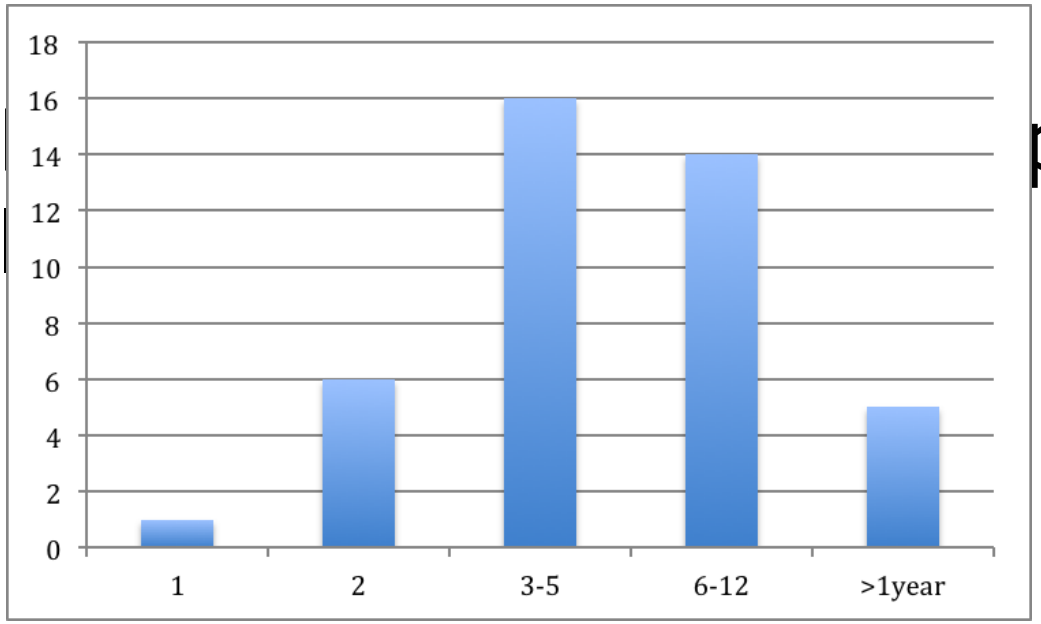
- Objective of the survey:
  - Learn the state of tool usage for testing mobile apps in Hong Kong
  - Methods:
    - Two associations
    - 49 responses (from three IT Fest events and from the Internet)
    - 42 returns (from 36 companies and 6 anonymous organizations)

Android Platform

- obile apps



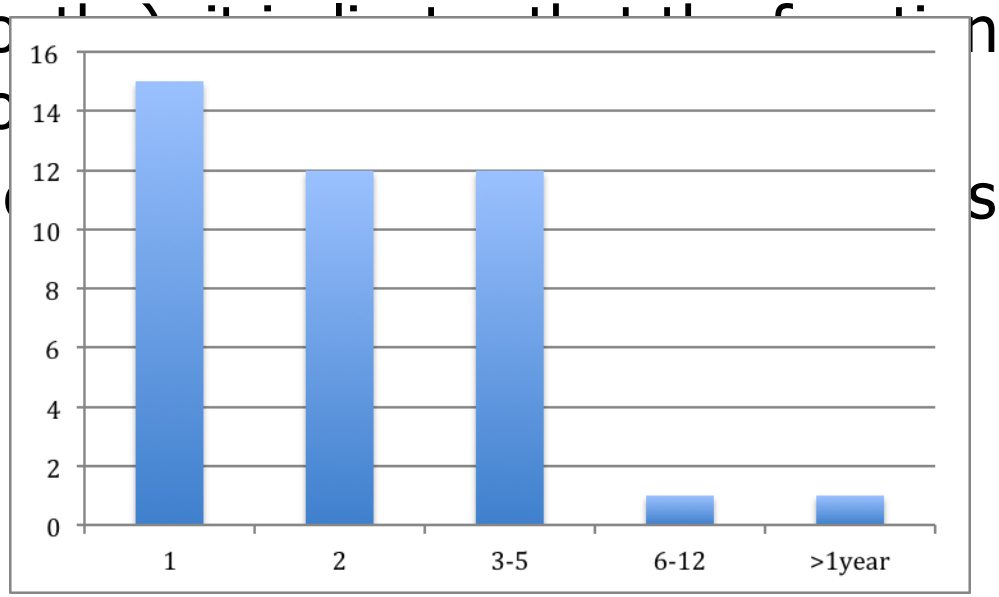
Project Duration



p project

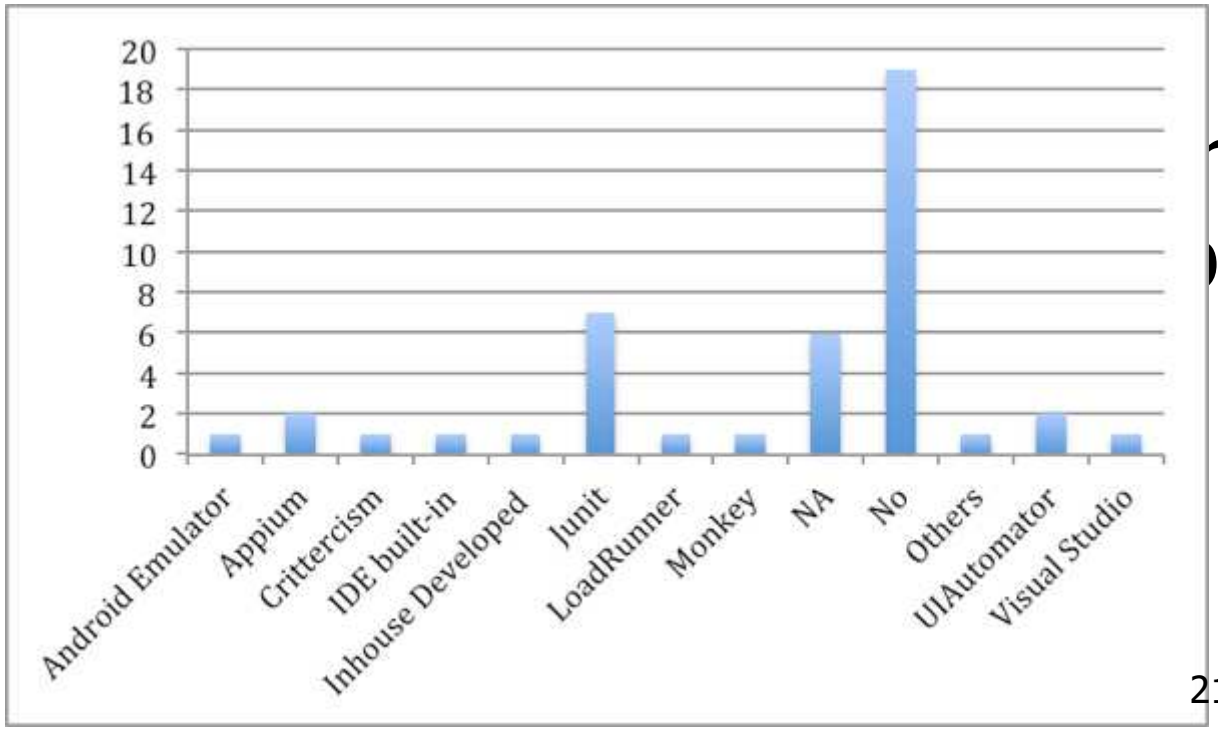
Testing

- When the development cycle is short (i.e. three or four mo[illegible]nality of the mo[illegible]
- Th[illegible]shorter.



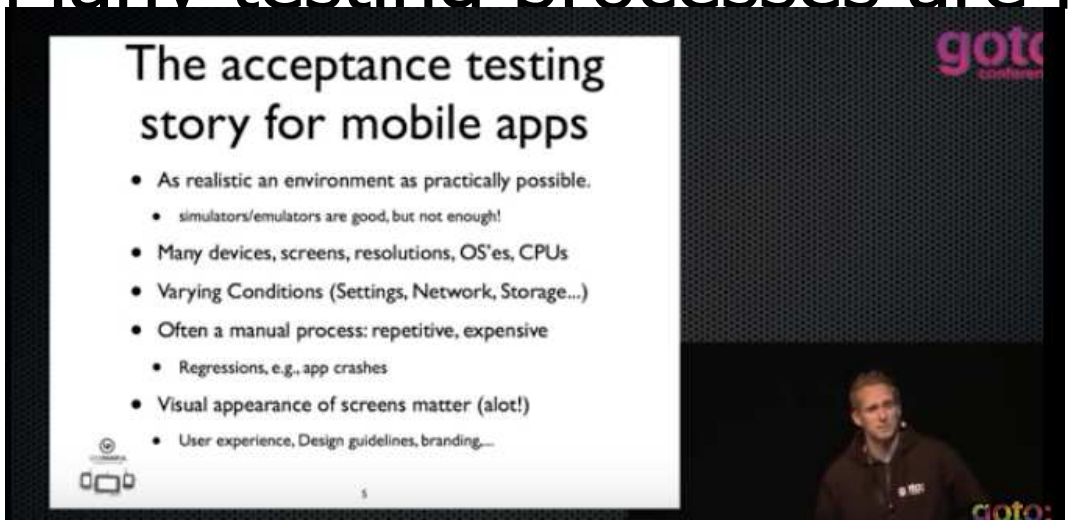
Tools

rrently
)p?

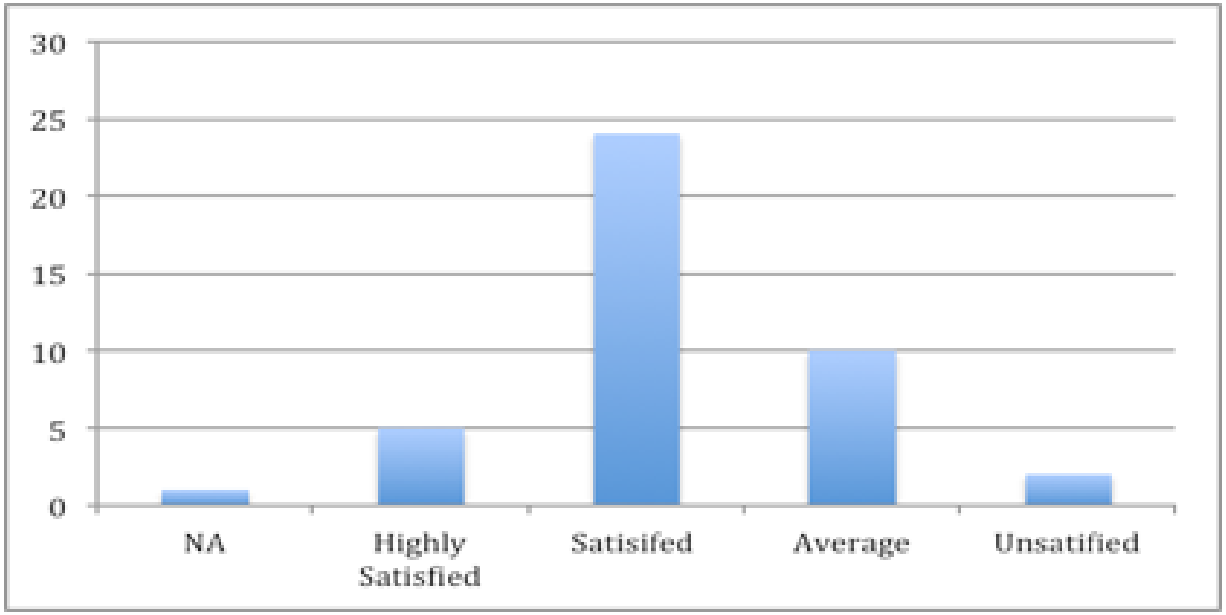


Manual Testing

- Many testing processes are manually
-

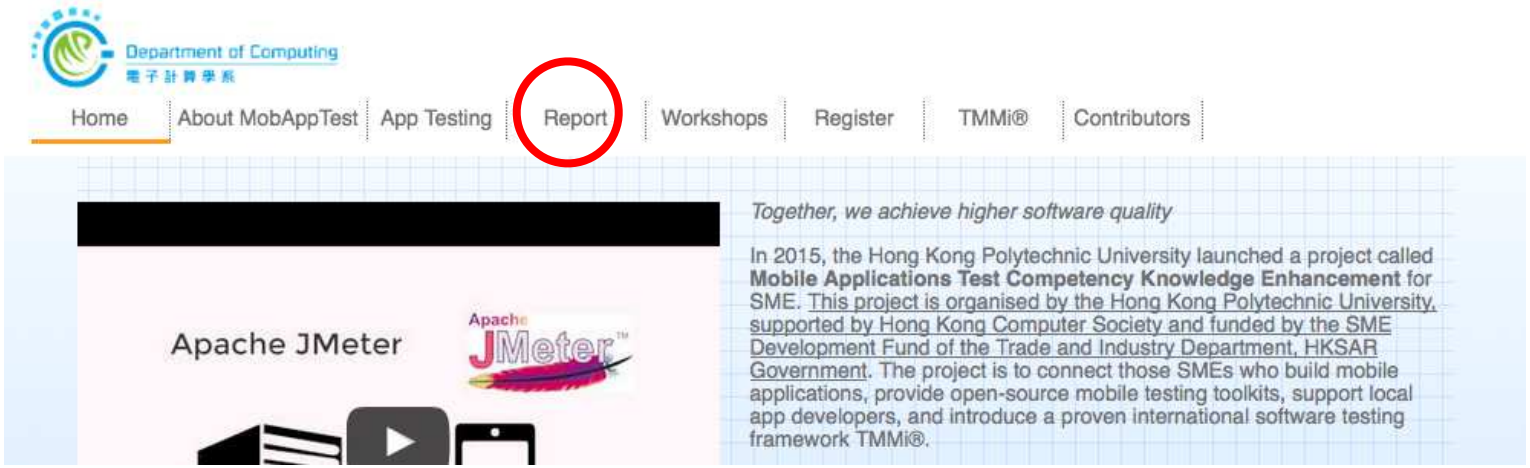


Satisfaction

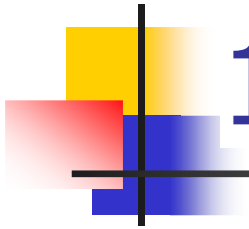


State of Test Tool Usage for Mobile Apps in HK

For more information

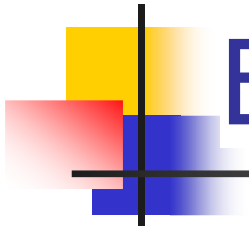


4 Types of Mobile Apps Testing



1 Unit Testing

- Unit test is a piece of testing code which is actually written in the same language that we build our software product.
- The Android SDK ships with JUnit, and Eclipse makes it easy to create a JUnit test project.

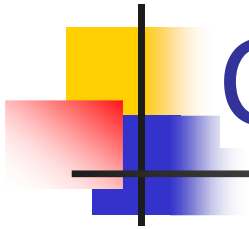


Example

```
public void testMyFirstTestTextView_labelText() {
    final String expected =
            mFirstTestActivity.getString(R.string.my_first_test);
    final String actual = mFirstTestText.getText().toString();
    assertEquals(expected, actual);
}
```

2 GUI Testing

- GUI testing aims to ensure proper functionality of the graphical user interface for an application and makes sure widgets/components conform to intended behaviors.



GUI Testing Tools

- MonkeyRunner
- UIAutomator
- Testdroid
- Robotium Recorder
- Sikuli

3 User Acceptance Testing

- Behavior driven development is an extension of unit testing.
- Unit testing examines functions/methods easily.
- Users describe a scenario that involves a number of operations, rather than internal methods.
- A single scenario involving calling a number of methods may not be easily written in unit test by testers or end users although it is relatively easy to do by programmers.

Example

```
Feature: Addition
  In order to avoid silly mistakes
  As a math idiot
  I want to be told the sum of two numbers

  Scenario: Add two numbers
    Given I have entered 50 into the calculator
    And I have entered 70 into the calculator
    When I press add
    Then the result should be 120 on the screen
```

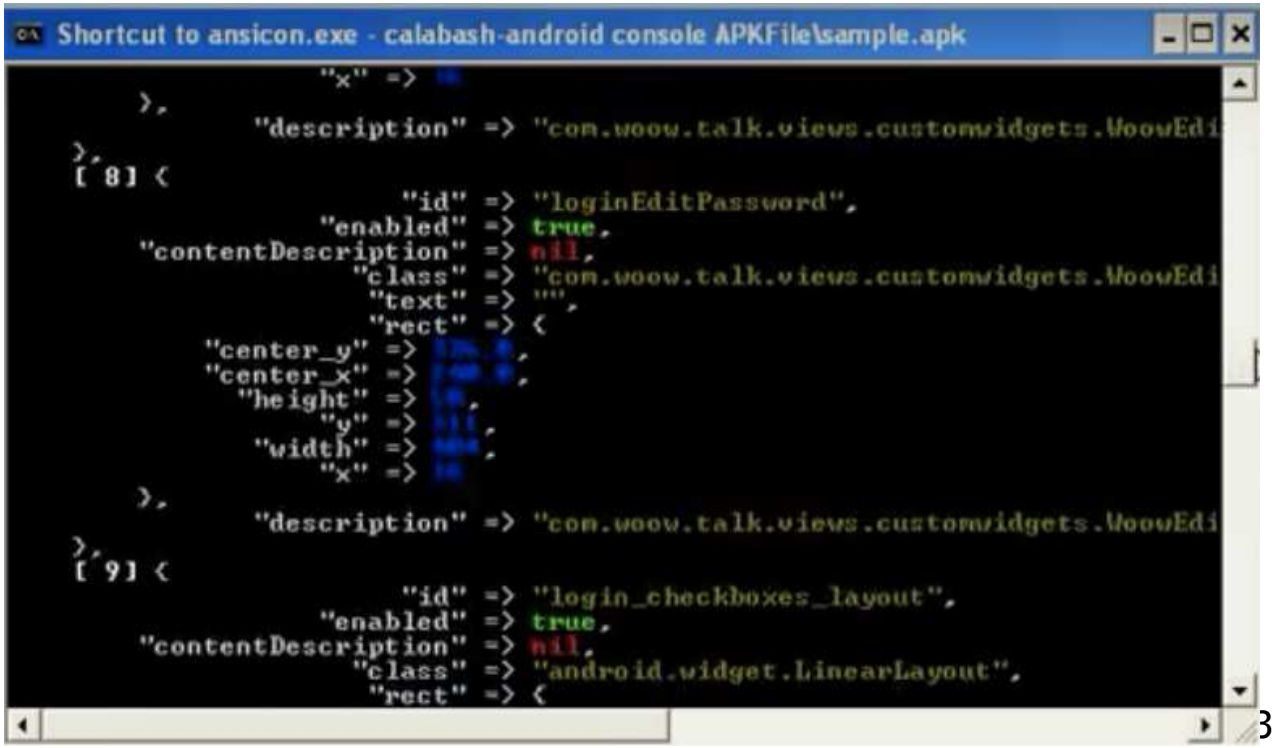
to write

gration

```
Given /I have entered (.*) into the calculator/ do |n|
  calculator = Calculator.new
  calculator.push(n.to_i)
end
```

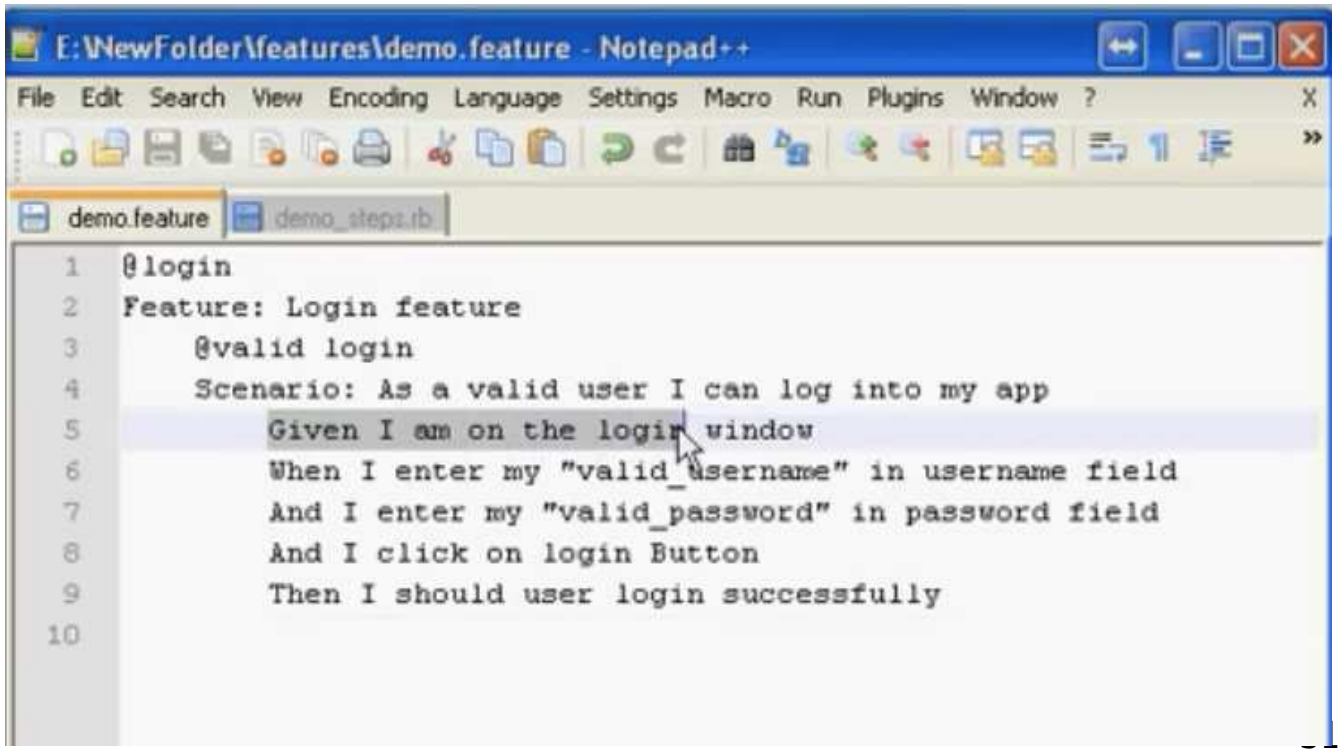
Example

calabash-android console "APK PATH"



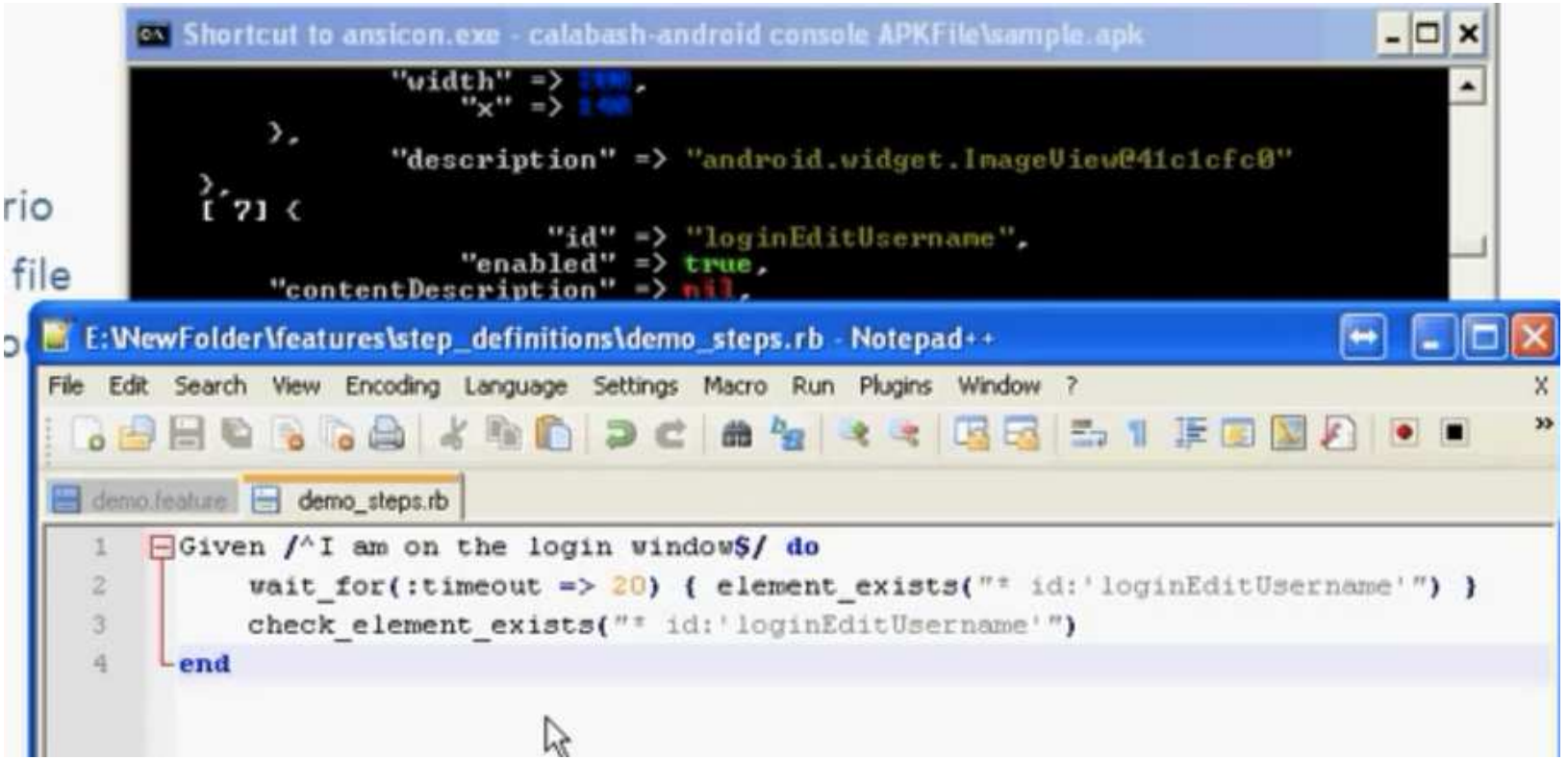
Example

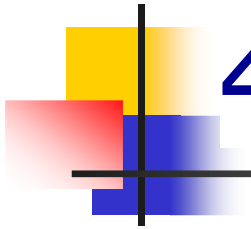
Open the feature file



Example

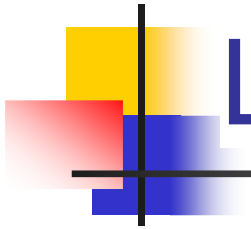
Open step definition file
Define the method





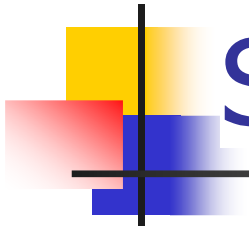
4 Performance Testing

- Network Performance
- Server Performance
- Mobile Performance for Local Applications



Load Testing

- A load test is usually conducted to understand the behavior of the system under a specific **expected load**.
- This load can be the **expected concurrent number of users** on the application performing a specific number of transactions within the set duration.
- This test will give out the response times of all the important business critical transactions



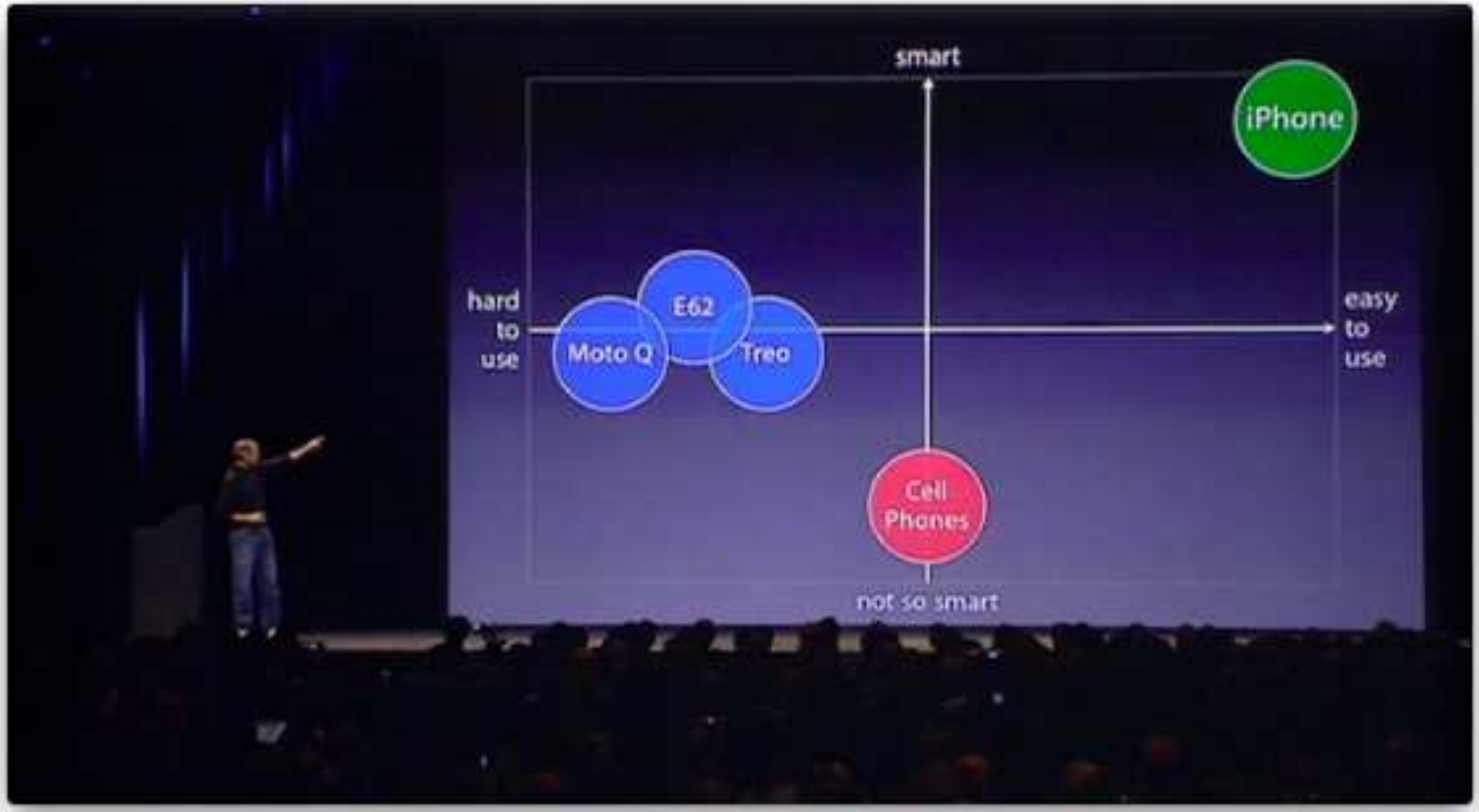
Stress Testing

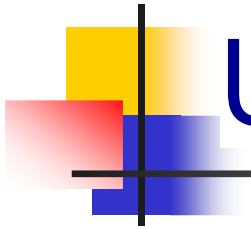
- In Stress testing we tries to break the system under test by overwhelming its resources or by taking resources away from it (in which case it is sometimes called negative testing).

5 Usability Testing (UX)

- Usability testing is a technique used in user-centered interaction design to evaluate a product by testing it on users.
- This can be seen as an irreplaceable usability practice, since it gives direct input on how real users use the system.

Usability vs. User Experience



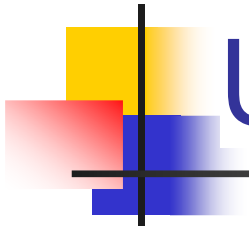


UI Problems

- A UI defect is a defect in how the software presents the information.
- UI defects range from visual problems like

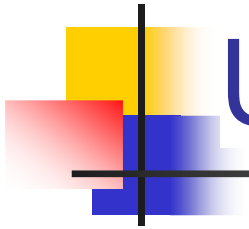
  - a link on the Web page has a wrong color to interactive problems like

  - it's hard for a user to figure out how to use a function.
- Example: If users cannot figure out how to put a book into the shopping cart, then the perfectly working code of the application doesn't matter



User Experience

- A user is involved
- That user is interacting with a product, system, or really anything with an interface
- The users experience is of interest, and observable or measurable

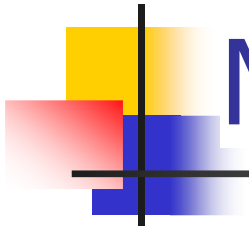


Usability vs. User Experience

- Usability is considered the ability of the user to use the thing to carry out a task successfully,
- user experience takes a broader view, looking at the individual entire interaction with the thing, as well as the thoughts, feelings, and perceptions that result from that interaction.

Example

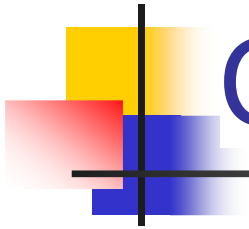
- Pick up a standard business card. Judge its size.
- What you're seeing is roughly the same size as the frame your mobile users have available to view your entire mobile site.



Methods of UX

- Paper Prototype (Manual/Tool)
- Card Sorting (Web and Mobile)
- A/B Testing (Web and Mobile)
- Heatmap (Available for Web)
- Eye Tracking (Avaliable for Web)

Paper Prototype



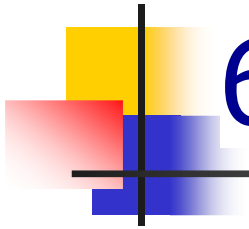
Card Sorting

- Card sorting is an old technique
- Use card sorting to find out how people think your content should be organised and get the user insights you need to make informed information architecture decisions.

Example

- Top 10 Best Stocks Performance
- Real Time Quote
- Stock Technical Indicator
- Financial News
- …
- …
- …

How the information is grouped in the menu so that users can easily to find?



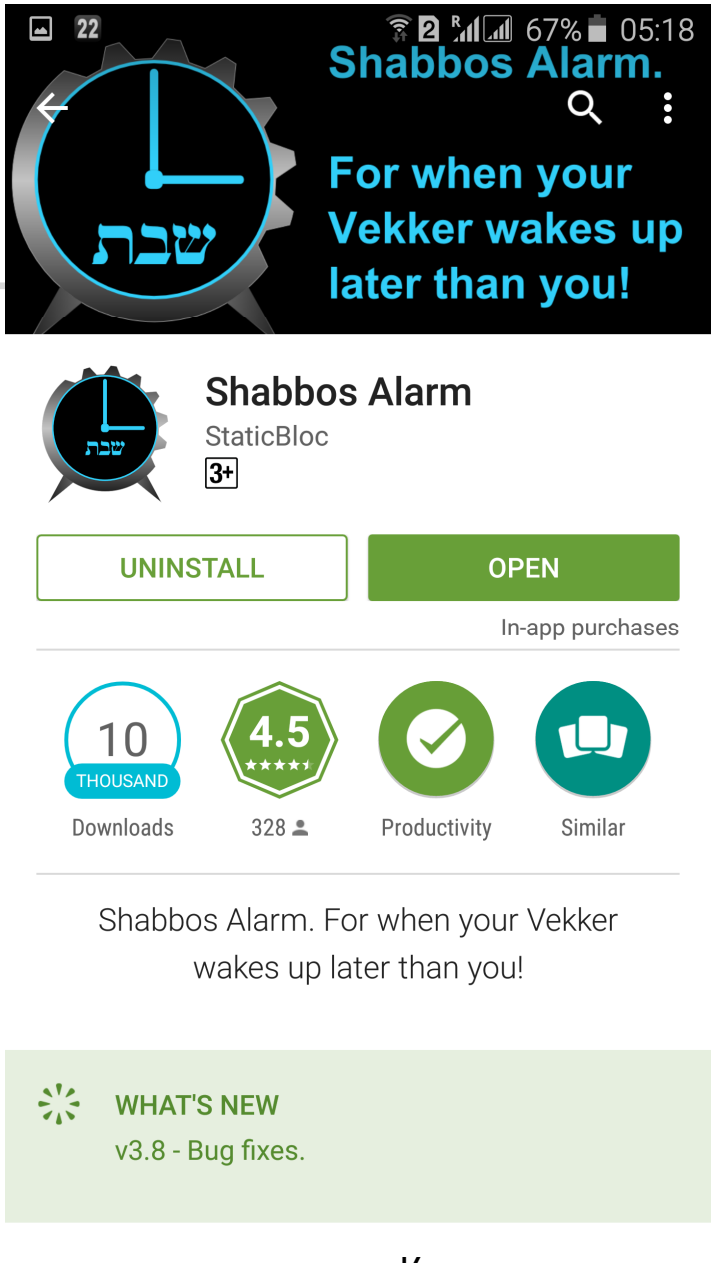
6 Power Consumption Testing

- Priorities of most developers involve things like features, performance, stability and user experience.
- But ignoring power consumption may end up with an app that undermines our hard work.

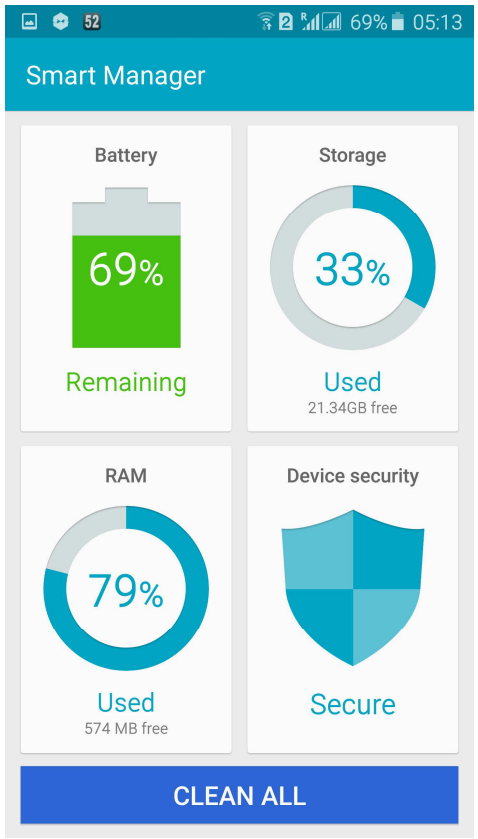
Users are watching

Question

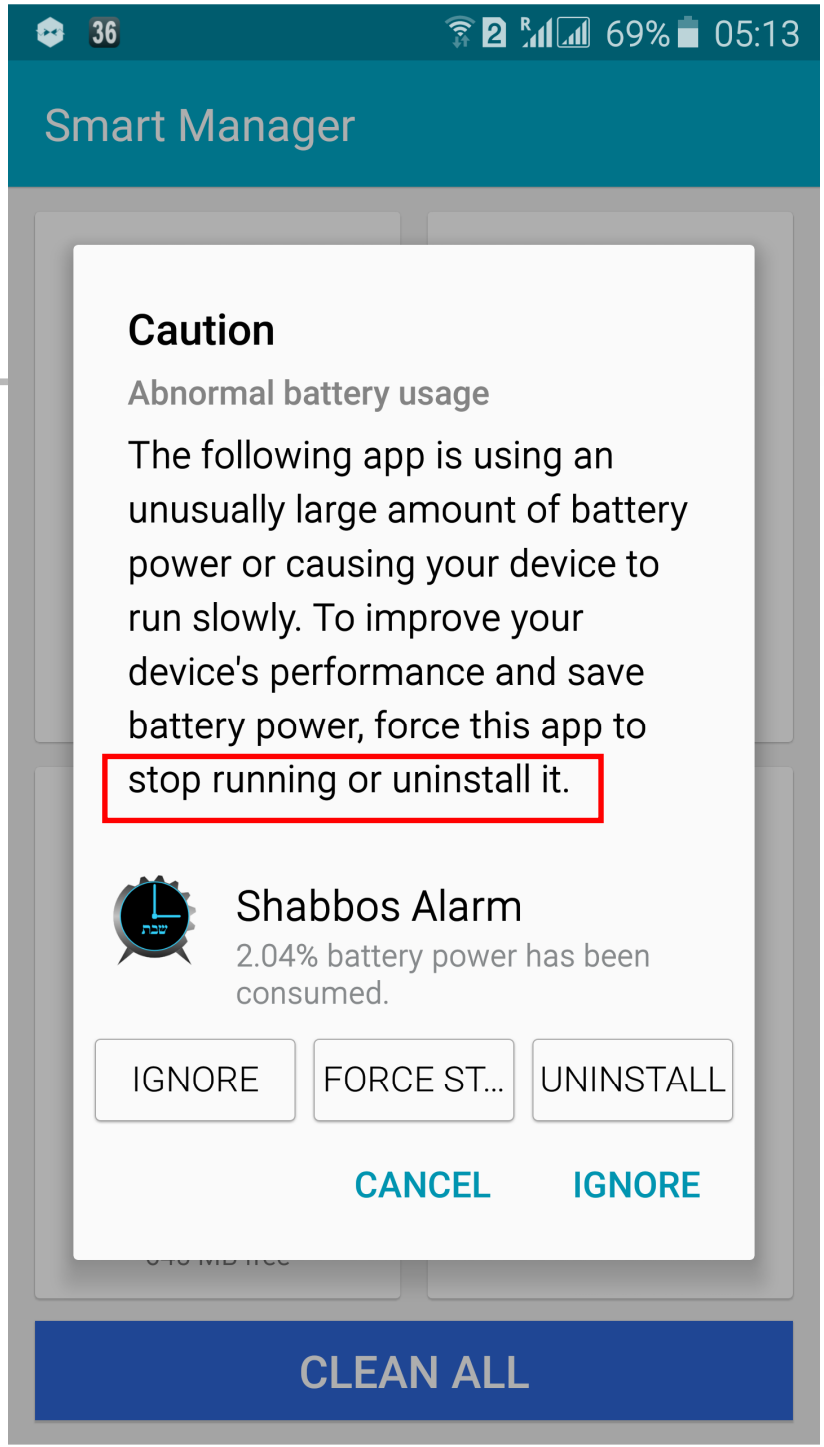
- Go to Play Store
- Find out how many stars this app gets ???



Example (Cont'd)



Developers



What is using power

1) Network calls, data transfers

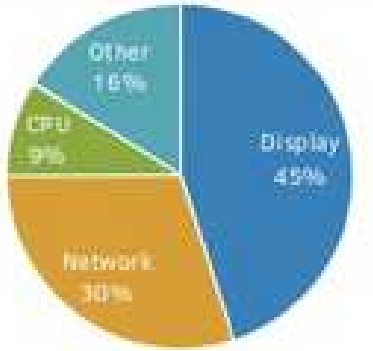
big chunks of data at random times, for data sync, analytics, ad networks…

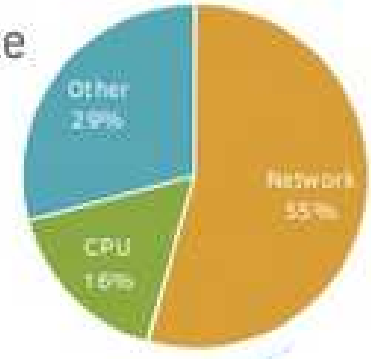
2) Location and sensors

always-on, highest accuracy, maximum rate

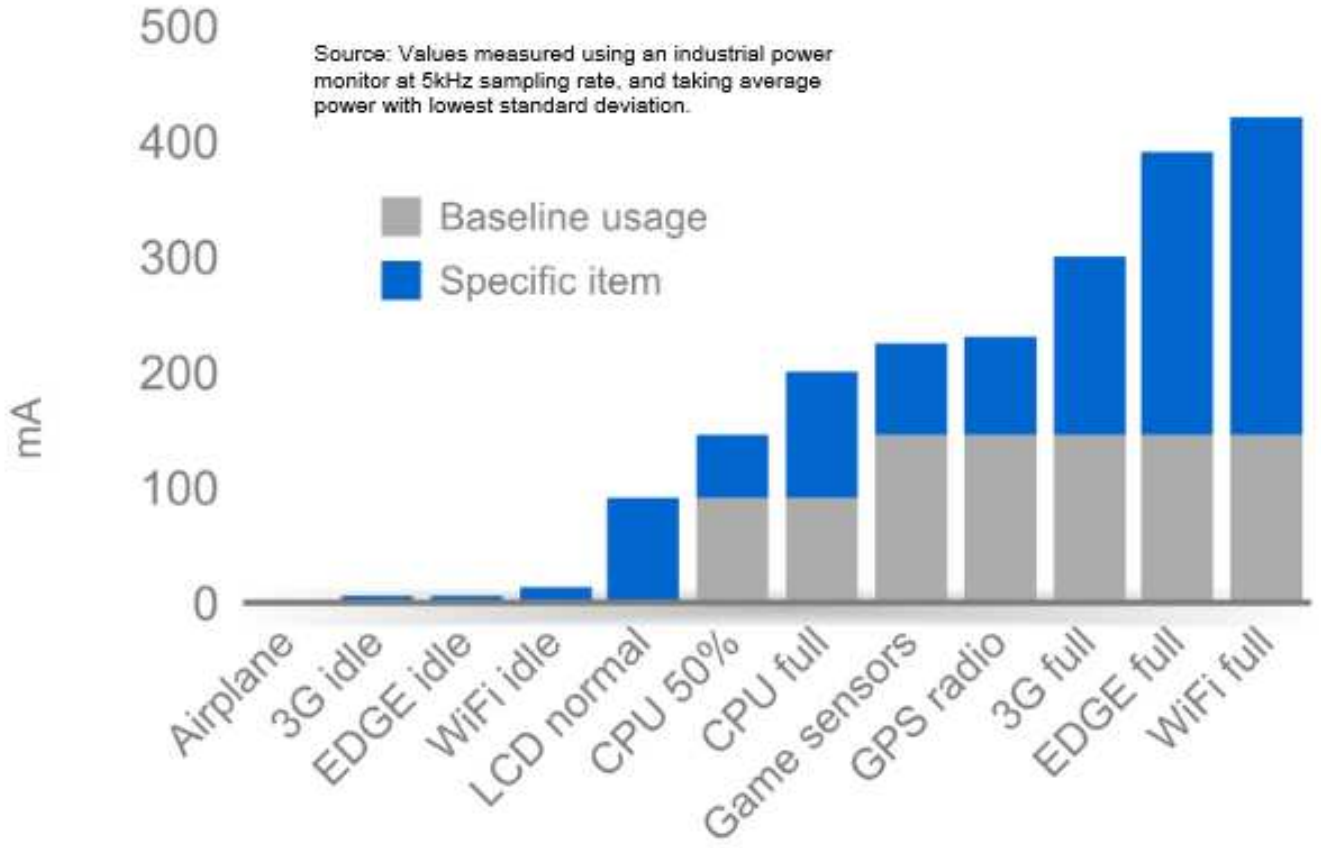
3) Inefficient code

useless work, bad data structures…





Study on how battery-consuming are specific services/sensor

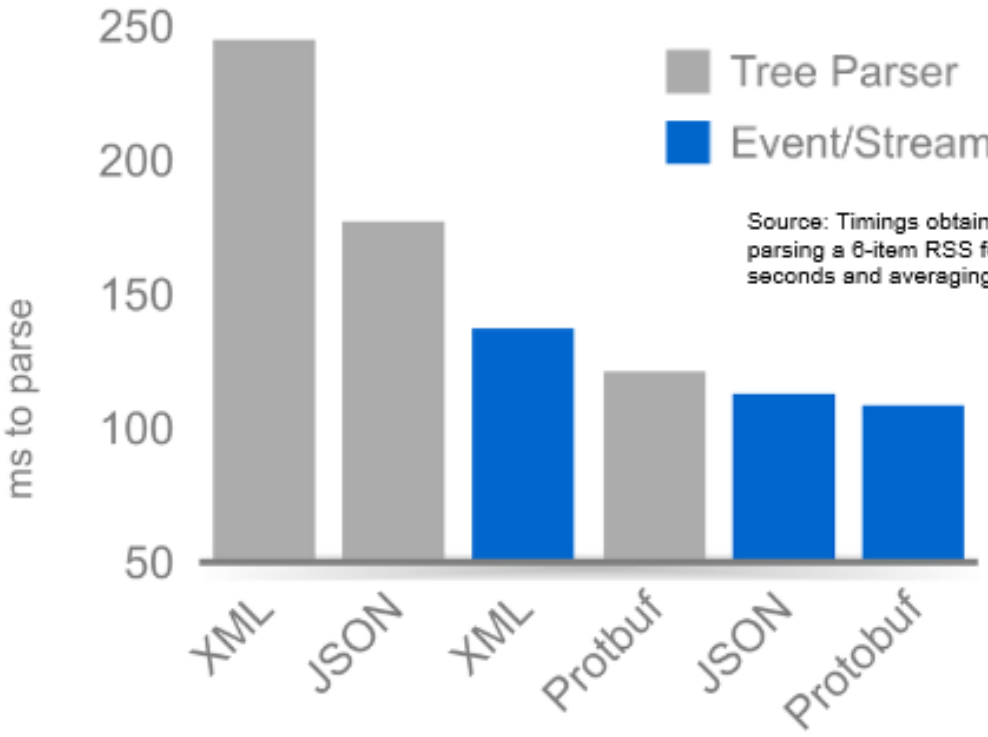


How can we do better?

```
ConnectivityManager mConnectivity;
TelephonyManager mTelephony;

// Skip if no connection, or background data disabled
NetworkInfo info = mConnectivity.getActiveNetworkInfo();
if (info == null ||
        !mConnectivity.getBackgroundDataSetting()) {
    return false;
}
```

G

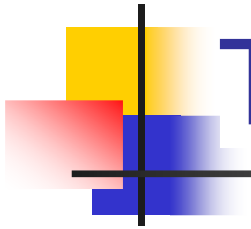
How can we do better?



Source: Timings obtained by downloading and parsing a 6-item RSS feed repeatedly for 60 seconds and averaging results.

parser

5 Testing Tools



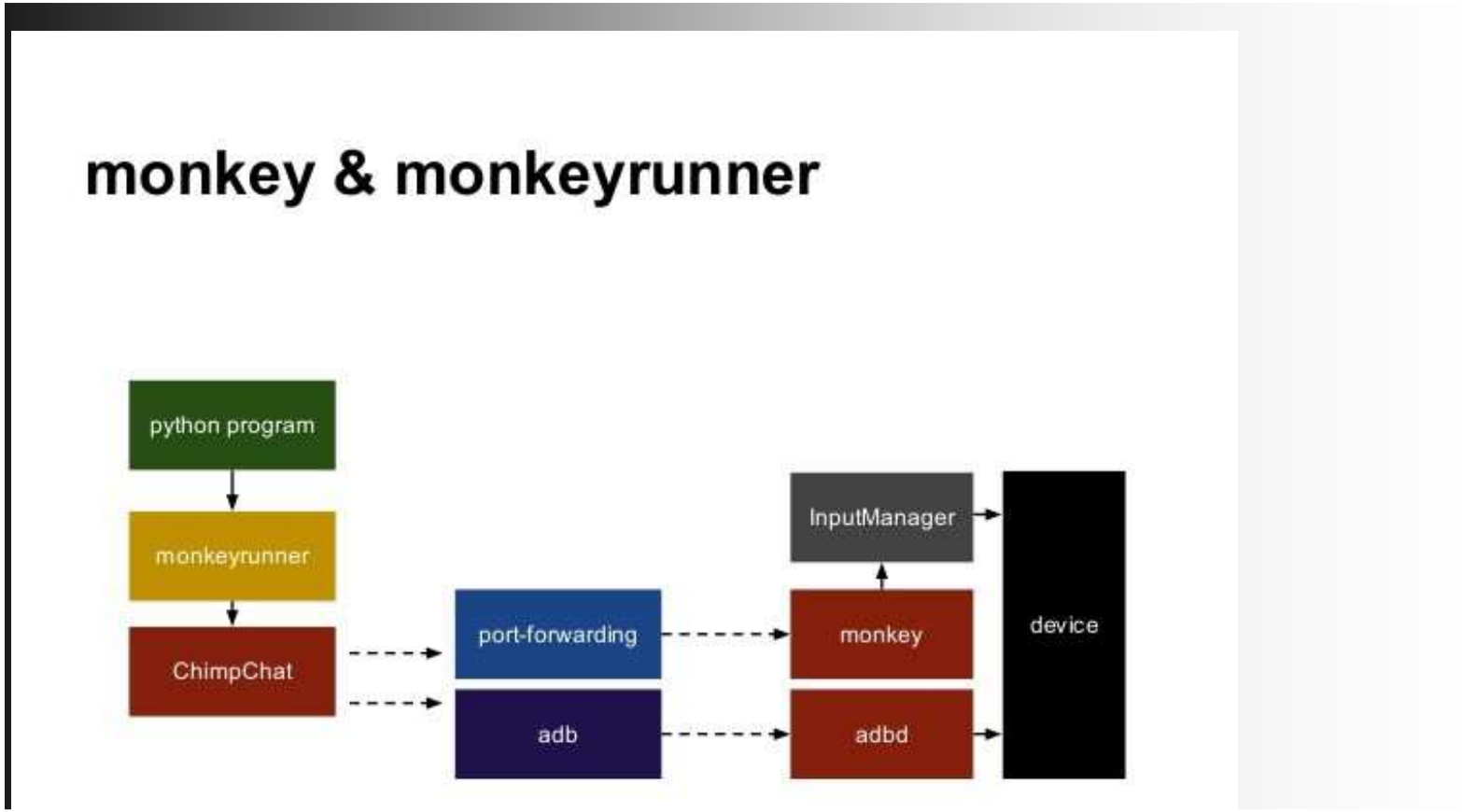
Test Tools

- MonkeyRunner
- Testdroid
- Robotium Recorder
- Sikuli
- Jmeter
- Xsort
- Apptimiz

MonkeyRunner

- It is a tool which provides an API for writing programs that control an android device or emulator
- Installation: Bundled with Android SDK
- Script: Python
- Free, come with Android SDK

MonkeyRunner

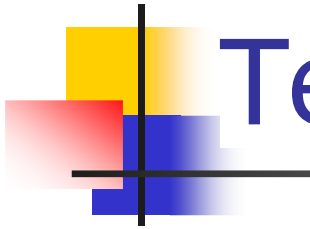


Key Functions & Benefits

- Device control: Direct click
- Automated testing
- Java code generated for testing
- Final screenshot generated
- Support Android application
- The touch and drag methods need the co-ordinates on the screen to be specified, *which limits the developing the scripts*

Example of Use

- Test the stability of the application by comparing with the final screenshot
- Run automated test that requires keystrokes input



Testdroid

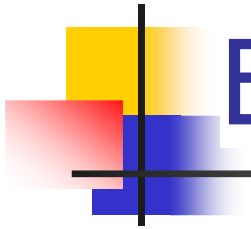
- Testdroid Recorder is a tool for developers and testers for recording user-actions and producing JUnit based test cases on mobile application and games
- No coding needed
- Paid service for cloud testing

Key Functions & Benefits

testdroid.

- Testdroid App Crawler: check compatibility (PAID)
- Logs, Exceptions, CPU & Memory profiles statistics generated
- Support both iOS and Android apps
- *Able to generate MonkeyRunner script * (NOT LONGER SUPPORTED)*

testdroid.



Example of Use

- Testing the application on devices with various sizes to check compatibility (e.g. Testing the application on 4’ devices and 5.7’ device)
- Check compatibility of the application
- Show the report of CPU usage of the application (paid version)

Robotium Recorder

- Robotium Recorder creates Robotium test cases.
- It utilizes and takes full advantage of the Robotium framework. Professional test cases that usually take weeks to develop can now be recorded in minutes.
- No coding needed
- License required

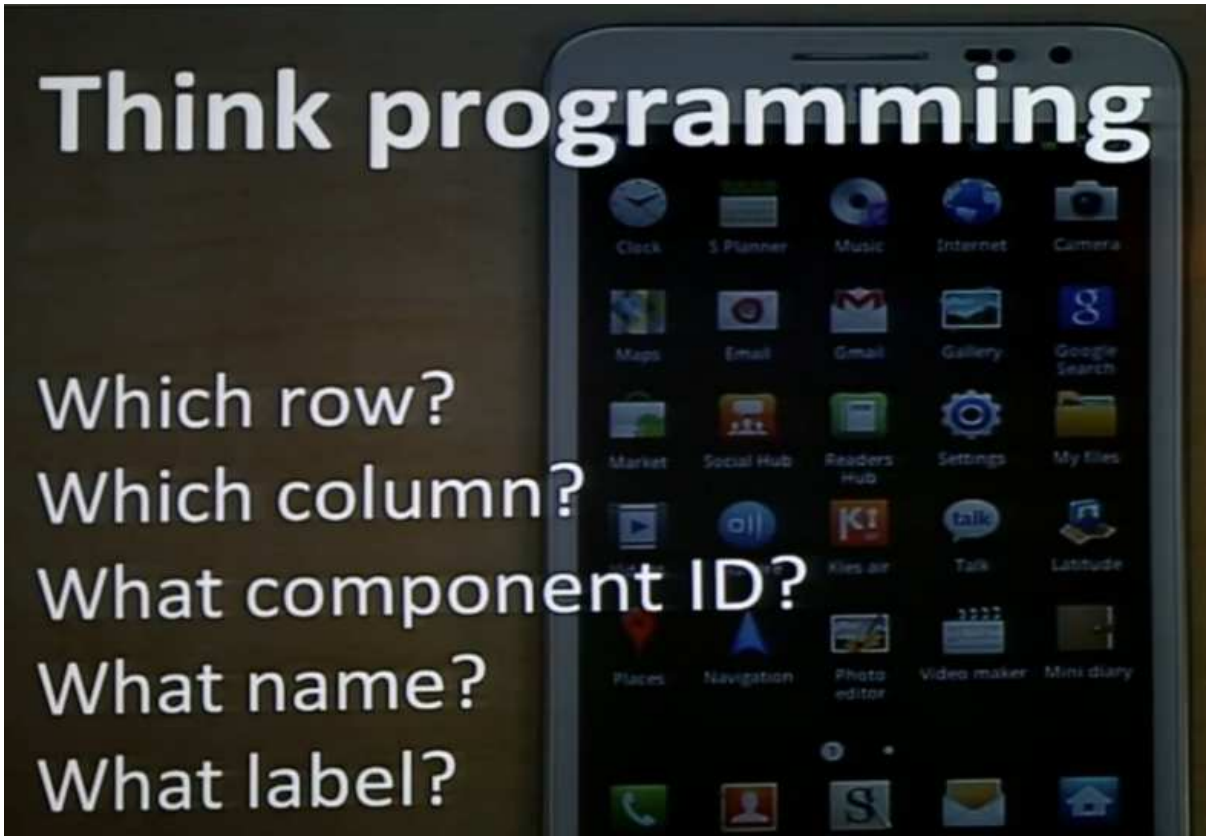
Key Functions & Benefits

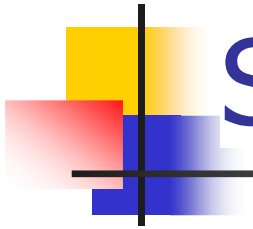
- Record from emulators and real devices by using your app
- Automatically detects resource ID
- No report generated
- Work on Eclipse and Android Studio
- Support for native and hybrid Android apps

Example of Use

- Similar to Testdroid

Tester Thinking





Sikuli

- Sikuli automates anything you see on the screen.
- It uses image recognition to identify and control GUI components.
- It is useful when there is no easy access to a GUI's internal or source code.
- Script: Python
- Free
- Source: Research project

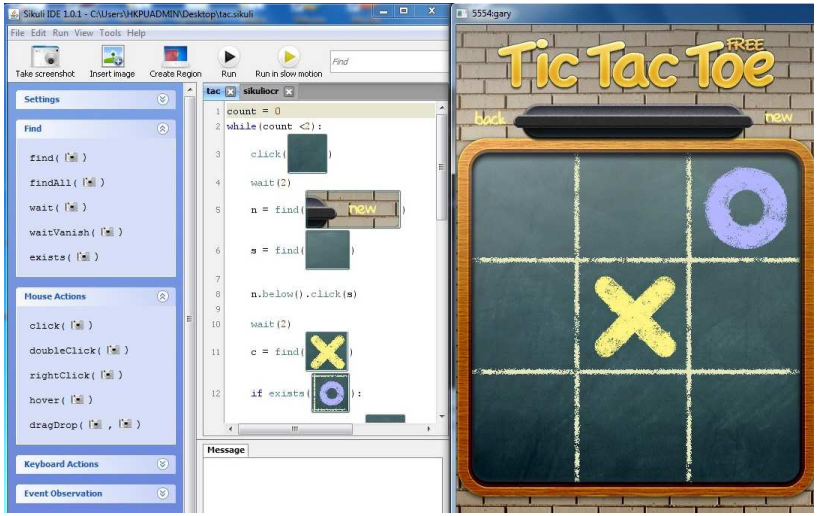
Key Functions & Benefits

- No source code needed, automatic detect resource ID
- Optical character recognition (OCR)
- Regular automated tests by batch
- Log file generated
- No script generated
- Able to run test not limited to mobile app, also on any GUI

Example of Use

- Test applications with more gesture actions (e.g. Tic Tac Toe game)

- Suitable for mobile app that uses map application (e.g. to display specific restaurant

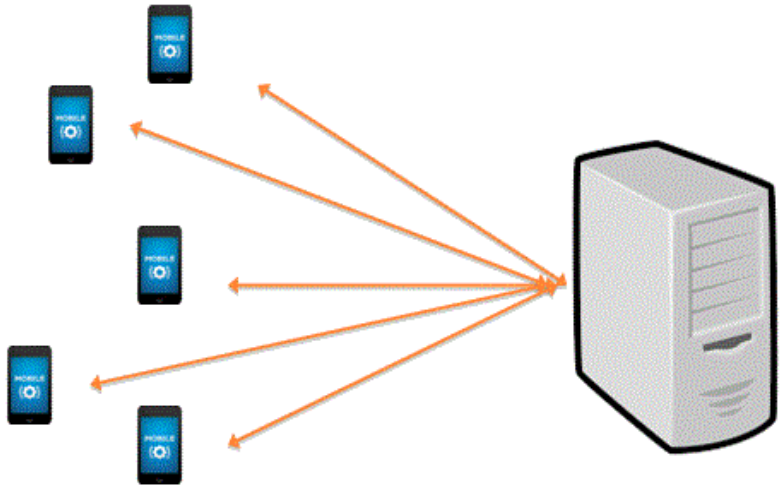


Example

```
switchApp("CleanMyMac.app")
click(  )
click( 

 )
while not find( 

 ):
  sleep(5)
click( 

 )
while not find( 

 ):
  sleep(5)
closeApp("CleanMyMac.app")
```

JMeter

- Apache JMeter may be used to test performance both on static and dynamic resources (Webservices (SOAP/REST), Web dynamic languages.
- No codin
- Open sou

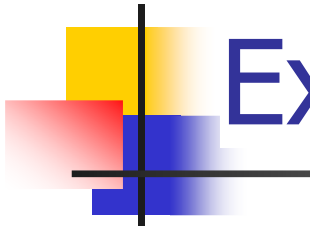


Key Functions & Benefits

- Creating threads to access server
- Record test plan using real device
- Manual modifiable test plan
- Distributed JMeter to perform large scale test on mobile app server
- Test plan automatically generated
- Performance report generated

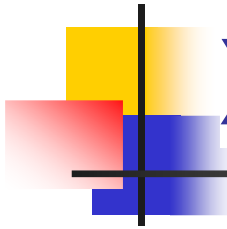
Report


Graphs to Display
Data
Average
Median
Deviation
Throughput
1639 ms
0 ms
No of Samples 520
Deviation 468
Latest Sample 1203
Throughput 106.112/minute
Average 1205
Median 1107



Example of Use

- Load testing on the server (e.g. checking the response time of the server)
- Stress test on the server (e.g. finding out the maximum concurrent users that the server can take)



XSort

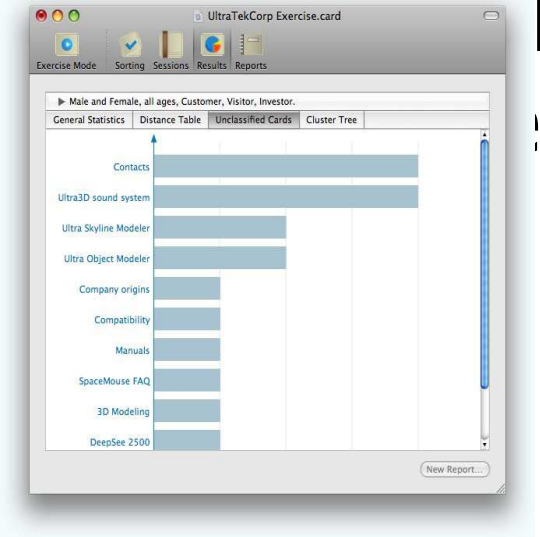
- xSort is a free card sorting application for Mac OS X aimed at user experience professionals and social scientists.
- No coding needed
- Free

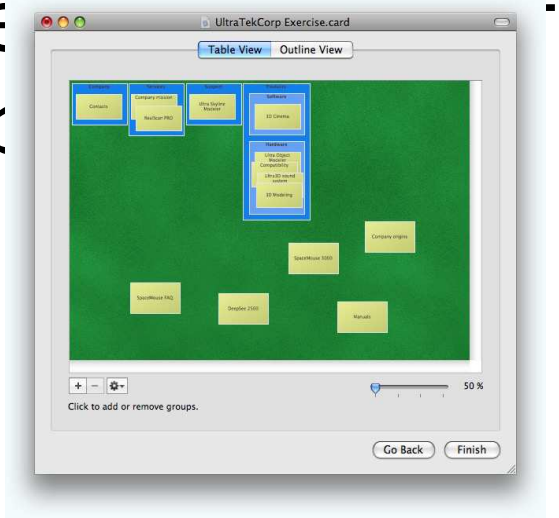
Key Functions & Benefits

- Developers can give a survey to the users about the arrangements of functions
- Statistics report generated: provide results according to the background of the users, e.g. Age, gender, education

Example of Use

- Let target users to group the items/ functions so that developers know how he ucction for ex





APPTIMIZE

Apptimiz

- In Internet marketing, A/B or split testing is the process of dividing web traffic among multiple versions of a webpage (or email, etc.) and evaluating which variation performs best at achieving a desired outcome, such as free trial signups or purchases.
- No coding needed
- Free/Paid service

Key Functions & Benefits

APPTIMIZE

- Efficient A/B Testing
- Perform testing on two different versions of the same application
- Provide usage statistic generated
- Cross platform supported

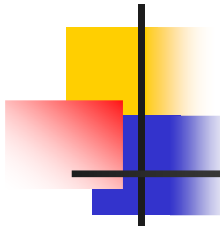
APPTIMIZE

Example of Use

- Test the real user preference on the same application with different user interface such as color scheme, font used

6 Government Initiative

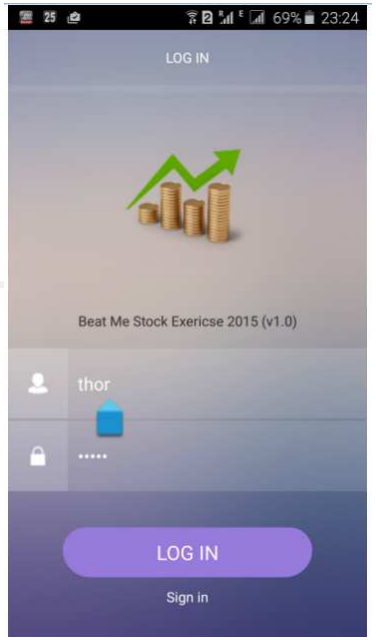
Mobile Applications Testing Competency Training for SME



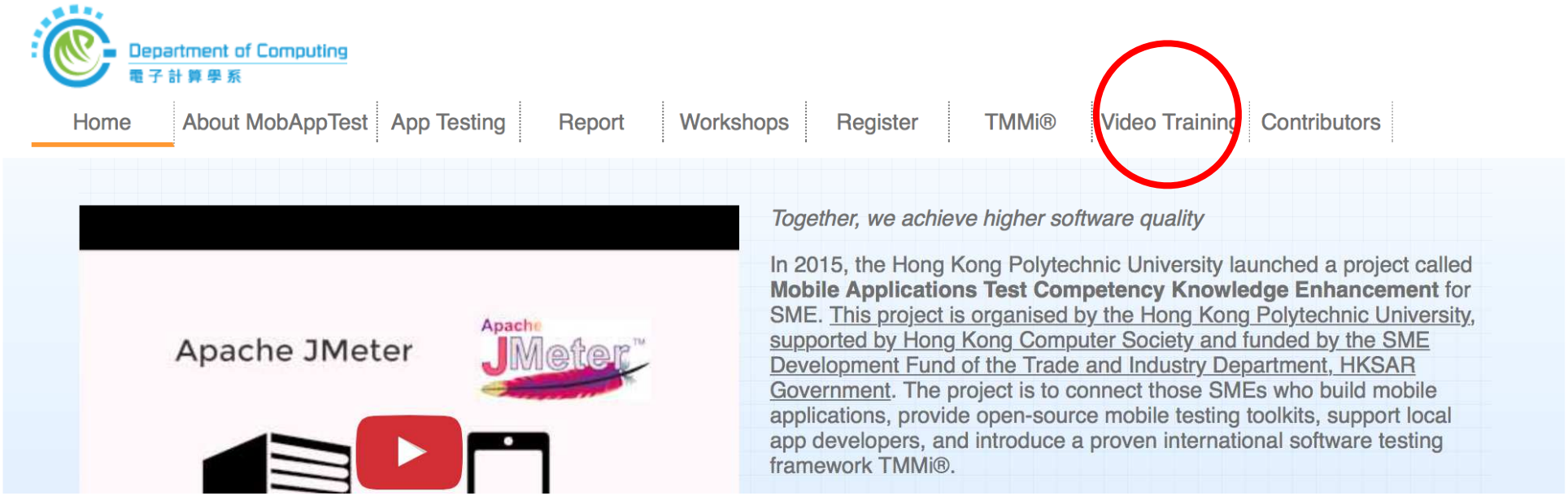
- This government-funded project aims to support a thriving ICT industry, through developing, training and nurturing ICT SME talents in mobile apps testing.
- We offer free mobile app testing seminars and training workshops to SMEs focusing on mobile apps development.

Coming Workshops

- Demo Mobile App
- Hands-on Approach:
  - Distributed JMeter
  - GUI Testing
  - Power Consumption
- Virtual Machine Environment
- Training Video



Workshop Highlight



Thank you

- *Your feedback is important to us. Please fill in the evaluation form.*