Presentation

First steps into the Android world

version feb.28.2012

Your presenter

John A. Mahady

john@AndrewInfoServices.com

mobile.AndrewinfoServices.com

Outline

- Let me introduce myself
- The state of the competitive marketplace
- Android Architecture
- Operating System
- Programming language
- Database
- Educational links
- Books
- Conclusion & my contact information

*** text in **yellow** is a web link and text in **green** is a local file ***

On November 5, 2007 Andy Rubin announced:

"[The] Android [Platform] – is more significant and ambitious than a single phone."

Google within the Open Handset Alliance (OHA) has delivered a complete set of software for mobile devices: an operating system, middleware and key mobile applications.

Top Mobile OEMs

Top Mobile OEMs 3 Month Avg. Ending Jul. 2011 vs. 3 Month Avg. Ending Apr. 2011 Total U.S. Mobile Subscribers (Smartphone & Non-Smartphone) Ages 13+ Source: comScore MobiLens			
	Share (%) of Mobile Subscribers		
	Apr-11	Jul-11	Point Change
Total Mobile Subscribers	*100.0%*	*100.0%*	*N/A*
Samsung	24.5%	25.5%	1.0
LG	20.9%	20.9%	0.0
Motorola	15.6%	14.1%	-1.5
Apple	8.3%	9.5%	1.2
RIM	8.2%	7.6%	-0.6

Source: comScore.com

Mobile Content Usage

Mobile Content Usage 3 Month Avg. Ending Jul. 2011 vs. 3 Month Avg. Ending Apr. 2011 Total U.S. Mobile Subscribers (Smartphone & Non-Smartphone) Ages 13+ Source: comScore MobiLens			
	Share (%) of Mobile Subscribers		
	Apr-11	Jul-11	Point Change
Total Mobile Subscribers	*100.0%*	*100.0%*	*N/A*
Sent text message to another phone	68.8%	70.0%	1.2
Used browser	39.1%	41.1%	2.0
Used downloaded apps	37.8%	40.6%	2.8
Accessed social networking site or blog	28.0%	30.1%	2.1
Played Games	26.2%	27.8%	1.6
Listened to music on mobile phone	18.0%	20.3%	2.3

Source: comScore.com

Top Smartphone Platforms

Top Smartphone Platforms
3 Month Avg. Ending Jul. 2011 vs. 3 Month Avg. Ending Apr. 2011
Total U.S. Smartphone Subscribers Ages 13+
Source: comScore MobiLens

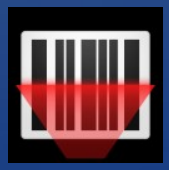
	Share (%) of Smartphone Subscribers		
	Apr-11	Jul-11	Point Change
Total Smartphone Subscribers	*100.0%*	*100.0%*	*N/A*
Google	36.4%	41.8%	5.4
Apple	26.0%	27.0%	1.0
RIM	25.7%	21.7%	-4.0
Microsoft	6.7%	5.7%	-1.0
Symbian	2.3%	1.9%	-0.4

Source: comScore.com

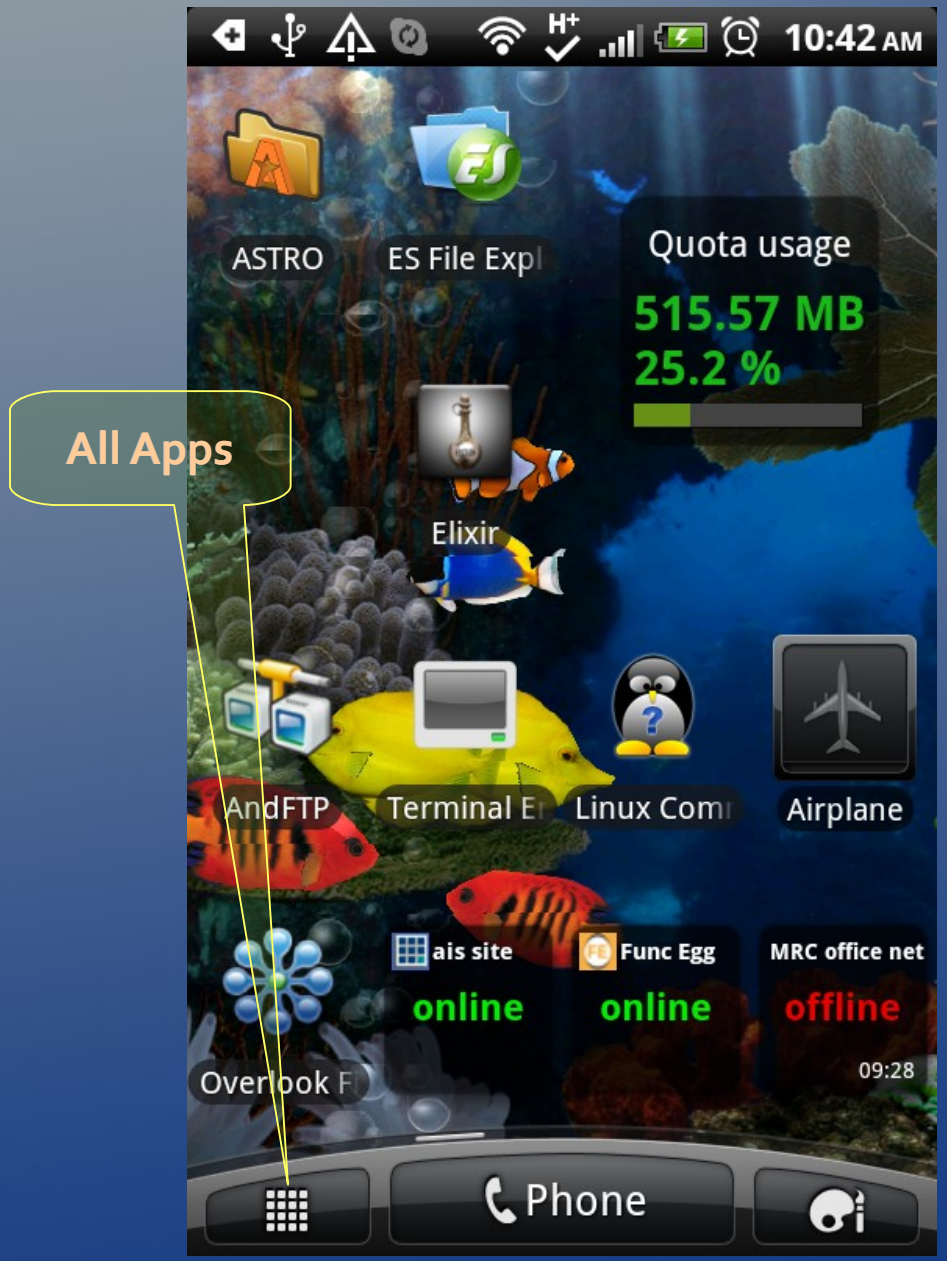
My phone - HTC Inspire 4G

- 4.3” touch screen, speaker and mic
- Hard buttons – power, volume.
- Soft buttons – home, menu, previous, search.
- Touch screen keyboard
- 8 MP camera with 720p HD video
- USB port and stereo audio jack.
- 1 GHz Qualcomm Snapdragon™ processor with 4 GB internal memory and 8 GB of SD card storage
- HTC Sense GUI
- Notifications and Quick Settings

Lifestyle changes - Apps

- Movie selection   eBay 
- Online banking: pay bills & check scans 
- Games   Translators  Tasks/Todo 
- Email -always on  Meetup.com 
- Ron Paul  Lotto Results  Google Mobile
- Barcodes  Voice Google  PhotoShop 

Lifestyle changes - Widgets



All Apps

Personalize

Place more frequently used apps on the desktop

Android Car

- Android Car (China only)
- Available April, 2010
- 10k – 19k USD
- Android 2.1
- Features
  - Real-time traffic
  - Directions
  - Internet
  - On-line chatting

Android vs iOS goals

- Not written to run on proprietary hardware.
- Open Source beats proprietary; no center!
- Android designed to run on many different devices from phones and tablets to refrigerators, automobiles, etc
- Android can be customized for private dedicated products.

Better, worse or just different ?

Developer Markets

- Retail
- Utilities e.g. CamScanner, ES File Explorer
- Business apps to support customers e.g. Chase, Skype
- Internal business processes e.g. sales, warehouse, work hours
- Who is paying and who owns it
- Lite Free and Pro $$
- New markets new apps - Create your own demand model
- Smartphones = new market vs. Tablets =replacement

Versions matter?

- *Android 1.5* no Blue-tooth support = disable it so your app still works on that older o/s version
- *Android 2.2* just-in-time compiler = 2x FASTER
- *Android 2.3* needs at least 1gig memory.

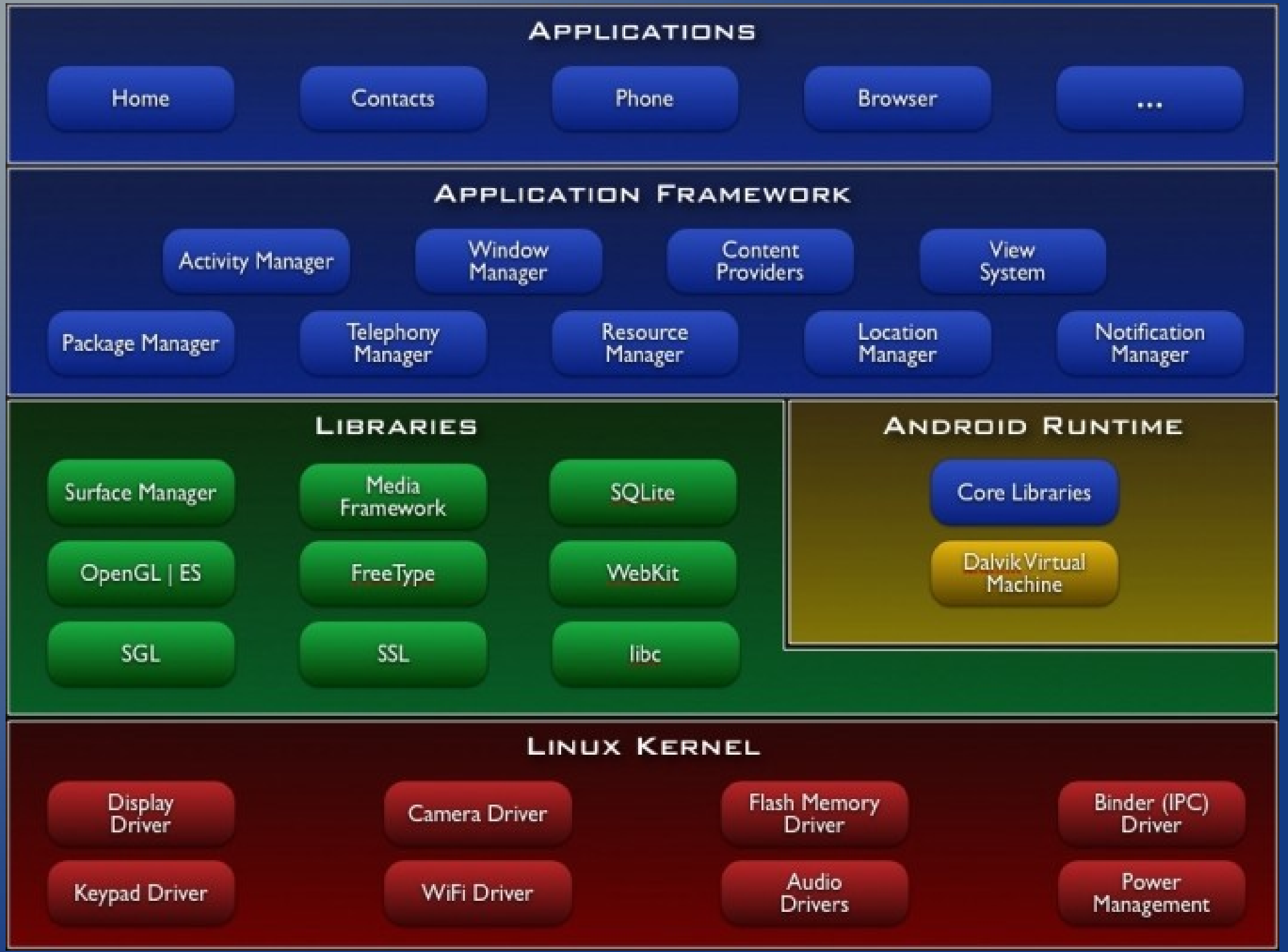
- Android name = API number = Nickname (alphabetical bakery items)
- Old hardware may not support update to operating system.
- When does your cell phone contract expire, 2 years?
- Add-ons from companies or you. Google, Cisco, HTC.
- No one has a generic Android phone. ex. HTC Sense

What is Android?

- Android is a software stack for mobile devices that includes an:
  - ***operating system***
  - ***middle ware / libraries***
  - ***key applications***
- The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language.

Android architecture

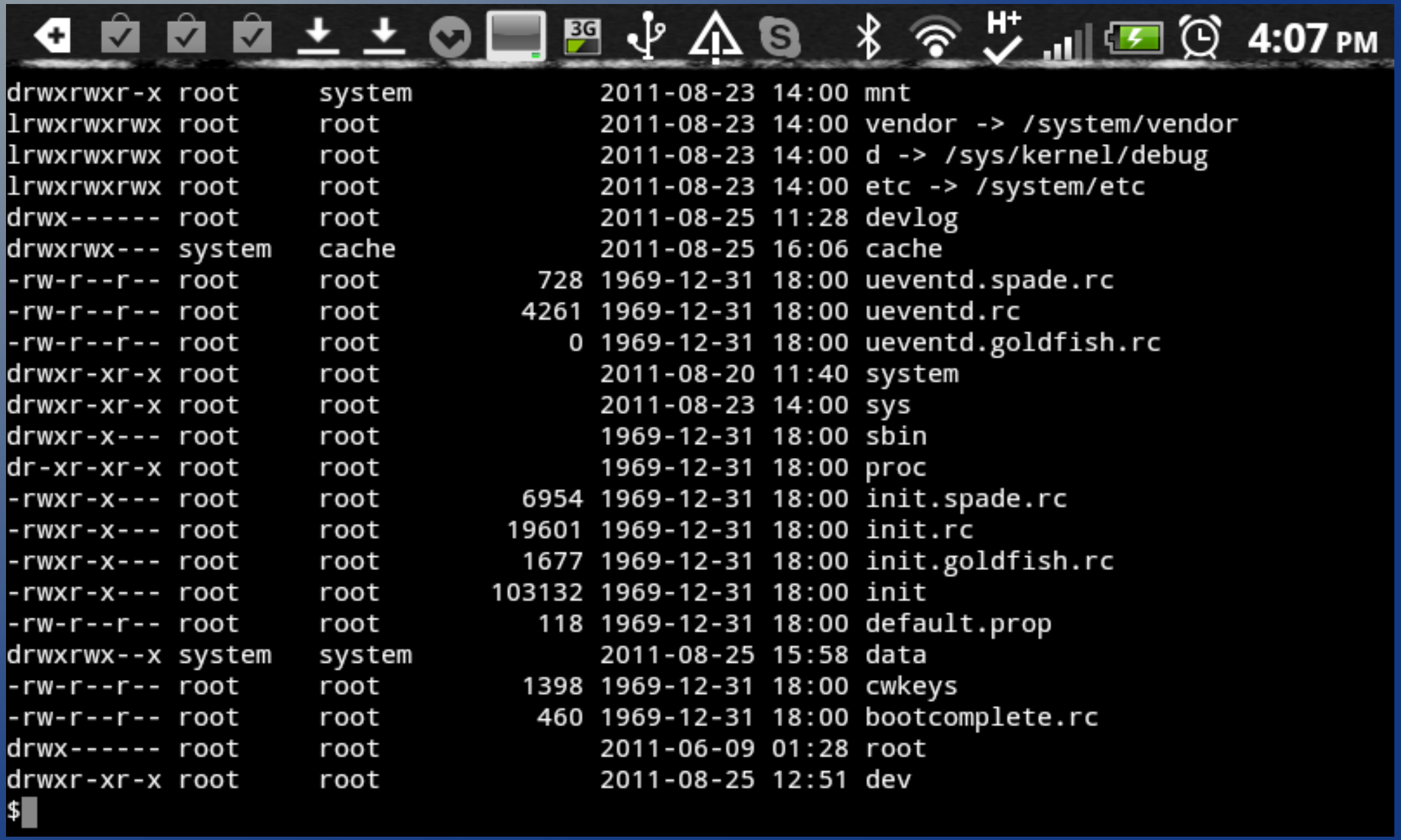
- Linux - operating system from Bell Labs
- JVM - Dalvik Virtual Machine
- Java - the application language from Sun
- Libraries - Android and Java
- SQLite - embedded database from US Navy
- Phone - the hardware
- Service - your voice and data plan
- Apps - included, downloaded, etc
- Sites - www designed for phones/tablets


Applications
Home
Contacts
Phone
Browser
...
Application Framework
Activity Manager
Window Manager
Content Providers
View System
Package Manager
Telephony Manager
Resource Manager
Location Manager
Notification Manager
Libraries
Surface Manager
Media Framework
SQLite
OpenGL | ES
FreeType
WebKit
SGL
SSL
libc
Android Runtime
Core Libraries
Dalvik Virtual Machine
Linux Kernel
Display Driver
Camera Driver
Flash Memory Driver
Binder (IPC) Driver
Keypad Driver
WiFi Driver
Audio Drivers
Power Management

What is Linux ?

- Linux is a UNIX clone written by Linus Torvalds
- License and cost are free - You can download it and read the source from the Internet or redistribute it under GNU licenses.
- User-friendly - Apple OS X is UNIX ***NOT*** Linux
- Linux has open source netfilter/iptables based firewall tool
- Linux is just a kernel. All Linux distributions or "distro" include a GUI system + GNU utilities (such as cp, mv, ls,date, bash etc) + installation & management tools + GNU c/c++ Compilers + Editors (vi) + and various applications such as OpenOffice, Firefox, MySQL. However, most UNIX operating systems are considered a complete operating system as everything come from a single source or vendor.
- More detailed info or google "**nixcraft**" for linux sys admins

Linux command line environment



Your future desktop?

Since Android is Linux …

- Canonical Ltd has created Ubuntu on Android, a full build of the distro powered by your phone.
- Boots and runs simultaneously.
- Shares the same Linux kernel.
- All the productivity tools and apps of the full Ubuntu desktop available to smart phone docked with a keyboard and monitor.
- All phone data and services are shared, e.g. contacts, telephony and SMS/MMS messaging in the Ubuntu environment.
- Can launch phone apps within Ubuntu environment.

www.ubuntu.com/devices/android

What is Android Java ?

- Java is object oriented where code is contained in classes that contain values and actions or properties and methods. Created so the same code can run on any platform by use of a Virtual Machine for each OS.
- Android uses the Dalvik Virtual Machine rather than the Java Virtual Machine.
- Java classes are compiled into Dalvik executables and run on the DVM.
- DVM has been written to run multiple instances efficiently.
- Android classes are specific for the platform.

Dalvik Virtual Machine

- Virtual Machines are software
- Dalvik is a ***Process VM*** or *application virtual machine* like Flash Player, .NET, Visual Basic, PHP. It is different than a *system virtual machine* like VMware or VirtualBox where an operating system is loaded.
- A ***Process VM*** runs as a normal application inside a host operating system rather than having its own operating system separate from the one on the platform. The VM is created when the process starts and destroyed when it ends.
- ***Process VM***s are implemented using an interpreter for just-in-time compilation for performance comparable to code compiled to machine code.

Android dangers

- Malware on Android devices
- Rooting your smartPhone = jailbreaking iPhone.
- Is your hardware warranty null and void ?
- Installing Custom ROM software.
- Unrooting harder than un-jailbreaking. Single hardware vendor advantage.
- Get a test machine and back it up first.

Security issues

- Symantec **Image**
- Permissions
- SD card - almost all apps can touch content w/o permission
- 3rd party download markets with rewrapped apps
- Antivirus software needed?
- Is your wifi on? Bluetooth?
- Symantec's white paper: Mobile Device Security
  - Examines the security approaches employed in Apple's iOS and Google's Android. **WWW** or **local**
- Battleground: Apps, mobile website, email/SMS

Android's Security Model

- Traditional access control e.g. login, password, idle-time screen locking.
- Isolation of data, apps and operating system kernel
- Permission-based security model. **Buyer beware!**
- ***Weak:*** Application Provenance by author digital signature. No examination of authenticity.
- Hardware Encryption of data only in Android 3.0+

Can be done by app developer.

"Google releases the programming source code for the entire Android project, enabling scrutiny from the broader security community "

PDF article A Window Into Mobile Device Security

by Carey Nachenburg, Symantec

Some permission examples

- *Install Packages* – app can install others apps critical
- *Modify/delete SD card contents* – RWE files appropriate for some apps but critical vulnerability for content.
- *Find (GPS) location* – no data exposed but you can be located.
- *Read logs / Read sensitive logs* – can read debugging/logging code that may hold personal info. No reason apps need this.
- *Read phone state and identity* – can expose IMEI and IMSI. Used to track piracy but can grab in and out phone numbers.
- *Read/write browser history and bokmarks* – your browsing habits can be tracked.
- *Read contact data, write contact data* – appropriate for social networking, contact management, SMS. Game apps, NO!
- *Full internet access* – malware needs this to steal your info. But needed by browsers, email, weather, cloud apps, free app Ads.

Overview 1/4

- Android applications are composed of one or more application components :
  - activities
  - services
  - content providers
  - broadcast receivers – an Intent-based publish-subscribe system, examples: SMS, battery-low, snooze alarm.

  - *Intent* = an action or event that connect activities, etc.

Overview 2/4

- Each component performs a different role in the overall application behavior, and each one can be activated individually (even by other applications).

Overview 3/4

- The ***manifest file*** must declare all components in the application and should also declare all application requirements, such as the minimum version of Android required and any hardware configurations required.
- This XML file is where Permissions are declared.

  Eclipse demo in "Hello World" app

  - Show AndroidManifest.xml
  - Add permissions and show in emulator

Overview 4/4

- Non-code application resources (*images*, *strings*, *layout files*, *etc.*) should include alternatives for different device configurations (such as different strings for different languages and different layouts for different screen sizes).

Multitasking

- services and broadcast receivers
- Applications can run in the background as long as memory management doesn't kill the process to grab memory critical for higher priority processes.
- Linux kernel supports background processes
- Bundles = state saving mechanism
- Services = supports persistent background apps like IM and music. These Server apps are like Unix daemons and are not killed in least-recently-used order when memory is low.
- iPad and iPhone don’t support multitasking
- How android mltitasks

Development

The environment and software tools

don't forget you need that important …

- USB power/data cable

… that recharges your phone while transferring data

- Buy a backup at Dollar Store

A low-end app development tool

- *App Inventor* for Android from Google Labs

appinventor.googlelabs.com

- A drag and drop web based IDE which aims to simplify building of apps. No java code generated or available.
- Beta & basic tool. Try it to experiment.
- **Good way to jump in for beginning developers; students.**

Future of App Inventor – good and bad

- After *Google Labs* was shut down Google quietly announced the discontinuation of App Inventor by end of 2011. link
- New home: Massachusetts Institute of Technology (MIT)
- smooth transition? Since apps are stored on servers
- The 5+ engineers on the team that developed App Inventor no longer involved.
- This announcement is a blow to the many kids, students, educators.
- Use for example/demo apps to be built in Eclipse etc
- NEW HOME 2012-april info.appinventor.mit.edu/

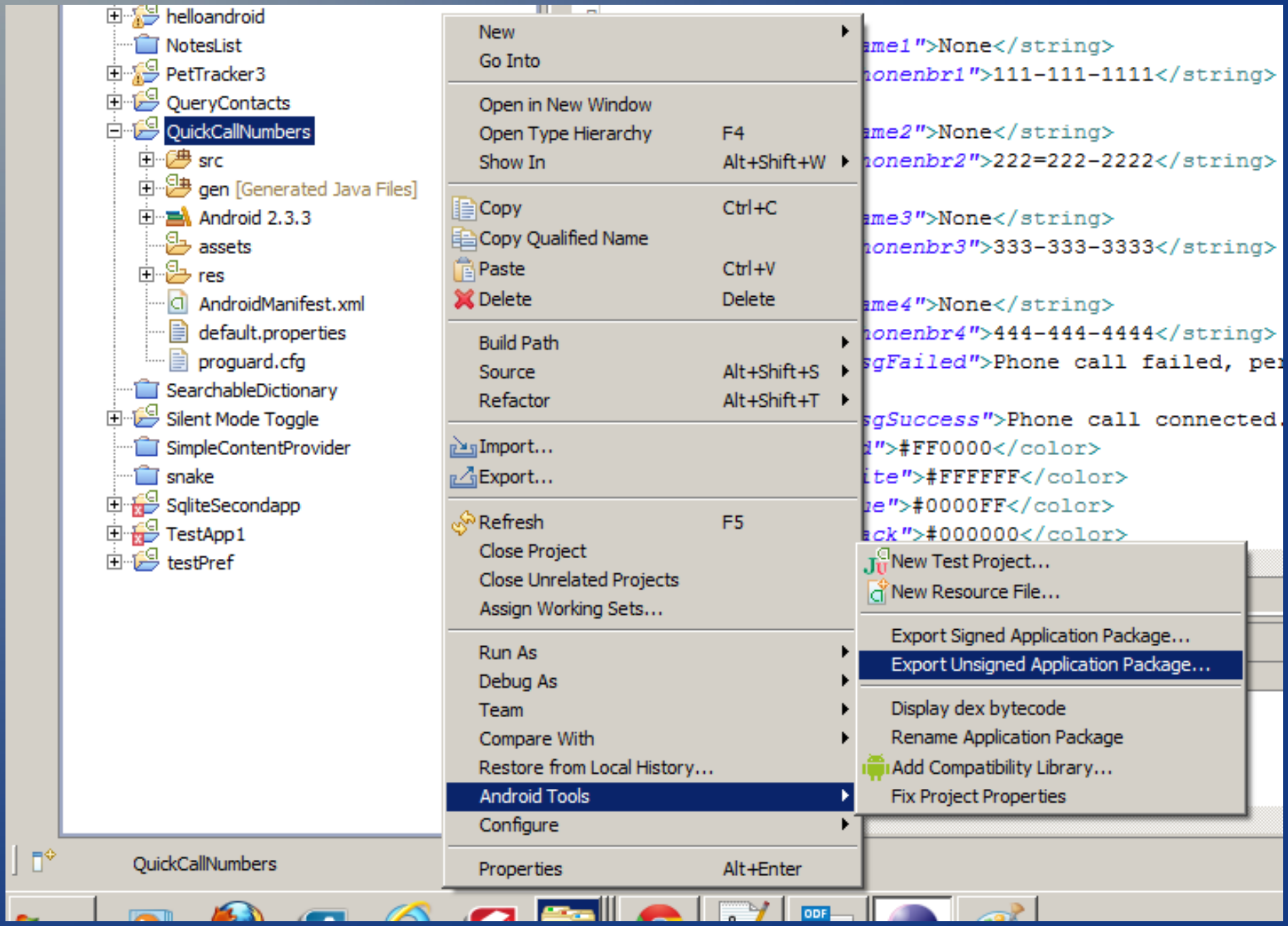
Source-to-compile cycle

1. You create your program in object oriented ***Java*** code and **XML** using a tool like Eclipse.
2. Android provides a tool "dx" which converts Java Class files into "***.dex***" (Dalvik Executable) files. This bytecode is produced only for the Dalvik Virtual Machine and **is not standard Java bytecode**. Its the compiled machine code for the DVM.
3. Android applications are then packed into an ***.apk*** (Android Package) file by the program "aapt" (Android Asset Packaging Tool) which is what you receive when you download an app.
4. Once delivered to the target machine the ***.apk*** is stored and used to install your app files in:

   data/data/<*app_package_name*>**/**

   data/data/<*app_package_name*>**/databases/**<*databasename*>
5. You can erase the ***.apk*** or save for virgin backup.
6. ***.apk*** is a condensed installation file. **Demo next page - QuickCallNumbers**

Demonstration - create apk and unzip



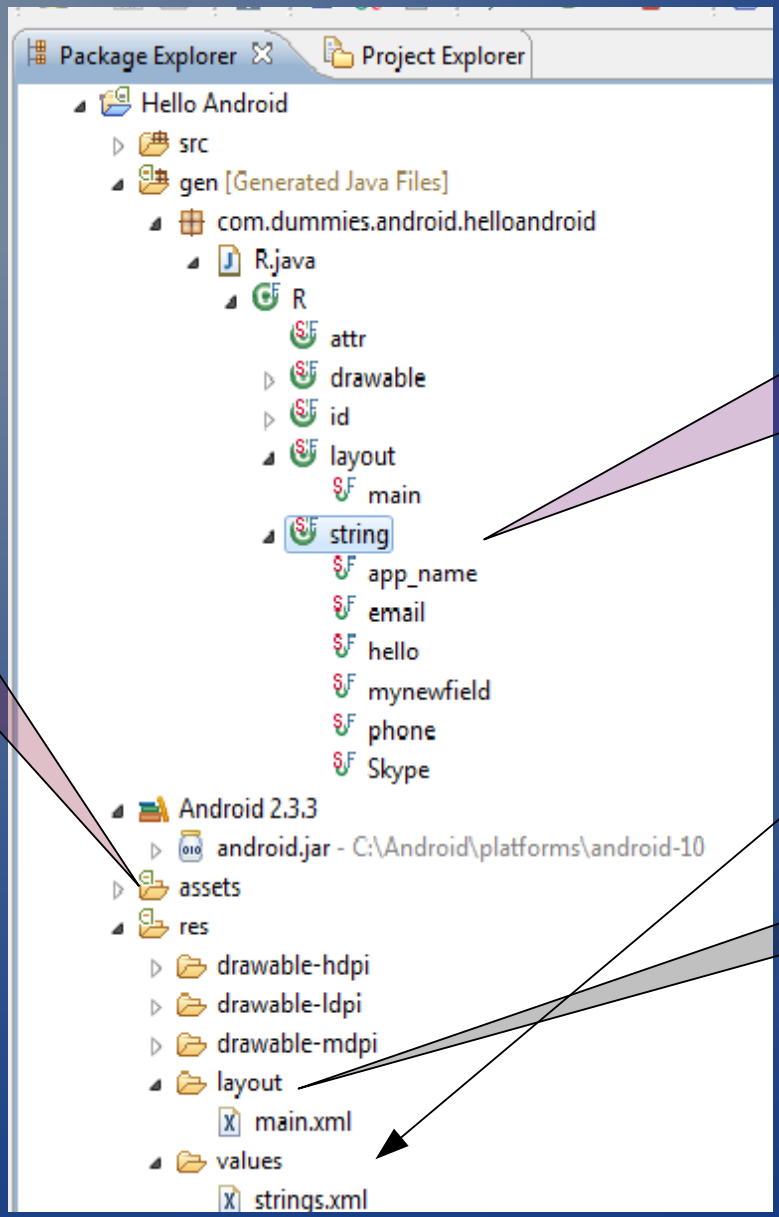
Your Development app directories

- ../ - main Project directory
  - **AndroidManifest.XML** identifies components that build and run the application.
  - **Default.properties** file identifies the properties of the project such as Android version
- .settings - eclipse environment settings
- assets - audio, video, text, sqlite databases. Raw files no ***res/ IDs***
- bin - *.dex and *.apk files created
- gen - automatically generated Java files that contains the R class in R.java links/subclasses the externalized resources in the ***res/*** subdirectories using IDs.
- res - externalizes resources such as strings, arrays, dimensions, colors, styles into XML files
- src - packages = classes = java code

Directory structure

- Project

SQLite databases go in *assets/*



XML resource files are automatically subclassed in the R package and stored in *gen/*

Layout/ references the R subclass pointers

Demo in live Eclipse Directory tree

Localization of your app

- Article: developer.android.com/guide/topics/resources/localization.html
- Two steps:
- Create separate files and store in separate directories
  - res/**values**/strings.xml english/ default
  - res/**values-es**/strings.xml spanish
- Test by changing your language in *Menu -> Language & keyboard*

The Professional Developer environment

Eclipse

This rich development environment includes

- ADT = Android Development Tools plug-in
- An Android device emulator in the DDMS
- XML editor
- tools for debugging : run-time, breakpoints etc
- memory tracking and performance profiling
- DDMS = Dalvik Debug Monitor Server
- screen capture tool : emulator or attached phone
- the offline version of the Android developer documentation

Developer environment installing all the pieces

- Java – best version is 5 or 6
- Eclipse
- Android add-ons
- USB drivers for windows etc
- Rooting your phone – not necessary for now.
- To install apps from a cable go to *Menu -> Settings*
  - Select *Unknown sources* checkbox
  - *Development* -> select *USB Debugging*
- http://www.ibm.com/developerworks/opensource/tutorials/os-eclipse-androidwidget/index.html?ca=dgr-eclipse-1

Screen capture in Eclipse

- *Use images for demos, documentation and upload to Market*
- You can screen capture an attached device or an emulator

1. First plug in your android phone via a USB cable
2. Select from main menu

   `Window -> Open Perspective -> DDMS`

3. Select your device in the Devices tab

   Make sure the device is "Online"

4. Click *Screen Capture icon* a small camera on the right side near the minimize/maximize icons
5. The image will pop up in a separate window
6. *Save* or *Copy* the image, click *Refresh* after switching to another screen on your phone.

Adb.exe - Android Debug Bridge

- adb is a versatile command line tool that lets you communicate with an emulator instance or connected Android-powered device.
- In your platform-tools/ subdirectory
- Put this directory in your PATH variable
- Windows: go to C: prompt Try these commands:
  - Run *adb shell*
    - *#sqlite3 /data/data/com.example.hello/databases/demo.db*
  - Run *adb devices*
  - Run *adb -d* or *adb -e* if you have one of each
  - Run *adb -s <device-name> shell*
  - ***adb -s emulator-5556 install helloWorld.apk***
  - ***adb pull <remote> <local>*** or ***push <local> <remote>***
- http://developer.android.com/guide/developing/tools/adb.html

Developer environment - websites

Android Full Application Tutorial

&

Android Game Development Tutorials

@

www.javacodegeeks.com

Publishing your apps

- Your own e-commerce website
- Market
- Google
- Amazon Market
- Private client release – Who owns it?

How/where store information data?

- Interact through Content Provider class and its methods
- Cache/memory
- Structured local text File in an app directory, e.g. Help screen
- XML structured file e.g. Preferences file; read/write capabilities.
- Databases
  - Android ships with SQLite and supporting classes.
  - MongoDB, e.g. one vendor mongolab.com created cloud based db using mongoDB
  - JavaDB
- On a private website server or with a cloud vendor. Why?
- Synchronization e.g. Gmail, company employees or catalog.

SQLite - the embedded database pg1

- "Lite" is about setup, administration, overhead, serverless *not* cababilities.
- Consortium: Mozilla, Oracle, Adobe, Nokia, etc.
  www.sqlite.org
- Cross-platform, zero-configuration, stored in a single cross-platform disk file
- Manage databases with command-line interface
  sqlite3 demo1.db
- multiple reads but one write process locks the entire database
- default configuration is case-insensitive comparisons of ASCII characters

SQLite - the embedded database pg2

- can also be used as an in-memory database engine
- Supports atomic commits = BEGIN…COMMIT
- version 3.6.19 supports foreign key constraints
- supports FOR EACH ROW triggers, not FOR EACH STATEMENT triggers
- dynamic datatyping as INTEGER, REAL, TEXT, BLOB, or as NULL
- embedded in Android, FireFox, Safari, Chrome, Skype, OS X, iPhone, iTunes, Airbus aircraft, Acrobat, QuickBooks, TurboTax, PHP, McAfee, etc
- www.sqlite.org/limits.html

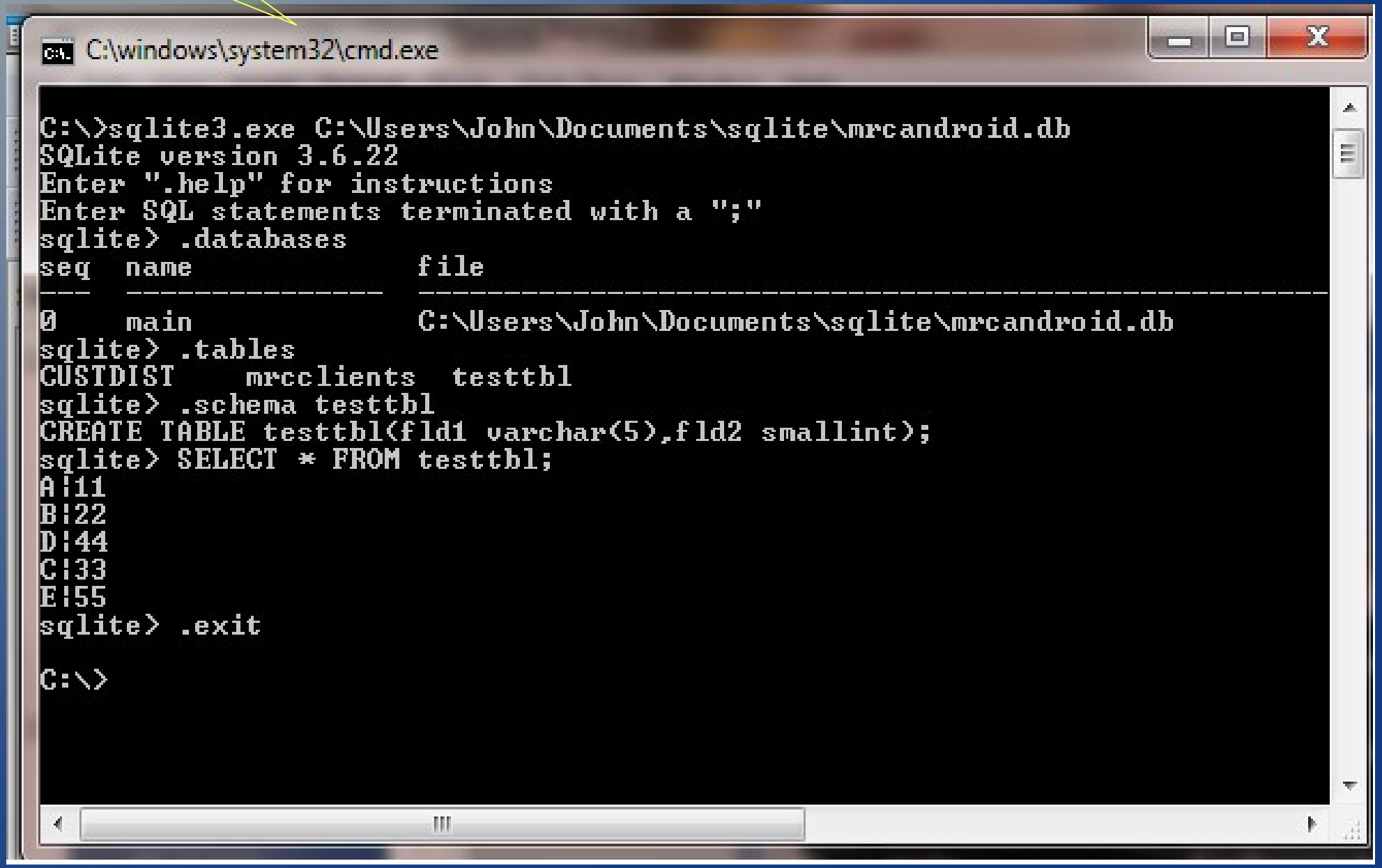
The hard way to manage a database

- CLI: command line interface. Included with SQLite installation
  - In windows: Start → type in "*cmd*" in Search box

    sqlite3.exe C:/users/john/Desktop/pet_tracker.db
  - Intro to CLI environment
  - Type *.help* for list of limited commands
  - sqlite> *SELECT * FROM tablename;*
  - sqlite> *SELECT * FROM SQLITE_MASTER* = metadata
  - Sqlite> .dump [tablename] to see all data on screen
  - # sqlite3 *
  - Make sure database exists in directory first.

Type
"cmd"
in Search

How it looks in the CLI



SQLite GUI tools

- SQLite Manager
- SQLite Database Browser
  - http://sourcforge.net/projects/sqlitebrowser/
- Sqliteman
  - http://sqliteman.com/
- Questoid SQLite Manager manages sqlite databases on an Android device emulator from within in Eclipse. Avoid this $$ and weak.

- Hint: just get familiar with the *sqlite3.exe* CLI and *adb.exe*

And .....

My preferred tool for SQLite

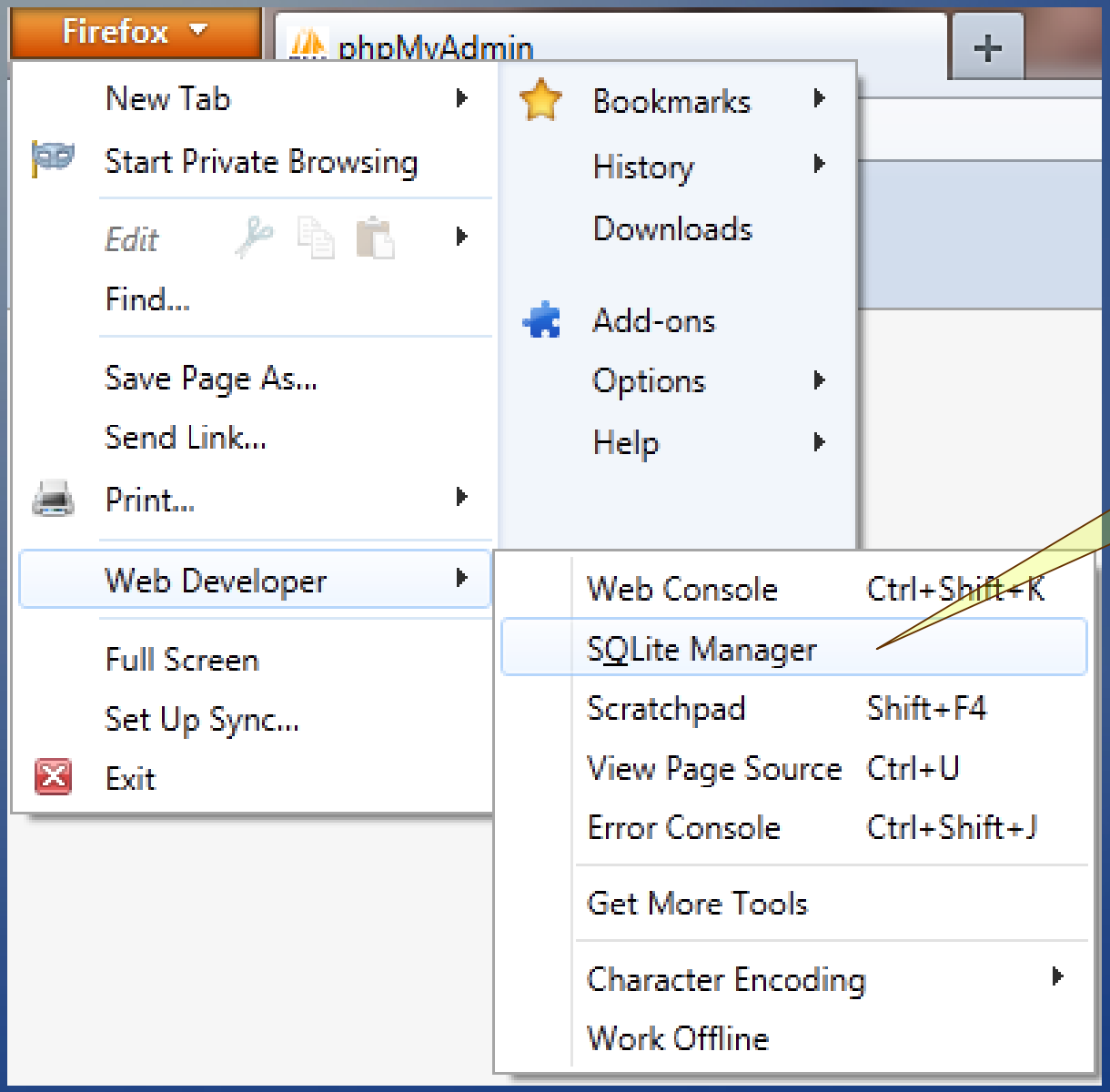
- **SQLite Manager** 0.7.6 - a great GUI tool

- You can download and install this free Firefox add-on

  addons.Mozilla.org

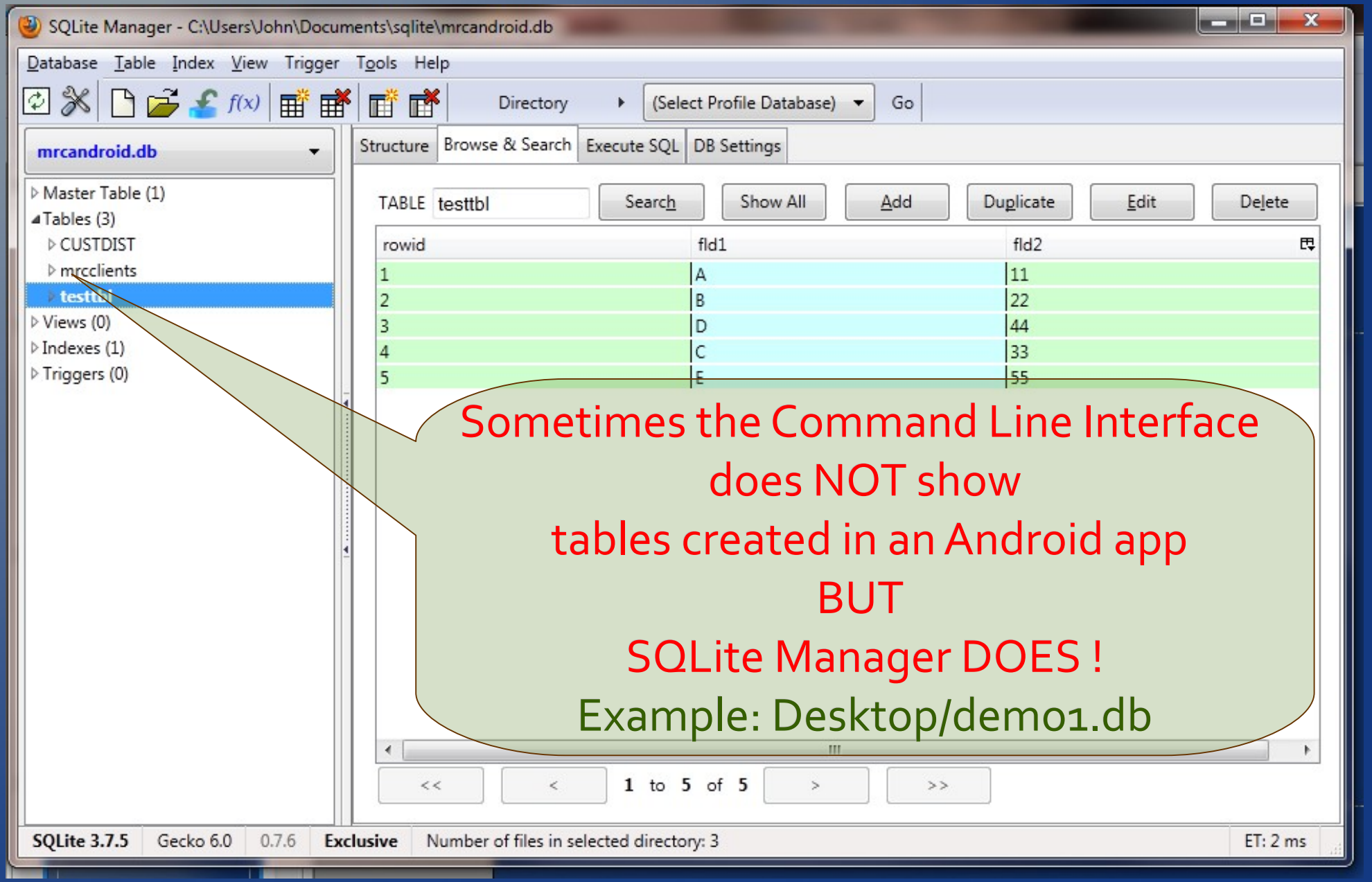
- Still waiting for a GUI SQLite database manager that runs on android emulator or device.
- Possibilities coming … stay tuned.

Open SQLite Manager in Firefox



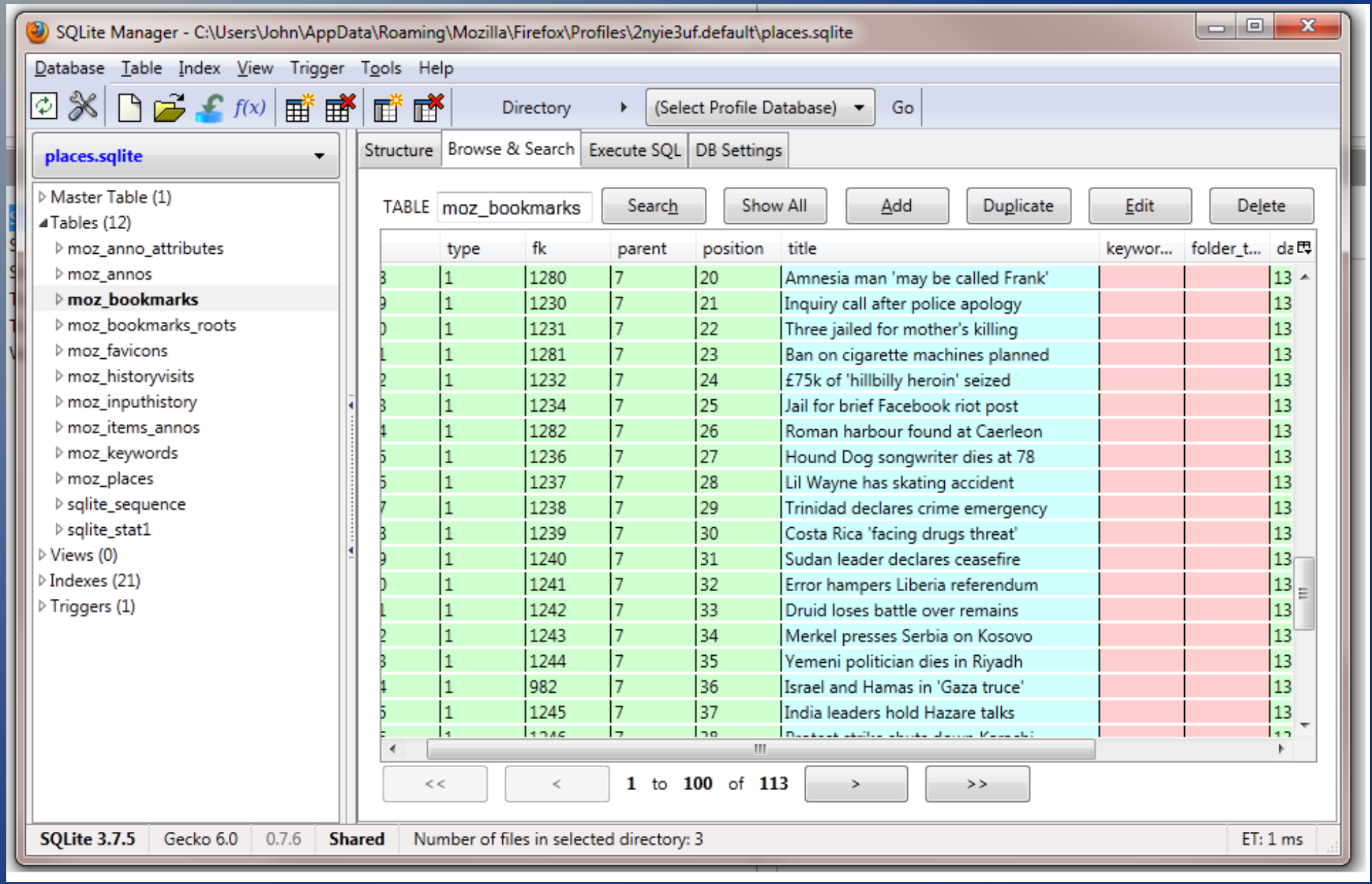
Open the SQLite Manager Add-on from the Web Developer Sub-menu.

How SQLite Manager looks



FireFox uses SQLite (*places.sqlite*)

C:\Users\John\AppData\Roaming\Mozilla\Firefox\Profiles\2nyie3uf.default



java package that exposes SQLite to the app
android.database.sqlite

CLASSES

SQLiteClosable	An object created from a SQLiteDatabase that can be closed.
SQLiteCursor	A Cursor implementation that exposes results from a query on a SQLiteDatabase. Is an Indirect Subclass of database.AbstractCursor
	Exposes methods to manage a SQLite database.
SQLiteOpenHelper	A helper class to manage database creation and version management.
SQLiteProgram	A base class for compiled SQLite programs.
SQLiteQuery	A SQLite program that represents a query that reads the resulting rows into a CursorWindow.
SQLiteQueryBuilder	This is a convenience class that helps build SQL queries to be sent to SQLiteDatabase objects.
SQLiteStatement	A pre-compiled statement against a SQLiteDatabase that can be reused.

Android Market links

The Android Market Website

Android Market for Developer Help

Installing off-Market apps

- http://www.brighthub.com/mobile/google-android/articles/37151.aspx

  First you need to do a couple things:

- On your android phone enable "Unknown Sources"

  Menu-> Settings -> Applications

- Also enable "USB debugging"

  Menu-> Settings -> Applications → Development

- *** Same steps as USB attachment to PC for developers ****

4 ways to install a third party app on your phone

APK files are basically Android package applications.

1. Download it from the Android Market if its there.
2. Use the Android SDK installed on your pc to move the file over to your phone. You need to install the Android USB drivers to connect the SDK software to your cell via USB.
3. Email to your android e-mail account, download it and then click on the APK file. It will install.
4. Download a file manager app from the Market, like *Astro File Manager*. Then click on the file when found.

Other legitimate markets

- Cisco Systems' Android-based tablet targets the enterprise.
- The government
  - The Army wants every soldier to carry a smartphone to stay networked..... A prototype device running Android called the *Joint Battle Command-Platform*, developed by tech nonprofit MITRE, is undergoing tests, the Army says. link
- *Google Music* vs *iTunes*
- Virtualization vendors:
  - Citrix *Xendesktop* and Vmware *View*

Future possibilities

- NFC -Near Field Communication
  - Mobile payments/commerce ex. *Google Wallet*
  - *Android Beam* for sharing info between devices
- QR codes everywhere
- Multiple environments on the smartphone e.g. VMware dual environment on a personal phone
- Social networking
- Mobile web sites that imitate apps rather than pc www
- Android on Intel chips in 2012.

Mobile Websites

PHP Magazine Mobile

- PC version web page

  mobile.phpmagazine.net view page

- Edition to be viewed on a mobile device

  m.phpmagazine.net view page

Building mobile websites on Android

- PHP for Android

- JQuery for mobile devices

10 tool apps for developers

- AndFTP 

- SilverEdit 

- PhotoShop 
- View Web Source 
- Mobile GA 

- DropBox 

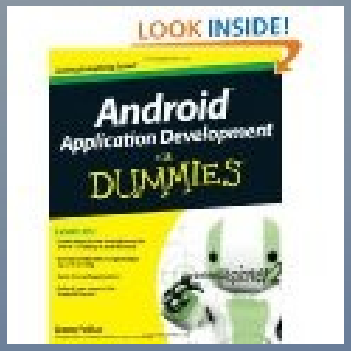
- WordPress Mobile 
- Thinking Space 
- Typography Junkies 

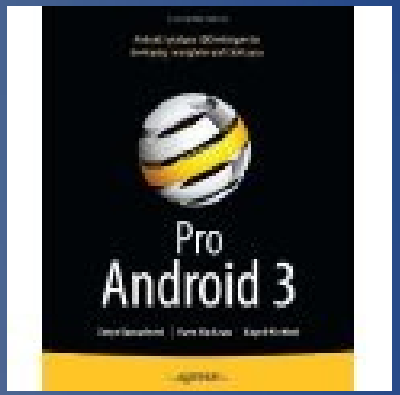
- HTML Test 

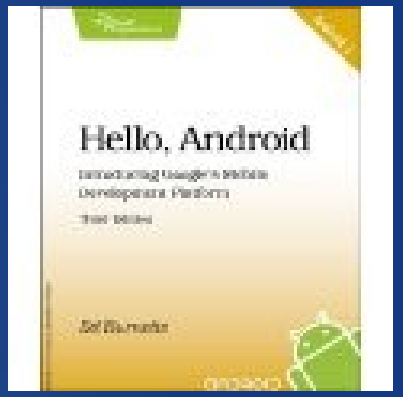
Fascinating websites for content and style

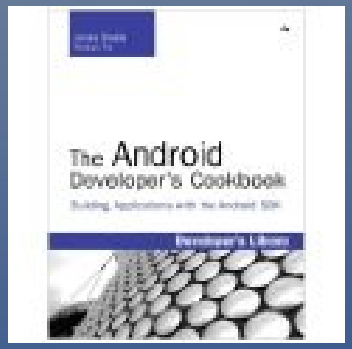
- chicagoandroid.com/
- www.xda-developers.com/
- www.appbrain.com/
- www.google.com/mobile/android/
- developer.android.com/
- AndroidPolice.com
- SmartPhoneBlogging.com
- eedailynews.com

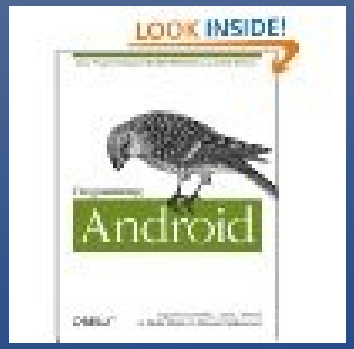
Books, books, and books...

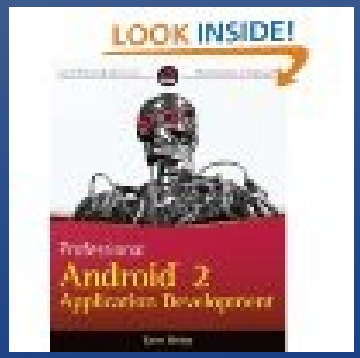












Thanks for participating

AIS b-card

John A. Mahady

Andrew Information Services

Wheaton, IL

312-560-8072

john@AndrewInfoServices.com