Google Android

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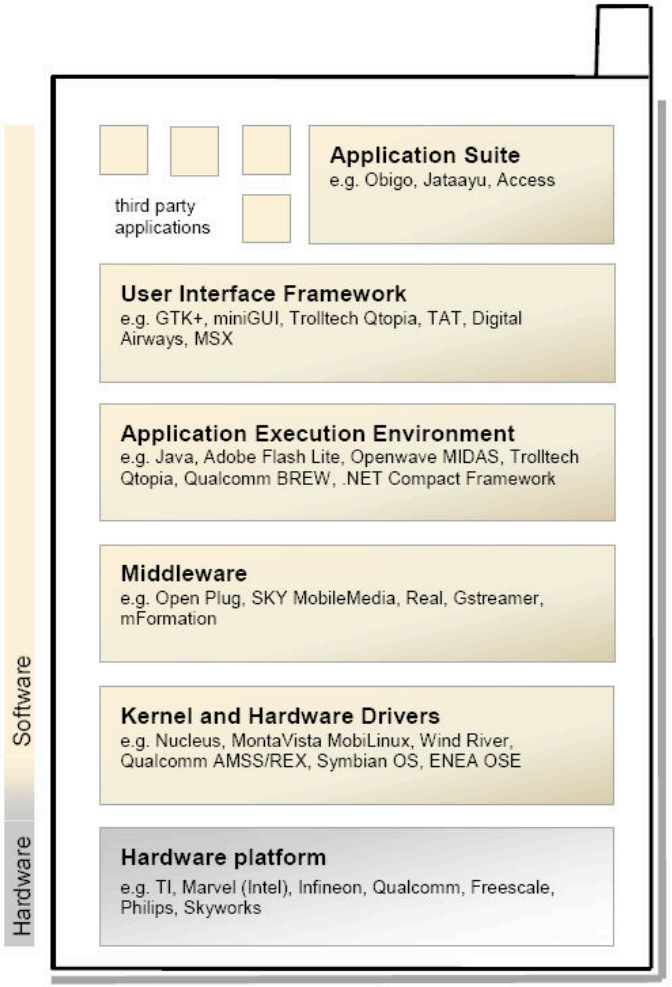
Agenda

- Introduction
  - Mobile Platform Overview
  - Background : Current Linux Mobile Platform
  - What is Android?
    - Features
    - Architecture
- Technical Detail
  - Android SDK
  - Porting Android to Real Target
  - Future of Android

A conceptual model for mobile software



Source: VisionMobile

- Software Stack
  - Kernel
    - the core of the SW (HW drivers, memory, filesystem, and process management)
  - Middleware
    - The set of peripheral software libraries (messaging and communication engines, WAP renders, codecs, etc)
  - Application Execution Environment
    - An application manager and set APIs
  - UI framework
    - A set of graphic components and an interaction framework
  - Application Suite
    - The set of core handset application (IDLE screen, dialer, menu screen, contacts, calendar, etc)

Mobile Platforms

- Feature Phone
  - Vendor Platform : Mocha, PDK, WAVE, WISE, KX, etc.....
  - Carrier Platform : SKTelecom TPAK, NTT i-Mode (WAP), Java, WIPI, BREW, etc……
  - 3rd Party Solution : TAT Cascade, Qualcomm uiOne
- Smart Phone
  - MicroSoft Windows Mobile
  - Nokia : Symbian, Series 60
  - Apple, iPhone – OSX 10.5 Leopard
  - Linux

Customers & Licensees

	Arima	BenQ Siemens	Bird	Cellon	Compal	Eastcom	Fujitsu	Group Sense Ltd	Hitachi	HTC	Huawei	IXI mobile	Kyocera	Lenovo	LG	Longcheer	Mio	Mitac	Mitsubishi	Motorola	NEC	Nokia	Palm	Panasonic	Pantech & Curitel	Sagem	Samsung	Sanyo	Sharp	Sony Ericsson	TCL	Toshiba	Vitelcom	Wistron	ZTE
A la Mobile																																			
Access Linux Platform																																			
Adobe Flash Lite		●					●		●				●		●				●	●	●	●		●			●	●	●	●		●			
GTK+																					●	●		●											
MiniGUI																																			
Mizi Prizm																											●								
MontaVista Mobilinux																				●	●			●											
Nokia S60														●	●							●					●								
Obigo Suite	●	●	●	●		●					●	●		●	●									●	●		●			●	●	●	●		
Openwave		●			●				●				●		●				●	●	●	●		●		●	●	●	●		●		●		
Qualcomm BREW			●		●	●					●		●	●	●					●		●		●	●		●	●	●	●	●	●	●		●
SavaJe OS								●							●	●																			
Symbian OS	●	●					●							●	●				●	●		●		●			●		●	●					
Trolltech Qtopia				●																●														●	●
UIQ	●	●																		●										●					
Windows Mobile					●					●							●	●		●			●				●								

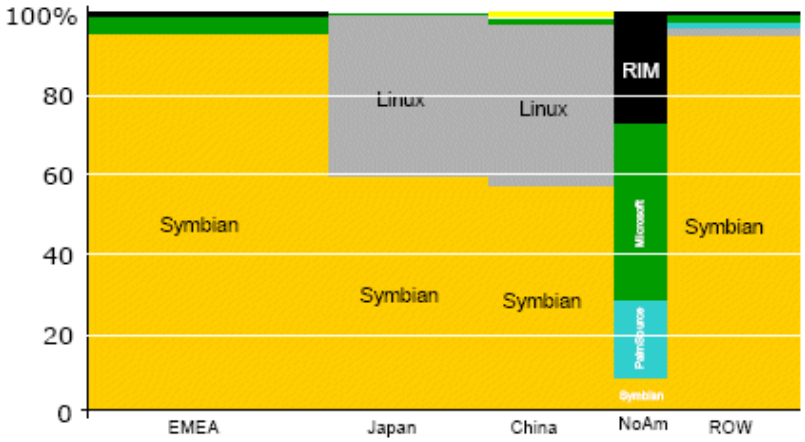
Not all customers or licensees are shown

Source:vendor data

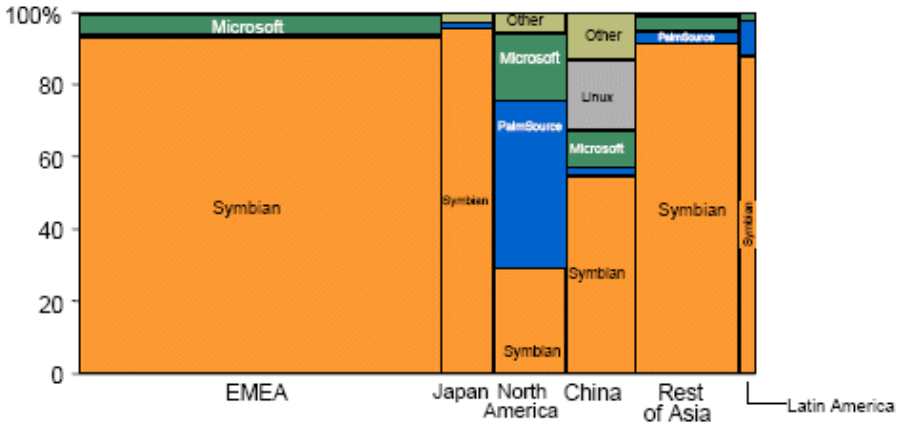
Smartphone OS Market Share by Region

Smartphone OS market share by region, 2006

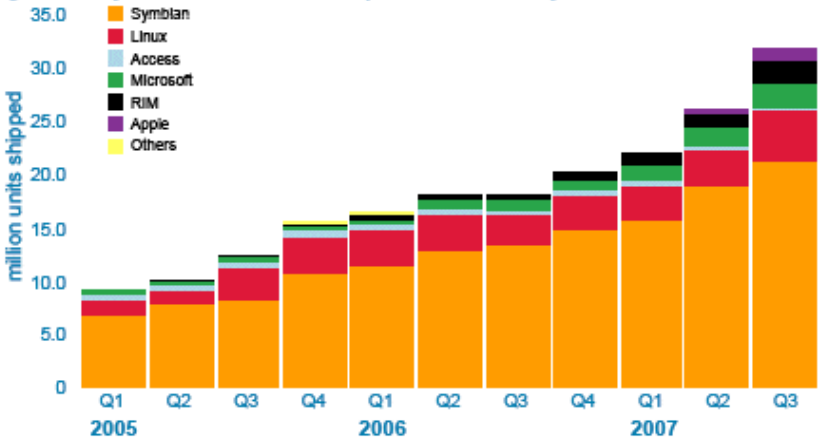
Source : Canalys



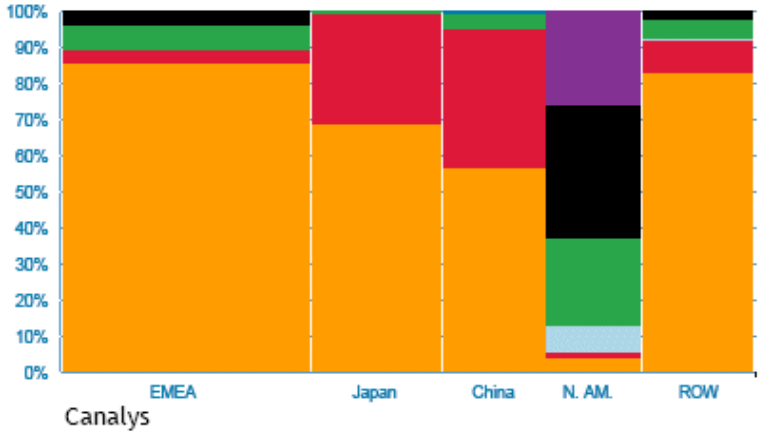
2004 smartphone unit sales by region by OS vendor



Quarterly worldwide smartphone sales by OS vendor



Q3 smartphone sales by OS vendor by region



Canalys

Current Linux Mobile Platforms

- LiMo Foundation
  - https://www.limofoundation.org/sf/sfmain/do/home
- TrollTech
  - Qtopia GreenPhone
  - Acquired by Nokia
- OpenMoko : GNU/Linux based software development platform
  - http://www.openmoko.org , http://www.openmoko.com
  - Linux Kernel, GUI using X. Org Server, GTK+,Matchbox window manager
  - First Supported phone, Neo1973 (also ported Qtopia)
- ALP (Access Linux Platform)
  - http://alp.access-company.com/
- Nokia N810 – Maemo
  - http://maemo.org/
  - Exploring the technical details of N810
    - http://arstechnica.com/journals/linux.ars/2007/10/22/looking-at-the-technical-details-of-nokias-n810-internet-tablet-operating-system
- MontaVista – Mobilinux
- Google – OHA, Android OS
  - http://www.openhandsetalliance.com/
  - Android : A complete set of SW for mobile devices
    - Operation System, Middleware, and Key mobile applications

Linux for mobile handsets

- Benefits
  - Linux is designed to avoid single-vendor domination
  - The Linux kernel has been ported to more than a dozen chipsets
  - Linux is cheap and open to innovation
  - Technically competent and cost-effective for converged devices
  - Several governments (most notably China) support Linux
- Challenges
  - The Linux kernel is optimized for desktop and embedded
  - Distribution lack the feature set requested by network operators (except Vodafone?)
  - No consensus on Linux's APIs
  - Mitigating legal challenges

Google – OHA

open handset alliance

中国移动通信 CHINA MOBILE
Audience
BROADCOM.
NUANCE
livewire
Living Image
intel
pv
esmertec
MARVELL
SkyPoP
Ascender Corporation
NVIDIA
SONiVOX sound that rocks.
ebay
QUALCOMM
WIND RIVER
htc smart mobility
Designing The Future KDDI
SiRF
tat
LG Electronics
NTT DoCoMo
Texas Instruments
noser
Sprint
MOTOROLA
Synaptics
Aplix Corporation
T-Mobile
SAMSUNG
TELECOM ITALIA
Telefónica

What is Android?

- **Android is……**

  a software stack

  for **mobile devices**

  that includes an

  operating system,

  middleware

  and **key applications.**

  ….

  developing **applications** …

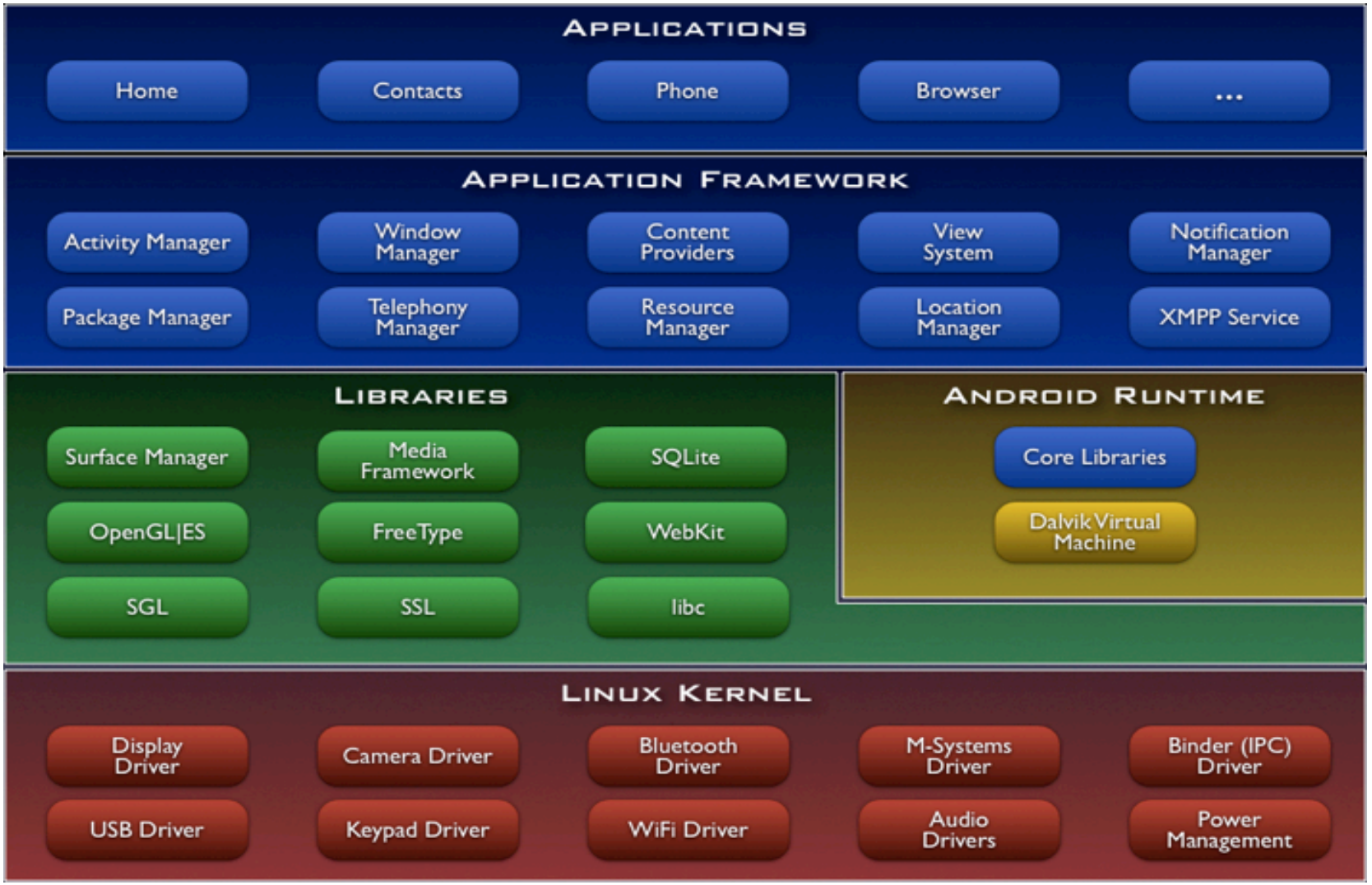
  using the **Java** programming language.

- History
  - 2001 search service for wireless device
  - 2005
    - Acquire Android (Andy Rubin : Danger CEO, Development Sidekick of T-Mobile)
    - Acquire Skia (2D Graphics for mobile device)
    - Acquire RegWireless (Browser and Email for mobile device)
    - Move Engineers from PalmSource (Dianne Hackborn, etc…)
  - 2007.11 Android SDK Release, OHA
  - 2008. 1H Android Developer Challenge
  - 2008. 2H Android Phone

Features

- Application Framework
  - Enable reuse and replacement of components
- Dalvik Virtual Machine
  - Optimized for mobile device
- Integrated Browser
  - Based on the open source WebKit engine
- Optimized Graphics
  - Powered by a custom 2D/3D graphics
- SQLite
  - For structured data storage
- Media Support
  - For common audio, video, image formats (MPEG4,H.264,MP3,AAC,AMR,JPG,PNG,GIF)
- GSM Telephony
  - (hardware dependent)
- Bluetooth, EDGE, 3G, and WiFi
  - (hardware dependent)
- Camera, GPS, compass, and accelerometer
  - (hardware dependent)
- Rich Development Environment
  - Device emulator, Debugging Tools, Memory/Performance Profiling, Plugin for the Eclipse IDE

Android Architecture

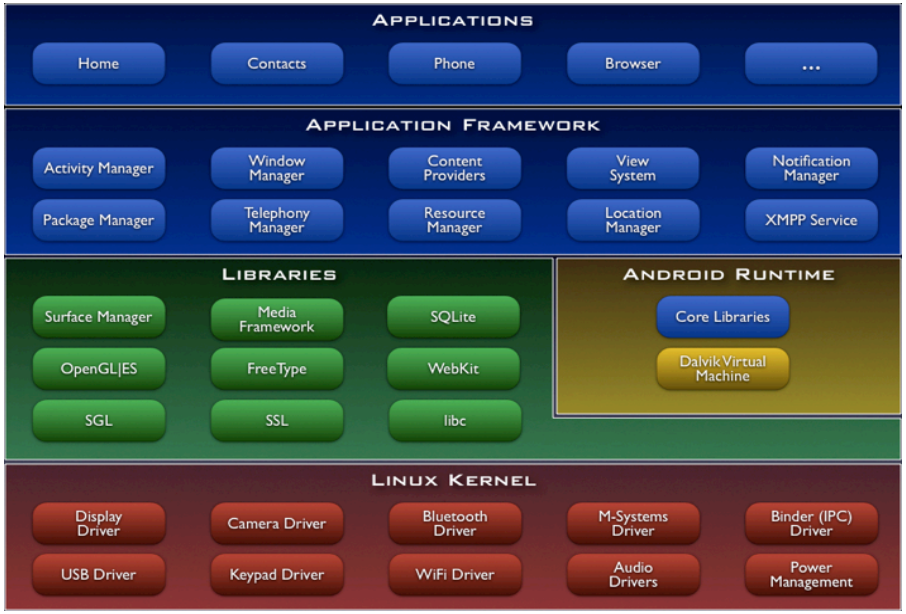


Android Runtime

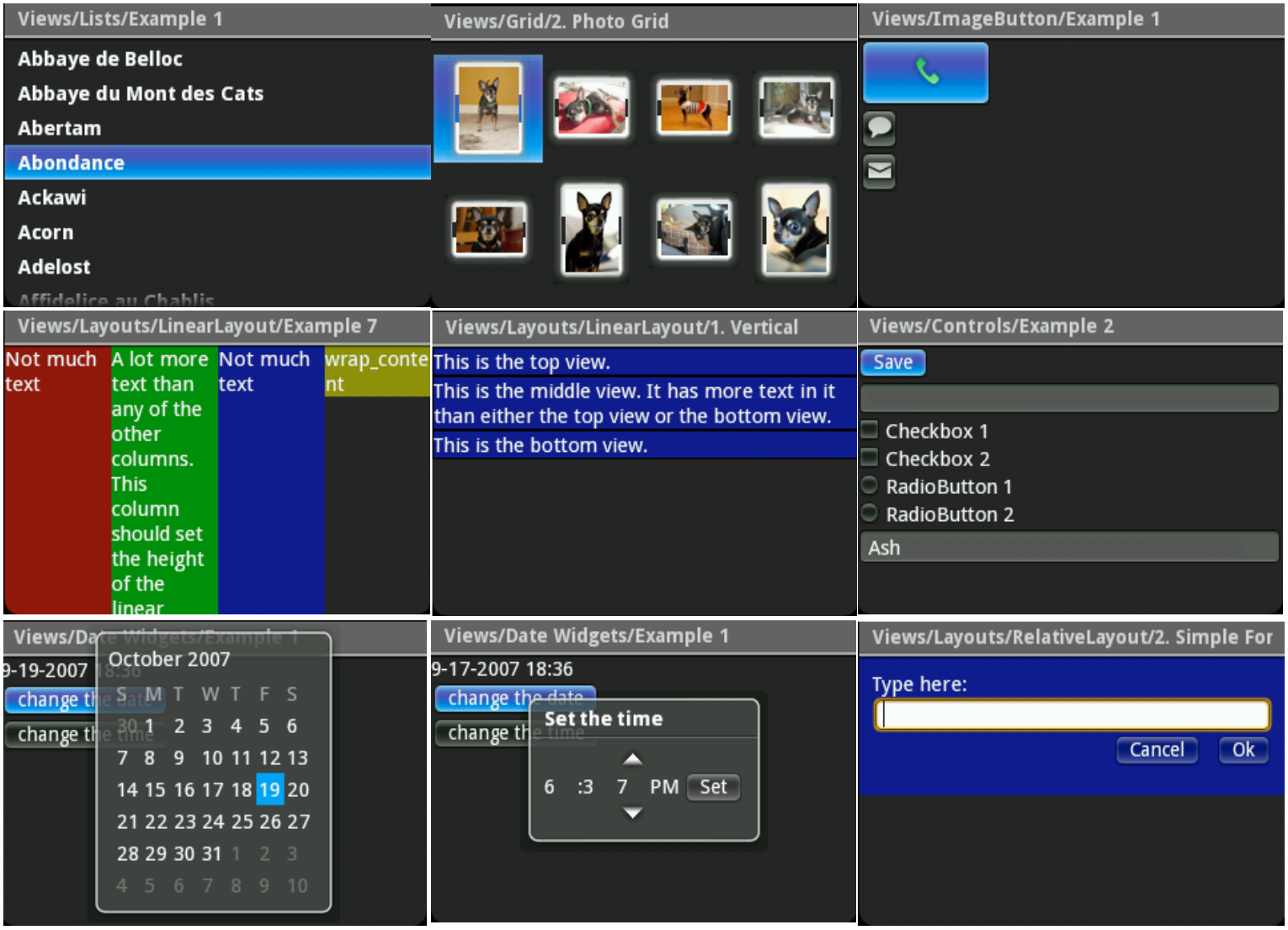
- Core Libraries
  - Provides the functionality of the Java Programming Language
  - Android Application runs in its own process, with its own instance of the Dalvik virtual machine
  - Dalvik VM : Java based license free VM
    - Register based VM, optimization for low memory requirements
    - Executes files in the Dalvik Executable (.dex) format
    - DX tool converts classes to .dex format
- Why Dalvik, Why Java?
  - Separate HW layer/ SW layer
    - Kernel is responsible for Security
  - Allow Multiple VM instance
  - To insure compatibility
    - Support different HWs (LCD, Keypad, …etc)
  - Avoid License Issues

Architecture in detail

- The Design goal of Android – Openness
  - Be as flexible as possible
  - How it handles access to data (Mashups on the internet and everything else)
  - Rapid development (XML, Java)
- IPC/Data Sharing Method
  - AIDL (Android Interface Definition Language)
    - COM/CORBA like IDL ← Binder
  - SQLite
  - Content Provider
  - FileSystem
- Dev Language?
  - App : Java
  - Framework : Java
  - Libraries : C/C++
  - OS & Driver : C
- Creating Native C Applications
  - Possible, but not supported



Views Sample



Android SDK

- Tools
  - Emulator : QEMU 0.8.2 + libSDL 1.2.12
    - Provide emulator console, telephony emulation, skins
  - DDMS (Dalvik Debug Monitor Service)
    - Thread/Heap/Process/Log Monitor
    - File Explorer
  - ADB Shell
  - Logcat, Android Log, Traceview
- Samples/Docs
- System and Software Requirements
  - Supported Operating Systems
    - Windows XP/Vista
    - Mac OS X 10.4.8 or later (x86 only)
    - Linux(tested on Linux Ubuntu Dapper Drake)
  - Supported Development Environments
    - Eclipse IDE
      - Eclipse 3.2,3.3 (Europa)
      - Eclipse JDT Plugin
      - JDK 5 or JDK 6
      - ADT (Android Development Tools plugin), optional
    - Other IDEs
      - JDK 5 or JDK 6
      - Apache Ant
    - GCJ(Gnu compiler for Java) not compatible

Porting Android to Real Target

- Board Spec.
  - Acumen Evaluation Board
  - CPU: PXA270 (ARMv5 based)
  - RAM: 128MB
  - NAND: 32MB
- Porting Procedure
  - Make file system image
    - Ramfs (rootfs), yaffs2 system, data image
  - Linux 2.6.23.8 porting (make android patch)
    - EABI(Embedded Application Binary Interface) Support
    - OpenBinder (google added)
  - Device Driver Setting
    - FrameBuffer
    - Keyboard
    - TouchScreen
    - Network
  - Tune scripts and settings
  - Porting Tools
    - strace, busybox, log, network, /init

Future of Android

- Business model
  - Organize the world's information and make it universally accessible and relevant
  - No direct-advertising component in the platform
  - Search and Advertisement (Network+Desktop → Mobile+Phone)
  - Will NOT make A gPhone
  - Google 700Mhz bid?

- A broad developer community
  - ASL (Apache Software License)
  - Linux Kernel is licensed under (GPLv2)

- Developer Challenge
  - $10 million in awards
    - Challenge I : Emulator Version (Jan 2. 2008~)
    - Challenge II : Handset Version (The second half of 2008)
  - Opened Project (~12/12)
    - Social Network (with 2d&3d animation)
    - FPS : Wi-Fi Army
    - Location Search : with google map
    - Drive By Ad. : Location base Ad.
    - Car Navigation
    - Mobile Shopping
    - Ebook with full text index : google phone search?
  - Location Base!
    - Almost Location Base Service except ebook, Social Network (over 80%)
    - Small group is discussing game/PDA apps

Mash Up

- Mash-up
  - New service with existing information
  - Not supported directly yet
- Source
  - Google : www.google.com
    - ride finder
    - maps : street view
    - search by location
    - video & youtube
    - mash-up editor
    - gtalk
  - GoogleMobile : www.google.com/m
    - gmail
    - calendar
    - notebook
    - docs
    - reader
    - picasaweb
  - 3rd Party?
- Android
  - H/W Support
    - GPS Location
    - Compass Direction Sensor
    - Accelerometer
    - Camera(Still/Video)
  - Network Support
    - GPRS
    - 700MHz W-MAN
    - Wi-Fi
  - Intent
    - Access Service via URL
  - XMPP
    - Google Instant Message

Mash Up Example