



# Using High Level View on Android Porting

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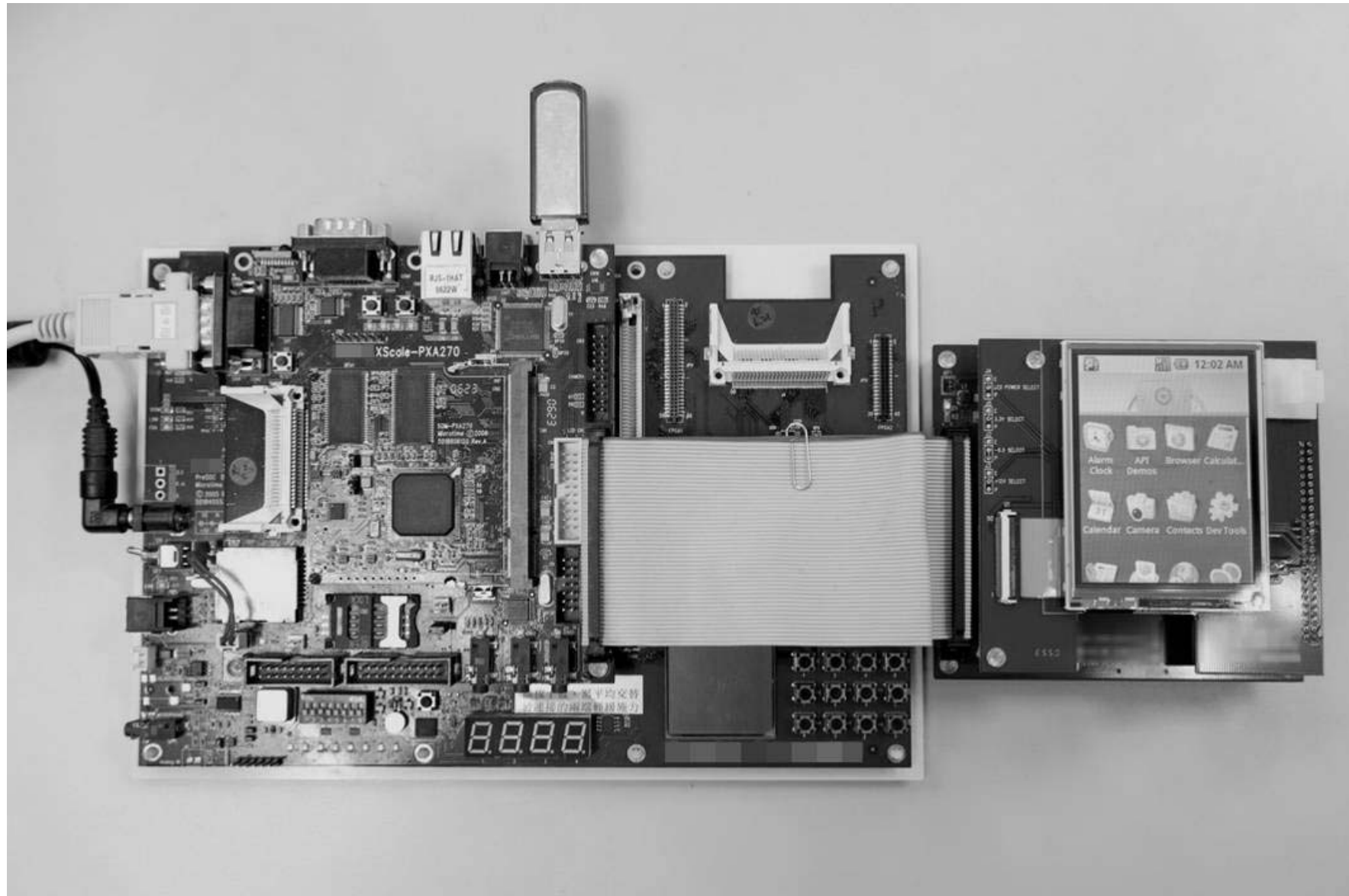
鍾文昌 Mask <mask.chung@gmail.com>

- 數年 Linux 及 Embedded Linux 相關開發經驗，開發產品包含 Set-Top-Box、手機及快速開機軟體等相關產品，接觸過 x86、MIPS 及 ARM platform，對 Linux kernel、Linux device driver、Shared Library、Application 等皆有所涉獵。
- 在 IC 廠完全沒有支援 Android 的情況下，獨立移植 Android 至 PXA270、OMAP3530 等硬體平台。
- 豐富的 Android Porting 授課經驗。





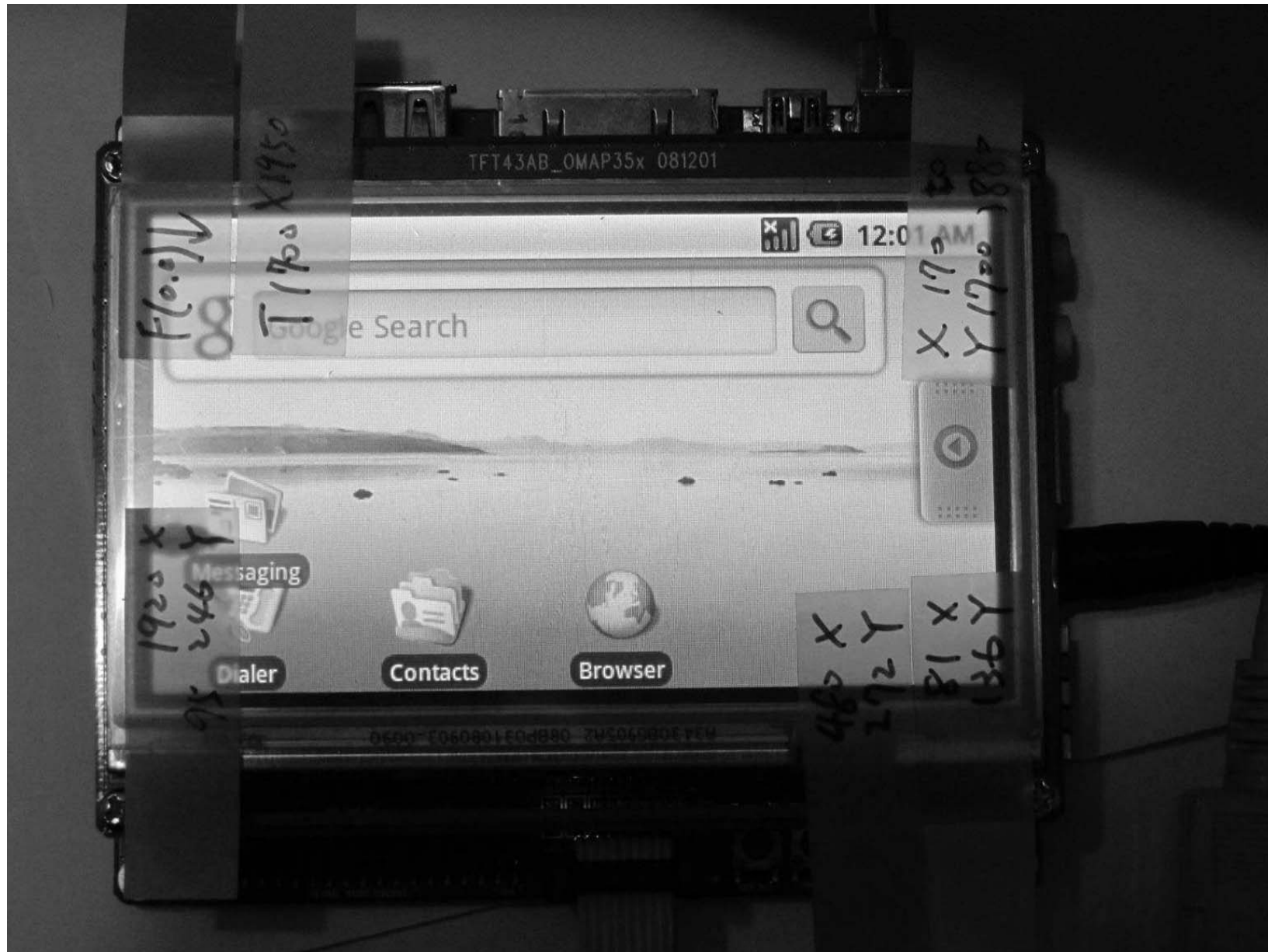
# Android 1.0 on PXA270



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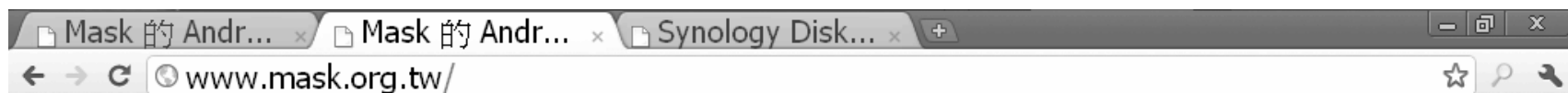
# Android 1.5 on OMAP3530



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# Demo



## OMAP3530

2009年12月首創台灣第一個上機實作 **Android** 移植實務課程, 講授 **Android** 系統底層移植實務技術剖析, 帶領學員實際移植 **Android** 至 **OMAP3530**. 本課程將在 **IC** 廠沒有提供任何 **Android** 相關原始碼的情況下, 帶您一窺從無到有移植 **Android** 的奧秘. 小弟為此課程量身打造一系列講義, 工具, 軟體, 原始碼, 開發環境以及從無到有移植 **Android** 的完整改版記錄, 課程內容兼具理論與實務, 包含移植流程說明以及實作步驟講解, 課程中將讓學員親手實作移植步驟並深入了解移植細節, 為非常紮實的實作訓練課程. 學員融會貫通後, 將有能力自行移植 **Android** 至未來的新硬體平台. 本課程絕對是台灣最高品質的 **Android** 移植技術與實作訓練課程. 課程中將提供開發環境及移植 **Android** 之完整改版記錄, 相關課程請參考課程資訊.







# Using High Level View on Android Porting

- Linux booting procedure
- How to trace Linux kernel
- Android booting procedure
- How to trace Android source code
- Treat Android as Black Box



# Embedded Linux System Architecture

**Application**

**Library**

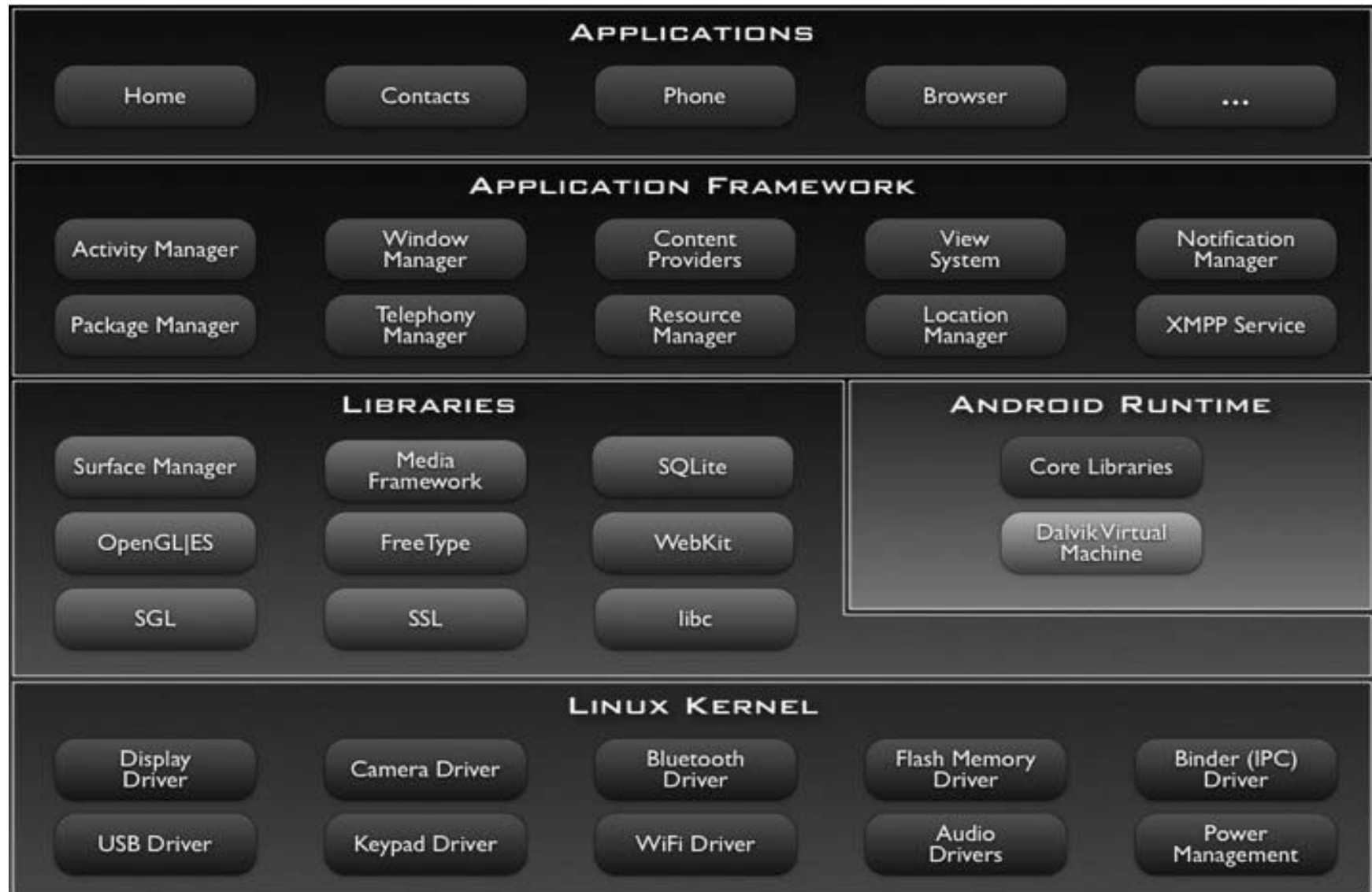
**Linux Kernel**

**Linux Device Driver**

**Hardware**



# Android Architecture



<http://developer.Android.com/guide/basics/what-is-Android.html>

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# Embedded Linux System Boot Sequence

**Bootloader**

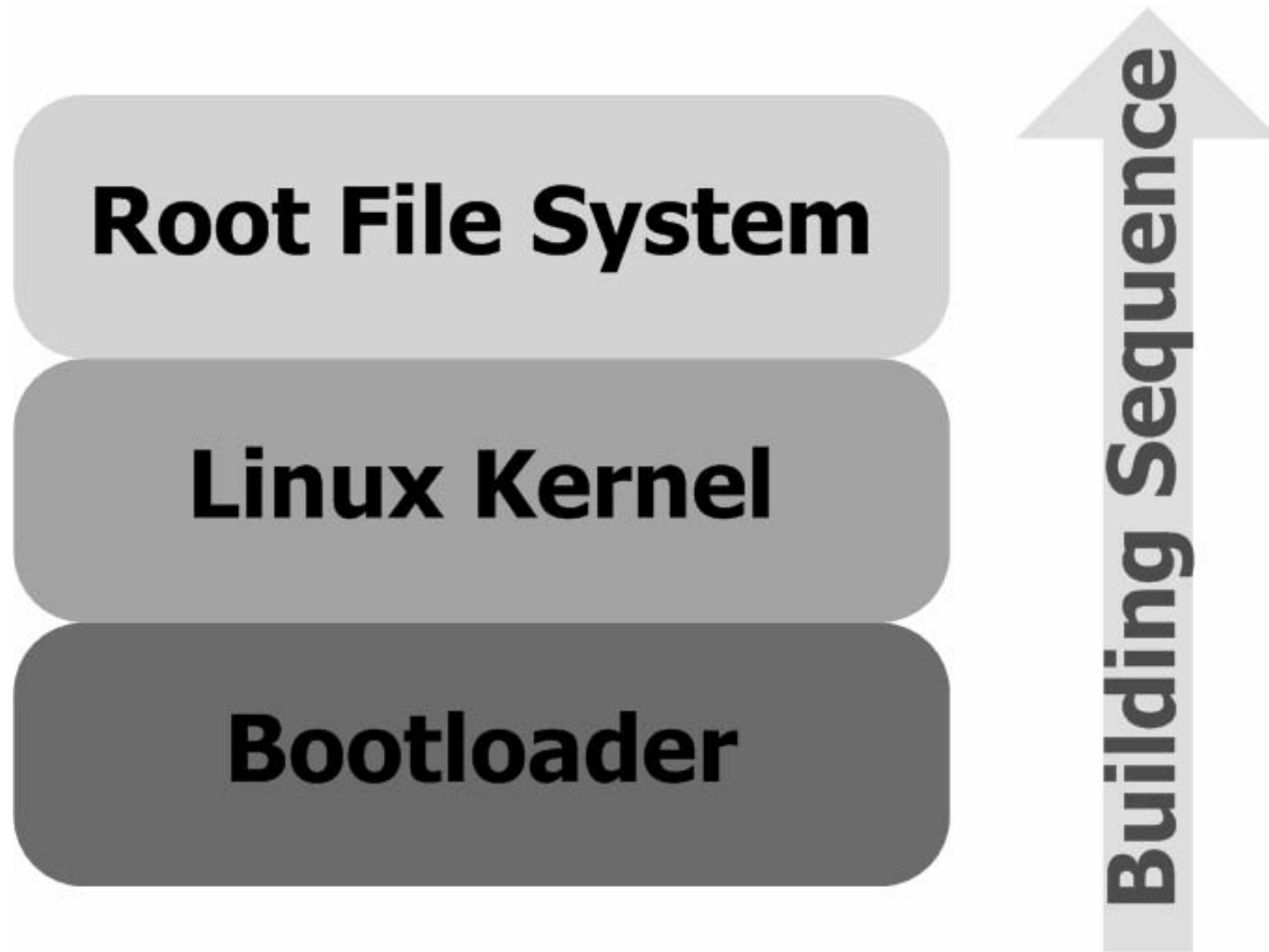
**Linux Kernel**

**Root File System**

**Boot Sequence**

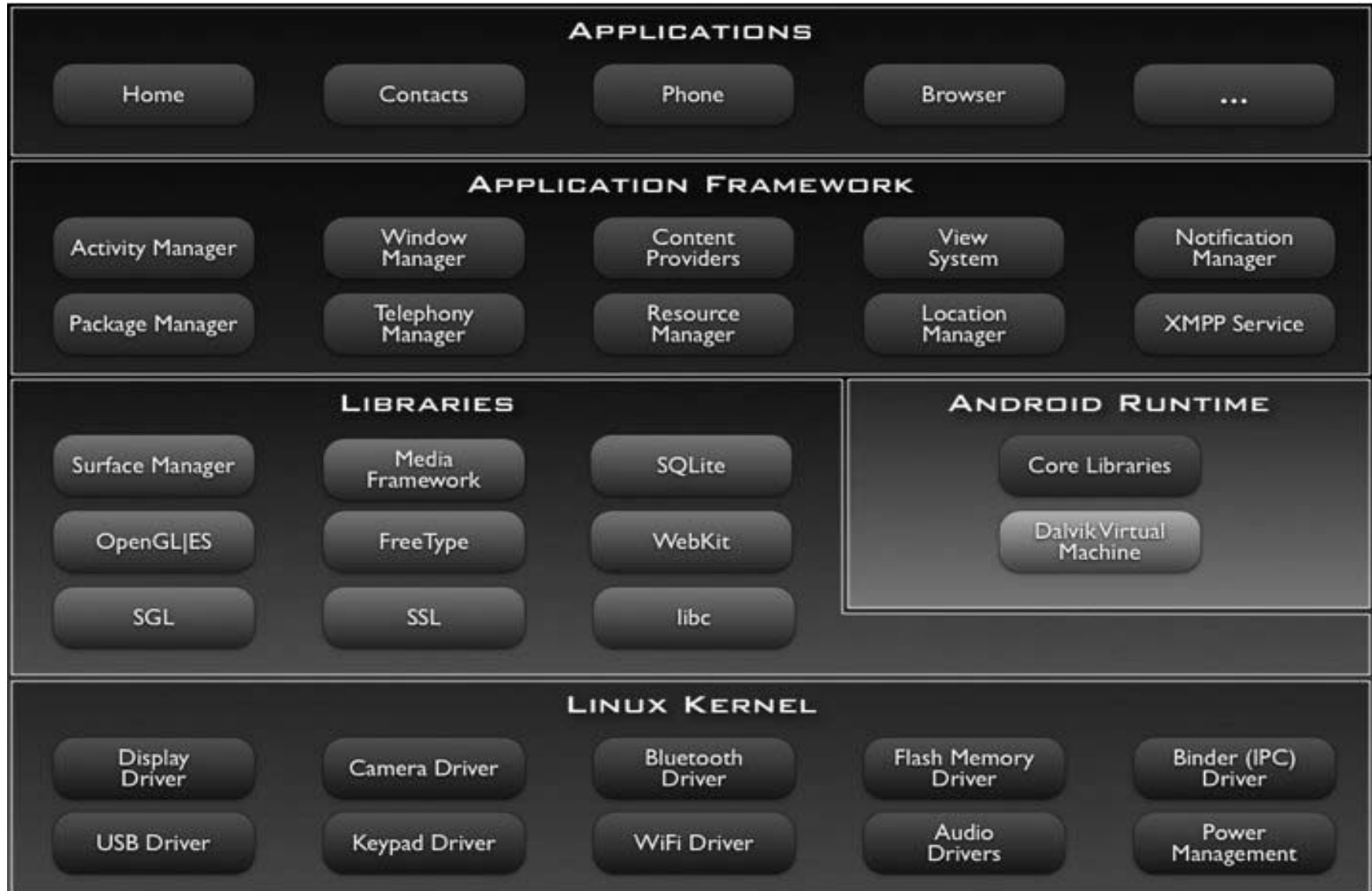


# How to Construct An Embedded Linux System





# Android Porting Flow



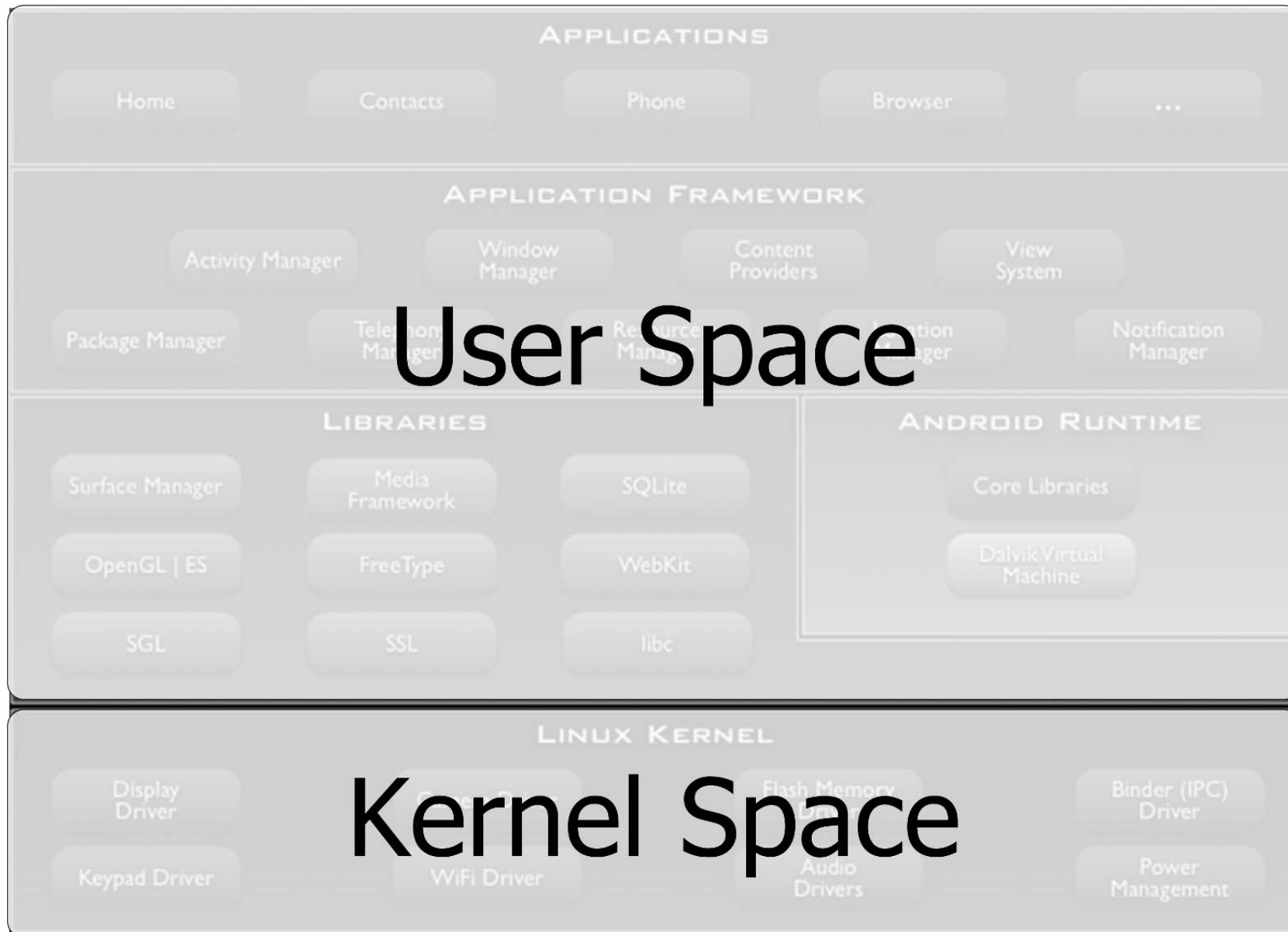
<http://developer.Android.com/guide/basics/what-is-Android.html>

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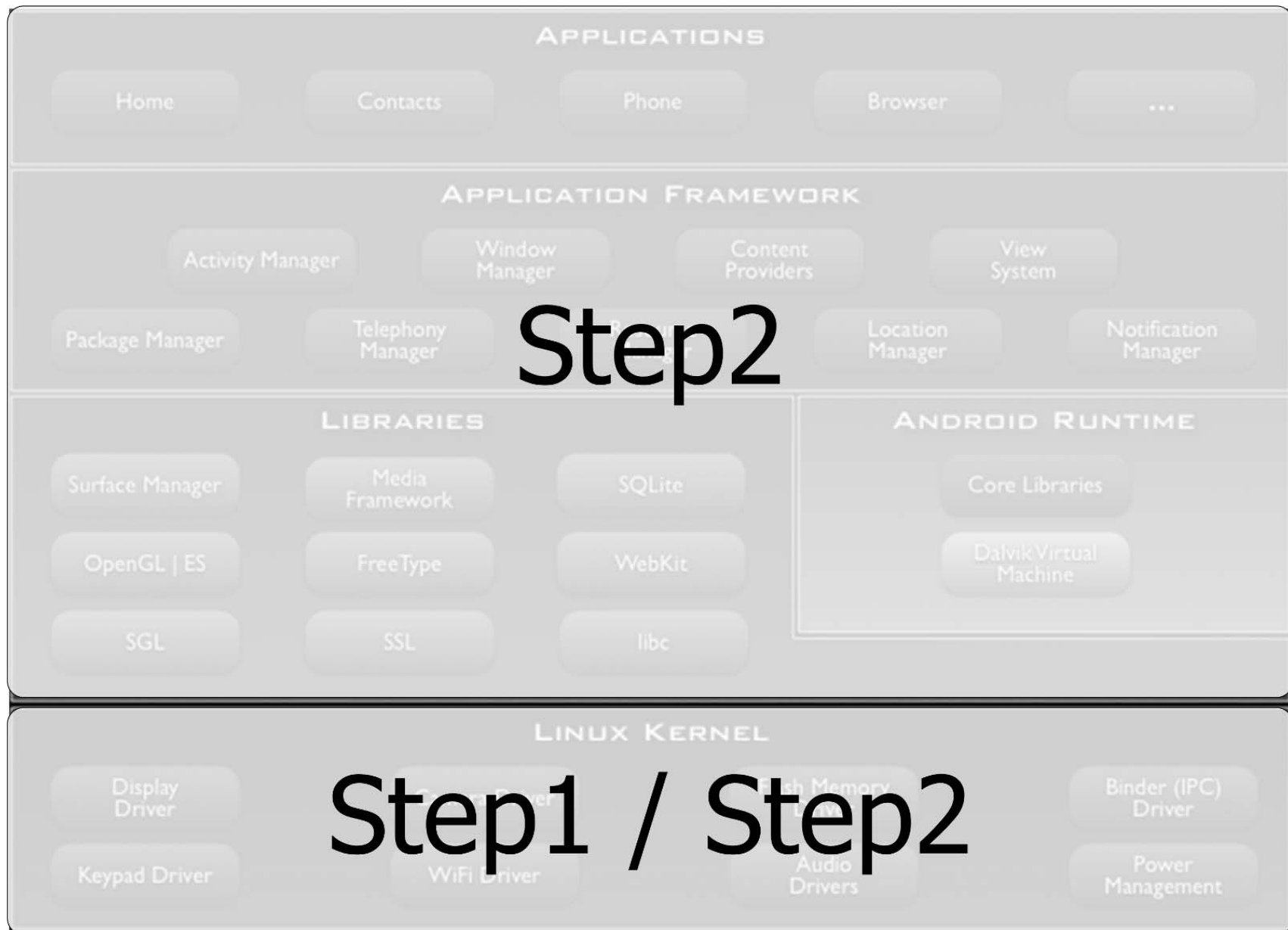


# Android Porting Flow (cont)





# Android Porting Flow (cont)





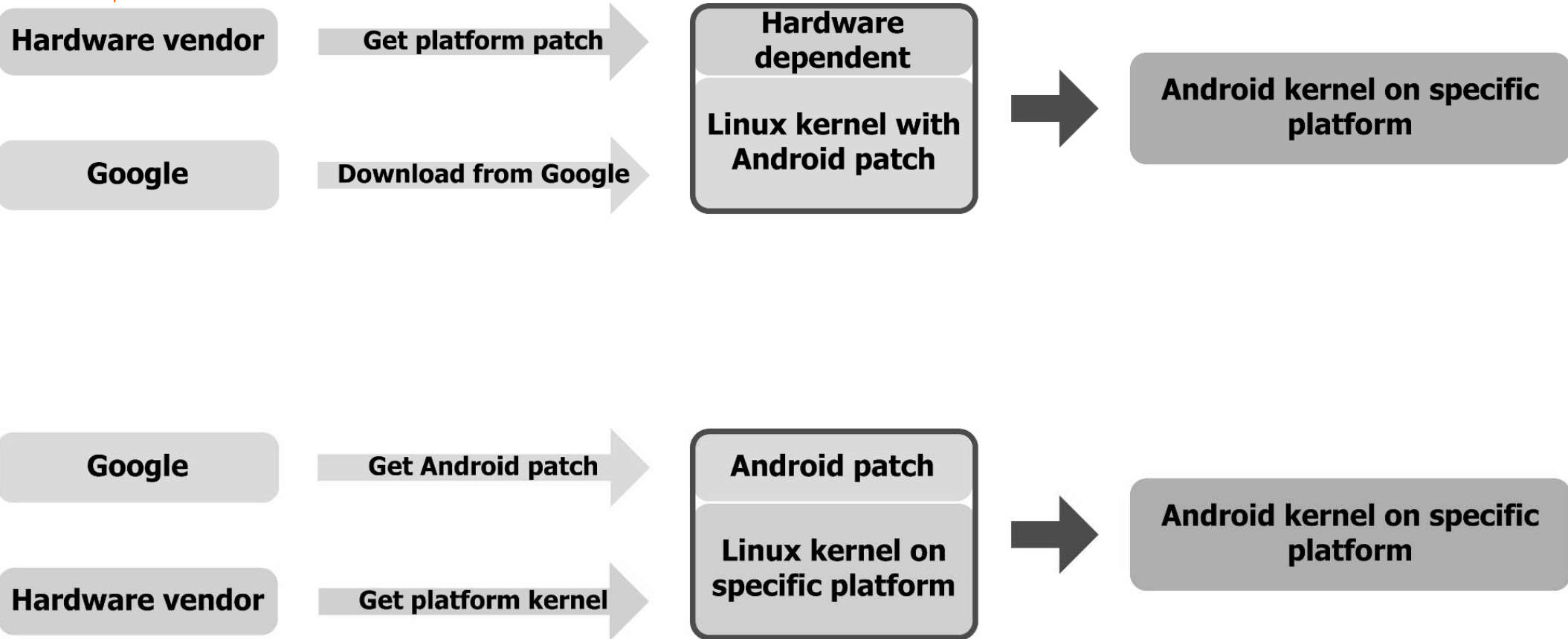
# Key of Porting Android

- Complex but not difficult
  - Attitude
  - Luckiness
  - Linux system architecture
  - Software utilities
  - Experience
- Only 2 ways
  - ctags
  - Burst-force
    - find & grep



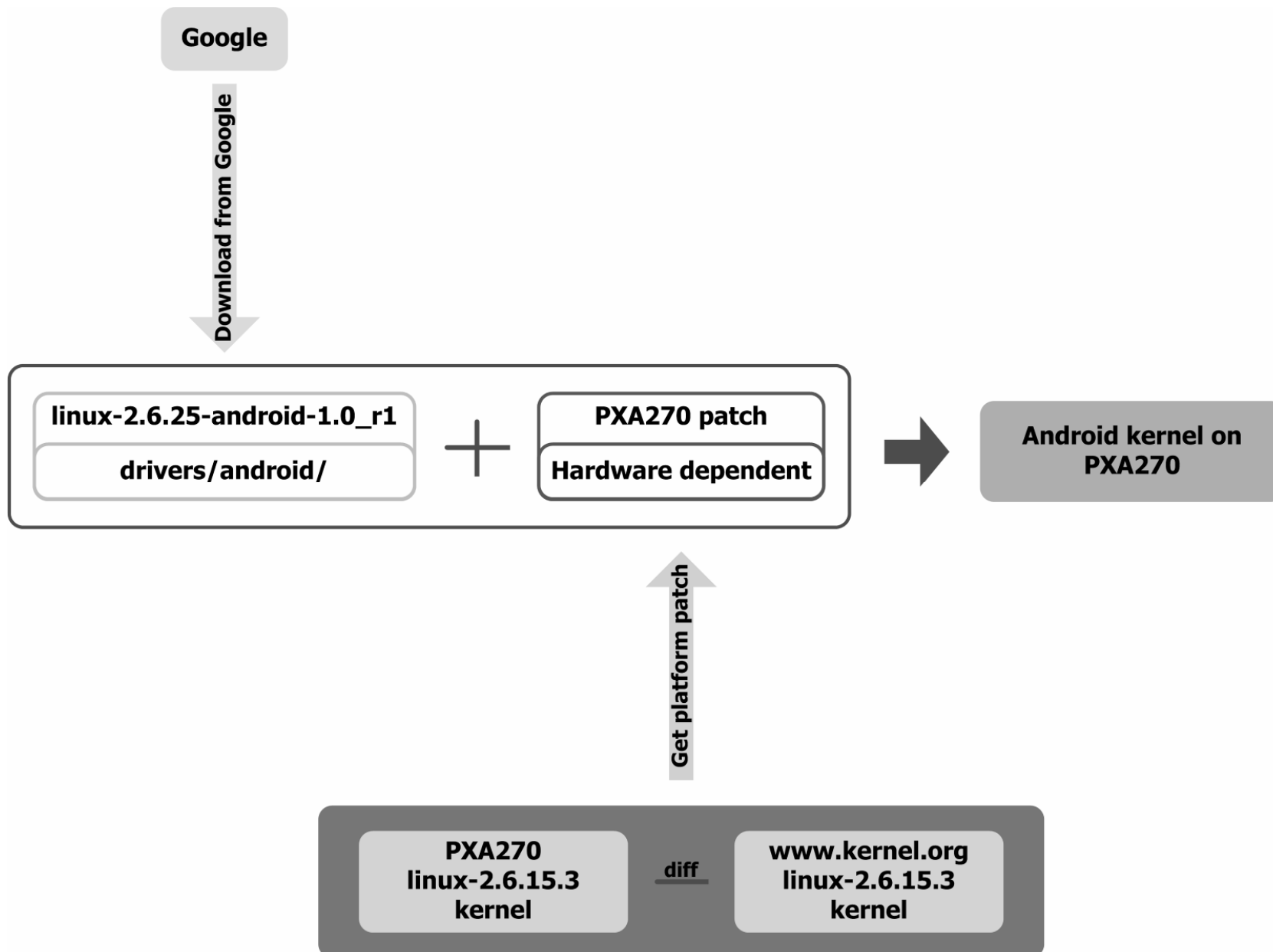


# Porting Strategy of Linux Kernel for Android



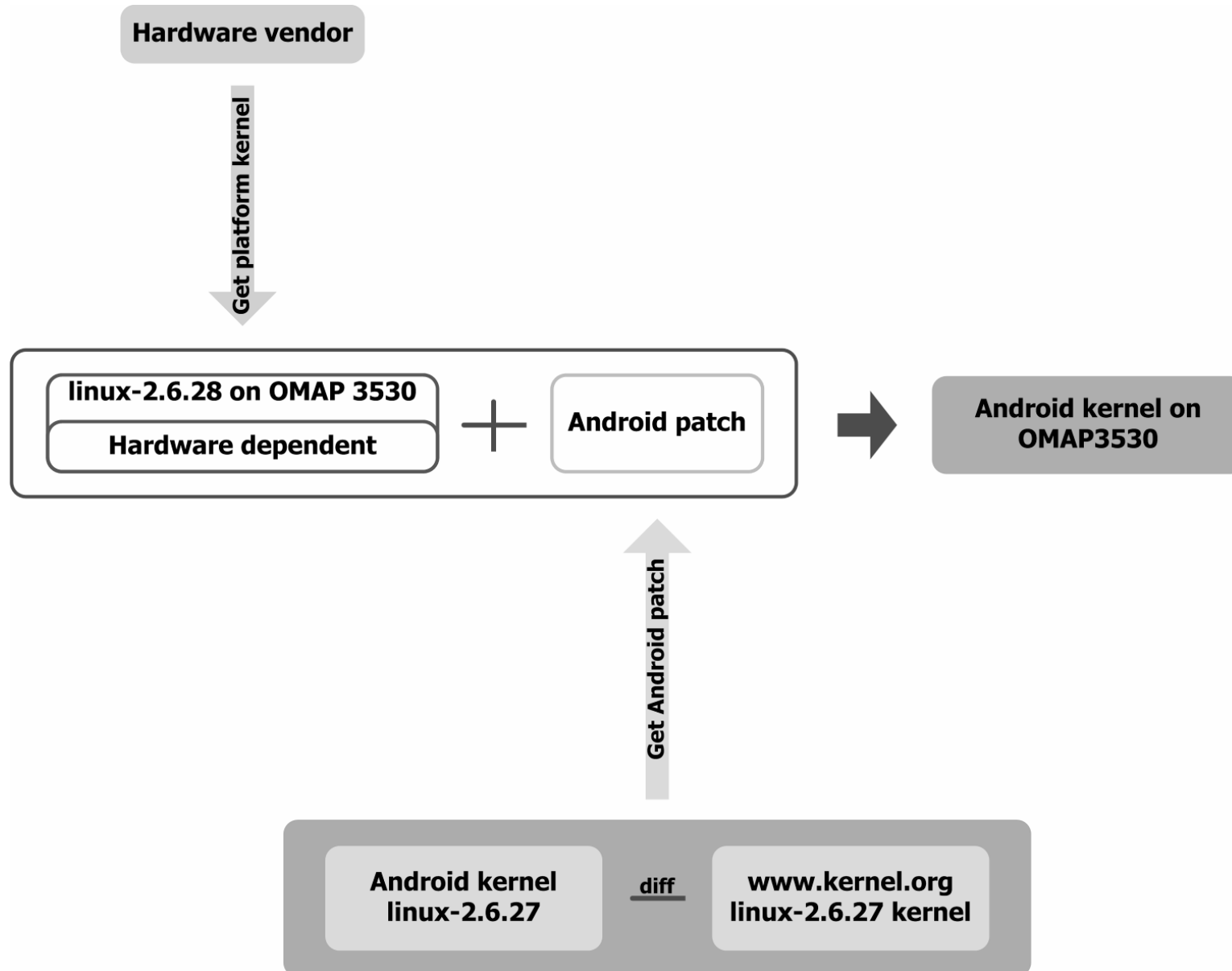


# Real Case on Porting Linux Kernel for Android





# Real Case on Porting Linux Kernel for Android (cont)





# Use Tools to Port Linux Kernel for Android

- Linux platform
  - Meld
  - KDiff
- Windows platform
  - WinMerge



# Meld

```
[2009.4.17-cdma-import] Settings.java : [4.17-release-1.0...
File Edit Settings Help
New Save Undo Redo Down Up Stop
2009.4.17-cdma-import : 4.17-release-1.0 [2009.4.17-cdma-import] Settings.java : [4.17-release-1.0] Settings.java
/cluster/3/home/mask/android/4.17/2009.4.17-cdma-import/frame Browse...
1098 public static final String SOUND_EFFECTS_ENABLED = "sound_eff
1099
1100 /**
1101  * The preferred network mode 7 = Global, CDMA default
1102  *                                4 = CDMA only
1103  *                                3 = GSM/UMTS only
1104  */
1105 public static final String PREFERRED_NETWORK_MODE =
1106     "preferred_network_mode";
1107
1108 /**
1109  * CDMA Cell Broadcast SMS
1110  * 0 = CDMA Cell Broadcast SMS disa
1111  * 1 = CDMA Cell Broadcast SMS enat
1112  */
1113 public static final String CDMA_CELL_BROADCAST_SMS =
1114     "cdma_cell_broadcast_sms";
1115
1116 /**
1117  * The cdma subscription 0 = Subscription from RUIM, when avai
1118  * 1 = Subscription from NV
1119  */
1120 public static final String PREFERRED_CDMA_SUBSCRIPTION =
1121     "preferred_cdma_subscription";
1122
1123 /**
1124  * Whether the enhanced voice privacy mode is enabled.
1125  * 0 = normal voice privacy
1126  * 1 = enhanced voice privacy
1127  */
1128 public static final String ENHANCED_VOICE_PRIVACY_ENABLED = "en
1129
1130 /**
1131  * Whether the TTY mode mode is enabled.
1132  * 0 = disabled
1133  * 1 = enabled
1134  */
1135 public static final String TTY_MODE_ENABLED = "tty_mode_enablc
1136 }
1137
/cluster/3/home/mask/android/4.17/4.17-release-1.0/frameworks/t Browse...
1059
1060 public static final String PARENTAL_CONTROL_LAST_UPDATE =
1061     "parental_control_last_update";
1062
1063 /**
1064  * Whether ADB is enabled.
1065  */
1066 public static final String ADB_ENABLED = "adb_enabled";
1067
1068 /**
1069  * Whether the audible DTMF tones are played by the dialer whe
1070  * boolean (1 or 0).
1071  */
1072 public static final String DTMF_TONE_WHEN_DIALING = "dtmf_tone
1073
1074 /**
1075  * Whether the sounds effects (key clicks, lid open ...) are e
1076  * boolean (1 or 0).
1077  */
1078 public static final String SOUND_EFFECTS_ENABLED = "sound effe
1079 }
1080
1081 /**
1082  * Gservices settings, containing the network names for Google's
1083  * various services. This table holds simple name/addr pairs.
1084  * Addresses can be accessed through the getString() method.
1085  * @hide
1086  */
1087 public static final class Gservices extends NameValuePairTable {
1088     public static final String SYS_PROP_SETTING_VERSION = "sys.set
1089
1090     private static volatile NameValuePairCache mNameValuePairCache = null;
1091     private static final Object mNameValuePairCacheLock = new Object()
1092
1093     /**
1094      * Look up a name in the database.
1095      * @param resolver to access the database with
1096      * @param name to look up in the table
1097      * @return the corresponding value, or null if not present
1098     */
1099 }
```



# KDiff3

The screenshot shows the KDiff3 application window. The menu bar includes File, Edit, Directory, Merge, Settings, and Help. The toolbar contains icons for file operations and navigation. The main window is divided into several panes:

- File Tree:** Shows a directory structure with files like doc, kreplacements, templates, test, qmake.internal.cache, autoadvance.xpm, common.h, diff.cpp, diff.h, difftextwindow.cpp, and directormergewindow.cpp. The 'diff.cpp' file is selected.
- Table:** A table with columns Name, A, B, C, Operation, and Status. It lists the files and their merge status. For example, 'diff.cpp' is in a 'Merge (manual)' state with 'In progress ...' status.
- File Information:** Shows details for the selected file, including its path and a table of file properties.
- Code Diff:** Three panes showing the diff of the selected file. The left pane (A) shows the original code, the middle pane (B) shows the modified code, and the right pane (C) shows the merged code. A merge conflict is visible in the merged code.
- Output:** A pane showing the output of the diff process, including a merge conflict resolution step.

Name	A	B	C	Operation	Status
kdiff3				Merge	
doc				C	
kreplacements				Merge	
templates				Delete (if exists)	
test				B	
qmake.internal.cache				B	
autoadvance.xpm				C	
common.h				C	
diff.cpp				Merge (manual)	In progress ...
diff.h				Merge (manual)	
difftextwindow.cpp				C	
directormergewindow.cpp				Merge (manual)	

Dir	Type	Size	Attr	Last Modification	Link-Destination
A	File	23436	rw	2002-10-13 13:19:57	
B	File	24361	rw	2002-11-03 15:06:37	
C	File	24402	rw	2002-11-17 15:18:48	
Dest	File	23501	rw	2003-01-10 16:59:50	

```
char* buf = new char[size+100];
int bytesRead = fread( buf, 1, size, f );
if( bytesRead != size )
{
    cerr << "File read error for file: " << file
    perror("");
    exit(-1);
}

fclose( f );
return buf;
}
```

```
char* buf = new char[size+100];
int bytesRead = fread( buf, 1, size, f );
if( bytesRead != size )
{
    std::cerr << "File read error for file: " <<
    perror("");
    exit(-1);
}

fclose( f );
return buf;
}
```

```
char* buf = new char[size+100];
int bytesRead = fread( buf, 1, size, f );
if( bytesRead != size )
{
    std::cerr << "File read error for file: " <<
    perror("");
    fclose(f);
    size = 0;
    return 0;
}

fclose( f );
return buf;
}
```

```
output : /home/joachim/kdiff3_testdir/dir4/kdiff3/diff.cpp
if( bytesRead != size )
{
<Merge Conflict>
    perror("");
    fclose(f);
    size = 0;
    return 0;
}

fclose( f );
return buf;
}

// First step
void calcDiff3LineListUsingAB(
const DiffList& diffListA,
```

<http://kdiff3.sourceforge.net/doc/screenshots.html>

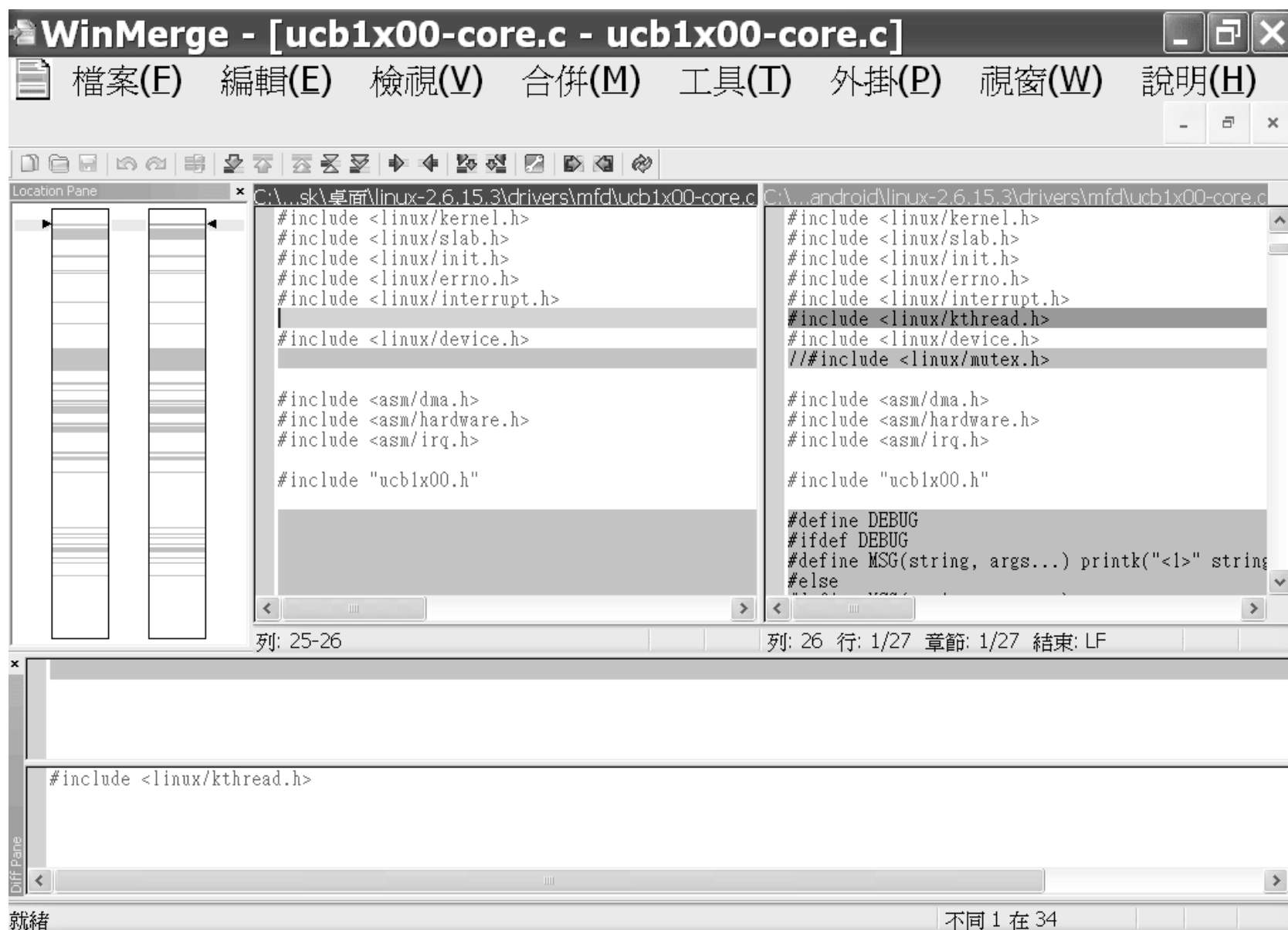
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# WinMerge





# Potential Problems on Porting Linux Kernel

- Data structure
  - Reference similar platforms
  - Reference multiple versions of Linux kernel
- Init section
  - Reference successfully compiled drivers
- Source dispersed
  - Only consider the BSP changed from the official Linux kernel
- File name changed
  - Same as the previous item



# Android Booting Procedure

- system/core/init/init.c (/init)
- /init.rc
- Daemons
  - adbd
  - rild
  - ...
- Zygote
- Service Manager
- System Service



# How to Trace Android Source Code

- `ctags --C++-kinds=+p -R`

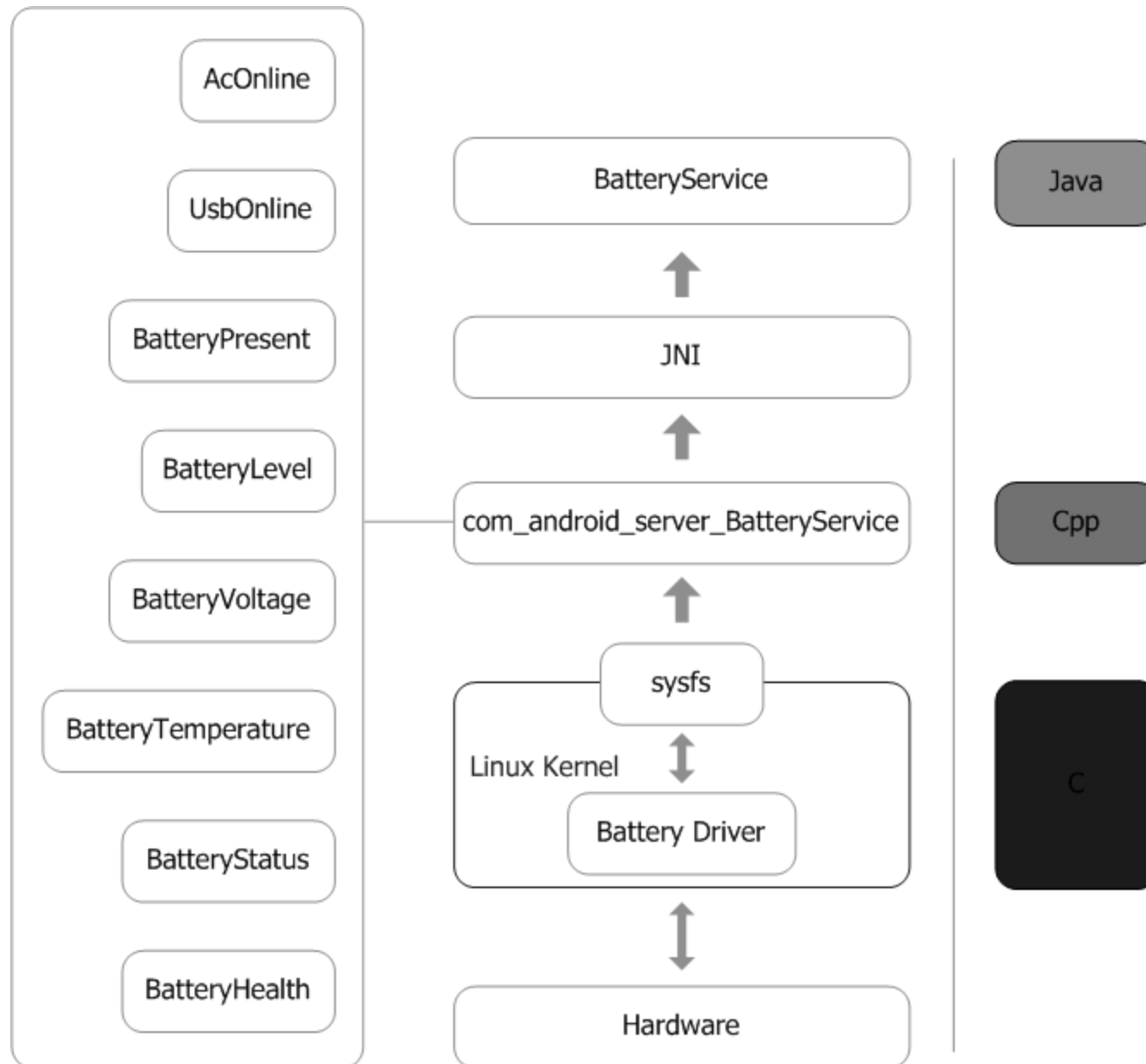


# Logcat

```
E/EventHub( 1589): could not get driver version for /dev/input/mouse0
I/EventHub( 1589): New device: path=/dev/input/event0 name=android-ke
I/SystemServer( 1589): Starting Bluetooth Service.
I/EventHub( 1589): New keyboard: publicID=65537 device->id=65537 devn
I/SystemServer( 1589): Starting Status Bar Service.
E/EventHub( 1589): could not get driver version for /dev/input/mice,
I/KeyInputQueue( 1589): Device added: id=0x0, name=android-keypad, cl
I/KeyInputQueue( 1589): Device added: id=0x10000, name=null, classes=
I/KeyInputQueue( 1589): X: min=0 max=920 flat=0 fuzz=0
I/KeyInputQueue( 1589): Y: min=0 max=950 flat=0 fuzz=0
I/KeyInputQueue( 1589): Pressure: min=0 max=1 flat=0 fuzz=0
I/KeyInputQueue( 1589): Size: unknown values
I/KeyInputQueue( 1589): absX=com.android.server.InputDevice$AbsoluteI
I/KeyInputQueue( 1589): absY=com.android.server.InputDevice$AbsoluteI
I/KeyInputQueue( 1589): absPressure=com.android.server.InputDevice$Ab
I/KeyInputQueue( 1589): absSize=null
I/foo ( 1589): ***** HAVE TOUCHSCREEN!
I/WindowManager( 1589): Input configuration changed: { scale=1.0 imsi
D/dalvikvm( 1589): GC freed 11328 objects / 708880 bytes in 162ms
I/SystemServer( 1589): Starting Hardware Service.
I/SystemServer( 1589): Starting NetStat Service.
I/SystemServer( 1589): Starting Connectivity Service.
```



# Android BatteryService Workflow





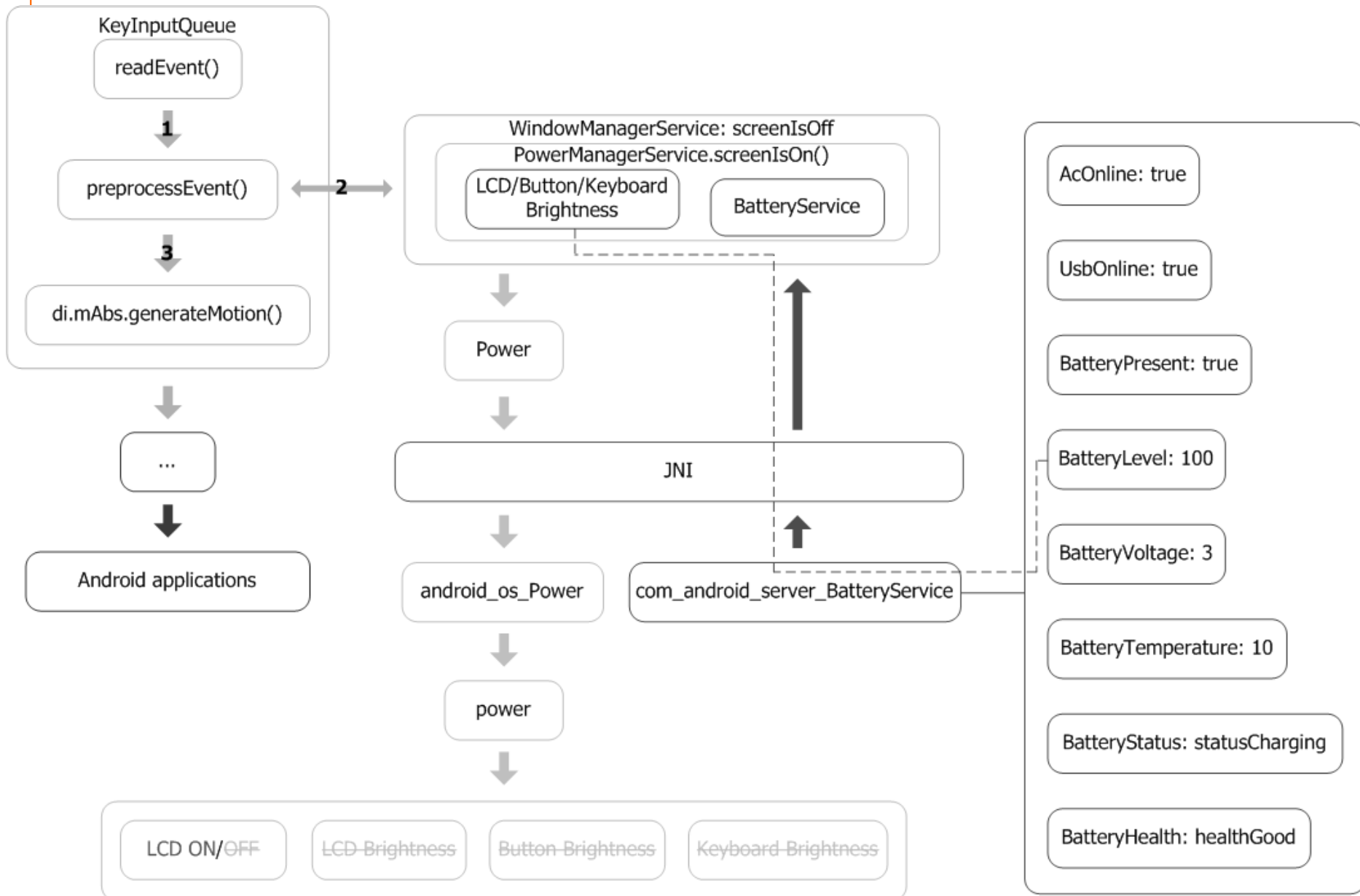


# Battery Driver

- Battery Driver creates the following sysfs entries
  - `/sys/class/power_supply/ac/online`
  - `/sys/class/power_supply/usb/online`
  - `/sys/class/power_supply/battery/status`
  - `/sys/class/power_supply/battery/health`
  - `/sys/class/power_supply/battery/present`
  - `/sys/class/power_supply/battery/capacity`
  - `/sys/class/power_supply/battery/batt_vol`
  - `/sys/class/power_supply/battery/batt_temp`
  - `/sys/class/power_supply/battery/technology`



# Relationship between Input Keys and Android Services





# Q & A