

Linux, Android and Open Source in the Mobile Environment

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3/5/10

Survey of Linux on mobile

Kernel+ open source in mobile world

Curious status of Android and why we care



Why do we care?

Linux is well-established on servers and in embedded,
but mobile is wide open.

Smartphone OS space is highly contested!

Mobile outcomes for Linux will have significant
consequences for other form factors.

What do we mean by “Linux”?

"anyone can call any kernel-derived operating system Linux" -- Jim Zemlin, Linux Foundation

"Linux is the kernel Linux is normally used in combination with the GNU operating system: the whole system is basically GNU with Linux added, or GNU/Linux. All the so-called 'Linux' distributions are really distributions of GNU/Linux." -- RMS

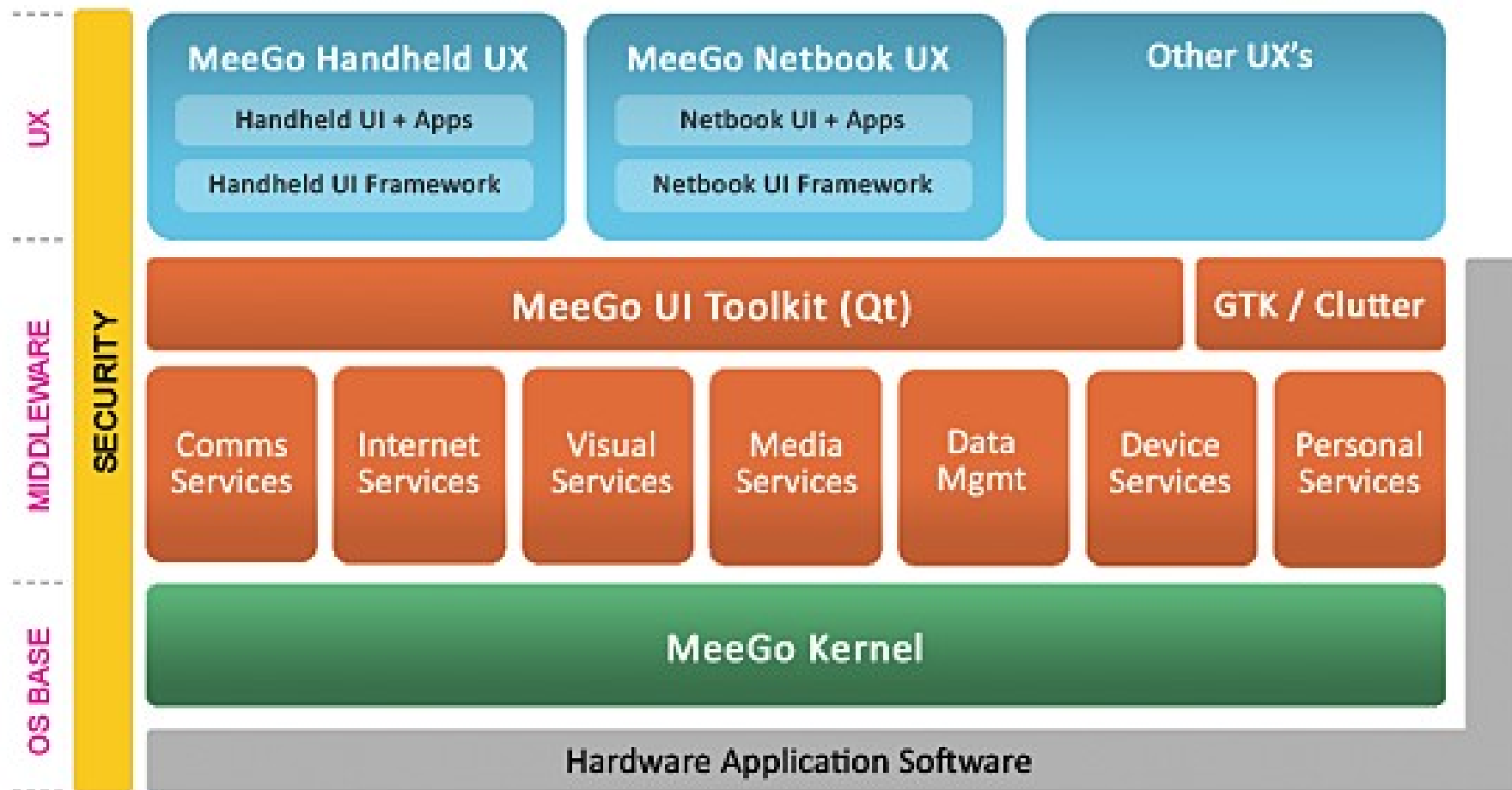
kernel.org's definition

Linux is a clone of the operating system Unix
It has all the features you would expect in a modern fully-
fledged Unix, including true multitasking, virtual memory,
shared libraries, demand loading, shared copy-on-write
executables, proper memory management, and
multistack networking.

Full “Gnu Linux” implementations

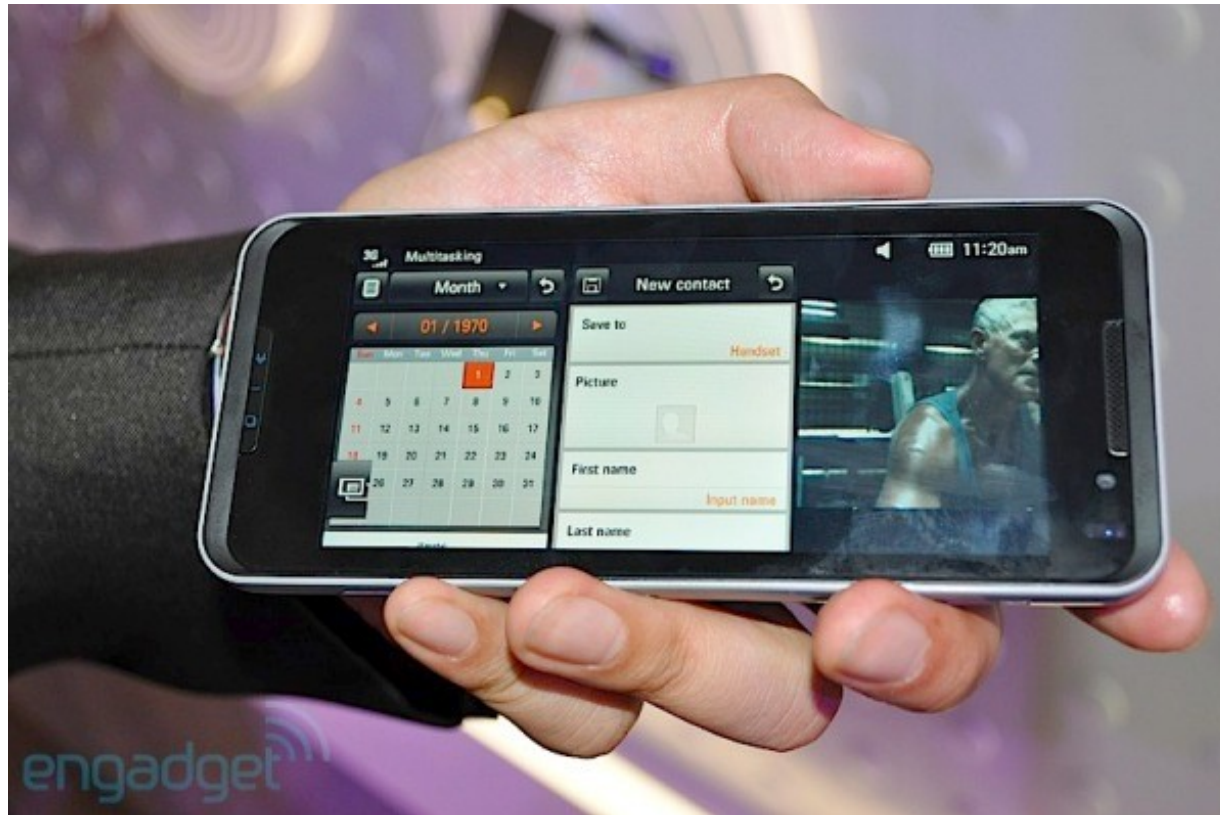
Name	Supported by	Hardware	Based on
MeeGo = Moblin + Maemo	Intel, Nokia, Linux Foundation	N900, LG GW990; ARM and x86 (Atom)	Fedora or Debian + Qt
LiMo + LIPS = ELIPS	LiMo Foundation, Wind River	NEC, Samsung, Panasonic, Vodafone, NTT	custom
Angstrom	Archos	Archos 5 Tablet	OpenEmbedded
Mer	? Fully open Maemo	N900	Ubuntu
AccessLinux, OpenMoko, MobiLinux	Orange, Access, MontaVista, OpenMoko	FreeRunner	various

MeeGo Architecture Diagram



Doesn't say "Linux"!

Intel's Moorestown SOC



LG GW990 running Moblin on Moorestown

Prospects for [MeeGo](#)

- Motivation is earlier market failures
- Aimed at netbooks and “slates” like Atom?
- Intel and Nokia continue separate app stores?!
- Committed fast-boot patches back to main tree
- GTK and Clutter de-emphasized



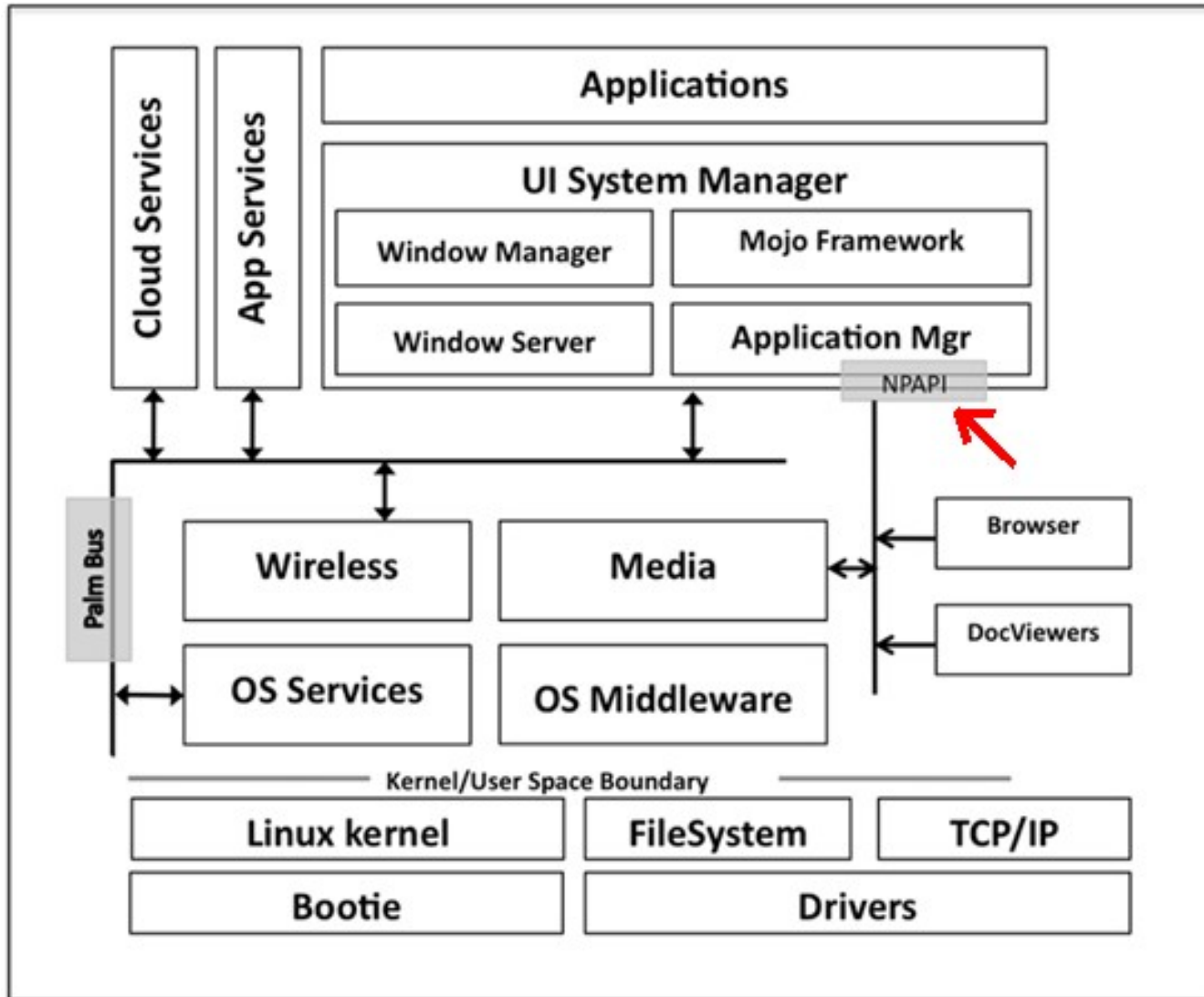
Linux Kernel Plus

Name	Support	Hardware	Platform	Language
Bada	Samsung	Wave	Own SDK	C++
webOS	Palm	Pre, Pixi	Browser/Mojo	Javascript
Chrome OS	Google	Samsung netbook	Browser	Javascript
Android	Open Handset Alliance, Replicant	myriad	JVM	Java

The most valuable piece of I.P. in
the world is . . .

the GPL'ed Linux kernel.

WebOS (and Chrome?) Software Stack



FaiB, even to OEMs, but not FaiF.

Android Software Stack



Android has some familiar features

```
root    9626   2     0     0     c0063504 00000000 S tiwlan_wifi_wq
wifi    9631   1     3084  516    ffffffff afe0c644 S /system/bin/wpa_supplicant
app_19  9689   50    119620 22424 ffffffff afe0d4a4 S com.google.android.apps.maps
system  9699   50    108768 14060 ffffffff afe0d4a4 S com.android.settings
app_44  9768   50    100604 14096 ffffffff afe0d4a4 S com.google.android.apps.listen:remote
app_44  9778   50    98776 14044 ffffffff afe0d4a4 S com.google.android.apps.listen
shell   10149  57     740   312    c0054578 afe0d14c S /system/bin/sh
root    10150 10149 740    316    c0054578 afe0d14c S sh
app_0   10167  50    95472 12640 ffffffff afe0d4a4 S com.android.alarmclock
app_6   10185  50    96144 12548 ffffffff afe0d4a4 S com.google.android.gm
root    10225 10150 884    316    00000000 afe0c27c R ps
# df
/dev: 49192K total, 0K used, 49192K available (block size 4096)
/sqlite_stmt_journals: 4096K total, 0K used, 4096K available (block size 4096)
/system: 69120K total, 58172K used, 10948K available (block size 4096)
/data: 76544K total, 67556K used, 8988K available (block size 4096)
/cache: 69120K total, 1224K used, 67896K available (block size 4096)
/sdcard: 7753728K total, 944832K used, 6808896K available (block size 32768)
# mount
rootfs / rootfs ro 0 0
tmpfs /dev tmpfs rw,mode=755 0 0
devpts /dev/pts devpts rw,mode=600 0 0
proc /proc proc rw 0 0
sysfs /sys sysfs rw 0 0
tmpfs /sqlite_stmt_journals tmpfs rw,size=4096k 0 0
none /dev/cpuctl cgroup rw,cpu 0 0
/dev/block/mtdblock3 /system yaffs2 ro 0 0
/dev/block/mtdblock5 /data yaffs2 rw,nosuid,nodev 0 0
/dev/block/mtdblock4 /cache yaffs2 rw,nosuid,nodev 0 0
/dev/block/vold/179:1 /sdcard vfat rw,dirsync,nosuid,nodev,noexec,uid=1000,gid=1015,mask=07
depage=cp437,icharset=iso8859-1,shortname=mixed,utf8 0 0
# █
```

But “Android/Linux” is *not* standard

(based on material by Matt Porter and Harald Welte)

- System calls handled by Bionic, based on BSD's libc
- Bionic is half the size of glibc
- Existing uClibc already established in embedded
- Chock-a-block with hard-coded constants and policies

Will the Android fork damage the kernel?

- [drivers/staging/android](#) removed from [kernel.org](#)
- Drivers don't build against main kernel
- OEMs cannot contribute drivers back to the kernel

Licenses vs. Governance

from [Andreas Constantinou](#)

Is the source code publicly available or to members only? Are code check-ins publicly accessible? Are the minutes from meetings publicly available? Are there any fees or contractual commitments (NDAs, etc) required for members? Who has the authority to release code and binaries (how is the release schedule determined)? Who is entitled to branch source code? How is the roadmap formed

More to consider than just source availability!

Android-based hacks



“Remixes” of Android coming from telcos: Frog Design.

Android-related open source

- FLOSS Dispenser: a free market for Android
 - CyanogenMod Project, alt build of Android
- Replicant Project aims to replace closed components
 - Debian can be installed on top of Android?
- OsmocomBB is FaiF GSM Baseband driver

Mobile Linux Take-aways

- LiMo, ELIPS, Bada, others will ship on millions of featurephones
- MeeGo is desktop Linux rejiggered for mobile
- webOS and Chrome OS are browser-based OS's founded on the Linux kernel
- 800-lb gorilla is “less than free” but may be unstoppable

Summary

- Linux-based mobile OS's differ in **architecture, libraries and governance**, not just in licenses and packages
- Linux community at large has a lot at stake

References and Sources

- Blog and Software Freedom Law Center podcasts by Bradley M. Kuhn on
Android/Linux's Future and Advancement of Mobile Software Freedom and Software Freedom on Mobile Devices
- Linux Weekly News <http://lwn.net/Articles/374612/>
- “Android Mythbusters” by Matt Porter
- “Mobile Megatrends 2009,” Andreas Constantinou
- Ofono and freesmartphone.org middleware projects

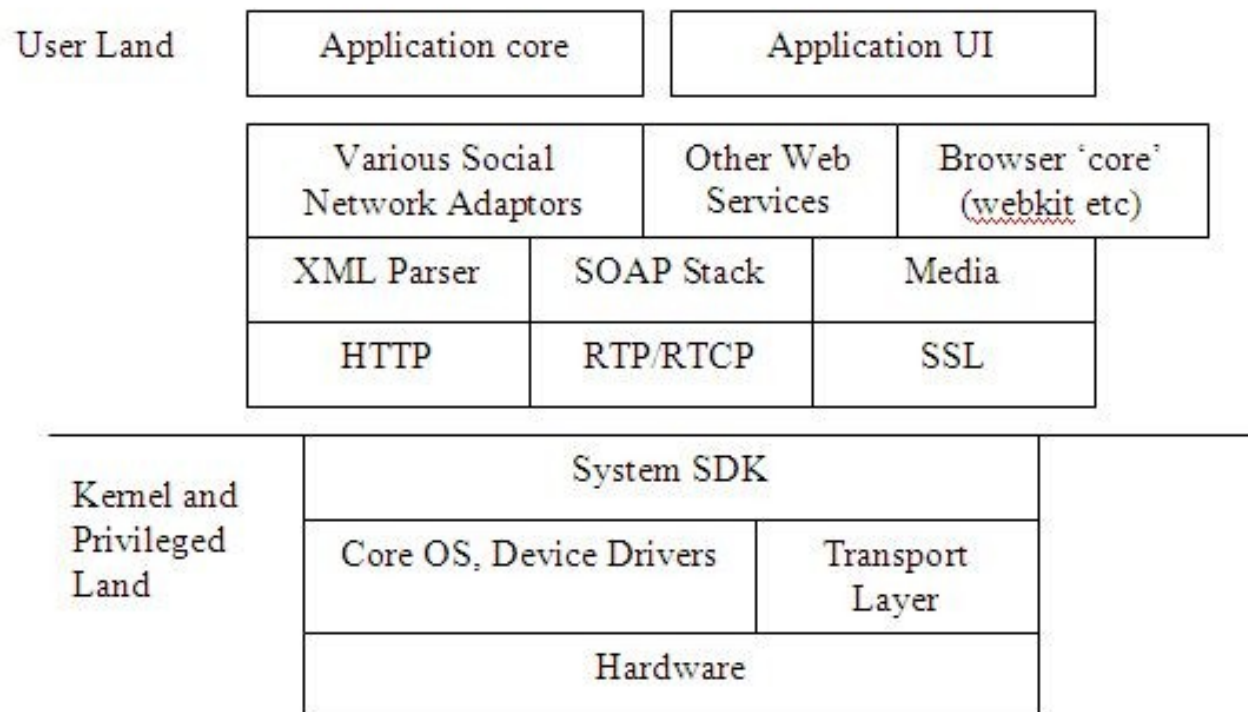
Licenses and Mobile Phones

- Maemo had plenty of closed components.
- WebOS and Bada: no licenses.
- Android is Apache-licensed but drivers are closed.
- Installation of “Google Experience” apps not permitted.

Symbian: completely irrelevant?

- As of 2010, fully open under Eclipse license – except for drivers
- Based on ancient Psion real-time microkernel
- Runs on many handsets, but they have closed bootloaders
- Only open hardware is TI's Beagleboard
- Free, but not “less than free” like Android
- Apps must be signed by Symbian Foundation

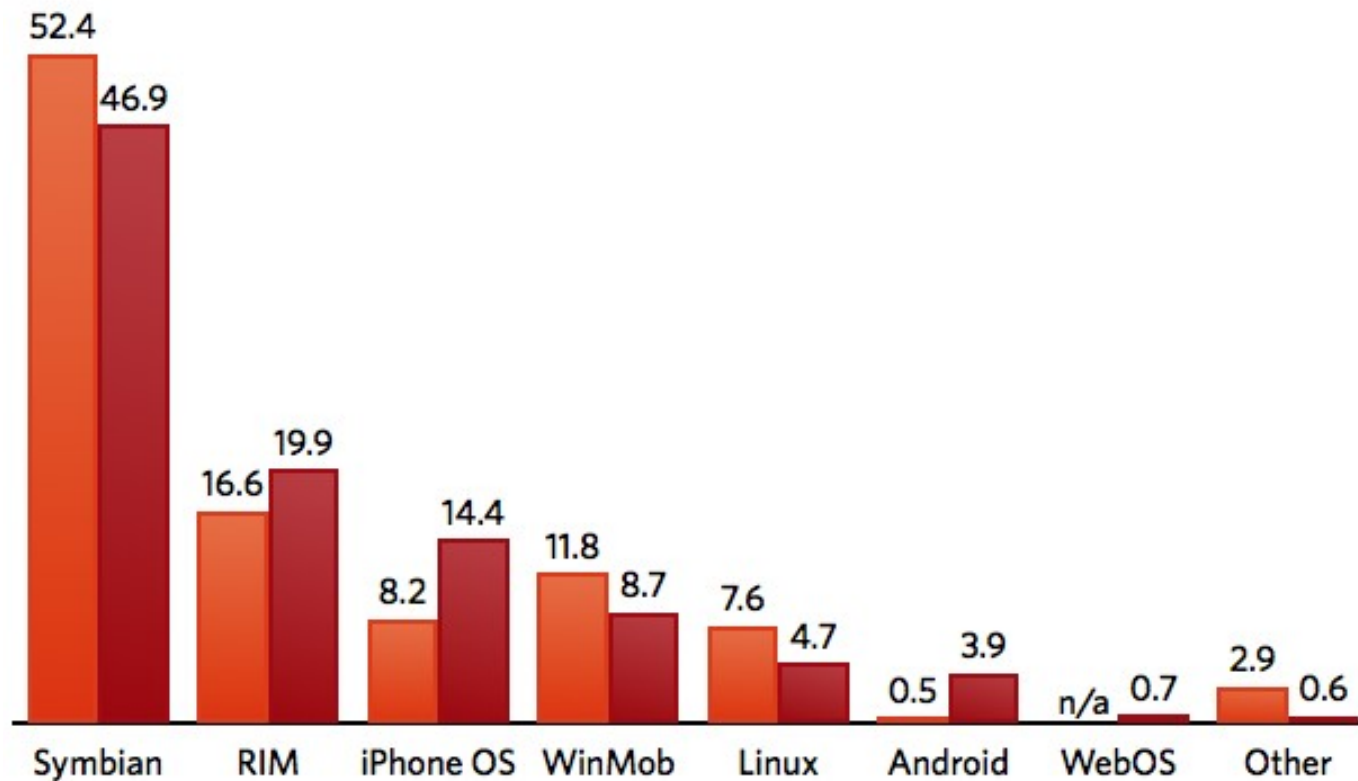
Traditional OS stack



Smartphone Sales by OS

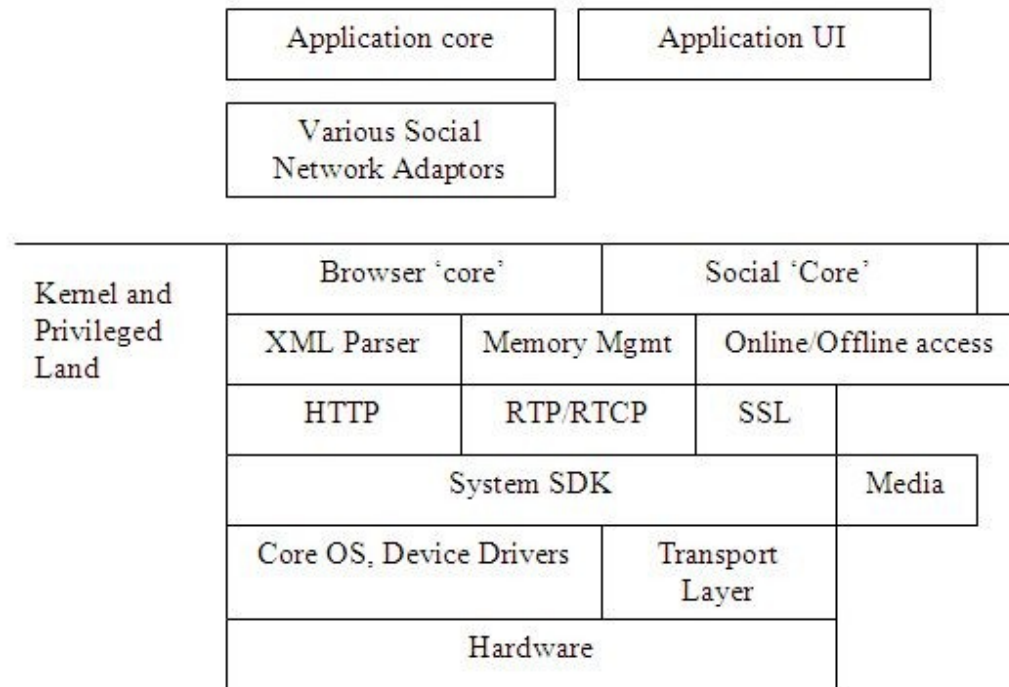
Worldwide smartphone market share by OS

Percent



Chrome OS Stack

User Land



The 'Browser' engine is the system execution engine.