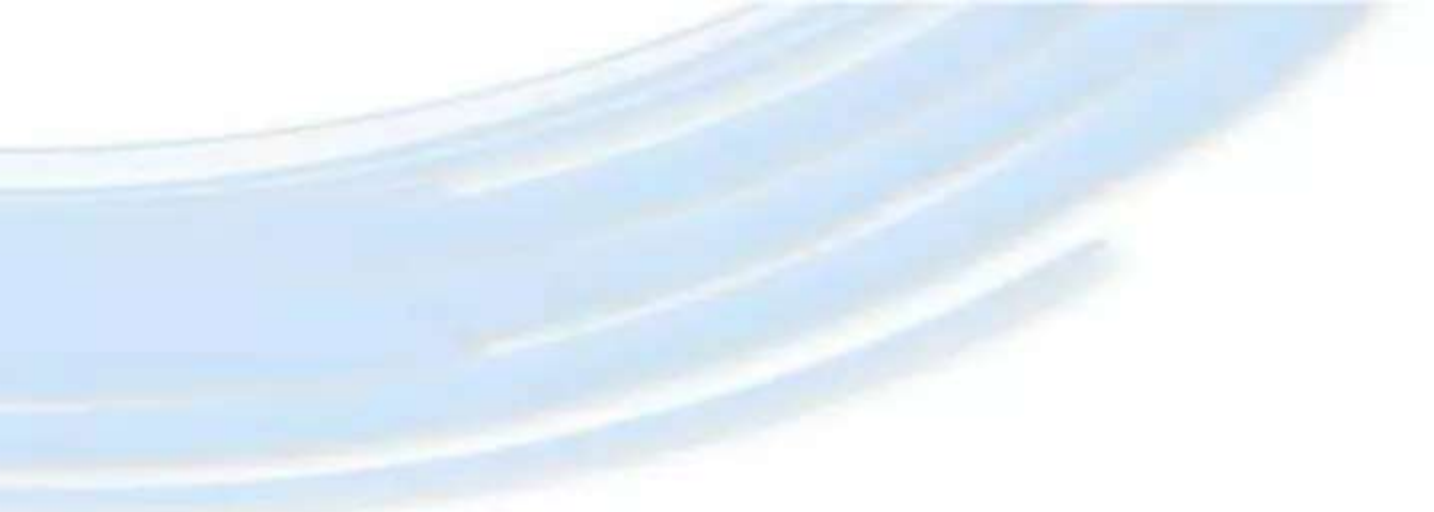




Mobile Operating Systems

Is it a PC?

Contents

- **Mobile Phones: Market Share and Operating Systems**
 - Symbian OS
 - Android
 - Mac OS X (iPhone)
 - Others (Windows Mobile, BlackBerry, Palm, Linux)
 - Cross-platform: Java ME
- **Future**
 - Outlook and predictions

About me: Andreas Jakl

- Assistant Professor at the **Upper Austria University of Applied Sciences, Campus Hagenberg** since 2006
- **Specialized on:**
 - Symbian OS
 - Qt
 - Java ME
 - Mobile Linux (Maemo)
 - (Android)



About me: Andreas Jakl

- **Experience:**

- **Forum Nokia Champion** (2007, 2008, 2009)
- Founded company “**Mopius**” in 2004
- Internship, Master’s Thesis and summer jobs at **Siemens / BenQ Mobile** (Munich, R&D)
- Studied Bachelor & Master of **Digital Media** in Hagenberg / Austria (2001 – 06)

- **Contact:**

- andreas.jakl@fh-hagenberg.at

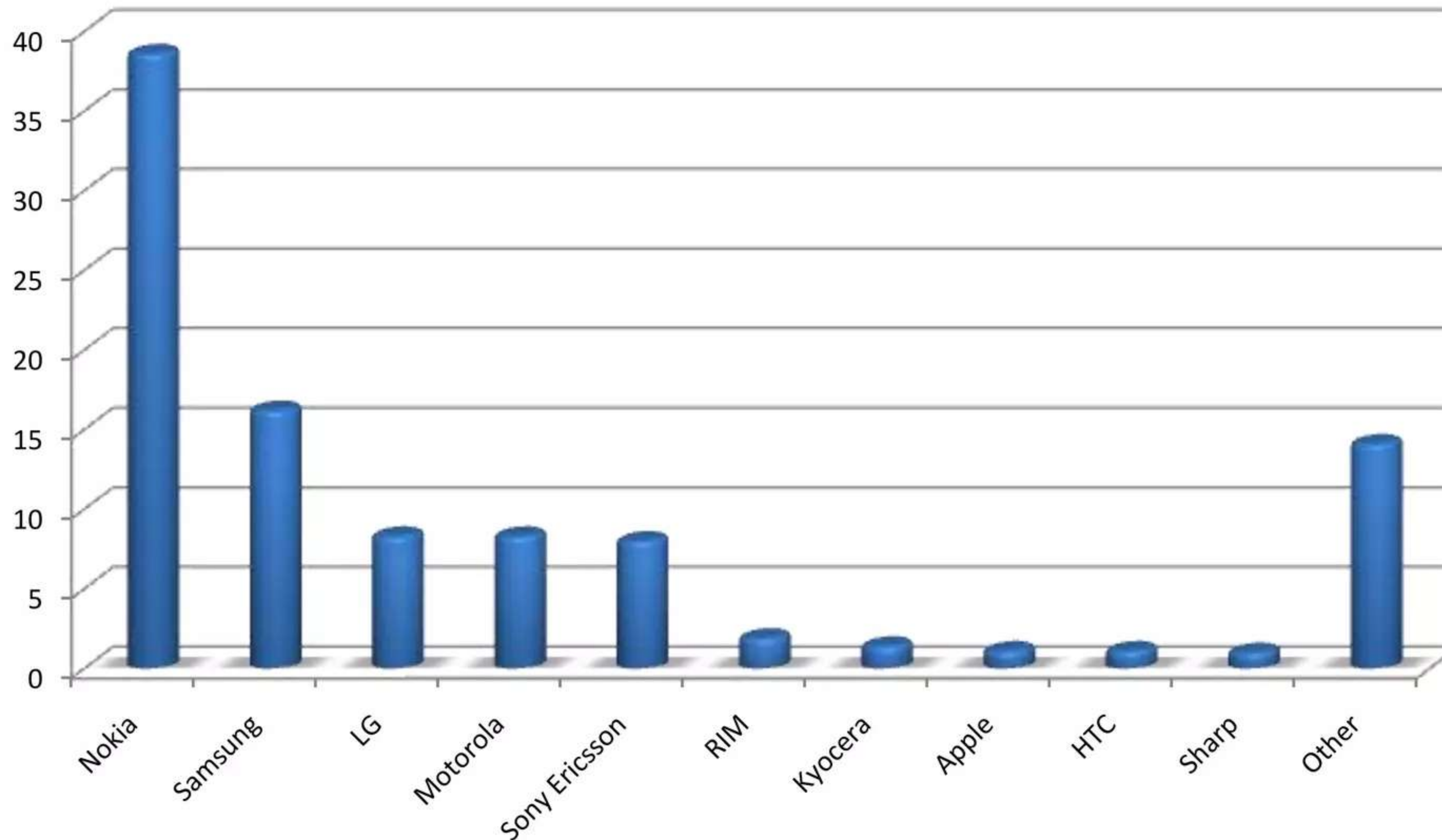


Android & iPhone?



Worldwide Market Share 2008

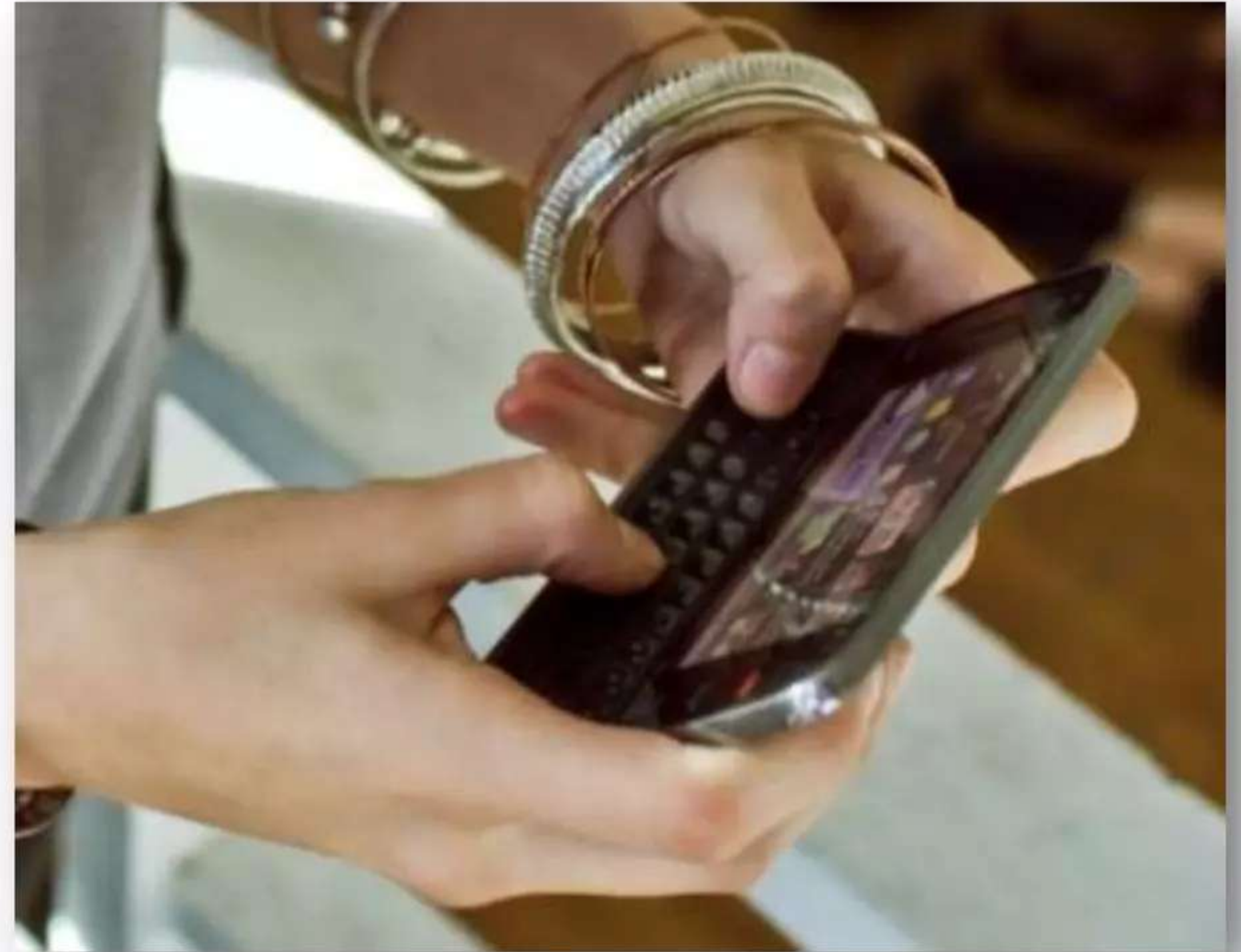
Total: 1.21 billion handsets
(1210000000)



Nokia	38,6%
Samsung	16,2%
LG	8,3%
Motorola	8,3%
Sony Ericsson	8%
RIM	1,9%
Kyocera	1,4%
Apple	1,1%
HTC	1,1%
Sharp	1%
Other	14,1%

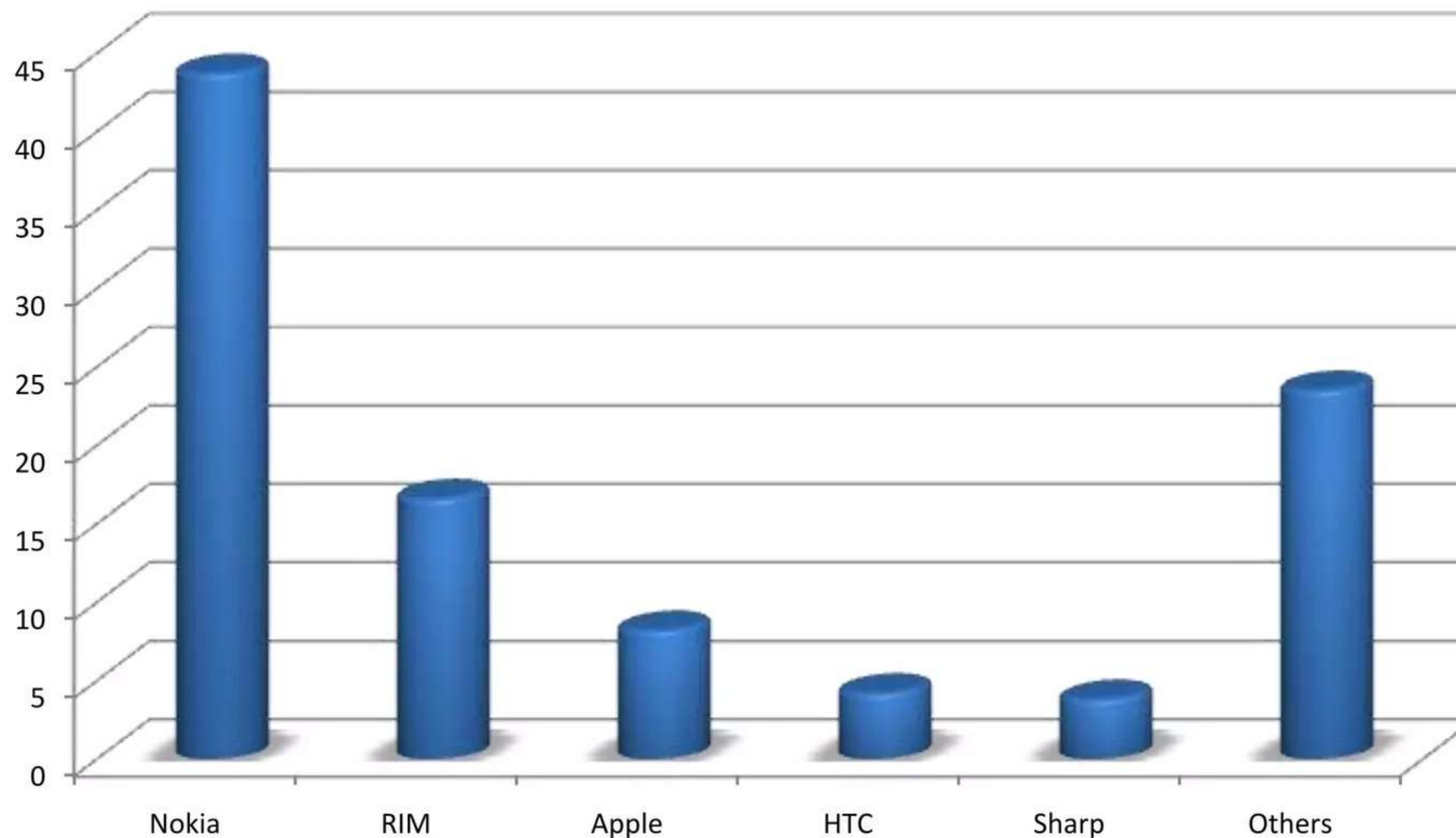
Smartphones?

- **Typical differences to feature phones:**
 - Traditionally more features, more software pre-installed
 - **Install own native applications**



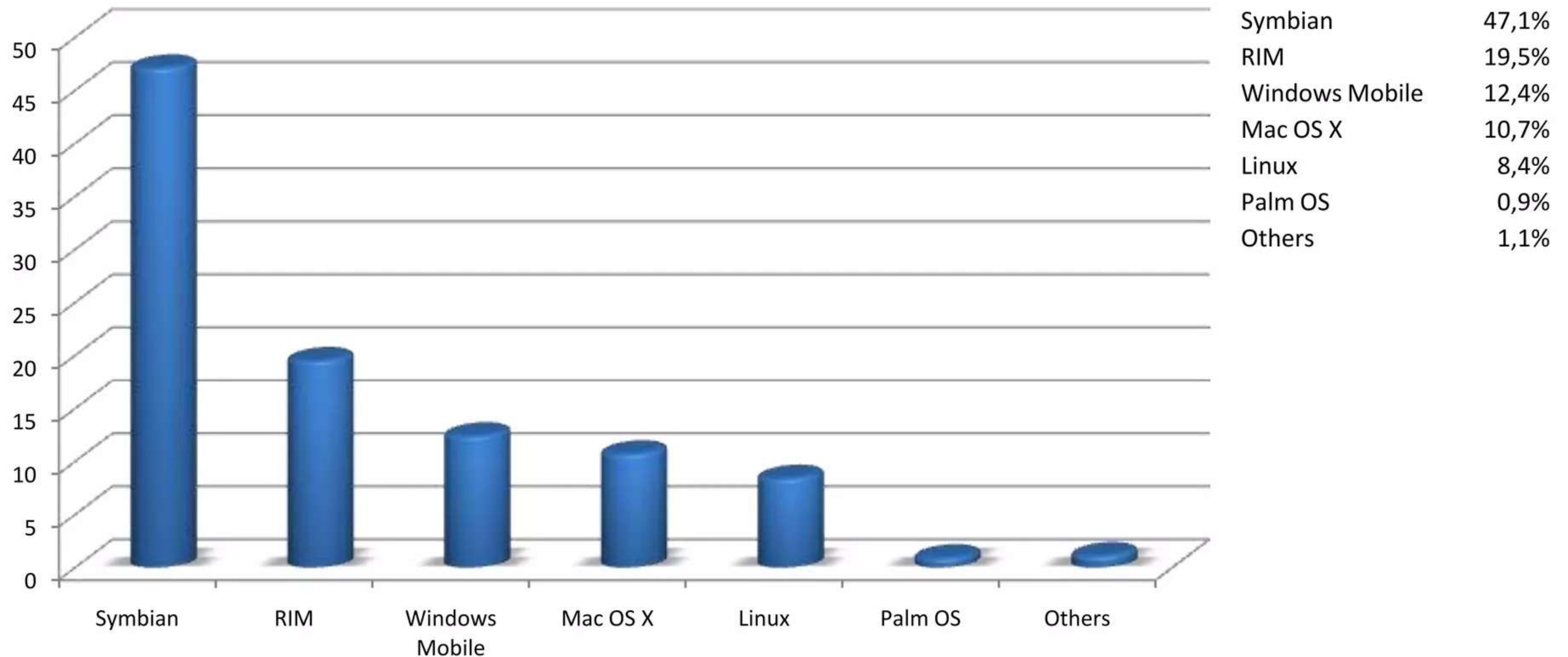
Nokia N97

Worldwide Smartphone Sales, 2008



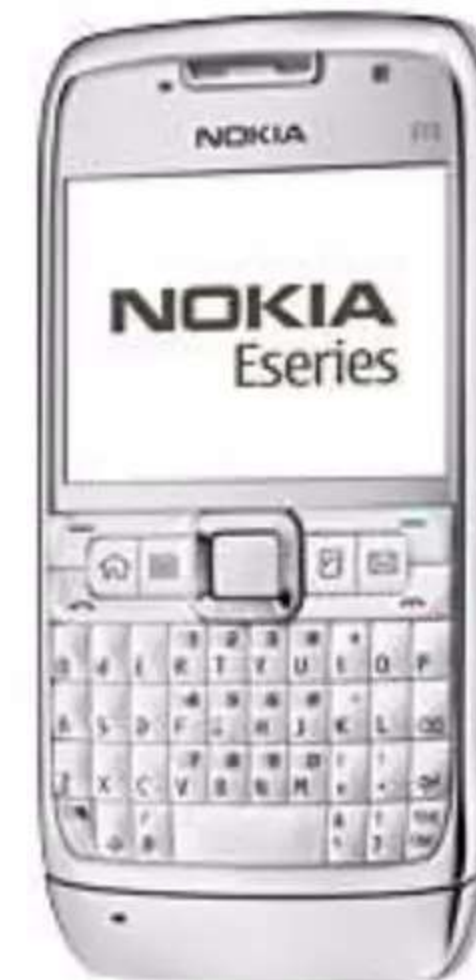
Nokia	43,7%
RIM	16,6%
Apple	8,2%
HTC	4,2%
Sharp	3,8%
Others	23,5%

Smartphone Operating Systems, 2008



Mobile Requirements

- **Limited resources**
 - CPU: 220 – 370 MHz (ARM 9/ARM 11), 64-128 MB Ram
- **No hard disc**
 - Therefore no virtual (= “unlimited”) memory
- **Power management**
 - Battery life, data safety in case of power loss is an issue
- **Compact**
 - Not much room for UI and the application itself
 - Reuse of common components important
- **Reliability**
 - Phone functionality always highest priority
 - “Always on”



Nokia E71



Sony Ericsson
Idou



Nokia 5800
XPressMusic



Nokia E90



Now Open Source!

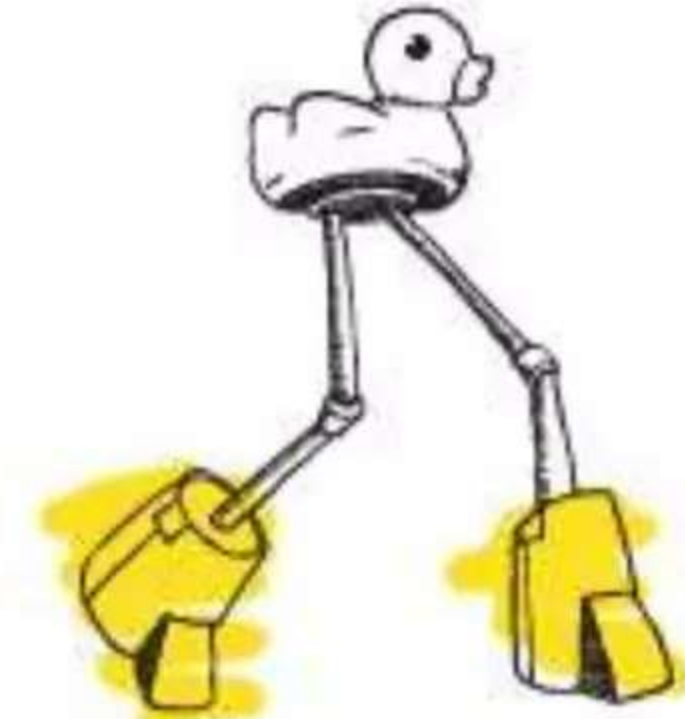
Symbian Foundation

Smartphone OS: Symbian

- OS designed for mobile environment
- Now owned by **Symbian Foundation** (UK)
 - Will turn Symbian OS **open source**
 - Free license for phone manufacturers
 - Nokia, Sony Ericsson, Samsung, LG, Sharp, etc.
- **Timeline:**
 - Foundation start: H1 2009
 - First unified platform release: 2009
 - First handsets: 2010
 - <http://www.symbian.org/>

**SYMBIAN
FOUNDATION**

Things are developing nicely



History



Psion Organizer II. Source: mobile2day.de

- 1984: Psion Organizer
8 Bit processor, 14x9cm, 2K RAM, 4K ROM, 8K datapak, 6 months battery life!
- 1986: Organizer II
The world's first proper PDA
- 1991: Psion Series 3
Sibo OS, 1.5+ million units sold

History



Psion Series 5. Source: mobile2day.de

- 1997: Psion Series 5 (EPOC 32 bit multitasking OS)
- 1998: Symbian Ltd. is founded
- 2000: First Symbian OS phone: Ericsson R380



Ericsson R380

History

- 2001: First 2.5G phone: Nokia 7650
- 2006: Nokia N95
- 2008: Symbian Foundation



Nokia 7650



Nokia N95

UI Platforms: S60



Nokia N97

- **Unified UI platform based on S60**
 - Official UI platform of Symbian Foundation
 - Former name: Series 60
- **Touchscreen support with S60 5th Edition**
 - 5800 XpressMusic, N97, etc.

Nokia UI Platforms: Series 40

- **Nokia Series 40 / 30 / 20**
 - **No Symbian OS**
 - For feature phones
(!= smart phones)
 - No C++ development possible



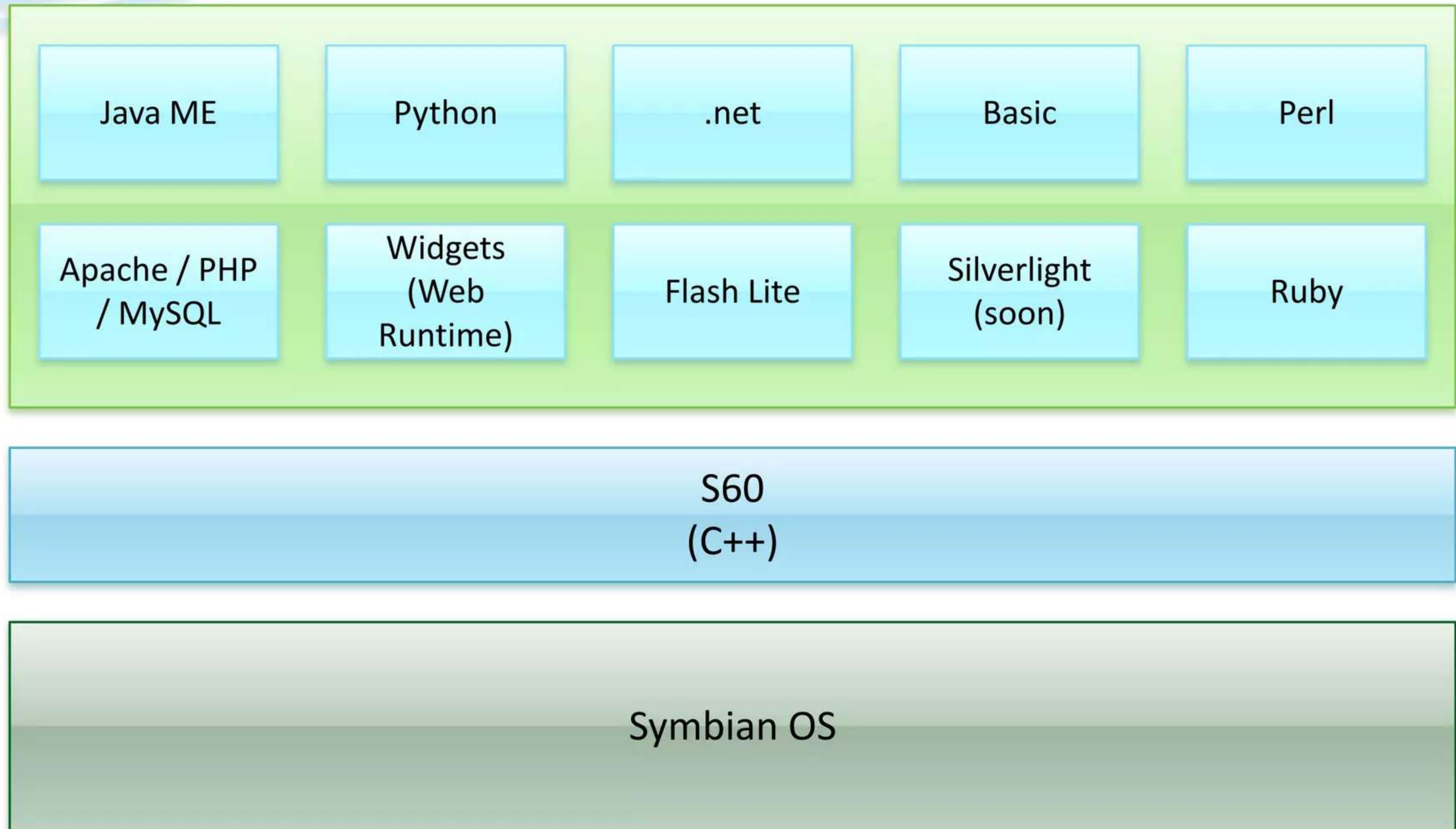
Nokia 6600 Slide

Samsung i8910 (Omnia HD)

- **3.7" capacitive touch screen**
 - AMOLED (640x360, 16 million colors)
- **Connectivity**
 - A-GPS, WLAN, UMTS, HSDPA
- **8 MPixel camera**
 - Face detection, smile shot, panorama, etc.
 - HD Video recording 720p
- **Multimedia**
 - RDS Radio, FM transmitter, 3.5 mm audio
 - MPEG4, DivX, H.263, H.264, etc.
- **Hardware**
 - 600 MHz, 3D graphics acceleration
 - Acceleration-, light-, proximity sensor, compass

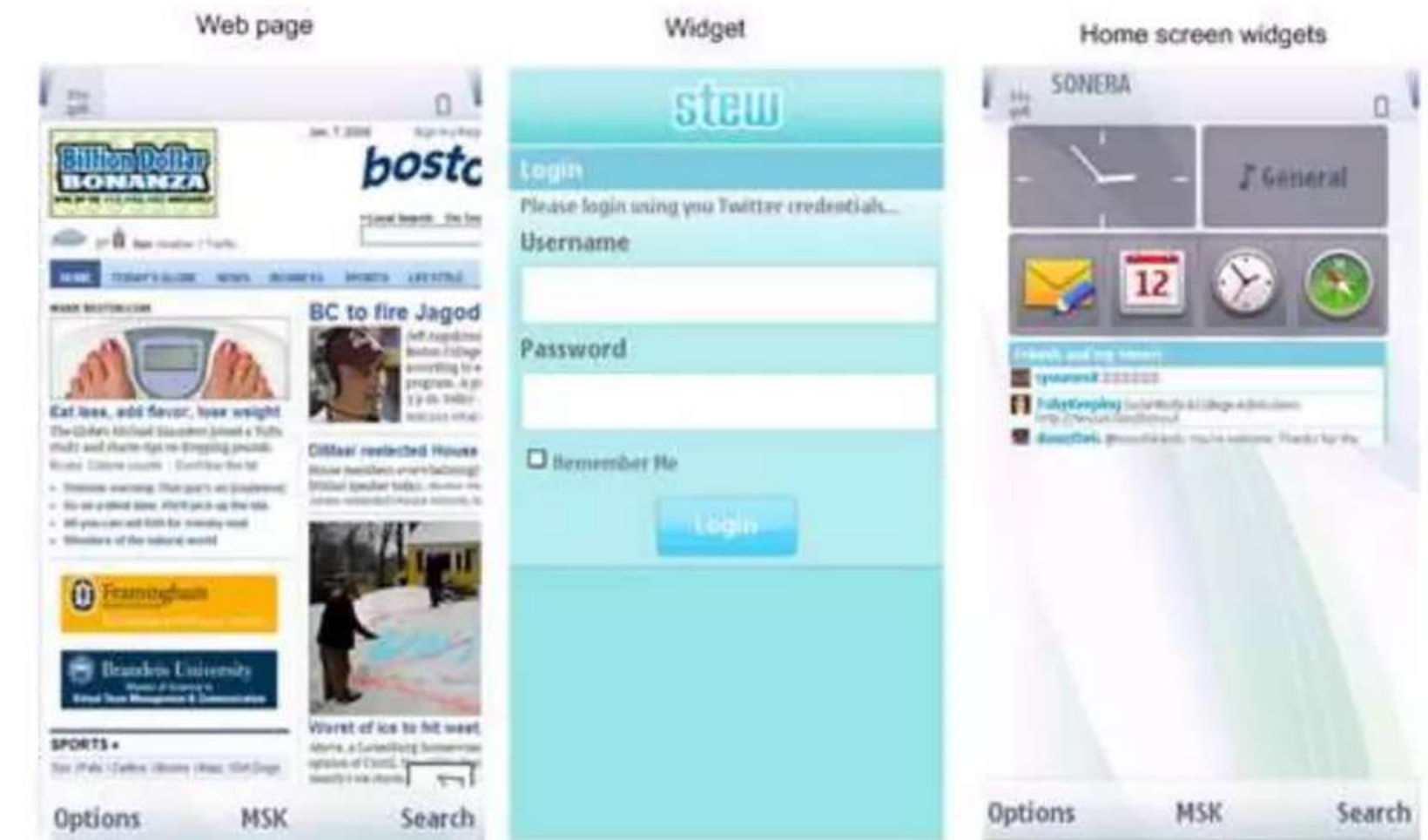


Symbian OS: Development



Widgets

- Web sites often not suitable for small screens
- **Widgets are “local websites” on the device**
 - Rendered using browser
 - Fetch web data using AJAX (Web 2.0)
 - Look & feel like native applications
 - **But:** easy development with HTML & JavaScript



Ovi

- **Internet services by Nokia**
 - Store (Applications)
 - Navigation (Maps)
 - Media Sharing
 - Messaging
 - Games (N-Gage)
 - Music store
 - Contacts, Calendar, File access





Open Handset Alliance

Google Android

Smartphone OS: Google Android



- **Developed by the Open Handset Alliance**
 - Based on Linux
 - Free licensing
 - Only G1 (HTC) in the market now
 - Sony Ericsson, Motorola, LG, Samsung, etc.
- **Interest of Google?**
 - Mobile advertising
 - User data (Google account required)
- <http://www.openhandsetalliance.com/>



Android: Development

- **Development:**

- Based on Java (Eclipse-Plugin)
- Emulator simulates ARM-CPU of phone
- Own Virtual Machine by Google (Dalvik)
- Linux not accessible for the user

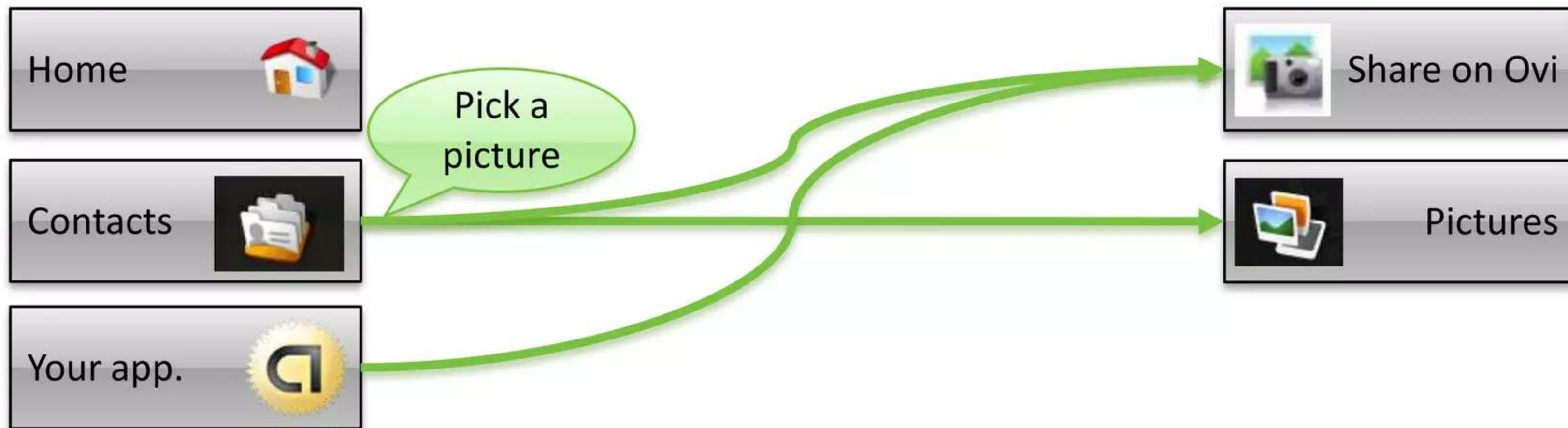
- **Why a Linux Kernel?**

- Hardware abstraction, driver model, security, memory & process management, networking



Replacing & Reusing Components

- **Client component makes a request for a specific action**
 - “Pick a picture” ← request is called “Intent”
- **System picks best component for that action**
 - Built-in Pictures application
 - Can be replaced with another application
 - New components can use existing functionality



Android Market



- Register with **Google account**
- **\$25 registration fee**
- **Payment?**
 - Free: no fee
 - Otherwise: 30% go to Google
- Rather open, but apps can be removed “that are not meeting acceptable standards, as determined by Google”
- <http://market.android.com/publish>



Apple iPhone

Mac OS X

Smartphone OS: Mac OS X (iPhone)

- **Based on OS X 10.5 (Leopard)**
 - Proprietary Unix-system by Apple
 - Devices:
iPhone (3G) + iPod Touch
- **Development:**
 - Requires latest Mac
 - iTunes for Sync
 - ObjectiveC
 - Developer Certificate



iPhone Performance

- Mobile platforms: **tricks required** for impression of speed
 - **Application startup: animates a screenshot**
 - Gives application time to load
 - User doesn't notice it!



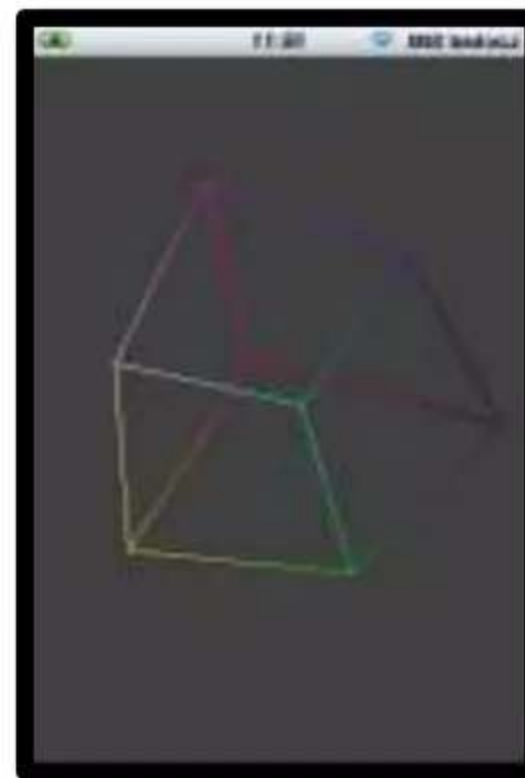
Tap application



Default.png is zoomed



Application is loaded



Last image is zoomed



Menu is visible again



iPhone AppStore

- **Central platform to sell iPhone applications**
 - **Business model:** 30% of income goes to Apple.
 - Content controlled by Apple
 - **Developer expenses:** 99\$ for dev program + a Mac (from 600€)
- **Easy Success?**
 - Only 1% of apps (~300) make profit
 - 5% sell good enough to pay development

Date	Available Applications	Number of Downloads
July 2008	500	0
September 2008	3000	100.000.000
October 2008	7500	200.000.000
December 2008	10.000	300.000.000
January 2009	15.000	500.000.000
March 2009	25.000	800.000.000

http://de.wikipedia.org/wiki/App_Store



<http://www.apple.com/iphone/appstore/>



There's more!

Other Platforms

Smartphone OS: Windows Mobile

- **Based on Windows CE**
 - Windows variant for embedded devices
 - First for Pocket PCs (PDA)
 - Telephony integrated later
- **Windows Mobile**
 - Variant of Windows CE
 - Current version: 6.5



Sony Ericsson Xperia X1

Windows Mobile: Development

- Often used for **industrial or business applications**
- Three development options:
 - **Win32-API**
 - Windows API in C
 - Native interface to the operating system
 - **MFC-API**
 - C/C++, Object-oriented
 - Extension of the Win32-API
 - **.NET Compact Framework**
 - Subset of the .NET Framework on the desktop
 - Most convenient way but application execution is slower than with other APIs



Windows Mobile 6.5

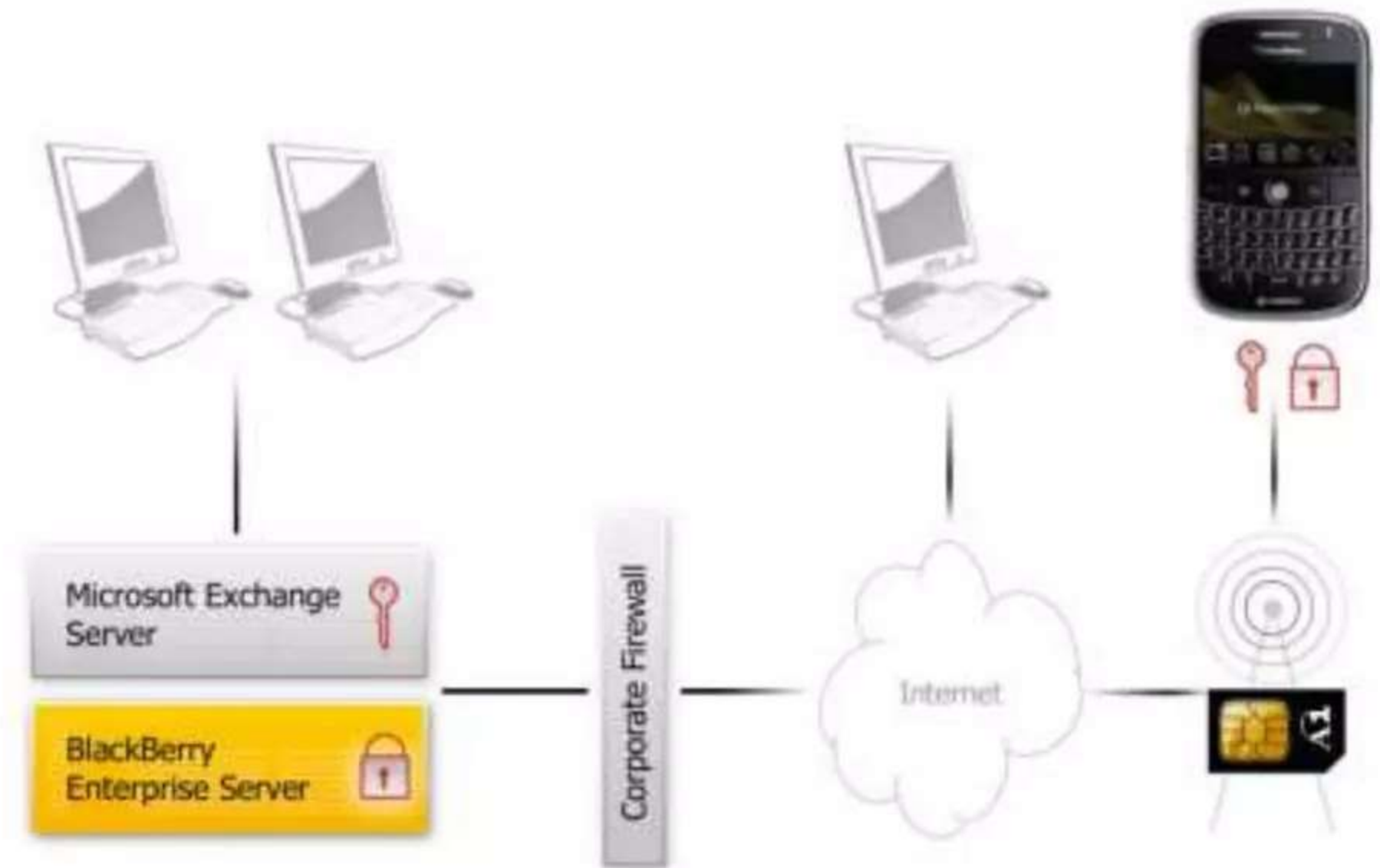
Smartphone (OS): RIM / Blackberry

- **Main focus: push email**

- RIM provides backend services
- Easy integration for companies
- Remote management of devices

- **Smartphone?**

- Only allows Java ME development for 3rd parties
- Extensions for web services etc.



Smartphone OS: Palm OS / WebOS



- **Founded in 1991**
 - Own operating system (Palm OS)
 - Has been very popular
 - On the decline in the last few years
 - Palm even released some Windows Mobile devices

Palm webOS – Resurrection?

- **webOS**

- Built on web technology
- Application development with HTML, JavaScript, CSS
- Mojo: JavaScript framework, access to UI, APIs and services
- Multitasking support

- **First device**

- Palm Pre (H1 2009)
- High hopes, enthusiastic previews

Andreas Jakl, 2009



webOS



Palm Pre

Mobile Linux

- **Openmoko**

- Two free, open source Linux smartphones:
 - Neo 1973
 - Freerunner
- **However:** not successful
- **Latest headlines (April '09):**
 - Openmoko cancels development of 3rd phone



Openmoko Freerunner

LiMo Foundation



- **Linux-based software platform**
 - Completely open (unlike Android)
 - Founded: January 2007
- **Only middleware OS (no UI or content)**
 - Main market: Asia
- <http://www.limofoundation.org/>

*Current
handset
manufacturers
(with released /
announced phones)*



Japanese Market



FOMA F903i



FOMA D703i



FOMA Raku-Raku
Simple



FOMA F704i



FOMA D702iBCL



FOMA F904i

Features include: Mobile TV, contactless payment and access, fingerprint authentication, waterproof, scented phones, touchscreen-keypads, GPS, “simple” phones, eBooks, barcodes, text-to-speech / speech-to-text →

<http://www.youtube.com/watch?v=1xQVnny0LSg>

Cross-Platform Development

- Only solution for cross-platform development:
 - **Java Platform, Micro Edition**
(Java ME, formerly J2ME)
 - Small subset of Java SE (desktop) plus many specific extensions (JSRs)
 - **2.6 Billion Java-enabled phones**
(8 out of 10 shipped in 2008)
 - Also used for Blu-Ray and Amazon Kindle 2



Java ME



Nokia N86 8MP

- **Main problem: Fragmentation**

- Optional APIs defined in JSRs

- Bluetooth
 - Location
 - Mobile 3D
 - Vector graphics
 - Mobile Media
 - File access
 - etc.

- **Attempts to solve fragmentation progressing slowly**

- Mobile Service Architecture
 - MIDP 3.0

Java Technology

- JSR 139 Connected, Limited Device Configuration (CLDC) 1.1
- JSR 118 MIDP 2.1
- JSR 246 Mobile Service Architecture Subset for CLDC
- JSR 75 FileConnection and PIM API
- JSR 82 Java™ APIs for Bluetooth 1.1
- JSR 135 Mobile Media API 1.1
- JSR 172 J2ME™ Web Services Specification (RPC package)
- JSR 172 J2ME™ Web Services Specification (XML Parser package)
- JSR 177 Security and Trust Services API for J2ME™ (SATSA-CRYPTO package)
- JSR 177 Security and Trust Services API for J2ME™ (SATSA-PKI package)
- JSR 179 Location API for J2ME™ 1.0
- JSR 180 SIP API for J2ME™
- JSR 184 Mobile 3D Graphics API for J2ME™ 1.1
- JSR 205 Wireless Messaging API 2.0
- JSR 226 Scalable 2D Vector Graphics API for J2ME™ 1.1
- JSR 234 Advanced Multimedia Supplements 1.0 (audio3d)
- JSR 234 Advanced Multimedia Supplements 1.0 (music)
- IAPI Info API
- eSWT UI API 1.0.3
- Nokia UI API 1.1

JavaFX



- **JavaFX** (<http://javafx.com>)
 - New **UI libraries** (graphics, media, web services)
 - **Consistent experience** across mobile, desktop, browser, TV, etc
 - **Plus:** use any Java library in JavaFX
 - Integrated with Java Runtime
- **JavaFX Script**
 - Simple declarative language, easier to learn
 - e.g., for artists to change sprite animation, without needing software developer
 - Advantage to JavaScript / ActionScript: integration with Java – reuse any Java library

JavaFX Mobile

- **Runs on Java ME (plus Android)**
 - Mobile content with same tools as Java FX
- **Availability?**
 - JavaFX Mobile Runtime needs to be pre-installed on the phone
 - No phones released yet
 - Currently endorsed by: SonyEricsson, LG





The Future

The Crystal Ball

- **Nokia**

- Also affected by crisis
- Focus shift from devices to services
- High potential with upcoming product portfolio
- Strong in emerging markets and with new technologies (NFC)

- **Motorola**

- Loss since RAZR
- No compelling new products in line-up, technologically behind

- **Sony Ericsson**

- Good products for mid-range, but not profitable
- Rumours of split (and no Playstation brand)

- **Samsung**

- Technologically good products, growing
- Uses all available phone platforms

- **LG**

- Solid products, nothing spectacular
- Growing without anyone noticing them

- **Apple**

- Only targets high end users, mass market not interesting for Apple -> how long until stagnation?
- Much depends on next product. iPhone Nano?

The Crystal Ball [2]

- **Android**

- Modern concept and OS
- Still slow to grow, no phones at Mobile World Congress in Barcelona
- Target group of Android? Only tech-savvy young persons?
- We'll know more by the end of this year with devices from Sony Ericsson and Motorola

- **Symbian**

- High commitment visible at Mobile World Congress
- Will grow strong for mid-range devices

- **Windows Mobile**

- Not much happened lately
- Everyone waiting for Windows Mobile 7
→ will it be able to compete against iPhone?

- **Java ME**

- Currently loses traction
- But still only way for cross-platform

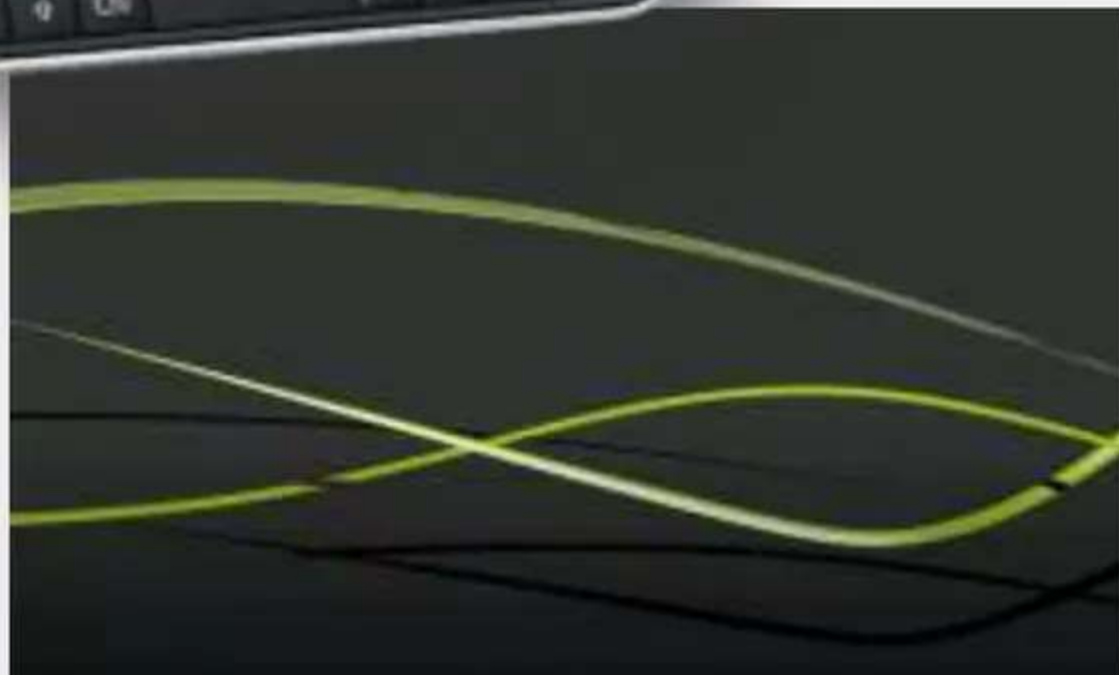
- **Java FX**

- How will it be received by phone manufacturers?
- Maybe not too many interested anymore

Nokia: Maemo 5



Nokia N810

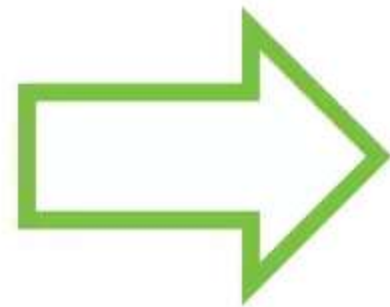


Maemo 5

- **Next generation devices**
 - Finger-optimized interface
 - Linux-based
 - Fully open source
 - New OMAP 3 core
 - OpenGL ES 2.0
 - Qt Kinetic (animation)
- <http://www.maemo.org/>

Cross-Platform: Qt

C++

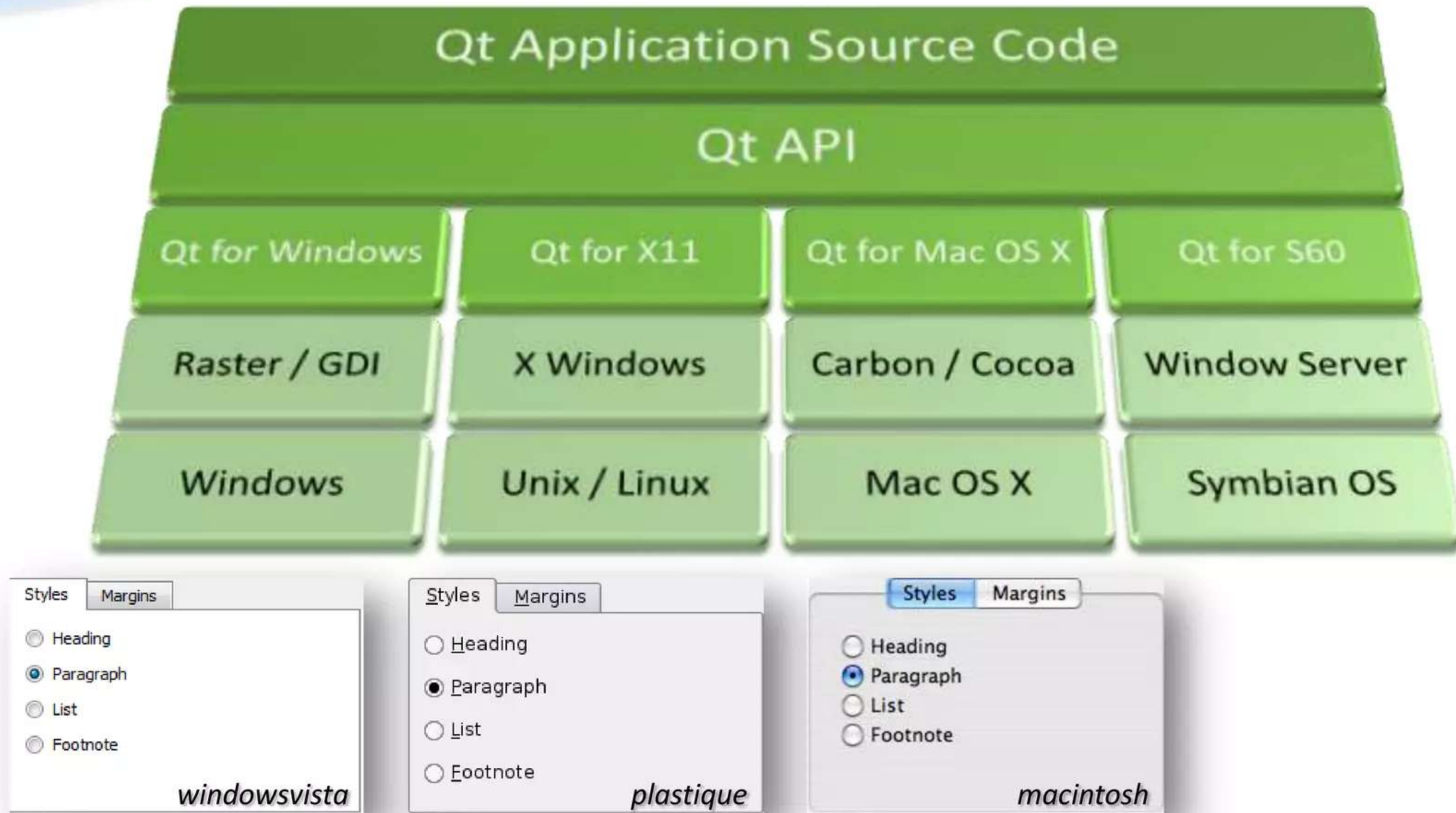


Java
Python
Ada
Pascal
Perl
PHP

*Maintained by
Qt open source community.
Not officially supported by Qt Software.*

Windows
Mac OS
Linux / X11
Windows CE
Embedded Linux
S60

Qt Architecture

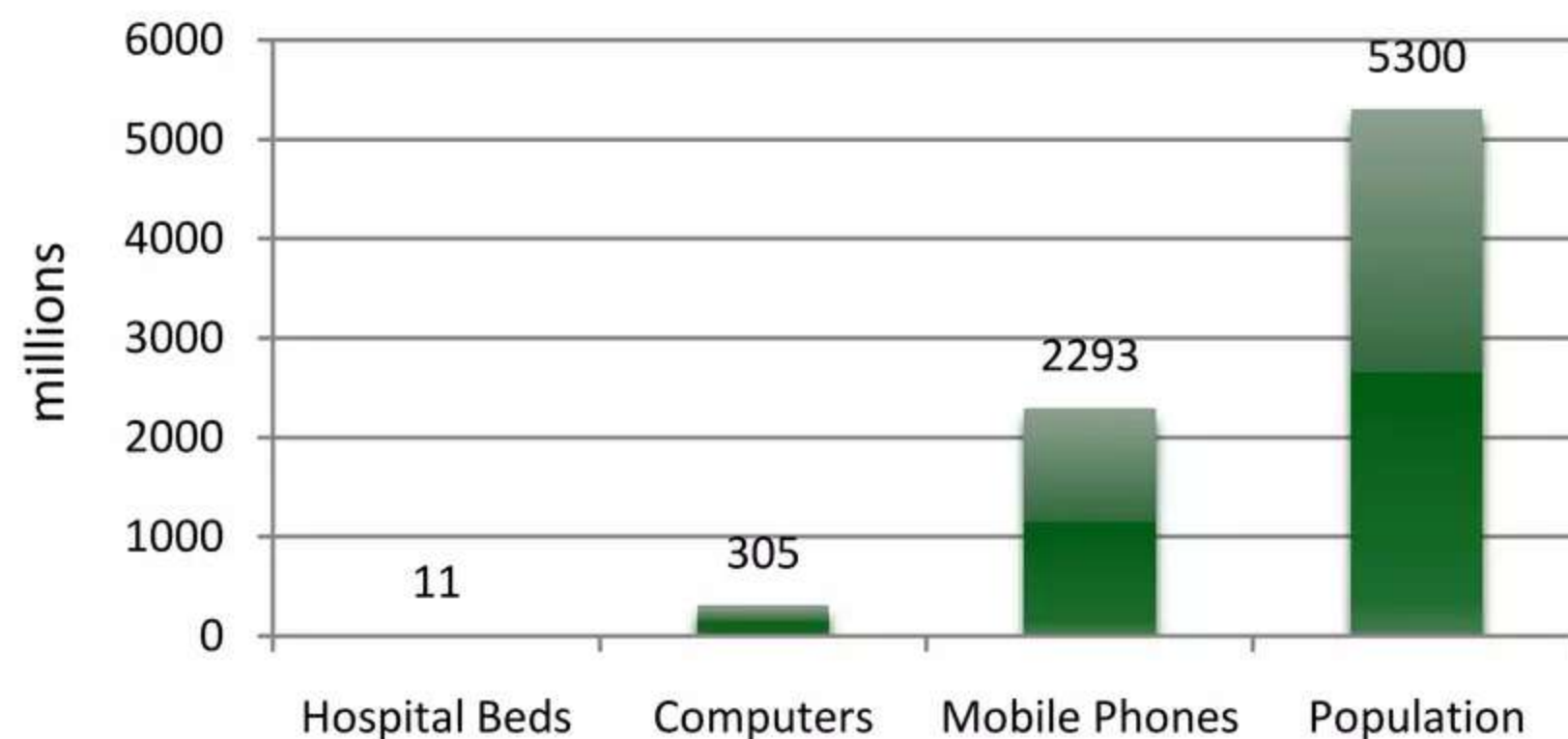


Developing Countries



- **Massive uptake of mobile phones**

- Only way to access internet
- Enormously successful new services



NFC for pension payment in India



<http://www.unfoundation.org/global-issues/technology/mobile-health-for-development.html>

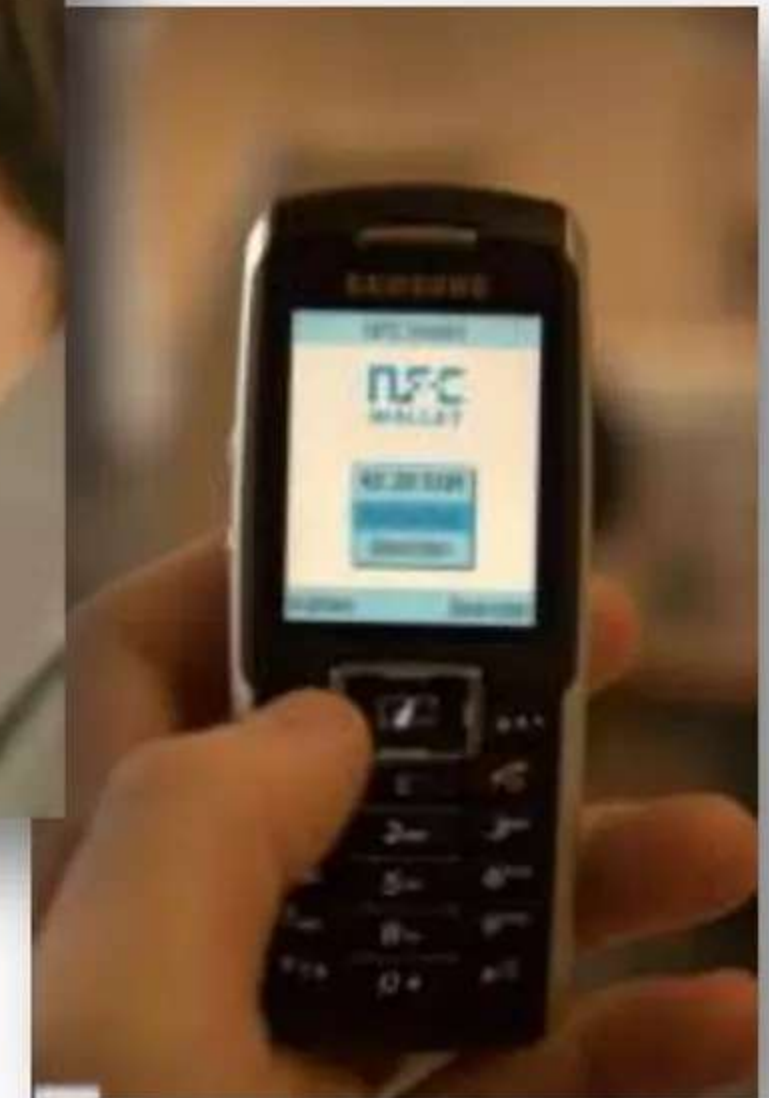
Specific Target Groups



Andreas Jakl, 2009

enberg - Mobile Computing

Near Field Communication



FH Hagenberg – Mobile Computing

- **Profound and up-to-date knowledge:**
 - Mobile software development (iPhone, Android, Windows Mobile, Symbian OS)
 - Mobile communication (GSM, UMTS, Bluetooth, Zigbee, etc.)
 - Navigation
 - Electronics, displays, etc.
 - Mobile business, entertainment, sports, health
 - Social skills and management



symbianresources.com

- Provides for free:
 - Student projects
 - Course slides:
Symbian OS,
Java ME, Qt
 - Tutorials
 - White Papers

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symbianresources.com

Tutorials - Projects - Links - Contact

Welcome

This site highlights several fascinating mobile student and research projects that introduce new ways of using your mobile phone. Additionally, you can download Symbian OS, Java ME and Qt materials from courses that were held at the University of Applied Sciences in Hagenberg, Austria. Best of all, everything is provided for free and with unlimited access (for personal use).

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