Mobile Development

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Hardware

- Main features
- Core platforms examples

Software

- Software architecture
- Operating systems
- Application development platforms

Applications

- Main applications

MediaArt

- Experiments using mobile devices

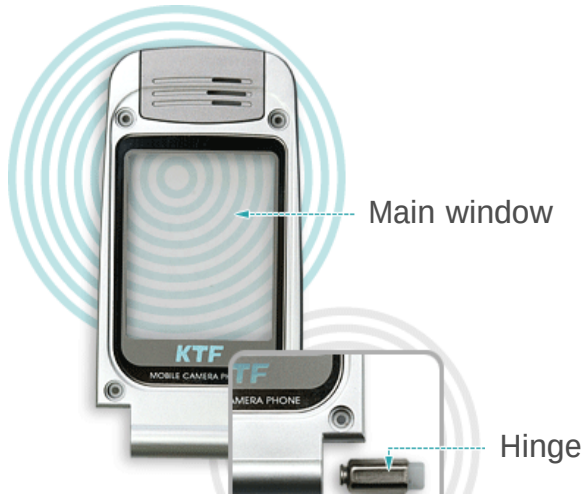
Flip upper & Flip lower

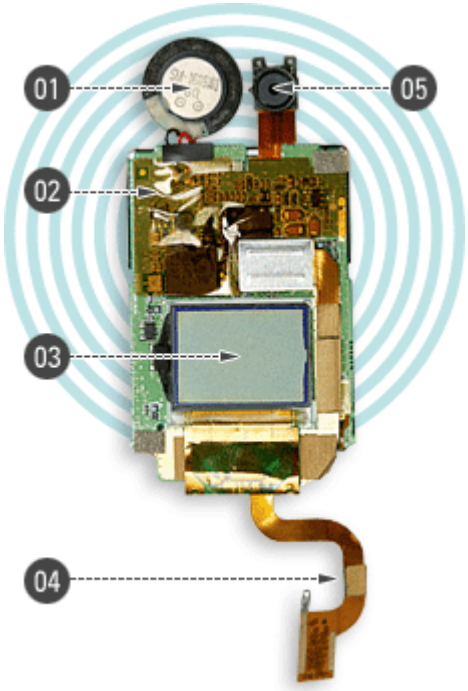
LCD module & Sub board

Main upper case

Main board

1. Flip deco
2. Sub window
3. Camera window
4. Reflection mirror
5. EMI paint





1. Speaker (Speaker + Receiver)

2. Static electricity protection tape

3. Sub LCD

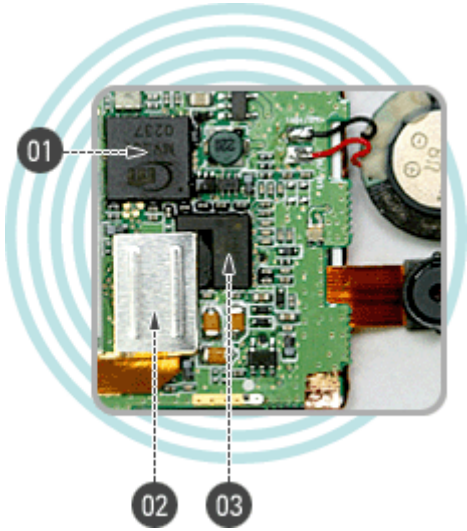
4. FPCB (Flexible PCB)
   - Connect LCD to Main board

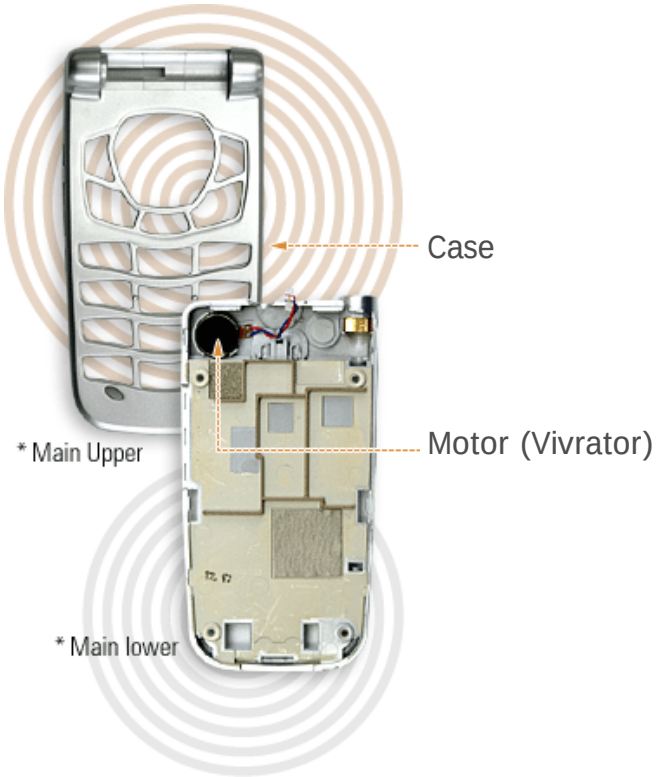
5. Camera
   - CCD or CMOS

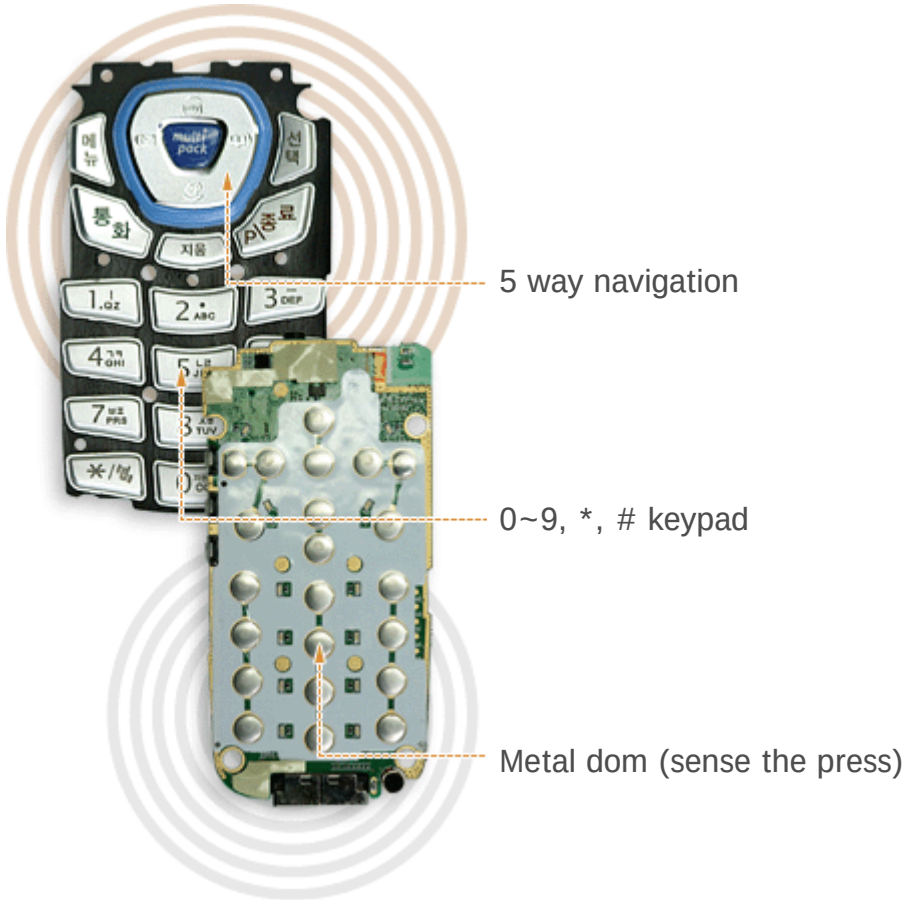
1. ASIC
   - Image capture and decoding etc.
   - Camera related process

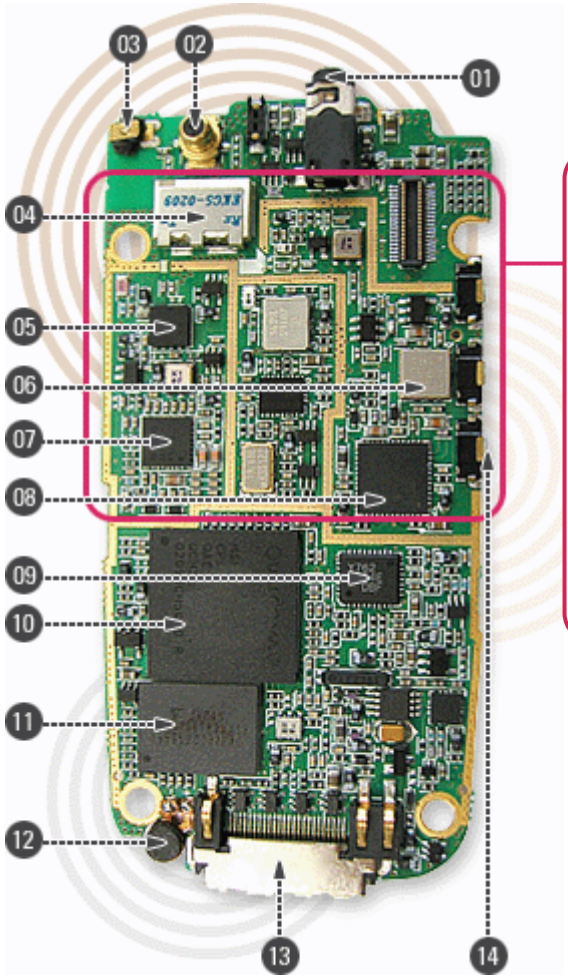
2. FPCB

3. DSP
   - Compress image and send to LCD




Case
Motor (Vivrator)
* Main Upper
* Main lower


5 way navigation
0~9, *, # keypad
Metal dom (sense the press)



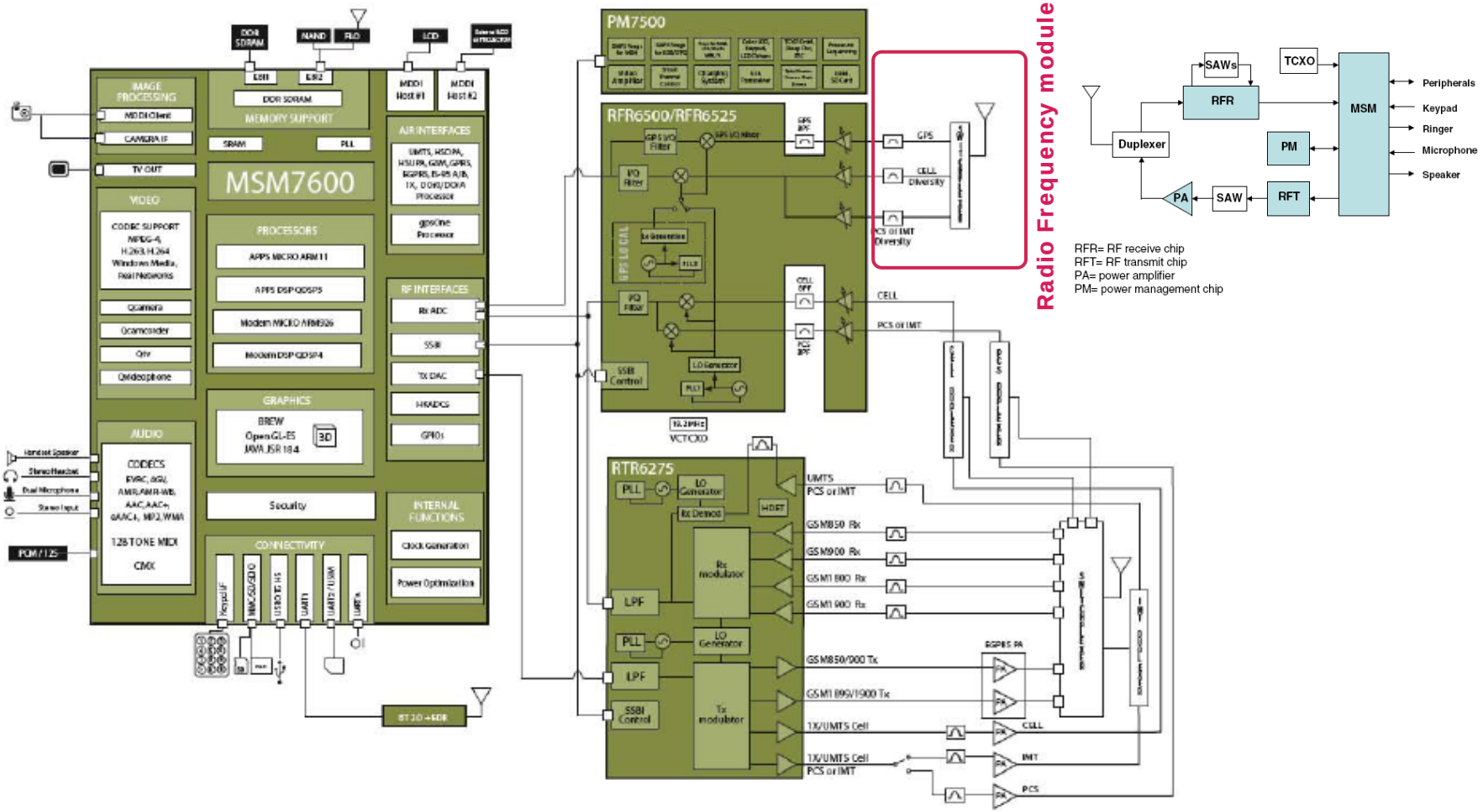
1. Ear mic jack
2. RF jack
   - RF verification jack after development
3. Antenna contact

4. Duplexer
   - Sort TX/RX from antenna
5. Power amp
   - Amplify signal
6. IF SAW filter
   - Filter noise and sent signal to IFR
7. RFT
   - Transmitter
8. IFR
   - Receiver

Radio Frequency module

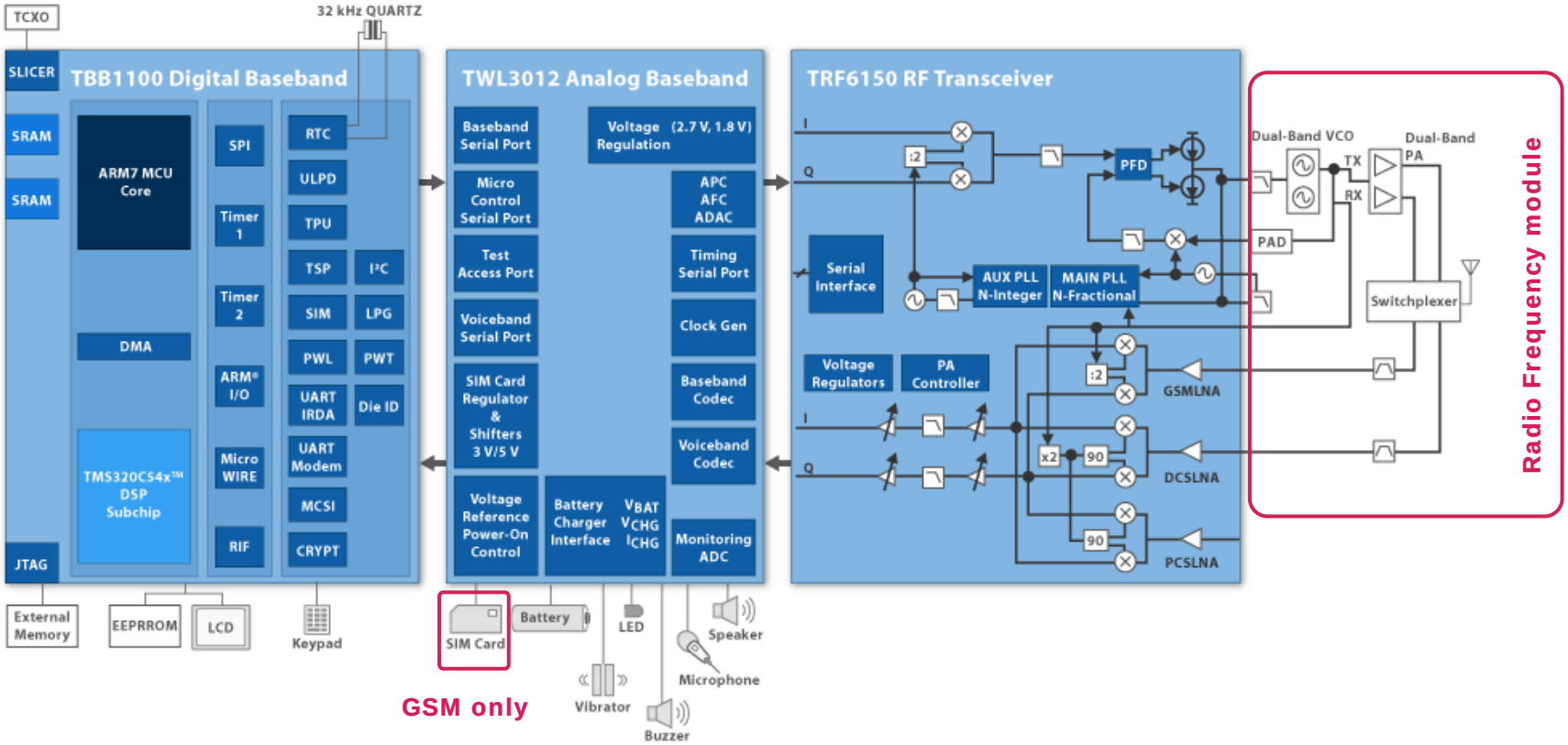
9. Sound chip
   - Yamaha is the most popular sound chip
10. MSM chip (Qualcomm)*
    - Main processor
11. Memory
    - ROM + RAM (recent : more than 200MB)
12. Mic
13. I/O Connector
    - Data communication
14. Switch
    - Side key connector

Example (Qualcomm MCU)

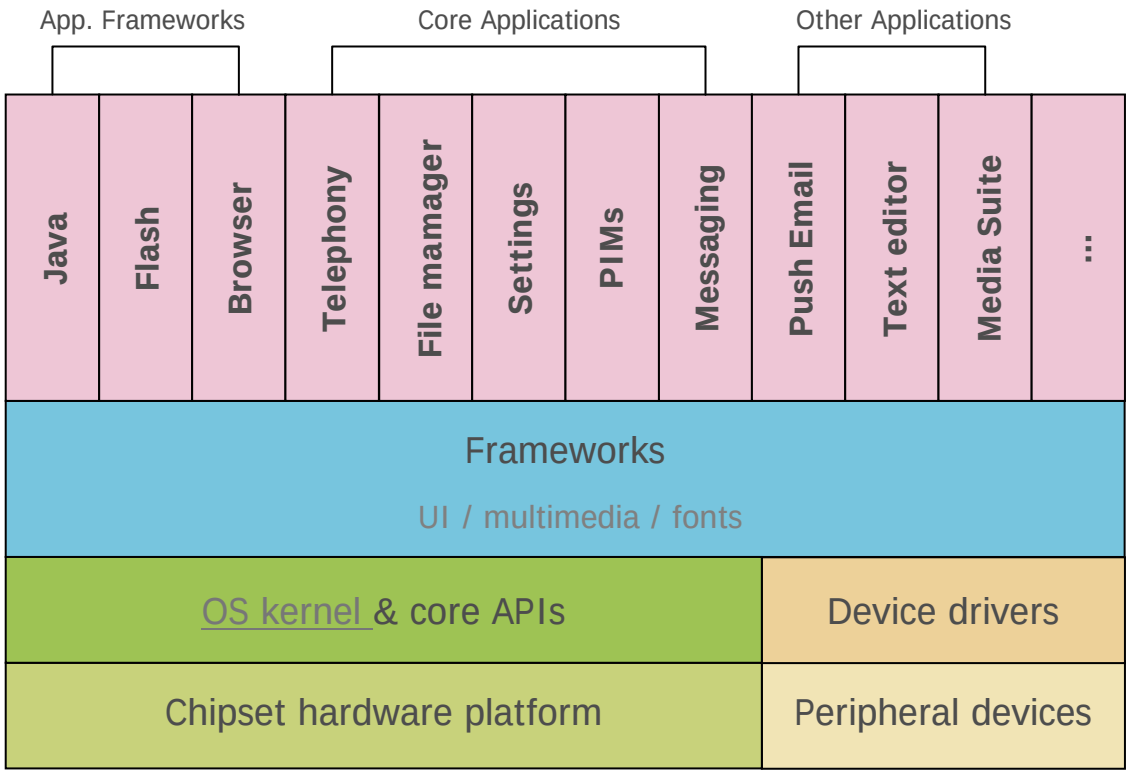


http://www.cdmatech.com/products/msm7600_chipset_solution.jsp

Example (TI MCU)



http://focus.ti.com/general/docs/wtbu/wtbuportal.tsp?templateId=6123&contentId=4646


App. Frameworks
Core Applications
Other Applications
Java
Flash
Browser
Telephony
File mamager
Settings
PIMs
Messaging
Push Email
Text editor
Media Suite
...
Frameworks
UI / multimedia / fonts
OS kernel & core APIs
Device drivers
Chipset hardware platform
Peripheral devices

Operating System

- More various than PC's OS

- Symbian / Palm OS / Windows Mobile / OS X

- Closed and proprietary OS environment : very limited custom software development

- Runtime environments provided : JVM (Java Vertual Machine), SWF (ShockWave Flash), etc

1. symbian

SDK for developers

- http://www.symbian.com

- Owned by Nokia etc.

- Offers APIs, user interface frameworks and reference implementations of common tools

- Default UI : Nokia Series 60, Series 80, UIQ(User Interface Quartz)

- Mainly C++ preference, but can also be programmed in OPL, Python, Visual Basic, Simkin, and Perl - together with the Java ME and PersonalJava flavours of Java.

- Microkernel architecture
  > contains scheduler, memory management, Bluetooth, IrDA, USB and UI APIs.
  > not contains networking, filesystem support (should be provided by user side servers)

- Flexibility but much vender side integration works

- Symbian phones : Nokia, Foma series (Japan), Soni ericsson, Samsung, etc.

2. Palm OS

- http://www.access-company.com
- Originally released in 1996
- Mainly for PDAs
- Combined with a suite of basic applications including an address book, clock, note pad, sync, memo viewer and security software
- Primarily coded in C/C++
- Provides development tools : CASL (Compact Application Solution Language), AppForge Crossfire (C# based), Handheld Basic, HB++ (Visual basic based)
- Java runtime environment, Plua (a version of Lua) are available

3. Windows Mobile

- http://www.microsoft.com/windowsmobile/default.mspx

- PocketPC 2002 (powered by Windows CE 3.0)

- Windows Mobile 2003 (the 3rd version of PocketPC)

- Based on the Microsoft Win32 API

- Similar to desktop versions of Windows : Start button, Excel, PowerPoint, Outlook, Windows Media Player and etc

4. Linux 

- http://www.linuxdevices.com/

- Open source

- Small footprint (around 2MB for a minimal installation)

- Motorola, Panasonic, NEC, Samsung, Telepong, Wildseed etc. adopted linux

5. OS X

All the power and sophistication of the world's most advanced operating system — **OS X** — is now available on a small, handheld device that gives you access to true desktop-class applications and software, including **rich HTML email**, **full-featured web browsing**, and applications such as **widgets**, **Safari**, **calendar**, **text messaging**, **Notes, and Address Book**. iPhone is fully **multi-tasking**, so you can read a web page while downloading your email in the background. This software completely redefines what you can do with a mobile phone. – from www.apple.com

Overview

Symbian	Strongly supported by Nokia with waning support from other device makers. Currently large device deployments in Europe, with little penetration in the US market.
Java ME	Ideal for an all-around solution, if the Java ME platform provides the needed functionality.
Python	Ideal for initial prototyping and concept testing when functionality falls outside Java ME.
Flash Lite	Ideal for Graphics-heavy options with a market that can support the Flash Lite player.
.NET Compact Framework	Ideal for deployment on homogeneous Pocket-PC devices.
Microbrowser Based	Ideal for lightweight functionality, a web-interface for an existing application with no latency concerns, or a widely varying platform base
BREW	Ideal for deploying applications for deployment on CDMA-based networks with a deployed Brew Content Platform especially if OTA app deployment is desired.
Pocket PC & Windows Mobile	Ideal for enterprise applications with an existing PC infrastructure and options for significant development investment.
Palm OS	Significant player with strong enterprise following in the important US market. PalmOS makes up the lions share of revenues for most consumer focused developers.

http://http://en.wikipedia.org/wiki/Mobile_development

Comparison

	Foundation	Learning Curve	Debuggers	Emulator available	IDE	Cross-Platform Deployment
Symbian	C++	Difficult*1)	Good	Free Emulator	Many choices	Compile per target
Java ME	Java	Average	Excellent	Free Emulator, Sun Java Wireless Toolkit, mpowerplayer	Eclipse, NetBeans Mobility Pack, Processing	Average*6)
Python	Python	Excellent	Average	Add-on to Nokia Emulator	Several, plugins for Eclipse	Interpreted language only on Nokia Series60
Flash Lite	ActionScript	Average	Good	Bundled with IDE	Macromedia Flash MX2004/8, Eclipse	Excellent *7)
.NET Compact Framework	C#, VB.NET	Average	Excellent	Bundled with IDE	Visual Studio 2005, 2003	Windows Mobile
Microbrowser	XHTML (WAP 2.0) WML (WAP 1.2)	Varies by Server-side scripting language	Good	Many	Many	Excellent
BREW	C	Difficult *2)	No Debugger *4)	No Emulator	Visual Studio 6.0, Visual Studio 2003 .net	CDMA handsets only
Pocket PC	C, C++	Average	Excellent	Bundled with IDE	Visual Studio 2005	Windows Mobile
Palm OS	C, C++	Excellent	Average	Free Emulator	Eclipse, CodeWarrior	Palm OS handsets only

*1) Unusual C++ APIs, poor debugger support, and Symbian 9 breaks binary compatibility
*2) But easier, and less featureful, than Symbian
*3) Excellent for Win32 developers
*4) Can use Visual Studio to debug the x86 testing code.
*5) Has a simulator for the x86 testing code
*6) Many VM implementations have device specific bugs necessitating separate builds
*7) Bundled – Top 5 mobile manufacturers, limited handset model support as of 3/06, best web compatibility

http://en.wikipedia.org/wiki/Mobile_development

Sun, Java wireless toolkit

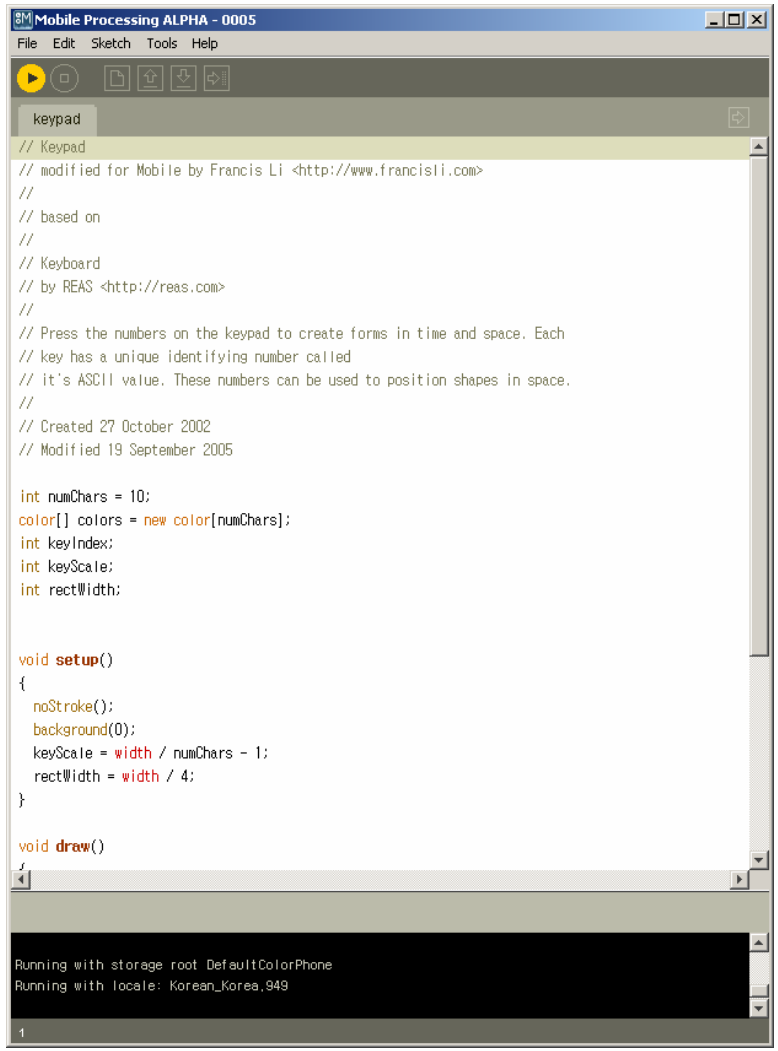
- JavaME developer's home : http://java.sun.com/javame/index.jsp

Mobile processing

- JavaME based development environment
- APIs for graphics, connectivity
- JavaME emulator
- Familiar to processing users

- Mobile processing : http://mobile.processing.org

Development environment



- Mobile processing : http://mobile.processing.org

Cellphone oriented libraries

Phone
This class provides access to the phone-specific features of the Phone library.

Phone
vibrate()
flash()
call()
launch()
fullscreen()
noFullscreen()

Messenger
This class provides the primary interface for sending and receiving messages.

Messenger
send()

EVENT_MSG_RECEIVED

Message
This class represents messages that have been received.
Message
readBytes()
readString()

Sound
This class is used to create sound objects for playback.

Sound
duration()
loop()
pause()
play()
playTone()
stop()
supportedTypes()
time()
volume()

Cellphone oriented libraries

Bluetooth
This class provides the primary interface for discovering and establishing a Bluetooth network connection.

Bluetooth
cancel()
discover()
find()
start()
stop()

EVENT_DISCOVER_DEVICE
EVENT_DISCOVER_DEVICE_COMPLETED
EVENT_DISCOVER_SERVICE
EVENT_DISCOVER_SERVICE_COMPLETED
EVENT_CLIENT_CONNECTED

Device
Objects of this class represent nearby devices discovered on the Bluetooth network.

Device
name
address
cancel()
discover()

Service
Objects of this class represent software running on devices that can be connected to via the Bluetooth network.

Service
name
description
provider
device
connect()

Client
Client objects are used to communicate with other devices and services.

Client
read()
readBoolean()
readBytes()
readChar()
readInt()
readUTF()
skipBytes()
stop()
write()
writeBoolean()
writeChar()
writeInt()
writeUTF()

Cellphone oriented libraries

MAudio3D
Library for 3D audio.

MNokiaUI
Library for supporting the proprietary Nokia UI API (including alpha channel support). Early Nokia phones only.

M3D
Library for 3D graphics.

MPush
Library for supporting push registry activation of applications (timer or connection activated).

MBluetooth
Library for Bluetooth communication.

MQRCode
Library for decoding QRCode 2D barcodes.

MClientServer
Library for creating client/server connections. Used with MBluetooth for creating discoverable services.

MSound
Library for sound playback and recording.

MLocation
Library for location positioning.

MVideo
Library for video playback.

MMessaging
Library for sending and receiving text messages.

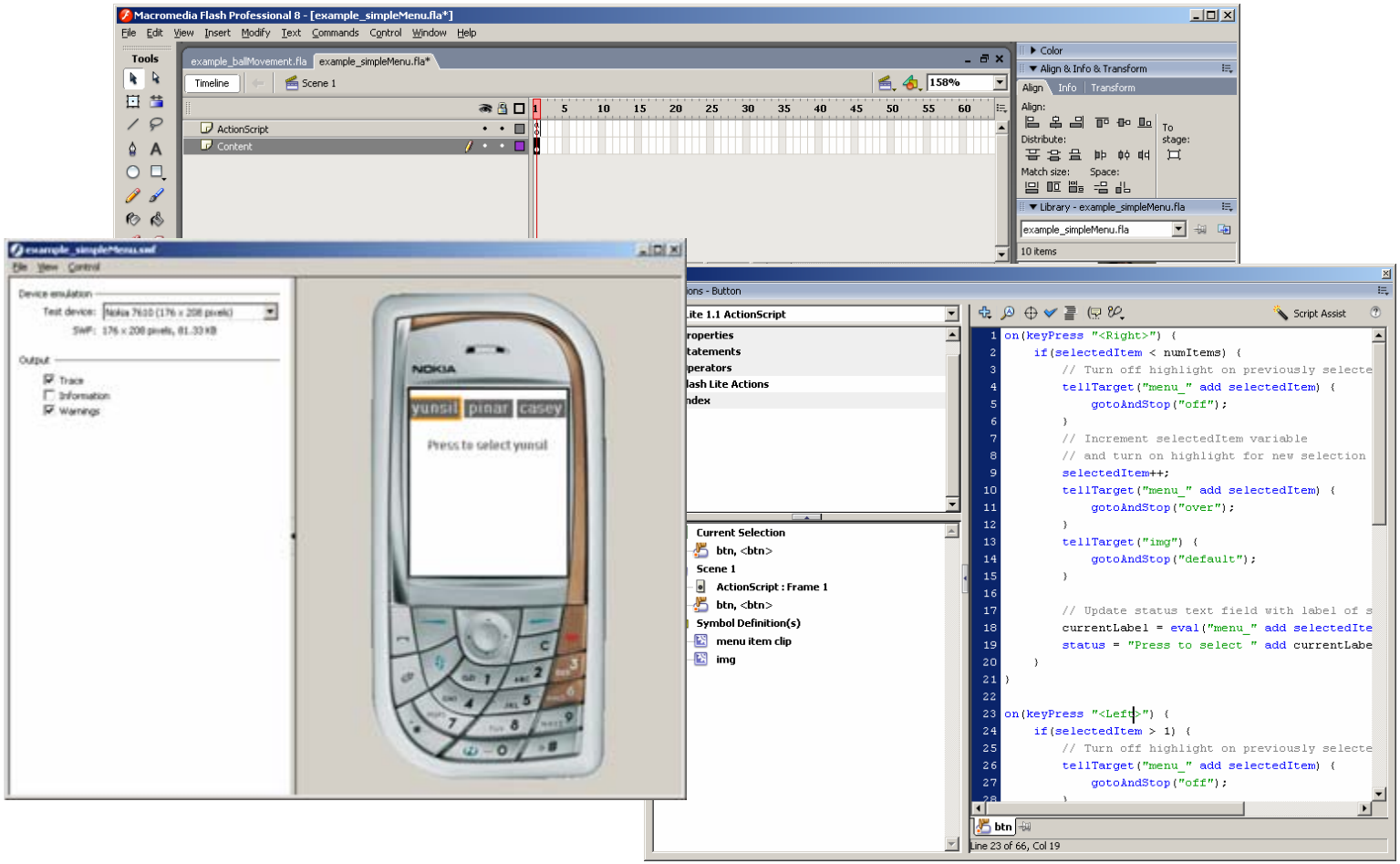
MWebServices
Library for consuming web services.

Macromedia FlashLite

- Lightweight version of Adobe Flash Player optimized for mobile phones and other devices
- Powerful graphic expression
- Support the W3C Standard SVG Tiny
- Presets for specific models of Nokia, DoCoMo etc. on Flash development

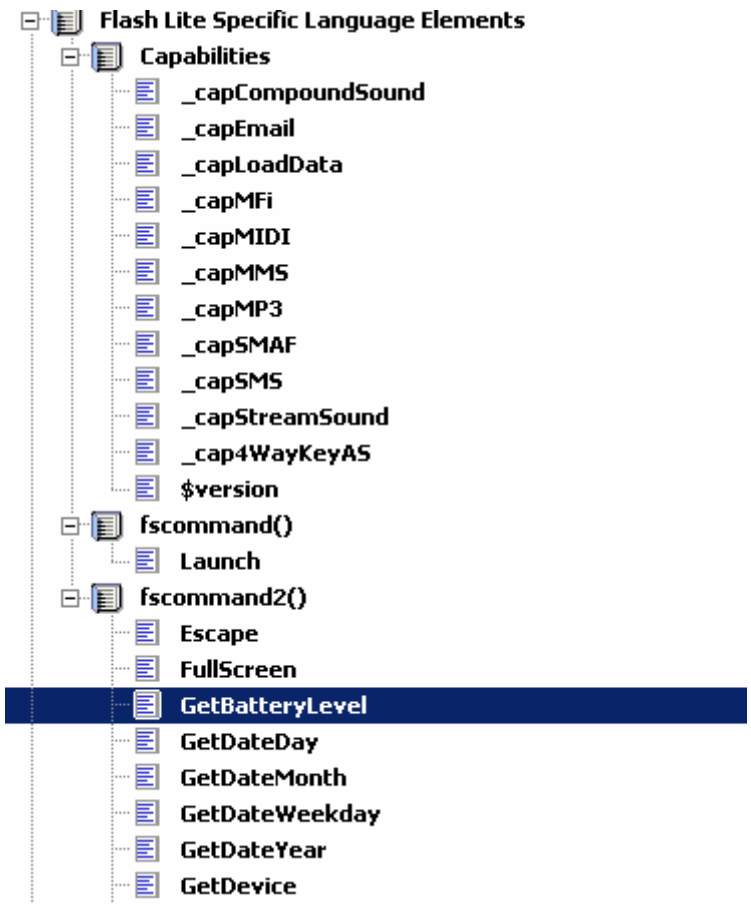
- Flash : http://adobe.com
- Flash Mobile and Device Seminar : https://admin.adobe.acrobat.com/_a227210/p75414944/?trackingid=CXND

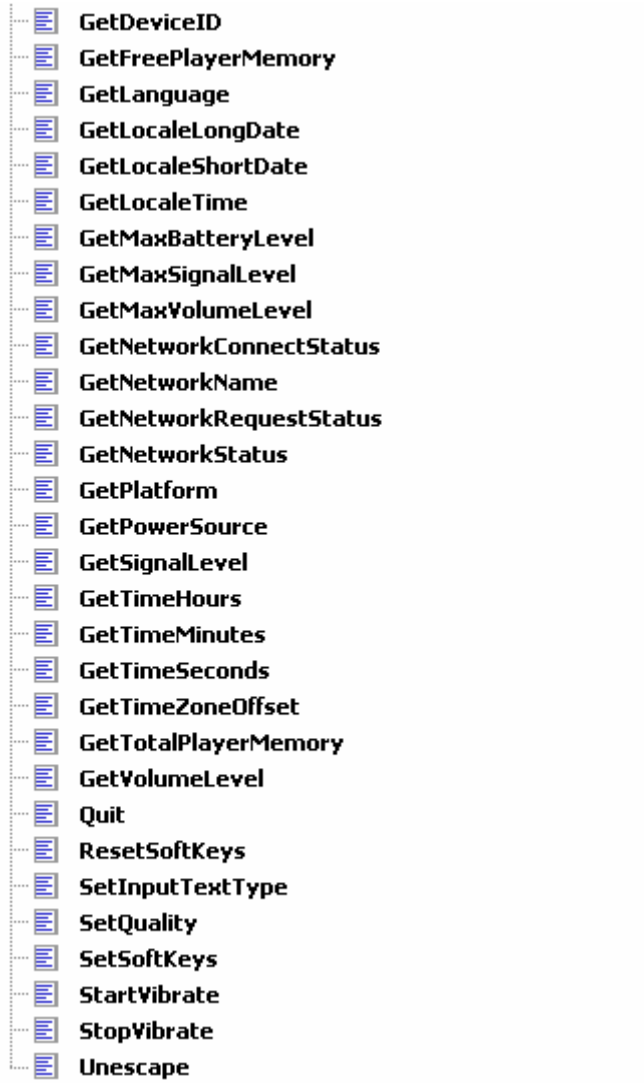
Development environment



- Flash : http://adobe.com
- Flash Mobile and Device Seminar : https://admin.adobe.acrobat.com/_a227210/p75414944/?trackingid=CXND

Cellphone oriented libraries





Overall

- Telephony

  Voice call / Video call / Conference call..

- Messaging

  Voice message / Text message / Multimedia message / Email / PTT..

- Media Suite

  Camera / Video / media player / MIDI / MP3 player ..

- PIM

  Organizer / Contacts / Alarm / Note..

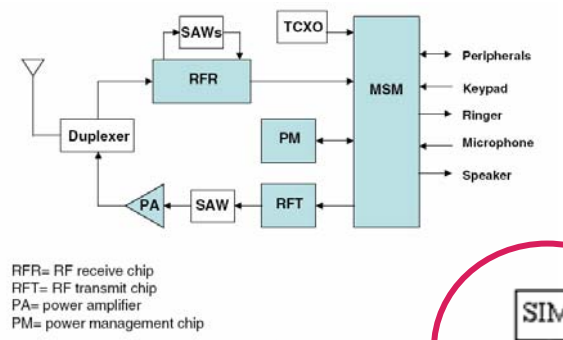
- Browser

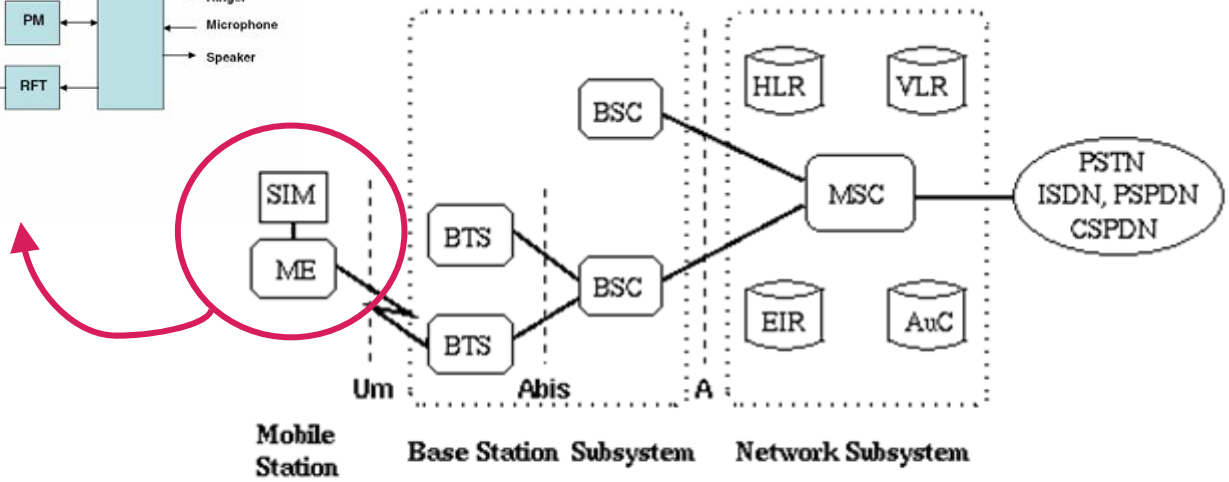
  WAP / Web browser

- Connectivity

  IrDA / Bluetooth / GPS

Telephony





SIM Subscriber Identity Module
ME Mobile Equipment
BTS Base Transceiver Station
BSC Base Station Controller
HLR Home Location Register
VLR Visitor Location Register
MSC Mobile services Switching Center
EIR Equipment Identity Register
AuC Authentication Center

Processing library related to Telephony

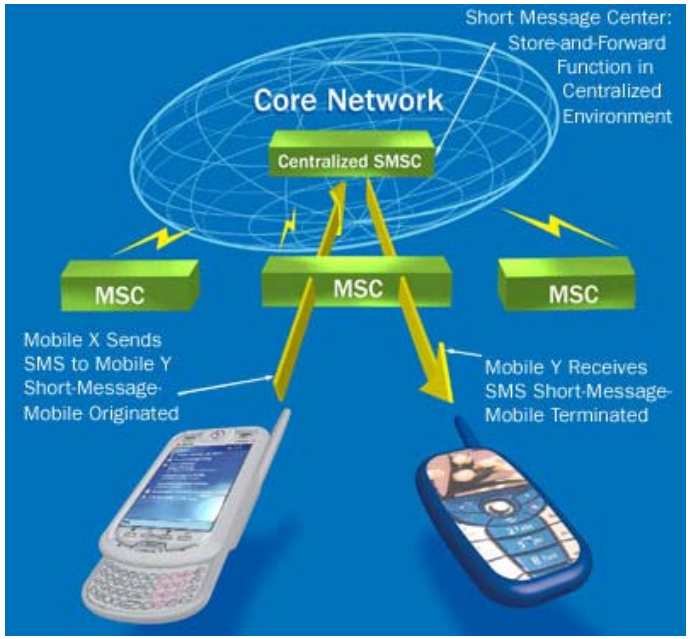
call()

Syntax : p.call(number)

Description
Calls the specified phone number. Returns true if the sketch must terminate before the call will be initiated.

Parameters
p Phone: any variable of type Phone
number String: phone number to dial

Message (SMS)



SMSC : Short Message Service Centre

SMS Data Dissected

message HALLO WORLD
sent from the number ++39 347 3820955
at 04h:55m:16s PM of the 13th of January 2002.

01	80	11	00	0A	81	43	37	28	90	55	00	00	A7	0B	C8	20	93	F9	04	5D	9F	52	26	11
SCA		ID	MR	DA							PID	DCS	VP	UDL	USER DATA									
SMS-SUBMIT TPDU																								
PDU RETURNED BY THE AT+CMGL COMMAND																								

07	91	93	43	29	00	50	90	04	0C	91	93	43	37	28	90	55	00	00	20	10	31	61	55	61	04	0B	C8	20	93	F9	04	5D	9F	52	26	11
SCA								ID	OA								PID	DCS	SCTS							UDL	UD										
SMS-DELIVER TPDU																																				
PDU RETURNED BY THE AT+CMGL COMMAND																																				

- SMSC – Phone data protocol : specific protocols for GSM MAPf framework such as SS7 or use standard email protocol such as SMTP or TCP/IP

FlashLite library related to SMS

_capSMS

Availability : Flash Lite 1.1.

Description
Numeric variable; indicates whether Flash Lite can send *Short Message Service* (SMS) messages by using the GetURL() ActionScript command. If so, this variable is defined and has a value of 1; if not, this variable is undefined.

Example
The following example sets canSMS to 1 in Flash Lite 1.1, but leaves it undefined in Flash Lite 1.0 Flash Lite 1.0 (however, not all Flash Lite 1.1 phones can send SMS messages, so this code is still dependent on the phone):

Code

```
on(release) {

    canSMS = _capSMS;

    if (canSMS) {
    // send an SMS
    myMessage = "sms:4156095555?body=sample sms message";
    getURL(myMessage);
     }
}
```

Processing library related to SMS

EVENT_MSG_RECEIVED

Syntax : Messenger.EVENT_MSG_RECEIVED

Description
This constant value is reported in **libraryEvent** when a message has been received. The data object is the Message received.

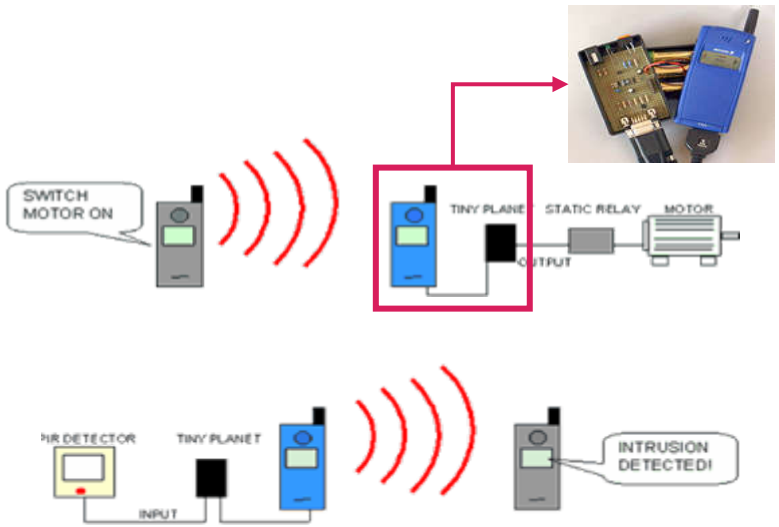
Code

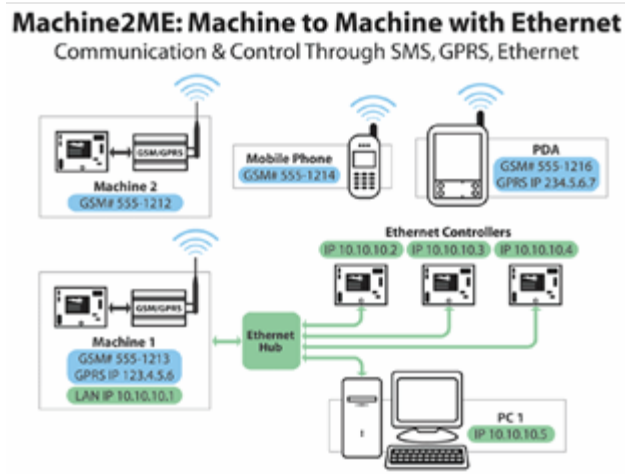
```
Messenger m;

void setup() {
    m = new Messenger(this); noLoop();
}

void libraryEvent(Object library, int event, Object data) {
    if (library == m) {
        switch (event) {
            case Messenger.EVENT_MSG_RECEIVED:
            Message msg = (Message) data;
            println(msg.readString());
            break;
        }
    }
}
```

M2M via SMS

- Control Motor device via GSM / GPRS wireless network

M2M related paper





Camera

- CCD / CMOS
- 5M pixel camera phone

- Moblog (Mobile + Weblog)
- consists of content posted to the Internet from a mobile or portable device generally involve technology which allows publishing from a mobile device

http://joi.ito.com/moblog/

Browser

- Microbrowser : web browser for handheld device considering low memory capacity
  get contents written in WAP
  Limited contents, service, needed WAP based page development

  What is WAP?

- Mobile full browsing : web-like browser, Nokia open source browser
  Mobile internet service is big issue

Browser

1. Opera browser

   Don’t need horizonal scroll

2. Nokia New Web Browser for S60

   Safari based open source browser

3. Openwave browser

4. Access Netfront browser

5. Obigo Teleca browser

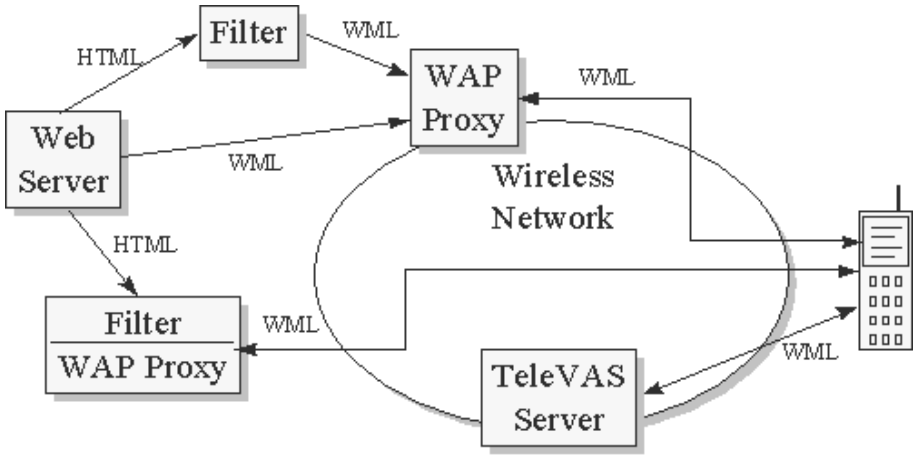
openwave

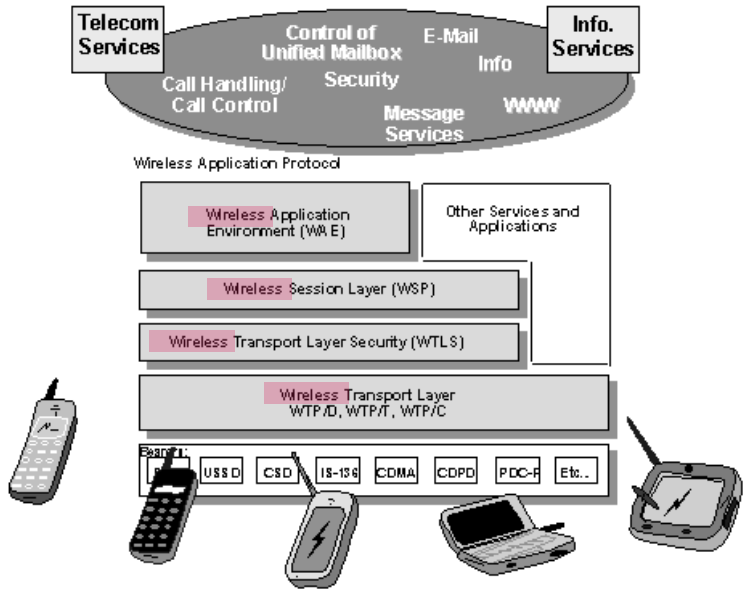
ACCESS

6. Safari browser : iPhone

WAP

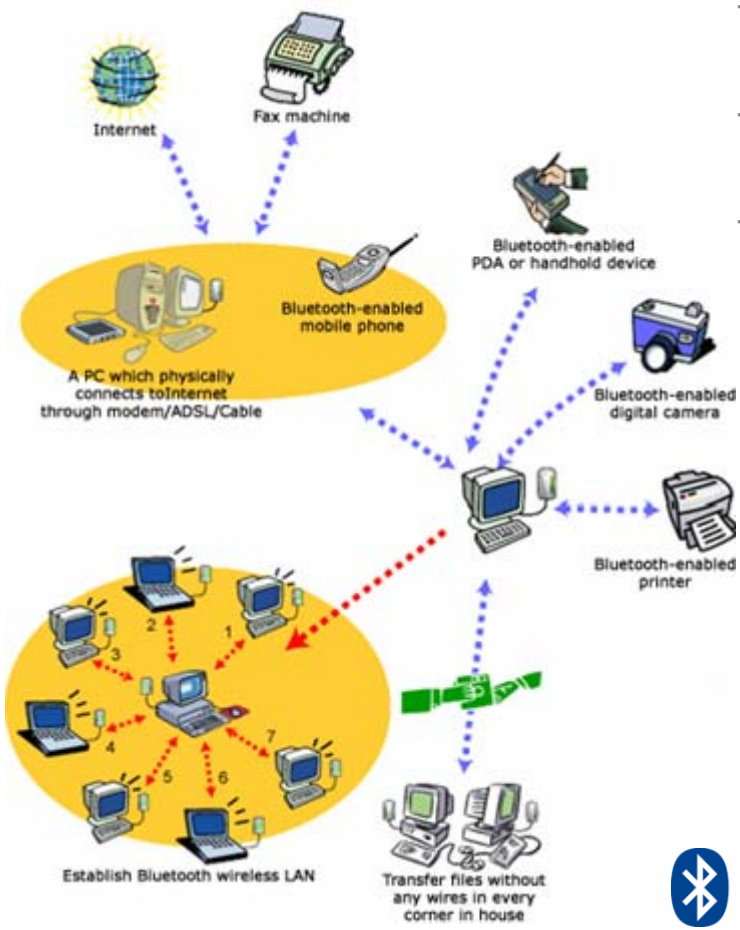
WAP (Wireless Application Protocol) is a major a breakthrough that achieves universal Internet-based information access on wireless devices. It will make it possible for developers to write once for all networks worldwide. Carriers will be able to implement gateways that work with many brands of phones and all applications and content. Handset manufactures can make high volume, low cost handsets for all carriers. - WAP (Wireless Application Protocol), Shunxing Chen & Linfeng Yang





http://www.tml.tkk.fi/Studies/Tik-110.300/1998/Essays/wap.html

Bluetooth



- Connect 2 or more devices which are in proximity
- Don't require high bandwidth
- More flexible than IrDA

Bluetooth®

Bluetooth project using processing

Bluetooth
This class provides the primary interface for discovering and establishing a Bluetooth network connection.

Bluetooth
cancel()
discover()
find()
start()
stop()

EVENT_DISCOVER_DEVICE
EVENT_DISCOVER_DEVICE_COMPLETED
EVENT_DISCOVER_SERVICE
EVENT_DISCOVER_SERVICE_COMPLETED
EVENT_CLIENT_CONNECTED

Device
Objects of this class represent nearby devices discovered on the Bluetooth network.

Device
name
address
cancel()
discover()

Service
Objects of this class represent software running on devices that can be connected to via the Bluetooth network.

Service
name
description
provider
device
connect()

Client
Client objects are used to communicate with other devices and services.

Client
read()
readBoolean()
readBytes()
readChar()
readInt()
readUTF()
skipBytes()
stop()
write()
writeBoolean()
writeChar()
writeInt()
writeUTF()

Bluetooth library for processing

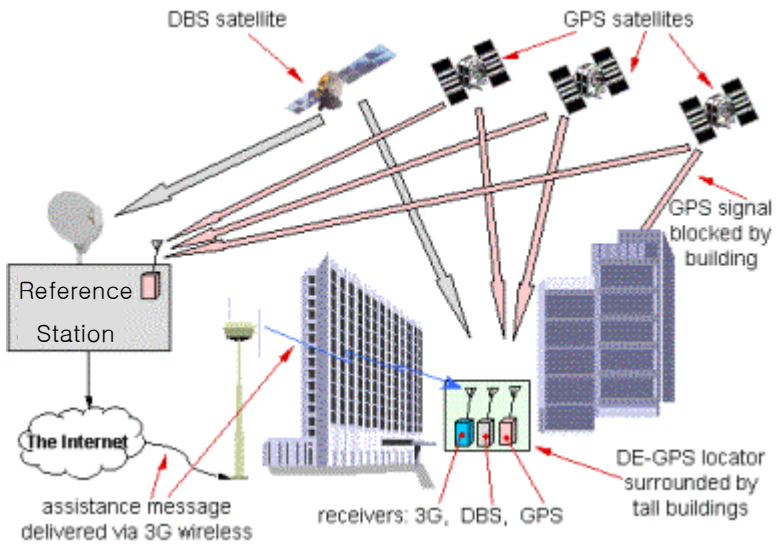
So here's "RoombaCtrl", a small Java program for your Bluetooth- and J2ME-compatible phone that works with the build-your-own Bluetooth adapter shown in the book "Hacking Roomba" or the pre-built RooTooth.

Useful Links for developer

Do-It-Yourself MIDP on Mac OS X
MPower free MIDP SDK for Mac OS X (the tutorial in the SDK is great)
Avetana Bluetooth implementation
J2ME Javadocs
Bluetooth library source code from Mobile Processing
Java APIs for Bluetooth

GPS (Global Positioning System)

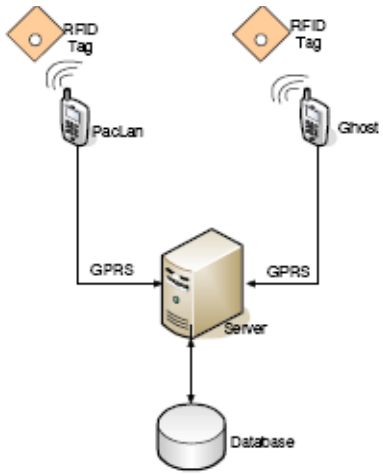
- Satellite navigation system
  > more about GPS



Experiments using mobile devices

- RFID PAC-LAN Game

Four other players take the role of the "Ghosts" who attempt to hunt down the PAC-LAN player. A Java 2 Platform Micro Edition (J2ME) application, running on a mobile phone, is connected to a central server using a General Packet Radio Service (GPRS) connection. The server relays to the PAC-LAN character his points and the position of the game.



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Experiments using mobile devices

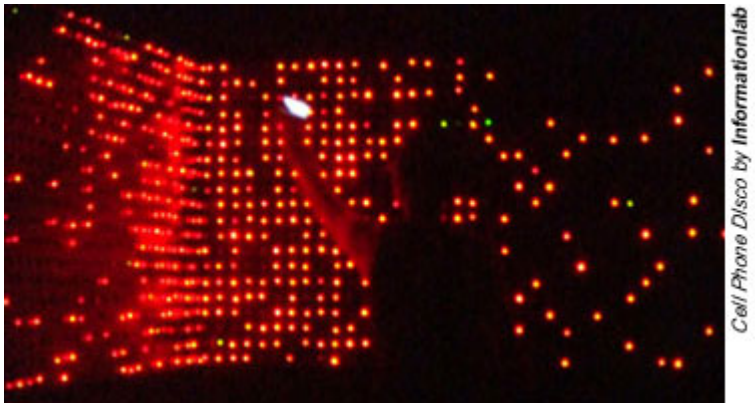
- Location Based Game project 1

We describe two games in which online participants collaborated with mobile participants on the city streets. In the first, the players were online and professional performers were on the streets. The second reversed this relationship. Analysis of these experiences yields new insights into the nature of context. We show how context is more socially than technically constructed. We show how players exploited (and resolved conflicts between) multiple indications of context including GPS, GPS error, audio talk, ambient audio, timing, local knowledge and trust. We recommend not overly relying on GPS, extensively using audio, and extending interfaces to represent GPS error.

Figure 5: the 3D city model (left) and online player's interface (right) for Bystander

Experiments using mobile devices

- CELL PHONE : Art and Mobile Phone



CELL PHONE: Art and the Mobile Phone
January 21 - April 22, 2007

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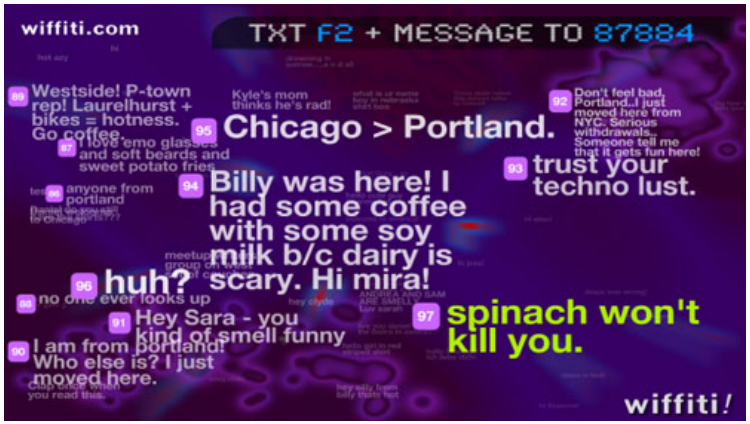
Art and the Mobile Phone explores some of the groundbreaking works that are being created by artists today using cell phone technologies. These works engage such features and technologies as camera phones, video phones, global positioning systems, Bluetooth technology, ring tone sounds, and messaging. Artistic interest in mobile phone technology lies not only in producing artworks for individual handheld devices, but in the potential of mobile phone technologies to create works that can be performative and participatory.

Experiments using mobile devices

- WIFFITI



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Wiffiti is a combination of text messaging and graffiti (wireless graffiti) which The Economist credits being starte d in Europe. Wiffiti allows a passerby to text a message to be displayed on a screen, wall, television, you name i t. Wiffiti is available in 8 locations currently, but is expected to grow. We expect most growth in wiffiti will be du e to advertiser interest, but time will tell.

Experiments using mobile devices

- Textual Healing

video >>

'Fear Fighter' is an interactive street projection. Asking the question, "What are you afraid of?" You text message your fears to the displayed number and they appear in his thoughts as he guns them down.

Experiments using mobile devices

- Colour by numbers

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1. Call +46 (0)70 57 57 807 and follow the instructions to colour the tower. The call has a time limit of 5 minutes, so that as many people as possible can get through.
2. Select the floors you wish to colour using the **buttons 0 to 9** on your phone. 0 is the topmost floor, and 9 the bottommost. Finish by pressing #. For example, if you want to colour the topmost four floors, you press 0123#. The colours on these floors are now controlled at the same time.
3. Colour the selected floors. Use the number buttons on your phone to mix red, green and blue until you get the colour you want.