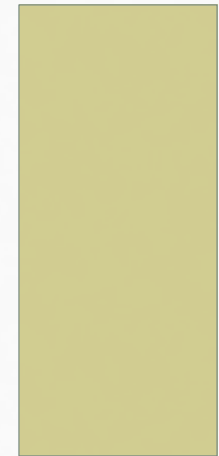


WAP, XHTML AND ANDROID

University Carlos III of Madrid
Service Engineering Laboratory

Jaume Barceló
Antonio de la Oliva
Ruben cuevas
Ignacio soto





BACK IN 1999,

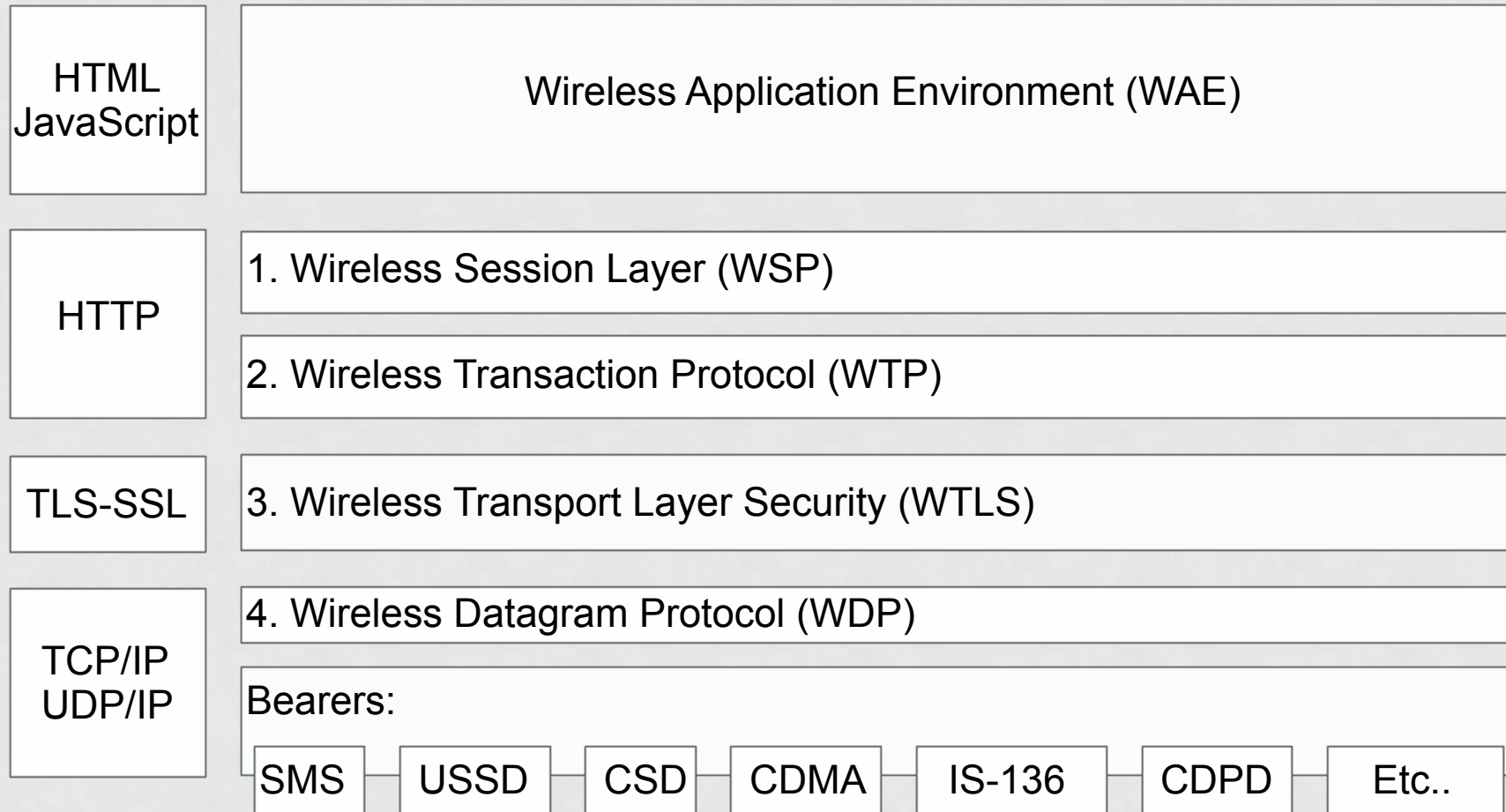
- Mobile and Internet communications were separate worlds
 - Nokia 7110, first mobile phone with a WAP browser.
 - WAP: Wireless Application Protocol.
 - Extra-simplified access to the Internet, due to terminal limitations and limited available bandwidth.

SMALL LIMITATIONS,

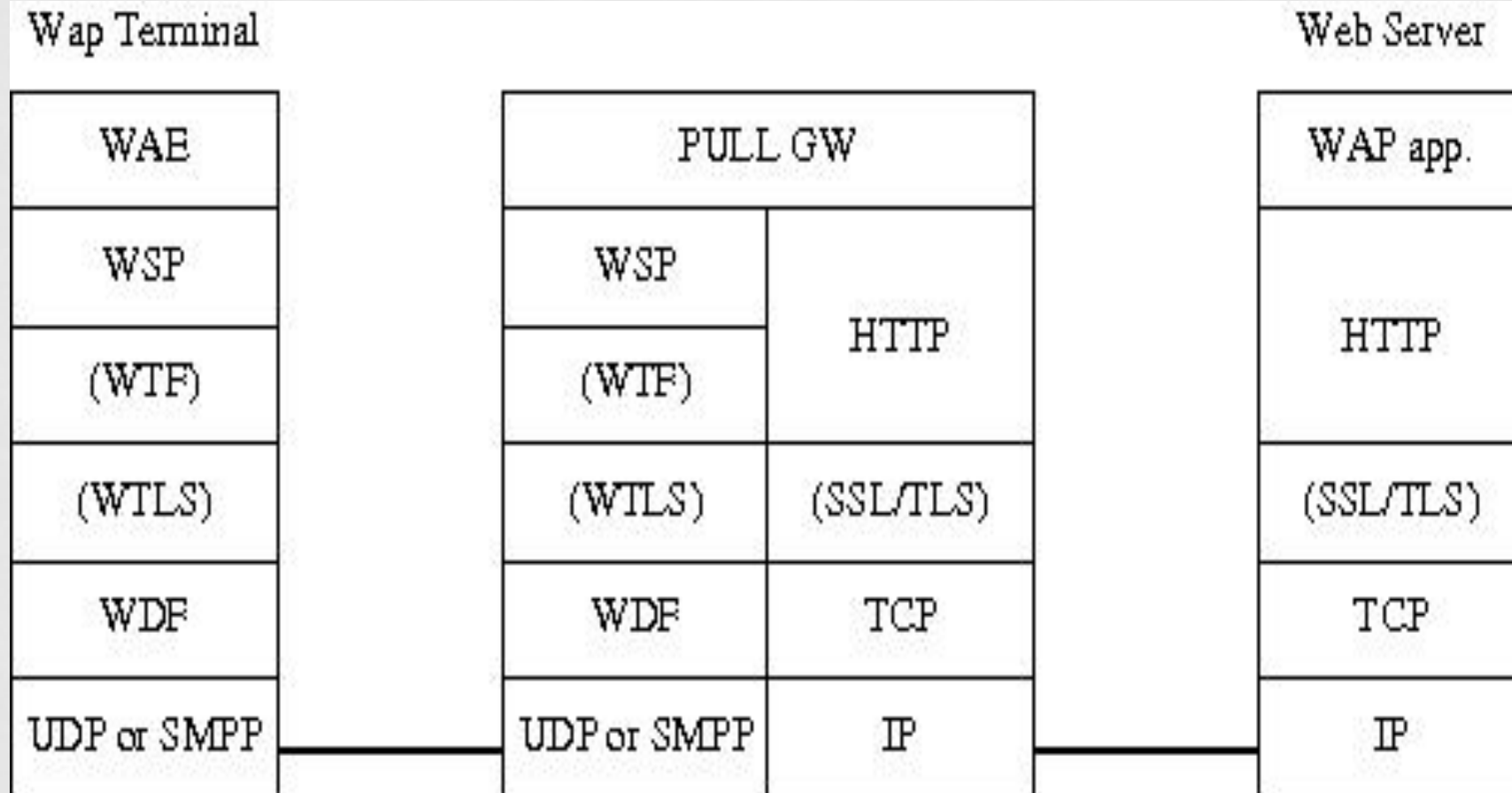
- Extremely limited bandwidth
 - SMS
 - Circuit-switching
 - Wait-and-pay
- A substantial increase thanks to GPRS (2.5G) ~ 56kbps
- Memory and processor limitations
- Low resolution monochrome screen
- No mouse, 15-keys keyboard

WAP PROTOCOL STACK

Internet Protocol Stack



A GW WAS REQUIRED



WIRELESS APPLICATION ENVIRONMENT

- In WAP 1.X
- Wireless Markup Language (WML)
- Relies on a card/desk paradigm
- WMLScript

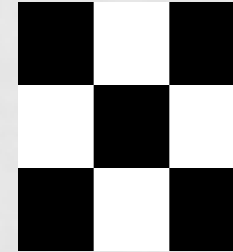
WML EXAMPLE

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
  <card id="card1" title="Tutorial">
    <do type="accept" label="Answer">
      <go href="#card2"/>
    </do>
    <p><select name="name">
      <option value="HTML">HTML Tutorial</option>
      <option value="XML">XML Tutorial</option>
      <option value="WAP">WAP Tutorial</option>
    </select></p>
  </card>
  <card id="card2" title="Answer">
    <p>You selected: $(name)</p>
  </card>
</wml>
```

WIRELESS BITMAP

- A very simple raw monochrome image format WBMP.
- Example from Wikipedia

The 3x3 bitmap:



becomes

Octet 1: 00000000 (WBMP type)

Octet 2: 00000000 (Fixed header)

Octet 3: 00000011 (Width) = 3

Octet 4: 00000011 (Height) = 3

Octet 5-7: 3 bits for data then Padding (8-3=5)

Octet 5: 010 00000 (Row 1)

Octet 6: 101 00000 (Row 2)

Octet 7: 010 00000 (Row 3)

WTAI

- Wireless Telephony Application Interface
- Allows access to some telephony functions (calls, contacts, calendar ...)

```
<card id="cM" title="MY_DOMAIN.com">  
  <p>  
    <b>Call A Taxi:</b><br />  
    <a href="wtai://wp/mc;%2B19035551212">903-555-1212</a>  
  </p>  
</card>
```

WAP PUSH

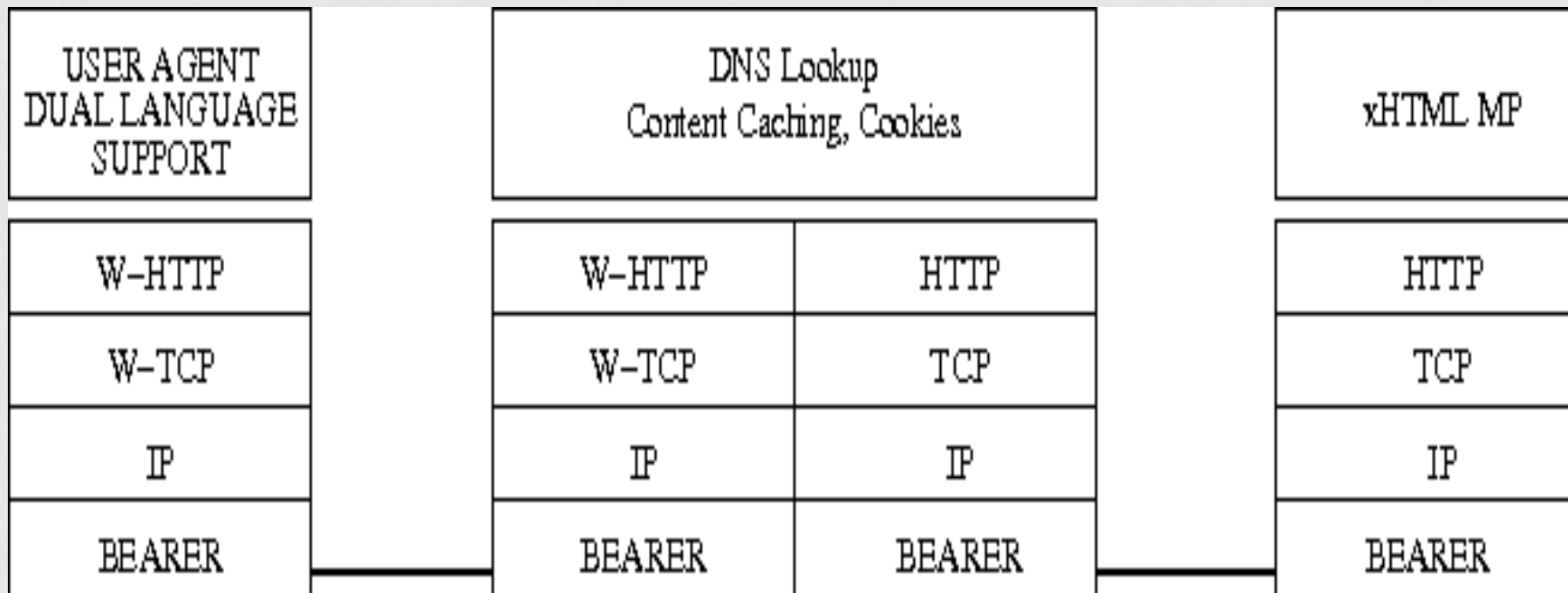
- Server initiated transaction
 - This option may save radio resources in applications in which the phone is waiting for a given event.
 - WAP push is sent over SMS
 - In practice, it has been widely used for advertising purposes.

WAP 2.0

- Several improvements
 - Support for Internet protocols
 - MMS
 - Xhtml
 - Color images
 - User Agent profile

A GW CAN BE USED TO IMPROVE PERFORMANCE

- Performance Enhancing Proxy



WAE

- Wireless Application Environment
 - WAP 2.0
 - Xtensible Hypertext Markup Language/Mobile Profile (XHTML/MP)
 - Cascading Style Sheets (CSS)
 - Similar to web development
 - Control on color, font face, etc.

XHTML/MOBILE PROFILE

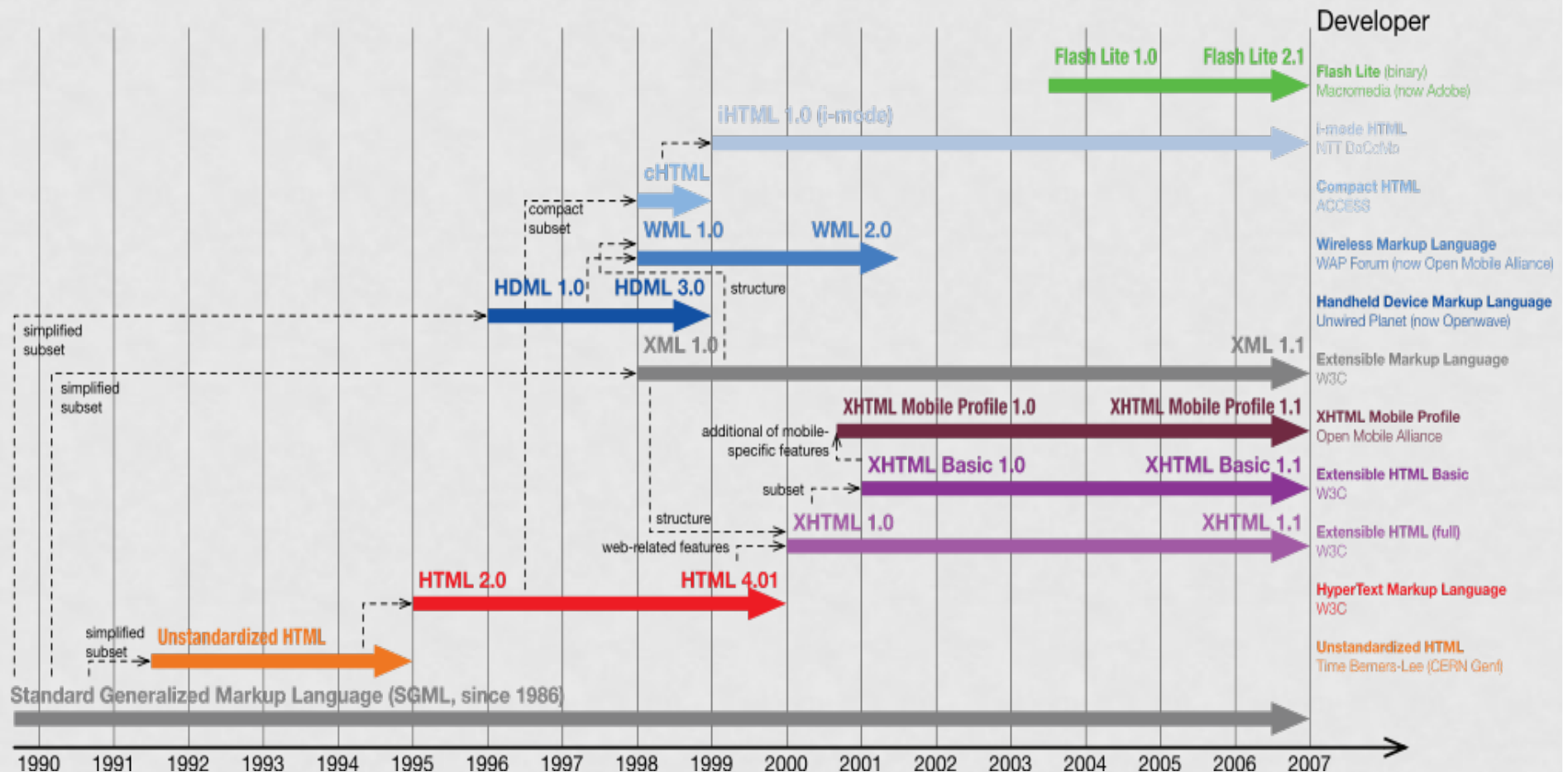
```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//WAPFORUM//DTD XHTML Mobile 1.1//EN"
"http://www.openmobilealliance.org/tech/DTD/xhtml-mobile11.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en">
  <head>
    <title>Hello</title>
  </head>
  <body>
    <p>Hello <a href="http://example.org/">world</a>.</p>
  </body>
</html>
```

XHTML/MP

- Features
 - WTAI is no longer available
 - It is an extension of xhtml and thus it is xml valid
 - Defined by the open mobile alliance
 - Each document must specify which xhtml/mp version is used

LANGUAGES FOR THE MOBILE WEB

Evolution of Mobile Web-Related Markup Languages

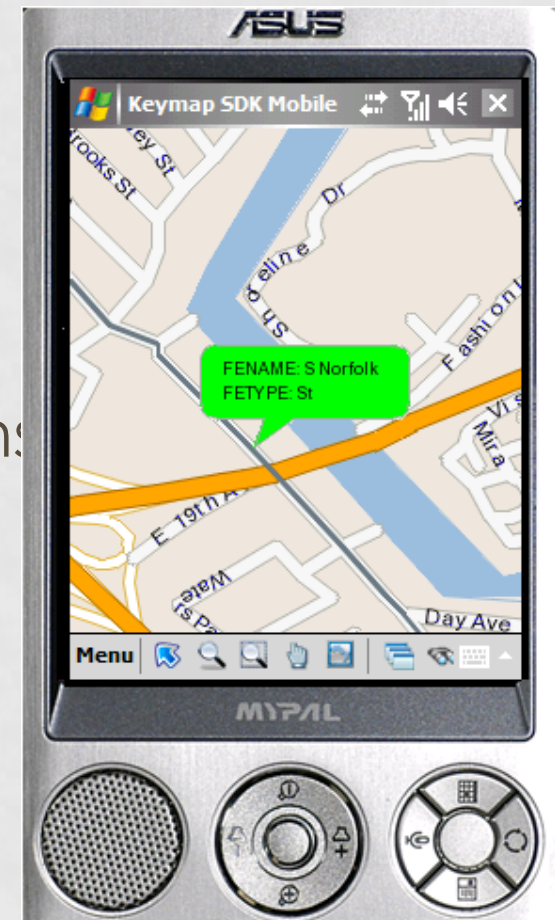


WHEN WAP WAS INITIALLY LAUNCHED

- It came short to the user's expectations
 - It was marketed as Internet in your handheld device. But the user experience was completely different to computer-based web browsing.
 - Operators tried to keep the users in their own walled garden. Vodafone Live, e-mocion.
 - Lack of “Killer-Apps”
 - Device heterogeneity hindered content development.
 - Prices were high and users were charged for connection time (and the service was slow).

THE MOBILE INTERNET IS BECOMING MORE POPULAR

- More 'powerful' devices (memory, processor, etc.)
- Large touchscreens
- 'More' bandwidth
- 'Flat' rates
- A myriad of contents and applications (some of them are useful)
- User friendly design
- Walk a mile in your user's shoes



HIGH EXPECTATIONS

- For mobile devices. As a users we want
 - Telephony and short messaging services
 - Internet browsing
 - Mobile applications such as
 - GPS navigation
 - Videogames
 - Spreadsheets
 - And any application we can imagine (and code).
- Mobile phones are our hand-held computers.

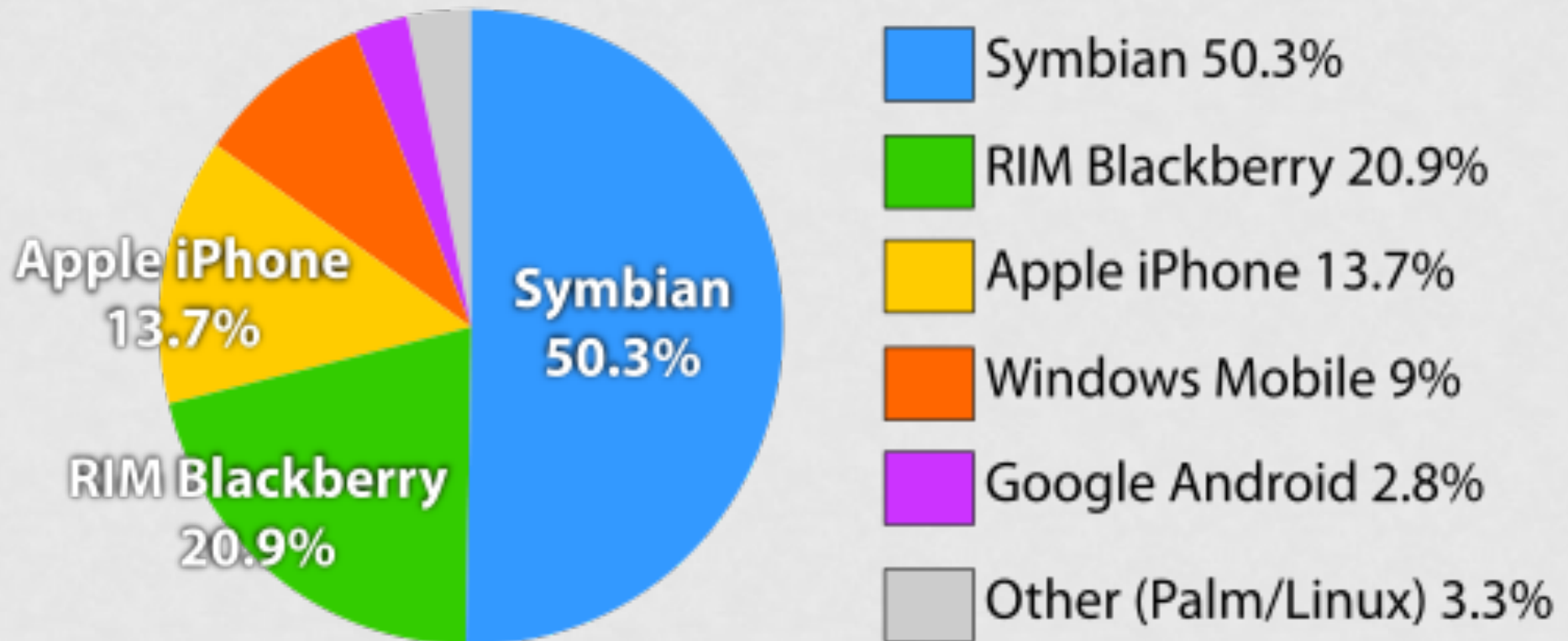
WHAT'S ANDROID?

- A mobile operative system
- It relies on a linux kernel
- A java development environment is available to program applications.
- A large fraction of Android has been released as open source code.
- There is a large application market.
- We can develop in Mac/Windows/Linux

The Android logo, consisting of the word "ANDROID" in a stylized, blue, sans-serif font. The letters are bold and have a slight shadow effect, giving it a three-dimensional appearance.

OTHER MOBILE OS

Global Smartphone Sales, Q2 2009



HISTORY

- Android was created by a start-up in Palo Alto
- Google buys Android in 2005
- Android becomes an Open Handset Alliance product in 2007
- The OHA includes
 - Software and Internet companies
 - Mobile operators
 - Mobile devices manufacturers
 - Semiconductors companies

ANDROID DEVELOPMENT

The image shows the Eclipse IDE interface for Android development. The main editor displays the following Java code:

```
package com.example.helloandroid;  
  
import android.app.Activity;  
  
public class HelloAndroid extends Activity {  
    /** Called when the activity is first created. */  
    @Override  
    public void onCreate(Bundle savedInstanceState) {  
        super.onCreate(savedInstanceState);  
  
        setContentView(R.layout.main);  
    }  
}
```

The Package Explorer on the left shows the project structure:

- ControlComidas
- Encuentrame
- HelloAndroid
 - src
 - com.example.helloandroid
 - HelloAndroid.java
 - gen [Generated Java Files]
 - Android 2.1
 - assets
 - res
 - AndroidManifest.xml
 - default.properties
 - HttpDownload
 - MessageList
 - OpenScreen
 - sudoku

The Task List on the right shows a task for the HelloAndroid class:

Property	Value
Info	false
Info	true
Info	April 6, 2011
Info	false
Info	/home/jt
Info	HelloAn
Info	/HelloAr
Info	394 byte

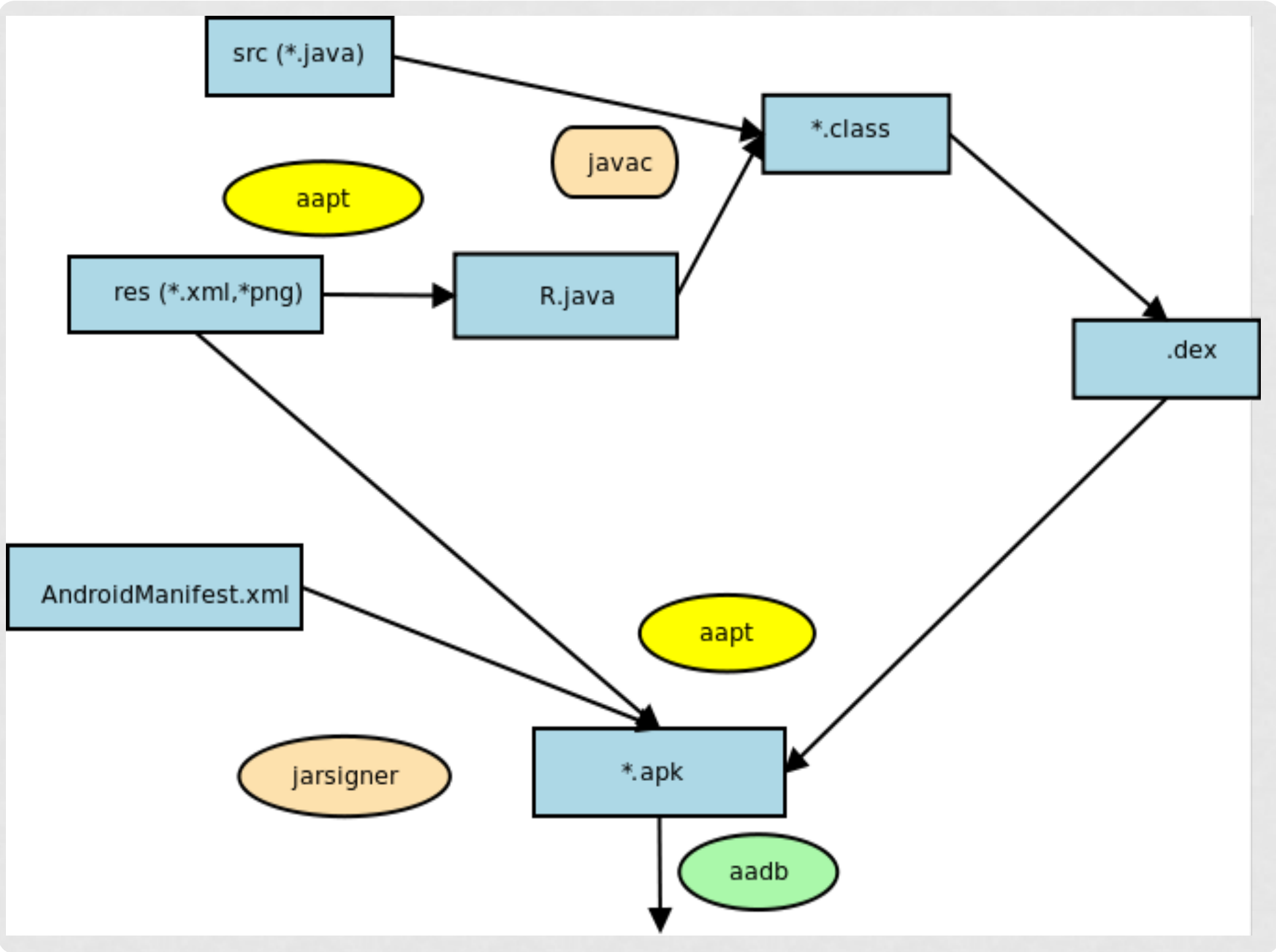
The Outline on the right shows the class structure:

- com.example.helloar
- import declarations
- HelloAndroid
 - onCreate(Bundle)

The Android emulator window (5554:my_avd) is overlaid on the code, showing a black screen with the text "A N D R O I D _" and a virtual keypad and navigation controls.

ANDROID DEVELOPMENT TOOL

- Android development kit is free
- Java SDK
- Android SDK
- (optional) Eclipse plugin with ADT



Applications

Home

Contacts

Phone

Browser

...

Application Framework

Activity
Manager

Window
Manager

Content
Providers

View
System

Package
Manager

Telephony
Manager

Resource
Manager

Location
Manager

Notification
Manager

Libraries

Surface
Manager

Media
Framework

SQLite

OpenGL | ES

FreeType

WebKit

SGL

SSL

Libc

Android Runtime

Libraries Core

Dalvik Virtual
Machine

Linux Kernel

Display
Driver

Camera
Driver

Flash Memory
Driver

Binder (IPC)
Driver

Keypad
Driver

WiFi
Driver

Audio
Driver

Power
Management

ANDROID PLATFORM

- Layered architecture
 - Applications run in separate Dalvik virtual machines.
 - Applications run as different linux users.
 - Hardware is presented through the abstraction layer of the OS.
 - Applications require permission to reach the hw and other applications.
 - When we install a new app, it will ask for permission to access the camera, wireless connection, etc.
 - If an app crashes, the phone OS and the remaining applications keep running.

APPLICATIONS

- Android comes with a large number of applications.
 - E-mail client
 - Sms
 - Calendar
 - Maps
 - Web browser
 - Contacts
- These apps are written in Java.
- You will create a new app throughout the course.

APPLICATION FRAMEWORK

- The architecture allows for apps to publish their abilities so that other apps can reuse them.
 - Views: buttons, text boxes, lists, ...
 - Content providers: to share data with other apps.
 - Resource manager: manages resources such as images or localized strings.
 - Notification manager: to show alerts in the status bar.
 - Activity manager: takes care of the app life cycle.

LIBRARIES

- System C library
- Media Libraries (mpeg,mp3,jpg,png...)
- Surface manager (display)
- LibWebCore (web browser engine)
- SGL (2D graphics)
- 3D libraries
- FreeType (font rendering)
- SQLite (database engine)

ANDROID RUNTIME

- Libraries that offer functionality that is **similar** to the java core libraries.
- Each application is an independent process running in its own DVM.
- A device can efficiently run multiple DVM simultaneously.
- Classes are stored in a .dex format which is different from java bytecode.

LINUX KERNEL 2.6

- Security
- Memory management
- Process management
- Network protocol stack
- Drivers

APPLICATION COMPONENTS

- An application is made of four different kinds of components
 - Activities: user interface
 - Services: run in background
 - Broadcast receivers: run a response to a given event.
 - Content providers: data interchange with other apps.

APPLICATION COMPONENTS

- There is no “main” component. We must specify in the manifest which is the component that is launched when the app starts.
- We can reuse components from another app. In this case we call directly the component and we can skip the initial component as defined in the manifest.

ACTIVITIES

- An activity is something that the user can do such as
 - Choose a picture from a set.
 - Write text for a message.
 - Choose a recipient for a message.
 - An activity has a graphical interface, either a window or all the screen.

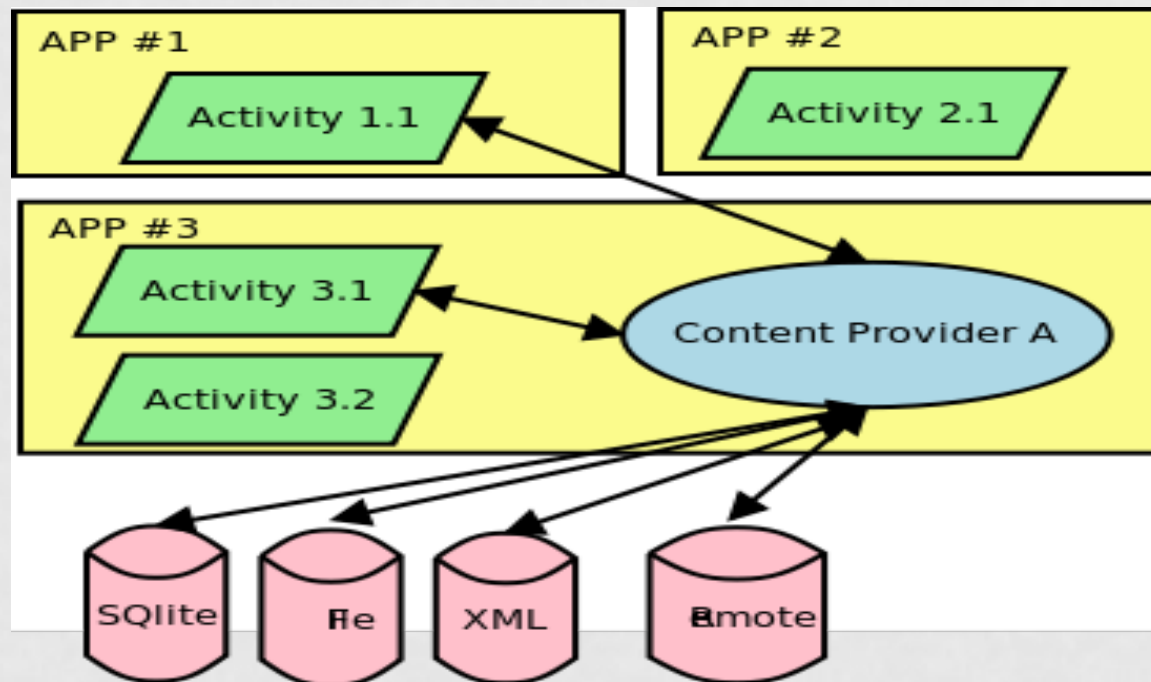
SERVICE

- Its a component that does not require user interaction, such as ...
 - Playing background music.
 - It is possible to connect with a service from an activity.
 - A typical example would be skipping a song from a playlist.

BROADCAST RECEIVERS

- They are used to collect event notifications such as
 - ...
 - The click of a button
 - Low battery alarm
 - Time zone change
 - An application can also send notifications. As an example, a given application can notify that a file download is completed.

CONTENT PROVIDER



ANDROIDMANIFEST.XML

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.example.helloandroid"
    android:versionCode="1"
    android:versionName="1.0">
    <application android:icon="@drawable/icon" android:label="@string/app_name">
        <activity android:name=".HelloAndroid"
            android:label="@string/app_name">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>

    </application>
    <uses-sdk android:minSdkVersion="2" />

</manifest>
```

SOME THOUGHTS

- For many people, the phone is the only computer available.
- And also the only window to the Internet
- The (r)evolution that we have discussed today has several implications that extend far beyond the technical focus of the course.

SUMMARY

- During the last decade, mobile Internet has become a reality.
- Our phone is our most personal computer.
- The best mobile services are still to be conceived. In fact, you are the ones that gonna invent and code them.

IMAGES CREDITS

- Some of the images used in these slides are released under a license that requires attribution.
- Nokia 7110
 - Original photo by Falense, Gimpshopped by OpSPin
 - Permission GFD
- Diagram Android Developers
 - Author: Alvaro Fuentes (Kronox)
 - Permission CC-BY-SA
- Standards Evolution
 - Author: Matthew Stuckwisch
 - Permission CC-BY-3.0
- Smartphone Market Share
 - Author: Lester
 - Permission: CC-BY-SA-3.0