Windows Embedded Compact

Android

Linux Embedded

Texas Instruments TechCampus, München July 6th 2011

Valter Minute, Windows Embedded MVP, Embedded Software Expert, Adeneo Embedded

Adeneo Embedded

OUR TEAM

50+ engineering team - experts in system integration on complex embedded devices

Engineering offices in Europe and USA

OUR PARENT COMPANY

Subsidiary of Adetel Group
a 600 employees company involved in complete embedded systems development

OUR EXPERTISE with TI technologies

Expertise for WinCE and Embedded Linux system integration on OMAP and DaVinci architectures

1st European company awarded as "Elite Design House" by Texas Instruments

Editor of the WinCE reference BSPs for TI OMAP and Sitara – reference drivers for WL1271

Consumer

Medical

Industrial

Automotive

Microsoft GOLD CERTIFIED Partner

Powered by Microsoft Silverlight

Excellence Awards 2007 - 2008 - 2009 — Windows Embedded Gold Partner

System Integrator Training Partner — Of the year

Texas Instruments Design House Network

TI Third Party Network Member — DSP — Texas Instruments

Texas Instruments

Adeneo Embedded

Adeneo Services

Evaluation

- Scheduled Trainings
- Private Class Training
- Benchmarking
- Feasibility Study / Proof of Concept

The Evaluation Kit used is offered for FREE at the end of the session ($1,495 value)

Get a jumpstart on learning how to implement either WinCE or Embedded Linux on an OMAP35x-based platform

Architecture

- System Architecture Consulting
- Design Review
- Reference BSPs and Drivers with Maintenance and Support
- Expertise on System Integration and Wireless communications

Direct collaboration with TI to ensure technical expertise & support to embedded system manufacturers

OMAP/Sitara Reference BSPs to secure design robustness
Wifi/Bluetooth Drivers for WL1271 Wireless module

Design

- Support Contract
- Turnkey HW/SW design
- Firmware Expertise
- Application Development

Benefit from our 10+ years of expertise to optimize cost and schedule

Be flexible with our set of services from support contract to complete turnkey design

Adeneo Expertise

Application Development

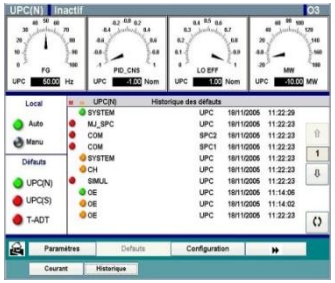
- Multimedia
- Custom GUI
  - *Silverlight*
  - *.NET Compact Framework*
  - *Qt Embedded*
- Real-time
- Data management
- Geo-localisation GPS
- Middleware
- Custom shells / Firmware update

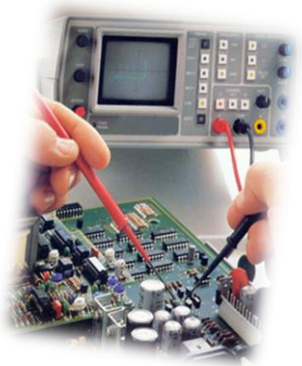
Firmware Expertise

- BSP Adaptation and customization for OMAP/Sitara based designs
- Wireless communication with WL1271 based solutions
- Custom drivers development
- OS optimization
  - *power management*
  - *boot duration*
  - *real-time performances*
  - *…*

Hardware Development

- Collaboration with a team of 100+ hardware design engineers from AdetelGroup
- Full turnkey hardware and software design
- Collaboration with TI both on the hardware side and the OS system integration





Agenda

- Windows Embedded Compact 7 & Silverlight for Windows Embedded
- Android
- QT & Linux Embedded

Windows Embedded Compact 7

Windows Embedded

Windows Embedded Compact

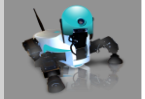

Portable media


Consumer


Thin Client


Industrial Automation


Telematics


Robotics

Windows Embedded Automotive 7

SYNC

Windows Embedded Handheld

Windows Embedded Enterprise

Windows XP Professional

Windows Vista

Windows 7


Kiosks


Entertainment

Windows Embedded Standard


Entertainment


Medical


Industrial Automation


Thin Client

Windows Embedded POSReady


Point of Service


Kiosks

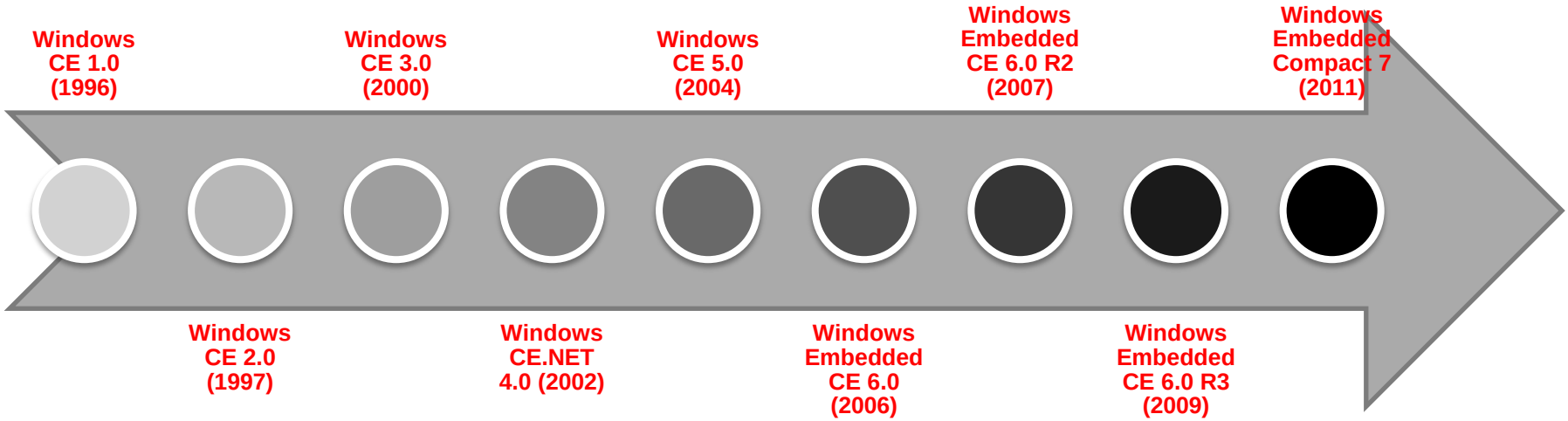
Windows Embedded Server

Server appliances

Texas Instruments

Adeneo Embedded

History


Windows CE 1.0 (1996)
Windows CE 2.0 (1997)
Windows CE 3.0 (2000)
Windows CE.NET 4.0 (2002)
Windows CE 5.0 (2004)
Windows Embedded CE 6.0 (2006)
Windows Embedded CE 6.0 R2 (2007)
Windows Embedded CE 6.0 R3 (2009)
Windows Embedded Compact 7 (2011)

OS Features

- **Multi-platform**
  - **X86, ARM, MIPS**
- **Hard real-time**
- **Win32 compatible API**
- **Designed to run on low power devices**
- **Componentizable**

OS Features

- Multi-process and multi-thread
- Networking
- Graphical user interface
- Multimedia
- Internet connectivity

Compact 7 New Features

- Multi-core support
- 3GB of addressable memory
- Support for ARMv5, ARMv6 and ARMv7
- Silverlight for Windows Embedded tools
- Multi-Touch
- Windows Compositor
- Updated browser
- DLNA

Real Time

- Up to 32K processes
- Infinite Threads
- 256 Priorities
- 1ms System Tick
- Low latencies
- Deterministic

Shared Source

- The full source code of the Windows Embedded Compact 7 kernel is available
- Sample BSPs and Drivers are provided in source format and can be modified and redistributed
- Source code is available only in licensed version
- Additional source code access is provided to MVPs, Gold partners and universities

Platform Builder

- Tool used to configure and debug the OS
- Visual Studio 2008 plug-in.
- Components can be selected from a Catalog
- Development and debugging inside the Visual Studio IDE
- Kernel debugger

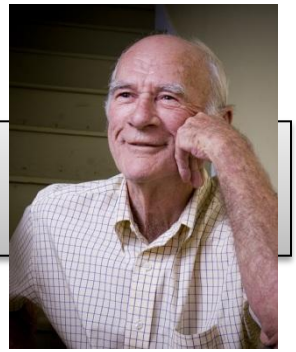
Platform Builder

Application Development

Native

- Allows access to all the OS features trough the APIs
- Allows Real-Time applications development
- Can provide a rich UI using Silverlight for Windows Embedded

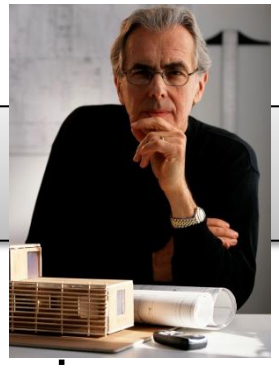
Managed



- Provides Rapid Application Development capabilities
- Provides a rich Windows-Forms based UI
- Provides a solid class library to access most of the features of the OS

Silverlight for Windows Embedded

Designer



- Knows how to design a simple and beautiful UI
- Don’t care about the complexity of source code
- Wants to control the way the UI behaves in the final application

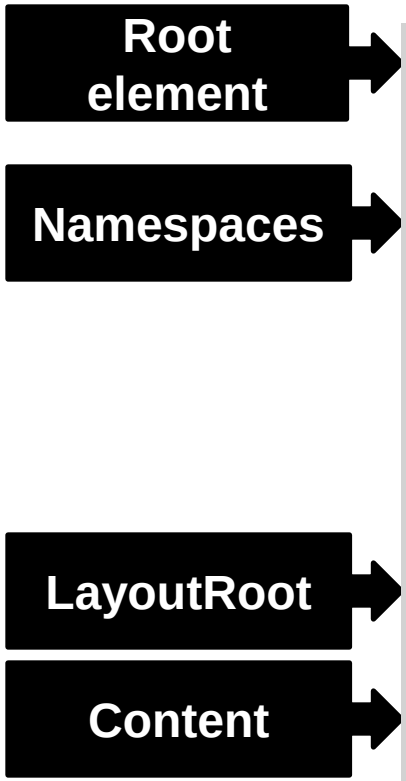
Developer

- Knows how to develop application code, leveraging all the features of the OS
- Don’t like to waste time coding animations and other UI-related stuff
- Wants to integrate the UI with minimal effort

XAML!

- Designers and developers must share a common language
- XAML is a XML-based language that can be used to describe application user interfaces
- XAML can be edited using graphical tools (Expression Blend)
- XAML can be easily integrated into applications

XAML Sample




```
<UserControl
   xmlns="http://schemas.microsoft.com/winfx/200
   6/xaml/presentation"
   xmlns:x="http://schemas.microsoft.com/winfx/2
   006/xaml"
   x:Class="WindowsEmbeddedSilverlightApplicatio
   n1.MainPage"
   Width="640" Height="480">
   <Grid x:Name="LayoutRoot" Background="White">
       <Button x:Name="mybutton"
       Margin="204,167,263,226"
       Click="Button_Click"/>
   </Grid>
</UserControl>
```

Expression Blend

Microsoft XAML-based technologies

- Windows Presentation Foundation (WPF)
- Silverlight
- Silverlight for Windows Phone 7
- Silverlight for Windows Embedded
- Similar concepts, different (and not 100% compatible!) implementations

Windows Presentation Foundation

- WPF can be used to develop local user interfaces for managed applications on Windows XP, Windows Vista and Windows 7
- It provides 2D and 3D rendering capabilities using DirectDraw and Direct3D
- Large feature set, biggest footprint

Silverlight

- Silverlight can be used to develop in-browser applications on Windows and Mac-OSX platforms
- It provides support for 2D graphics and managed code development
- It provides support for running applications offline using local storage, but require a browser to run

Silverlight on Windows Phone 7

- Provides support for developing managed applications for Windows Phone 7 smartphones
- Applications can be downloaded from the Windows Phone Marketplace
- No interop support and no support for interfacing native code (“sandbox”)

Windows® phone

Silverlight for Windows Embedded

- Provides support for native application development on embedded devices running Windows CE 6.0 R3 or Windows Embedded Compact 7
- Provides support for hardware acceleration.
- Can be used to customize the user interface of operating system components

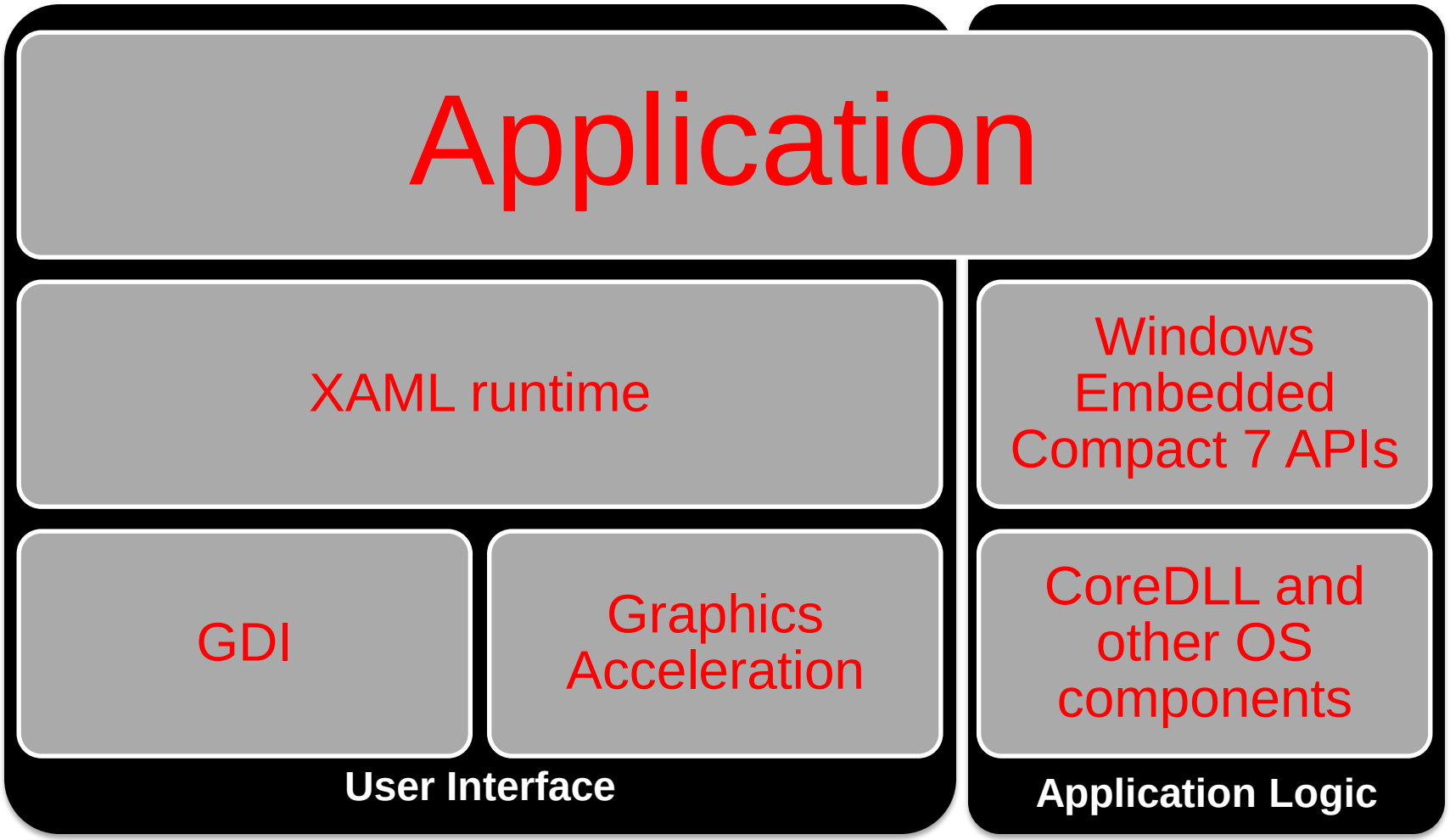
Comparison

	WPF	Silverlight	WP7	Silverlight for Windows Embedded
Local application user interface	●	limited	●	●
In-browser applications		●		
3D support	●			
Managed code support	●	●	●	
Native code support				●
Access to OS features	●	limited		●
Hardware acceleration	●			●
Marketplace			●	
Visual Studio Version	2010	2010	2010	2008

Windows Embedded Silverlight Tools

- Expression Blend Plugin
- Wizard for project creation as Platform Builder subproject and Visual Studio application
- Automatic update of source code to reflect XAML modifications

XAML Runtime



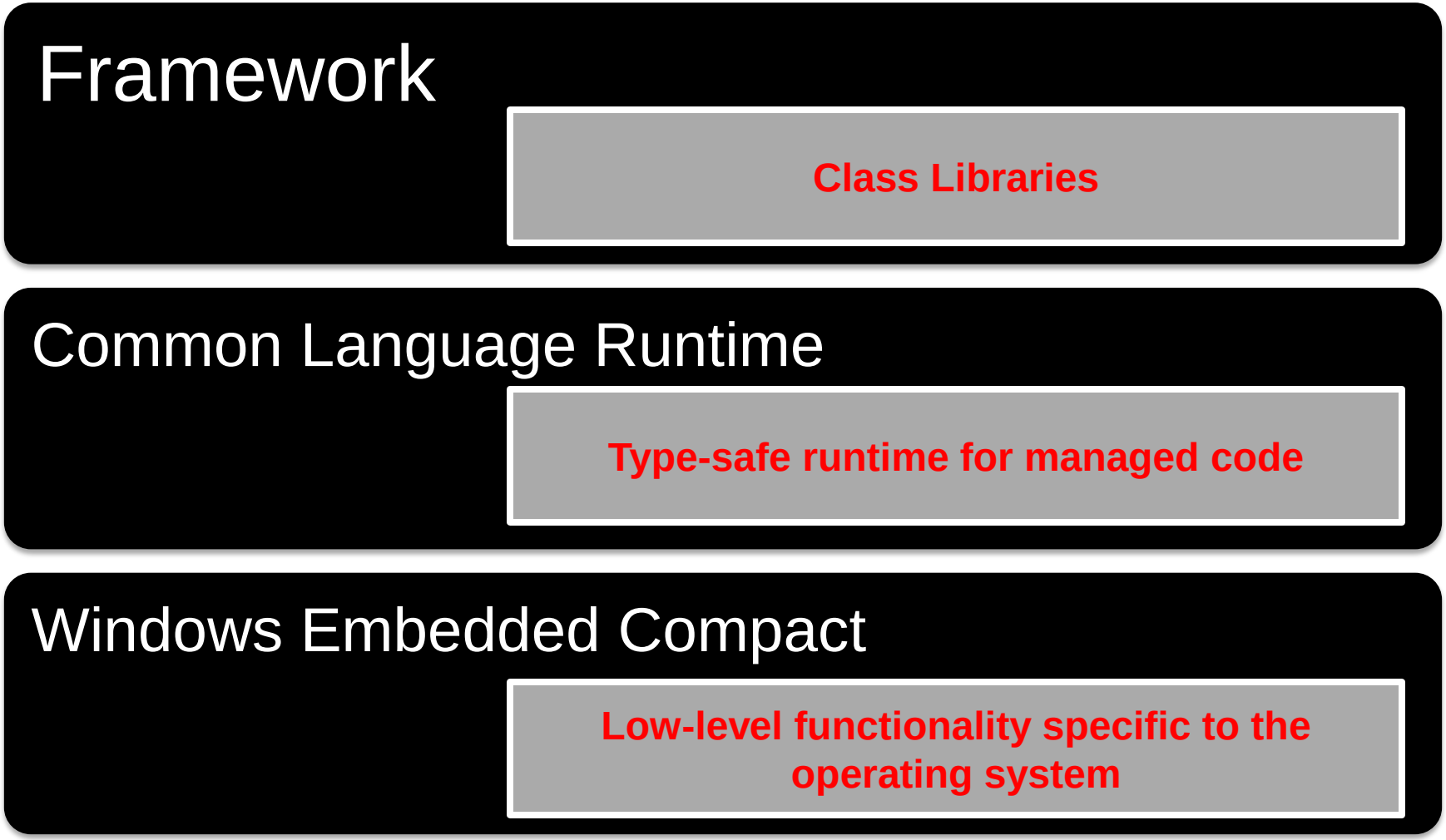
Silverlight for Windows Embedded

DEMO

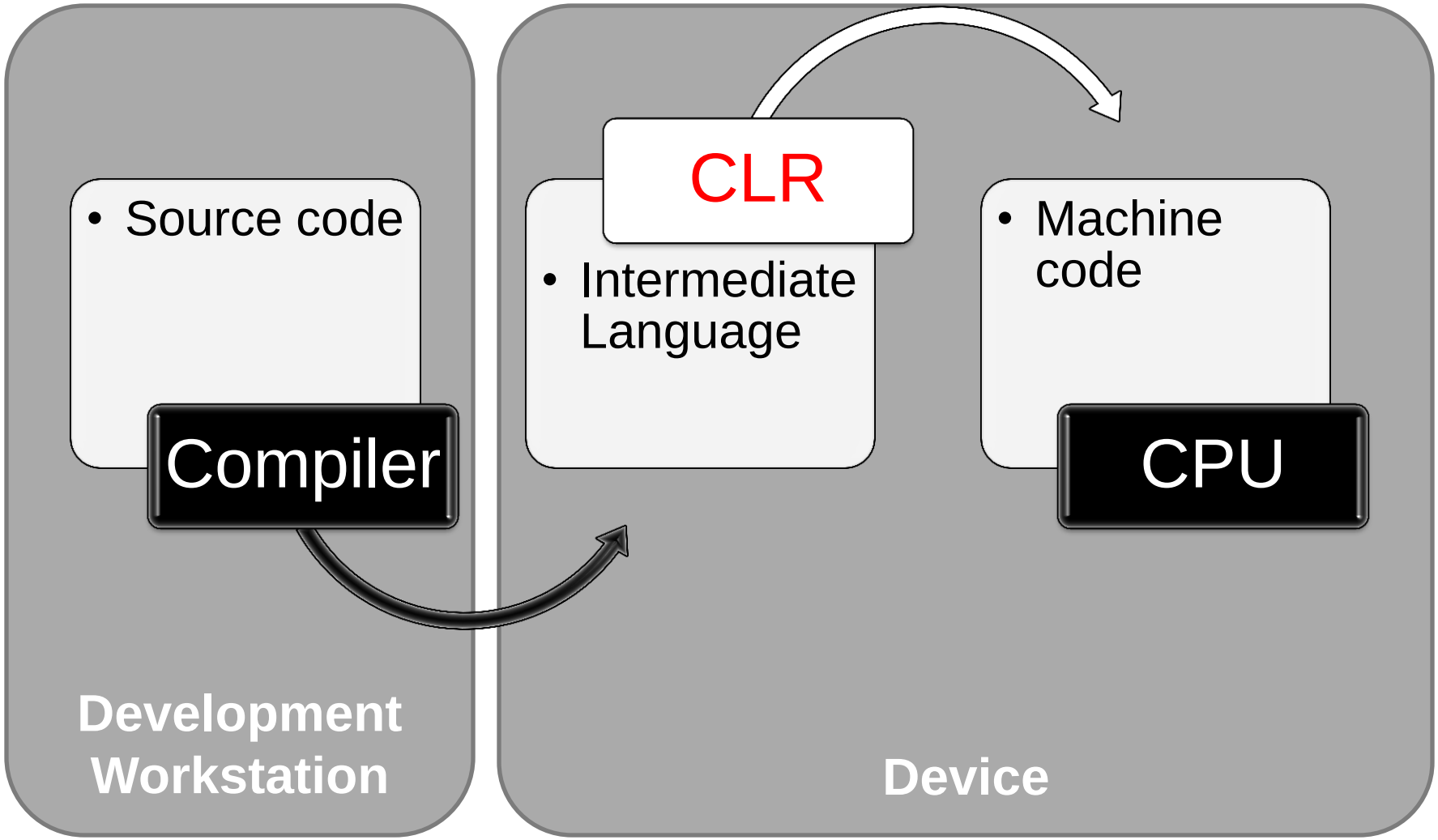
Managed Application Development

- Support for Compact Framework 3.5
- Compatibility with desktop versions of the framework
- Visual Studio 2008 can be used for UI design and application development
- Easy access to XML data, databases etc.
- Lacks WPF support

Compact Framework Architecture



Source Code to Machine Code



.NET Compact Framework

DEMO

Android

Android

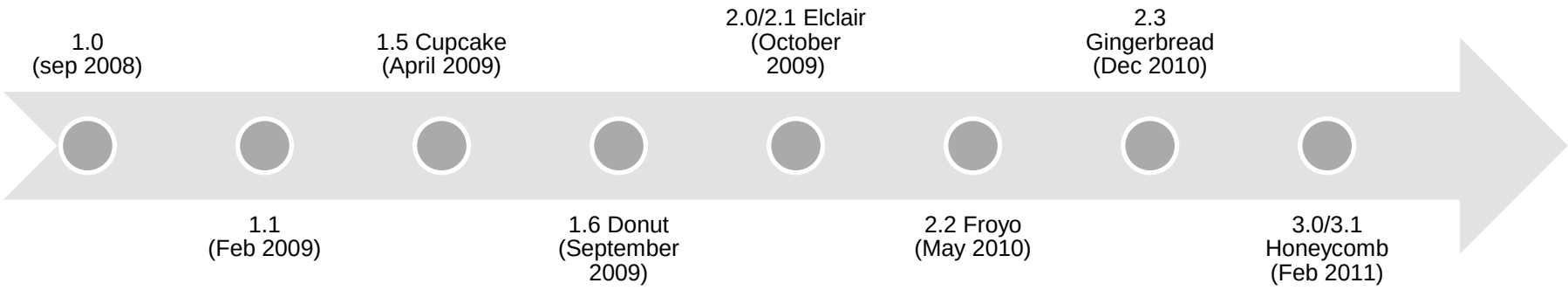
"Android is an operating system for mobile devices such as cellular phones, tablet computers and netbooks."

(Wikipedia 2010)

"Android is a software stack for mobile devices that includes an operating system, middleware and key applications."

(Wikipedia 2011)

Android Versions



- Ice Cream Sandwich (announced at 2011 Google I/O) should merge Gingerbread and Honeycomb and is planned for Q4 2011

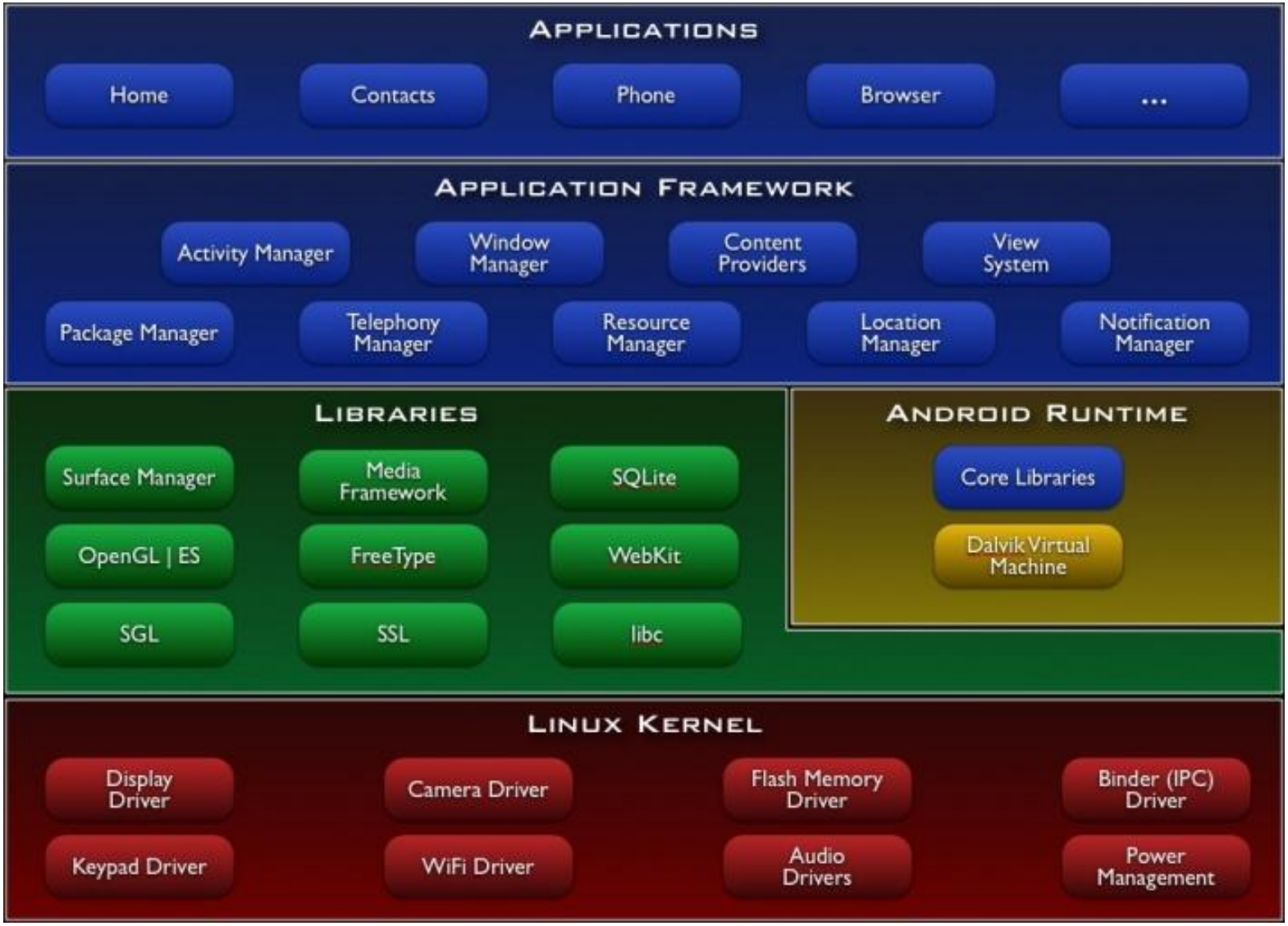
Android is Linux?

- Android is based on the Linux kernel
- Includes some architecture changes in the kernel (security, power management...)
- Does not support the full set of GNU libraries (bionic is used as C library)
- Provides a java-based API for application development that is currently not supported on Linux

Android Components License

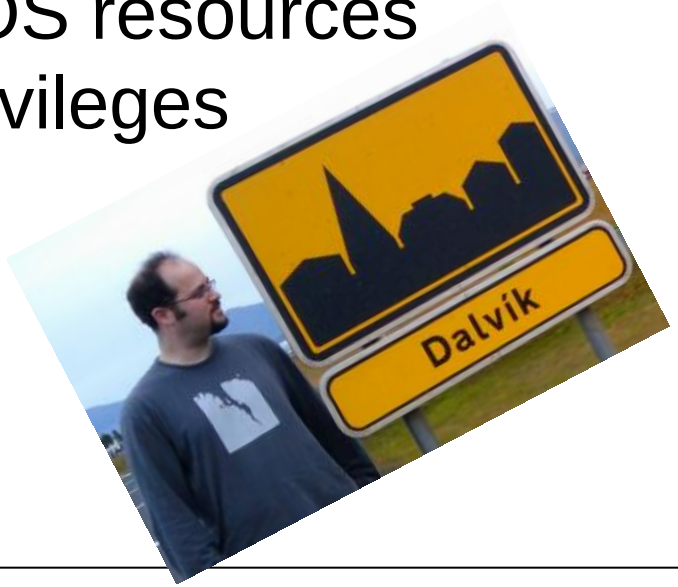
- The kernel is released under GPLv2, Android-specific code is available but is not merged in the mainline kernel
- Bionic, the Dalvik virtual machine and other Android key components are released under the Apache Software License 2.0

Android Architecture



Dalvik

- Open source virtual machine
- Indipendent from Sun/Oracle implementation
- Just in time compiler since version 2.2
- Does not run standard Java bytecode
- Provides a VM instance for each application and manages limited access to OS resources depending on application privileges



The Android SDK

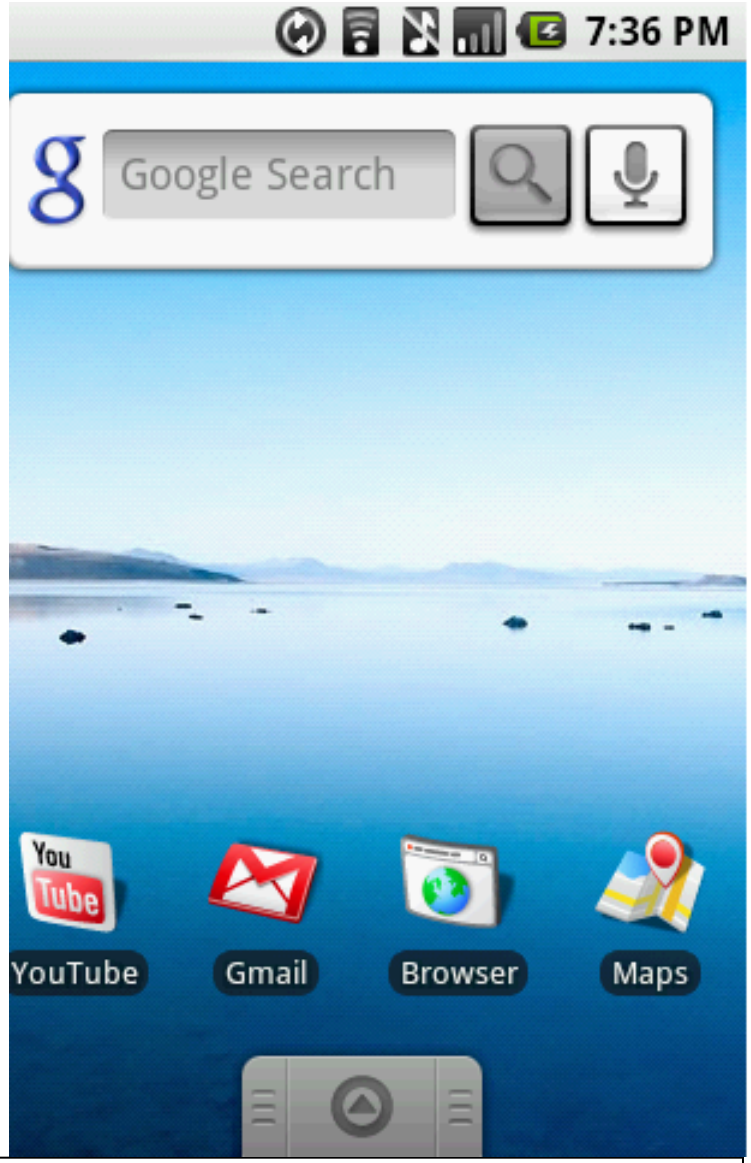
- Includes all the tools required to develop Android applications in Java (compiler, debugger, emulator)
- Provides a plugin for Eclipse to support RAD-like application development and interactive debugging inside the IDE
- The «Android Native Development Kit» allows development of native components that can be integrated with the existing class library to provide additional features

Android NDK

- Allows development of native components or applications on Android
- Native applications are supported since ver. 2.3 (Gingerbread)
- Native modules can be built for ARMv5 or ARMv7
- Only libraries accessible through the NDK provide a stable interface

Activities

- Android applications are called «Activities»
- Multiple activities can run at the same time but only one is active
- Activities can be suspended and resumed to free resources
- Activities UI can be defined using XML files that can be designed using the eclipse plugin



Android

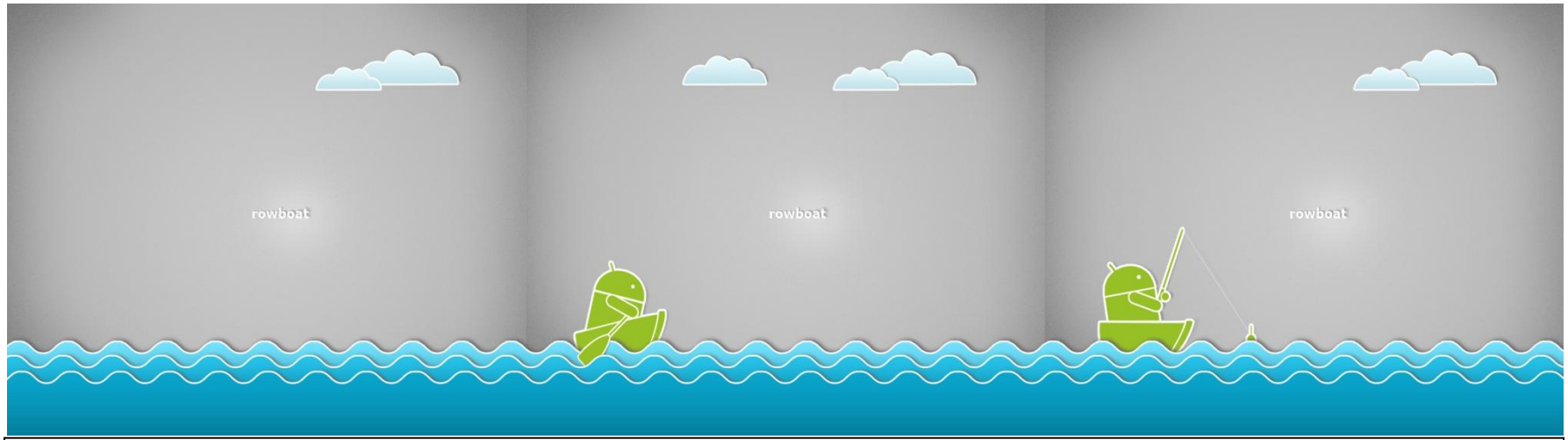
DEMO

Android Porting

- Porting Android on a device requires a porting of the Linux kernel and Android specific features (power management, graphics support etc)
- Google does not provide a simple way to port and customize Android
- Not all the applications are available as free software. Some applications are proprietary and Google provides them with a separate license

Rowboat Android

- Android porting on TI CortexA8 platforms
- Can provide a good starting point for porting Android on a specific device
- Can be accessed using a git repository or by installing the TI Android SDK
- http://arowboat.org



Android Device Certification

- To use the Android trademark a device must be certified as compatible with the Android Compatibility Definition Document (CDD)
- Compatibility can be asserted using the Compatibility Test Suite that is available for free
- Compatibility is a mandatory requirement to access the Android marketplace and license Google proprietary apps.

Embedded Linux

Embedded Linux

- There are many different Linux distribution that target embedded devices.
- Different UI frameworks can be used to develop applications and graphical user interfaces
- Integrating the different parts required to develop an embedded Linux device from scratch is possible but challenging

Arago and Open Embedded

- Arago-project.org
- Is an overlay over OpenEmbedded and Agnstrom Linux mantained by TI
- Is used to generate Linux SDKs for TI platforms
- Provide a tested and reliable set of features and simplifies the integration steps required to build a custom Linux version for a device base on TI's SOCs.

QT

- Portable framework developed by Trolltech/Nokia
- Available on many platforms
  - Linux
  - Windows
  - MacOS
  - Windows CE
  - Symbian
  - Embedded Linux
- Provides a rich class library
  - UI
  - OS access in a portable way
  - Multimedia
  - Webkit

QT User Interface Design

- User Interface elements can be designed using QT Creator
- A rich C++ class library provides easy access to OS features and user interface elements in a portable way
- UI layout can be designed and saved as QML files that can be loaded by applications

QT User Interface Design

Some Discussion Points

Hardware Support

- Writing a BSP of some kind of drivers (wi-fi, USB etc.) from scratch is complex and can require time and money
- Choosing components knowing the level of support provided by the operating system is important to reduce the overall project costs
- TI provides Linux and Windows CE/Embedded Compact support for its 32bit ARM processors

Integration

- An OS providing integrated components can shorten development time
- Integrated build system, debugger and application development environment can simplify development and debugging of the different software layers
- A standard set of APIs can simplify application porting and provide access to commercial applications and an experienced developer base

Integration

- Android provide a set of features, APIs (both native and java-based), a development environment and a growing developer community
- Windows Embedded Compact provides a catalog of integrated components, no standard SDK and support for native API/frameworks and Managed framework widely used in the Windows developer community
- TI provides Linux SDKs to ease the integration work and Arago/Open Embedded can be used to pick-up components that are easy to integrate

Customizability

- Choosing the right set of features for a dedicated embedded device can reduce the resource requests and provide more stability
- The OS can be modeled on the device and application needs
- User interface can be designed and implemented for a specific usage

Customizability

- Android requires a defined set of Kernel features and has no componentization features
- Windows Embedded Compact can be customized by choosing components provided by MS or third parties or by re-implementing or customizing the components that are provided in source code format
- Linux provides the maximum degree of customizability, giving the user the chance to choose different implementation of the same technology and customize the open-source ones

The «best» Operating System

- All those Operating Systems (and others) are used by thousands of developers to develop many different kinds of devices
- Choosing the right OS is one of the key steps in making a successful device
- There is no absolute «best» OS, you should evaluate wich OS is the best one for your specific project considering:
  - Hardware support
  - Key features
  - Development team experience
  - Licensing

Q&A

Window Embedded Compact

- Download the evaluation version of Visual Studio 2008 and Expression Blend 3 from: http://www.microsoft.com/windowsembedded/en-us/downloads/download-windows-embedded-compact-ce.aspx
- Install BBSDK.MSI (provided in the zip file)
- Create a bootable SD card using the SDCardBootUtility using the MLO, ebootsd.nb0 and nk.bin (provided in the zip file)
- Configure 192.168.111.1 as static IP address for your PC network card

Contacts

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Android (Ubunto 11.04 32bit)

- Download and install Eclipse version 3.7.0 from http://www.eclipse.org/downloads/download.php?file=/eclipse/downloads/drops/R-3.7-201106131736/eclipse-SDK-3.7-linux-gtk.tar.gz
- Download and install the Android SDK from http://dl.google.com/android/android-sdk_r11-linux_x86.tgz
- Use the SDK manager to dowload and install the Android SDK ver 2.2
- Install the Android plugin for Eclipse following this instructions: http://developer.android.com/sdk/eclipse-adt.html#installing

Android (Ubunto 11.04 32bit)

- Untar beagleboard-xm-android.zip
- Put a microSD card (2GB at least) in your reader and check the device assigned to it (ex: /dev/sdb)
- Run the mkmmc-android.sh script proving the SD card device as parameter.
- Boot your beagleboard-xm and connect it to the PC using an USB cable.
- Go to the platform-tools folder of the Android SDK installation and run:
  adb devices
- If the devices is reported with ????????? as ID, run:
  sudo adb kill-server
  sudo adb start-server