Embedding Success

Salon ENOVA - Choisir son OS

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Company overview

WW Offices

France HQ (30+)

US (25+)

Germany (10+)

Qt Technology Partner

Windows Embedded Gold Partner

QNX SOFTWARE SYSTEMS

Sales Reps

Japan

Taiwan

Korea

India

Italy

Israel

OUR MISSION

Secure OEMs embedded design success by providing OS Expertise combined with in-depth knowledge of processors' architecture on multiple operating systems such as Windows CE, Embedded Linux, Android and QNX.

Competitive Partner for Embedded Devices

Silicon Vendor partners

Texas Instruments Design Network Platinum Member

Qt Technology Partner

freescale Connect Proven Partner

XILINX ALLIANCE PROGRAM MEMBER

intel Embedded Alliance

Windows Embedded Gold Partner

QNX SOFTWARE SYSTEMS

Market Focus


Automotive


Handheld Devices


Medical


Consumer


Industrial Automation

Adeneo Embedded

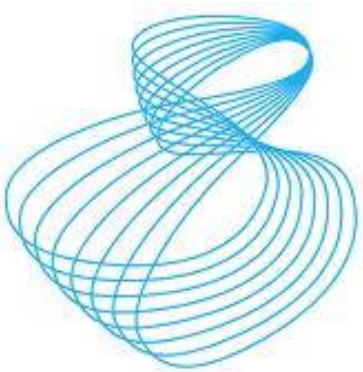
System Integration partners

Specializing in

Business Model

Key partnerships with Silicon Vendors and OS providers allows us to build strong expertise on the latest processor offerings and OS technologies. Combined with our engineering expertise we offer the best technical expertise and services to enable customers design their products

Adeneo Embedded - Core Expertise



Product Expertise

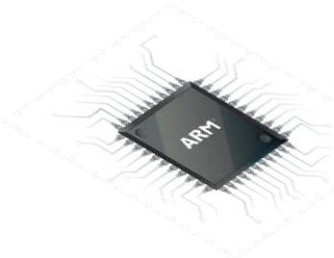
- Power management – optimization to meet device specific requirements
- Boot time – fast boot implementation (<500ms boot times)
- Communication stacks – performance improvements (NDIS 6.1 etc…)
- BSP and Application testing (for certifications)

Application Expertise

- Full custom application development using
  - Silverlight, .Net CF
  - Qt
  - HTML5
  - Native C++, Java
- Data management, cloud connectivity and middleware stack integration

System Expertise

- Custom device driver development
  - Connectivity – wireless, bluetooth, cellular
  - Multimedia – audio/video h/w acceleration, codecs integration, camera interface, OpenGL/VG/CL, DirectShow etc…
  - Storage/Industrial – SATA, PCIe, USB, CAN etc…
- OS feature implementation
  - Real-time, full power management, 3rd party stack integration



Firmware Expertise

- development of reference BSPs for SV architectures
- adaptation of reference BSPs for custom designs
- OS optimizations based on final product requirements

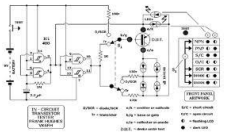
Services offering

Productization

- Production quality BSP and driver optimizations
- System performance optimizations including graphics, boot time and real time behaviors
- Validation and testing of entire BSP and other software stacks
- Testing services for certification
- Full application development

Prototyping

- BSP customization and driver development
- 3rd party stack integration support
- Application technologies enablement



Design

- BSP and OS Support – support contracts
- Design reviews
- Reference BSP support and updates
- 3rd party software and h/w selection/integration guidance

Evaluation

- Trainings – scheduled/customized onsite (3-5 days)
- System level consulting
- Benchmarking, proof of concept development

Competitive Partner for Mobile Devices

adeneo mobility

Mobile Applications

- UI/UX Design and implementation for Mobile devices
- Natural UI
- Smartphone Middleware
- WPF, OpenGL, XAML
- Performance optimization
  - *Graphical rendering*
  - *UX effects*
- Enterprise, BtoB, BtoC applications

Cloud Connected Applications

Get a full control of your embedded device via the Cloud.

B2C Applications

Experts in XAML, HTML 5, Java and more, our team masters the different technologies for mobile application development.

B2B Applications

Deep, understanding of specific requirements of B2B markets, providing up to date business applications on the latest devices.

Qt

Windows 8

SAMSUNG

Mobile Apps References at a glance

Adeneo Embedded

Adeneo mobility

Qt Technology Partner digia

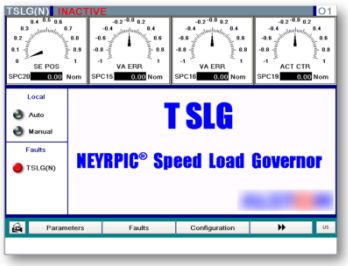
Windows Embedded Gold Partner

Windows 8

Fleet Management
UI and App dev
Navigation integration

Smartphone Applications
Windows Phone and Android
UI Design, Application dev

Interactive Point of Service
Natural UI, Kinect Application



Industrial Supervision
UI and Data management App
Industrial bus communications

Home Energy Management
UI and Data management App
Zigbee/Wifi communications

Consumer Application
Complete UI and SW

Metering Maintenance
Software architecture
UI design

Contact us for more information about our solutions and services

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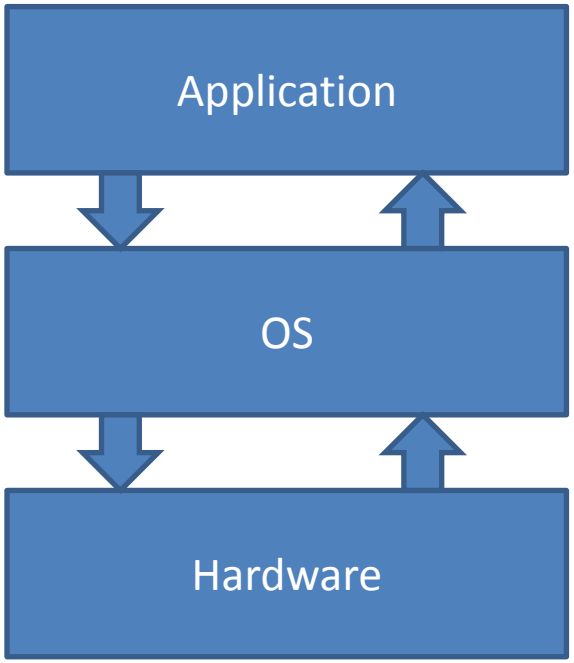
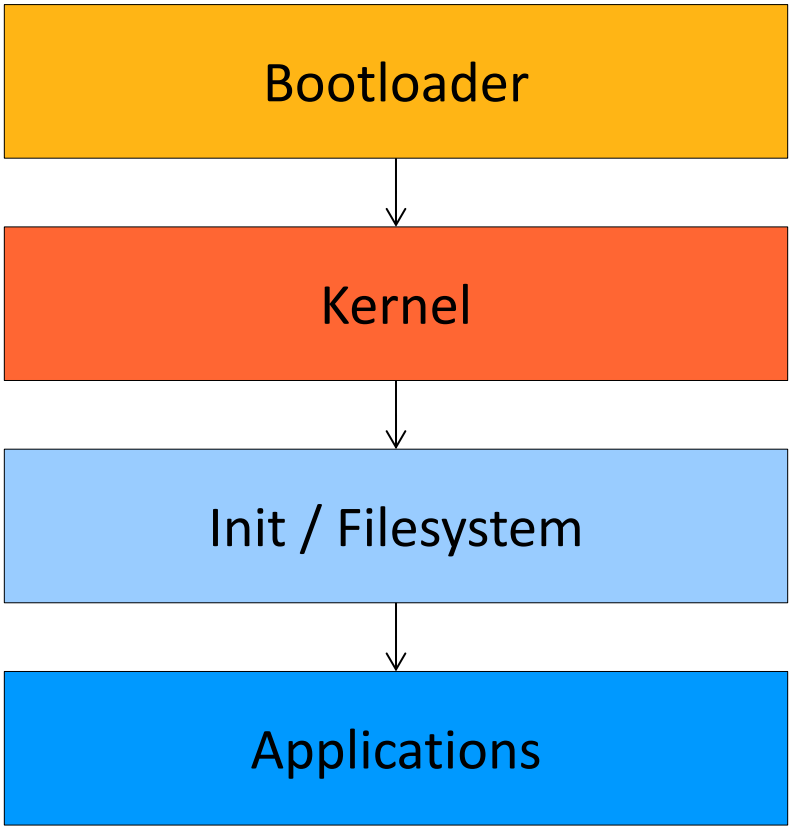
OS Concepts

- Manages HW resources
- Provides services to applications
- Typically covers
  - Process management
  - Interrupts
  - Memory management
  - File system
  - Device drivers
  - Networking (TCP/IP, UDP)
  - Security (Process/Memory protection)
  - I/O



Embedded OS Bootup



Embedded OS specifics

- Might have to be real-time
- Multi-thread, multi-process
- Reduced memory (RAM, flash)
- Power consumption
- Firmware updates
- Robustness / reliability
- …

Typical hardware environment

- Specific way to flash bootloader
- Debug messages over serial port
- Download of OS over USB/Ethernet
- Debug of OS over USB/Ethernet
- Deploy and debug app over USB/Ethernet

Windows Embedded Compact 7

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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

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

Embedded Linux

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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

Linux key features

- Portability
  - Supported architectures (see arch directory in the Linux sources): alpha, arm, m68k, x86, mips, powerpc, sparc...
- Scalability
  - Used on small embedded devices to super-computers
- Security
  - The code is constantly being reviewed by the community
- Reusability
  - Many drivers and platforms are part of the mainline. No need to reinvent them!
  - Well-defined coding standards
- Community support
  - Easy to find support and documentation

Linux development model

- Latest version is 3.13
  - About one release every 3 months
  - Stable branches are maintained by a dedicated team (only the security fixes are backported)
- Kernel sources available on http://kernel.org/
  - Can be downloaded as archives or with git
  - “Mainline” or “Vanilla” kernel: contain the main, generic branch of development
  - Released by Linus Torvalds after integrating the changes made by all other programmers
- Not all the Linux code is part of the mainline
  - Silicon Vendors typically manage their own tree

Licensing considerations

- The Linux kernel is licensed under the GPLv2
- The GPL does not require you to release your modified version, or any part of it. You are free to make modifications and use them privately, without ever releasing them.
- The GPL requires you to make the modified source code available to the program's users, under the GPL.
- GPL FAQ

- Before reusing code and libraries, check the license of the different software packages!

- Other open licenses exist (Apache, BSD, GPLv3, LGPL)
  - Different possibilities/constraints

Android

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Android

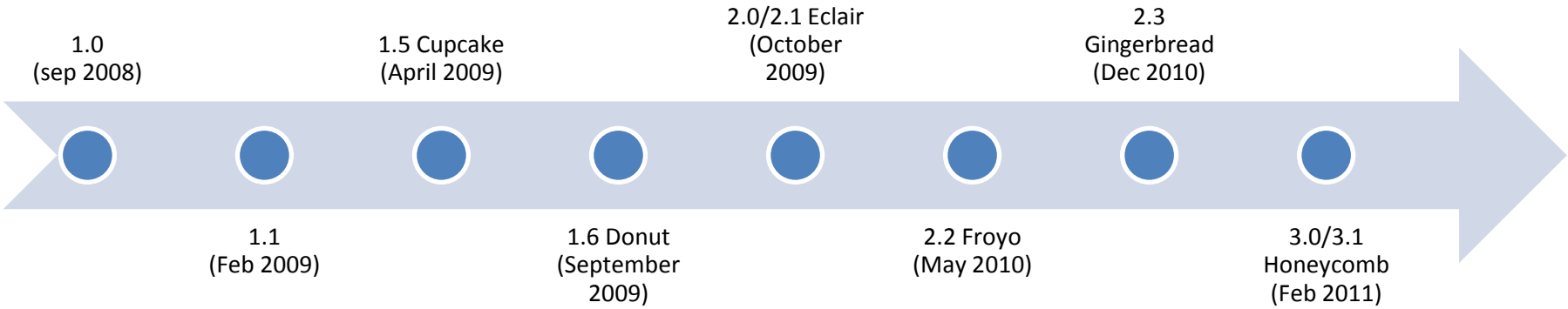
"Android is an operating system for mobile devices such as cellular phones, tablet computers and netbooks."

(Wikipedia 2010)

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

(Wikipedia 2011)

Android Versions



- Latest 4.x
  - ICS
  - Jelly Bean
  - Kitkat

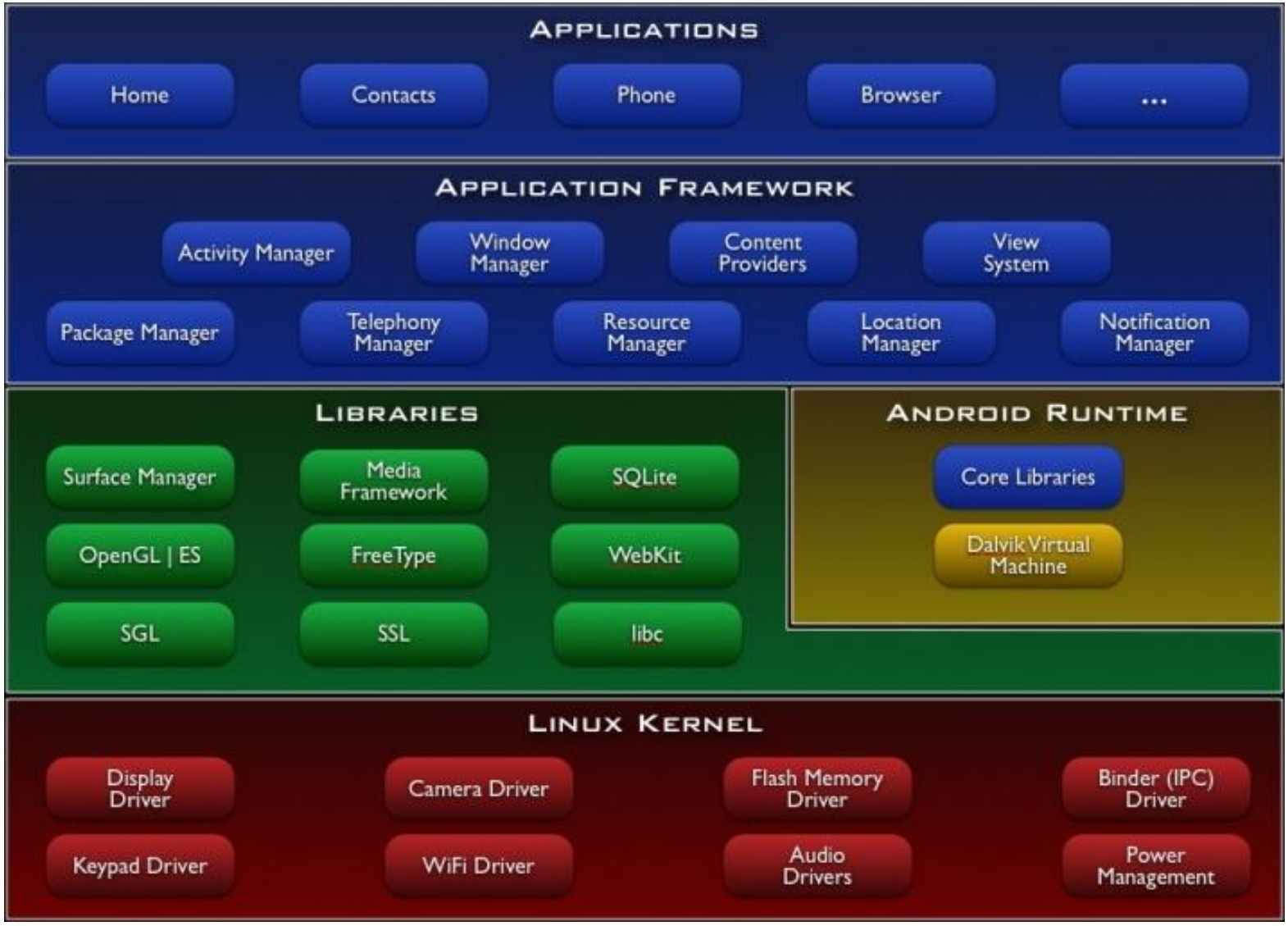
Android is Linux?

- 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

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

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.

Adeneo Embedded

QNX - VxWorks

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Main differences

- Real-time OS
- Efficiency
- More expensive (NRC + RC)

VxWork – technical info

- Real-time OS from WindRiver
- Supports ARM, MIPS, PowerPC and X86
- SMP / AMP
- Multitask
- Preemptive scheduling + round-robin
- Fast context switch
- Low interrupt latency

VxWork - technical info

- POSIX compliant
- Workbench development environment in Eclipse
  - Development
  - Debug
  - System analysis
- Certifications D0-168

QNX: overview

- Real-time OS purchased by Research In Motion in 2010
- Built around a micro-kernel called « Neutrino »
  - Micro-kernel handles only task scheduling, inter-process communication, interrupts and timers
  - Rest is being handled by user processes
- IPC messages are built to be really efficient
- Bootloader allows loading the micro-kernel as well as dynamic launch of OS components

QNX: technical info

- Connectivity:
  - Wifi/BT
  - USB,
  - Ethernet
- Critical Process Monitor
  - Monitore processes (including drivers)
  - Kill the process in case of exception
  - Restarts the process with pre-defined parameters
- Real time : overall good performances
- GCC compiler

QNX: technical info

- Proprietary license
  - Momentics tools (based on Eclipse) has to be purchased
  - Source code is provided except kernel and critical libraries
  - Per product royalties
- Support
  - QNX proposes dedicated support contracts
  - Updates
- Full-compliant POSIX APIs
  - Provides compatibility with POSIX compliant applications
- Graphical Frameworks:
  - Qt
  - Photon
  - Screen: new graphical layer which will be the used by OpenGL, Qt, etc…

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Comparison and Case studies

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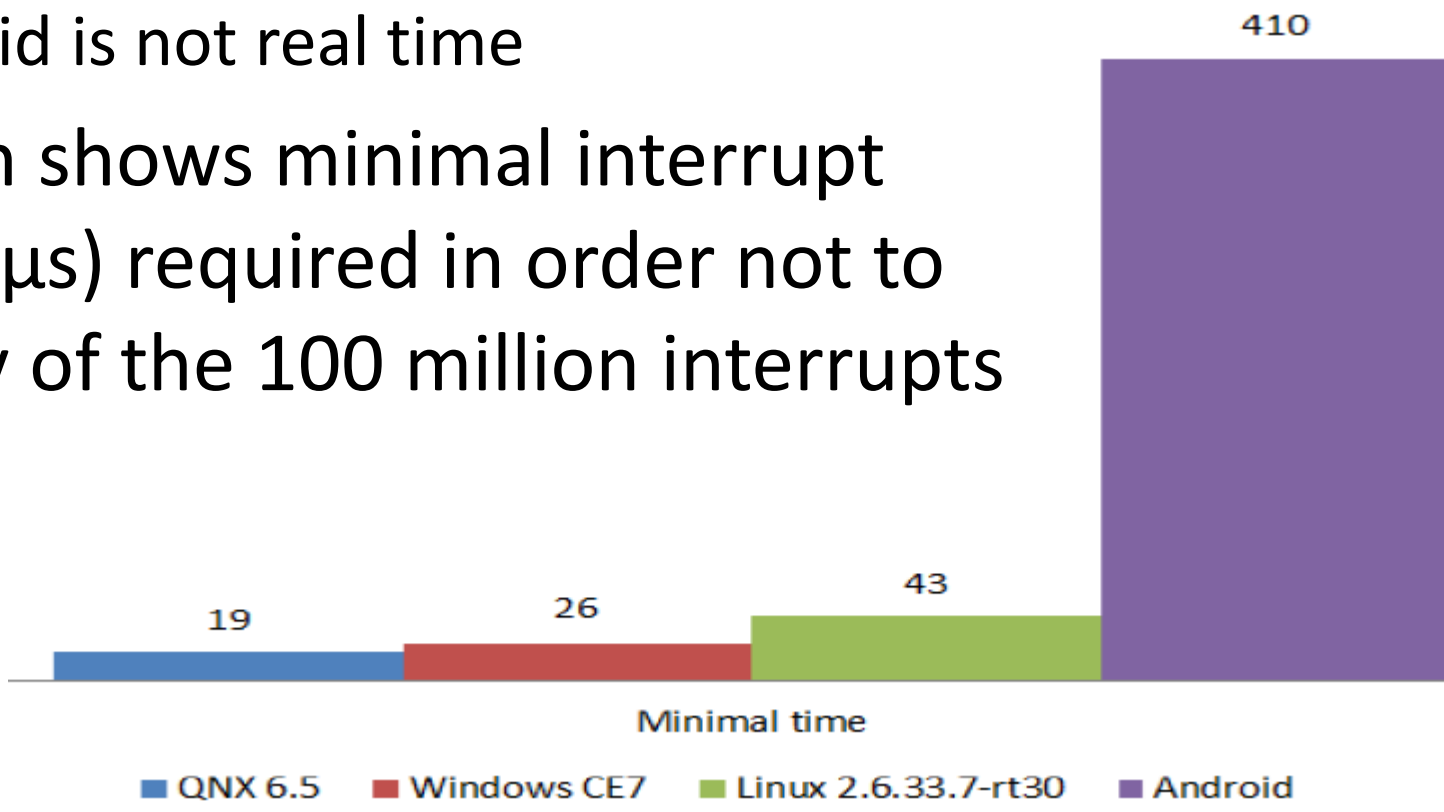
Bootup time / Memory footprint

- Features are linked...
- Memory footprint
  - WEC and Linux are similar
  - Android usually bigger
- Bootup time
  - All of them can be optimized
  - Android usually slower / optim more complex
  - Linux usually slightly better than WEC

Real time

- Realtime support
  - WEC real time by default
  - Linux need patches for preempt
  - Android is not real time
- Diagram shows minimal interrupt period (µs) required in order not to lose any of the 100 million interrupts (BBXM)



License / Ownership

- GPL:
  - need for providing modified source code (Linux/Android kernel)
  - Can't be used if can't redistribute the code (e.g. WEC kernel)
- Royalty: need to pay per device (WinCE)
- Patents: to be monitored, independent of the OS (MS patents should be covered when using WECs)

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
- Linux BSP usually integrated in distributions that allow selecting the features according to the needs. Linux has a rich set of standard APIs which makes drivers integration easier

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

Hardware support

- Windows Embedded Compact 7 will need at least ARM11/cortex A8 to run. SMP is in its first stages
- Android needs HW opengl support to run correctly.
- Linux is versatile. Can work on a wide variety or arch, even small ones. Usually 1 step ahead on new CPU support.

Application technologies

- Silverlight: for WEC only.
  - New/exciting user experience
  - Ressource consuming
- Java
  - Avail on Linux through JVM installations
  - Android has a “non-standard” java
  - No relevant JVM available for WEC7/ARM
- C#:
  - Supported on WEC7 through Compact Framework
  - Supported on Linux through Mono
- QT will be cross-platform

Longevity / Support

- Android
  - Lead by phone market
    - frequent changes in the OS
    - Bad support for previous versions
- Windows Embedded Compact
  - Major release every 2 or 3 years
  - OS patches made available by MS during 10 years
- Linux
  - Good compatibility across versions
  - Frequent updates (patches)
  - Submission/mainlining: a win/win approach!

Summary

Feature	Linux	Android	Win Embedded
Memory footprint	+	-	+
Bootup time	++	-	+
Royalties/reuse	++	++	-
Integration	+-	++	+
Customizability	++	-	+
Hardware support	++	--	+-
Real time	-	--	+
Applicative technologies	++	-	+
Longevity	+	--	++

Conclusion

- 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
- Linux is certainly #1 used today
  - But there's still good reasons for OEMs to go with others
  - It is certainly everywhere... But not for everyone!