Your partner in development
René Janssen (Accountmanager)
r.janssen@logic.nl

Android vs Linux

- **Introduction Logic / emtrion**

- **HMI as example**

- **Architecture of Android vs Linux**

- **Process visualization, real time**

- **Accessing process variables, GPIO**
  - ➢ In Android
  - ➢ In Linux

- **Customizing Android vs Linux**

- **Certification**

- **Summary**

emtrion

Logic Technology is the logical choice!

As Europe's market leader, we provide companies developing high-tech electronics with tools and software that increases the productivity of the developers as well as the quality of their output.

We are here to allow you to focus on what is really important:
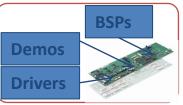
The creation of great products!

There's always a Logic Solution!

Computer Modules

Custom Designs

Developer Kits

Support

SW products

BSPs

Demos

Drivers

SW Engineering

Consulting
whole concepts
Feasebility studies
Customer Specific SW

Android

2011

2010

2009
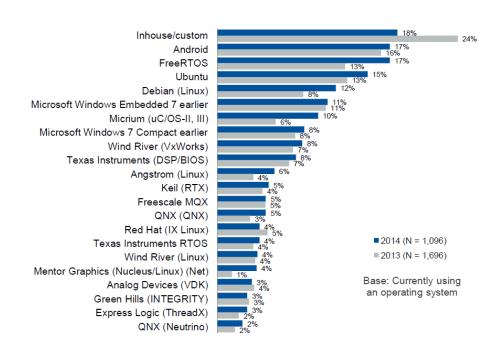
http://developer.android.com/about/index.html

Used Operating Systems

There's always a Logic Solution!

Android Not Only For Smart Phones

- **Android TV**
- **Android Tablet**
- **Home Phone System**
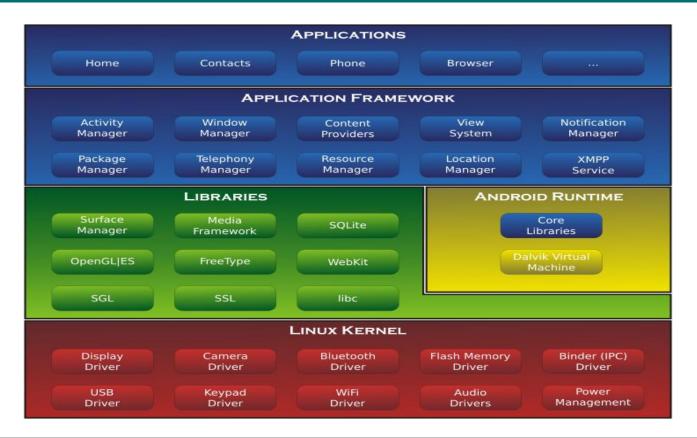- **Home Command Center**
- **Washing machines**
- **Camera**

http://www.digitaltrends.com/mobile/demoing-the-app-controlled-samsung-smart-washer-and-dryer/#!BHNVy
http://timesofindia.indiatimes.com/photo/20859231.cms
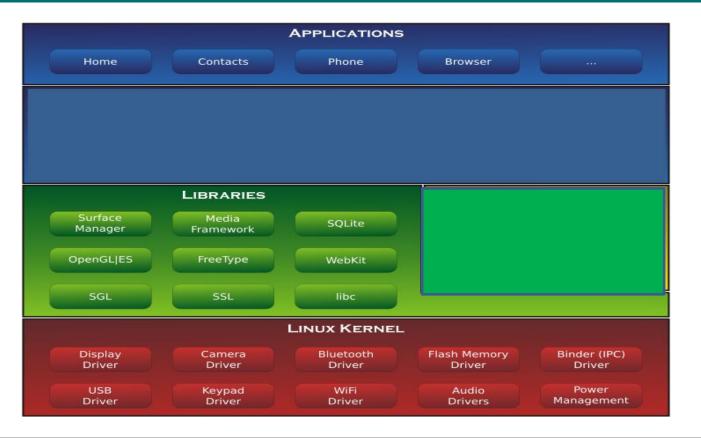
Architecture Of Android

There's always a Logic Solution!
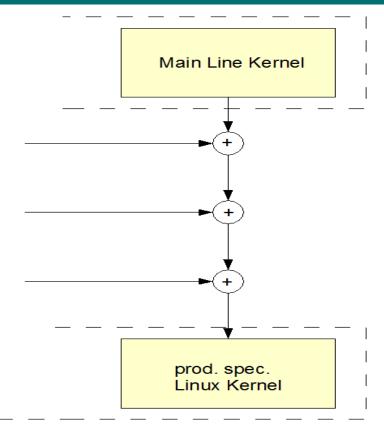

APPLICATIONS

| Home | Contacts | Phone | Browser | ... |

LIBRARIES

Surface Manager	Media Framework	SQLite
OpenGL|ES	FreeType	WebKit
SGL	SSL	libc

LINUX KERNEL

| Display Driver | Camera Driver | Bluetooth Driver | Flash Memory Driver | Binder (IPC) Driver |
| USB Driver | Keypad Driver | WiFi Driver | Audio Drivers | Power Management |

Main Line Kernel

Patch of the SOC supplier
(Freescale, TI, Renesas, …)

Patch of the board supplier
(emtrion, …)
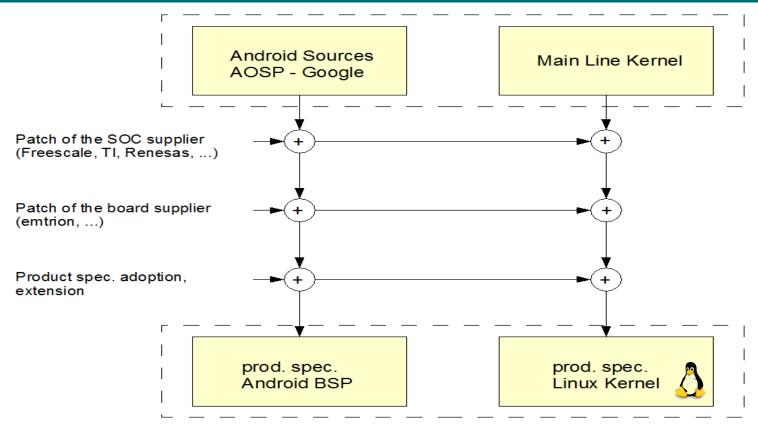
Product spec. adoption,
extension

prod. spec.
Linux Kernel

```
hico@ubuntu:~/work/android_mx6_kitkat/myandroid$ . build/envsetup.sh
including device/emtrion/dimm_mx6/vendorsetup.sh
hico@ubuntu:~/work/android_mx6_kitkat/myandroid$ lunch

You're building on Linux

Lunch menu... pick a combo:
     1. aosp_arm-eng
     2. aosp_x86-eng
     3. aosp_mips-eng
     4. vbox_x86-eng
     5. aosp_manta-userdebug
     6. dimm_mx6-eng
     7. dimm_mx6-user

Which would you like? [aosp_arm-eng] 7


============================================
PLATFORM_VERSION_CODENAME=REL
PLATFORM_VERSION=4.4.2
TARGET_PRODUCT=dimm_mx6
TARGET_BUILD_VARIANT=user
TARGET_BUILD_TYPE=release
TARGET_BUILD_APPS=
TARGET_ARCH=arm
TARGET_ARCH_VARIANT=armv7-a-neon
TARGET_CPU_VARIANT=cortex-a9
HOST_ARCH=x86
HOST_OS=linux
HOST_OS_EXTRA=Linux-3.5.0-48-generic-x86_64-with-Ubuntu-12.04-precise
HOST_BUILD_TYPE=release
BUILD_ID=KOT49H
OUT_DIR=out
============================================

hico@ubuntu:~/work/android_mx6_kitkat/myandroid$ make –j 16
```

Android – Writing Apps
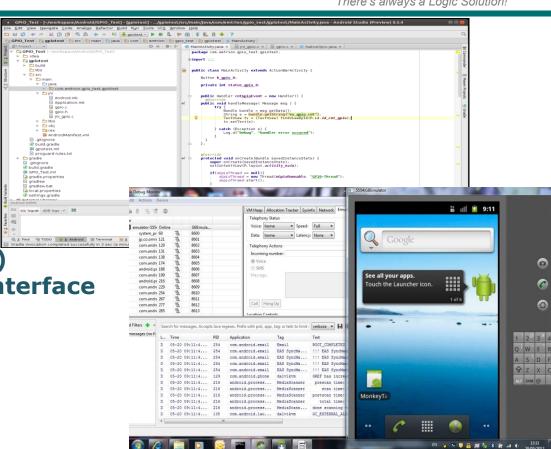
NDK
- **Supports (Java ,C/C++)**
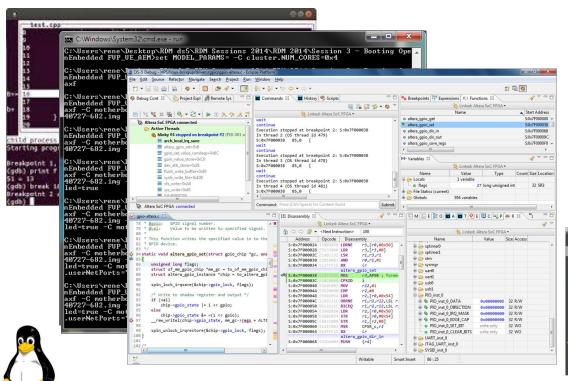- **Closer to HW / Native Interface**
- **BSP development**

SDK
- **Only Supports Java**
- **App development**

Linux Development Tools
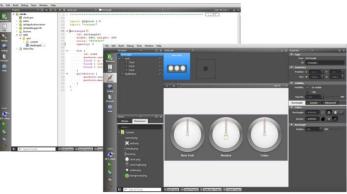
Kernel
- **GCC / Commandline**
- **Yocto,LTIB,......**

Drivers / Application
- **Eclipse**

HMI
- **QT (creator)**

- **Interface between human and technical process**
  - ➤ Visualization of process information
  - ➤ Controlling a technical process
- **Industry – HMI**
- **Household – white goods, brown goods**
- **Neither PC nor Smart-Phone**
  - ➤ Only one application
  - ➤ No „app-store"
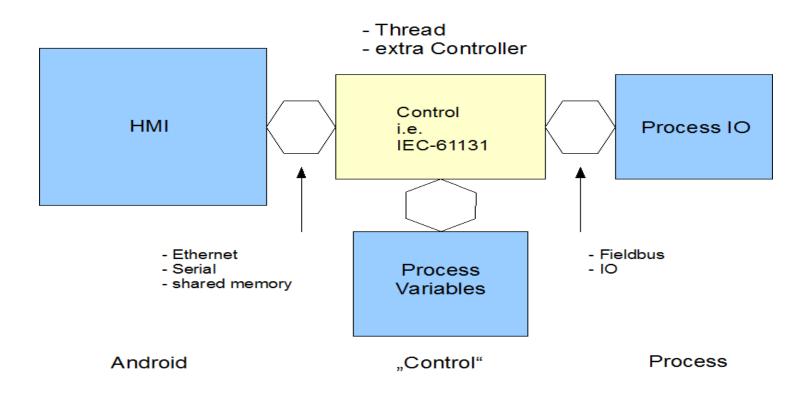 - ➤ Rich multimedia functionality, well known api

http://techshohor.com/news/7941

- **Abstract description of a process, input and output variables, marker, implemented as a data structure in a programm. Shared memory.**

- **Process control language i.e. IEC-61131**

- **Cyclic and deterministic update of the process variables**

- **Non deterministic visualization of the process data**

- **Deterministic processing of commands initiated via the HMI – special situation for alarms**

Android :

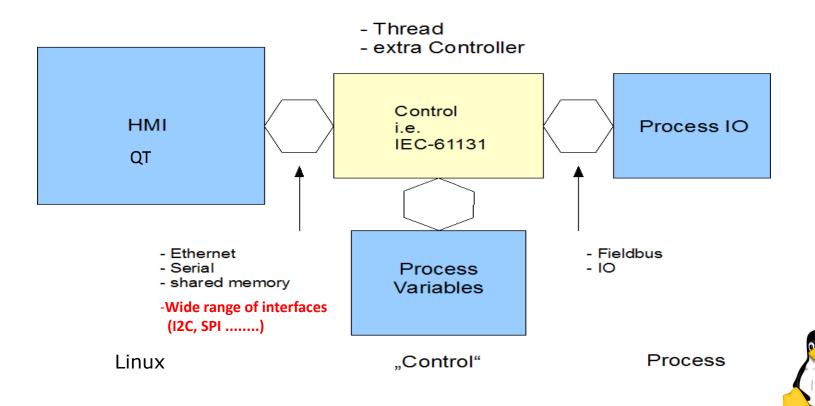- **Java based applications run in a virtual machine (Dalvik, ART)**
- **Garbage collector not optimized for real time**
- **Powermanagement ←→ wakelock**

- **Android not suitable for running realtime applications**
- → **Coprocessor for realtime tasks needed**

Linux :

- **No virtual machine**
- **RT Patches available**
- **Better Powermanagemant features**

Permissions

Android :
- **Services running with „system" permission, Linux kernel components usually have „root" permission**
- **Apps running with own UID and GID**
- **Application Lifecycle management**

- **Direct access to sysfs not out of the box possible**

Linux :
- **Through device drivers access to sysfs**

Android – Accessing Hardware (GPIO)

Android initialization

init.rc

write /sys/class/gpio/export 'xx'
write /sys/class/gpio/gpioxx/direction 'out'
chmod 0666 /sys/class/gpio/gpioxx/value

Application

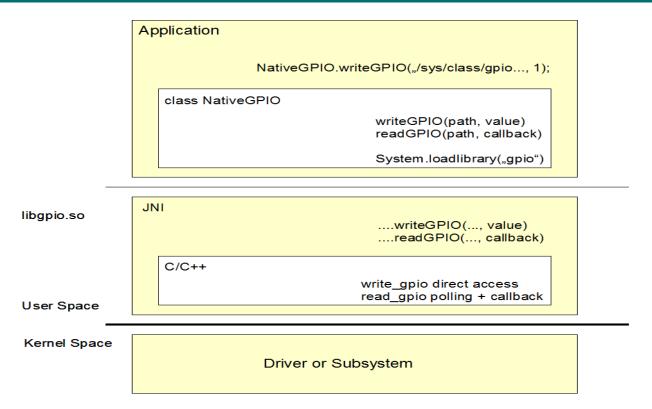out = new FileOutputStream("/sys/class...);
out.write(....)

User Space

Kernel Space

Driver or Subsystem

GPIO Access Using NDK

Application

NativeGPIO.writeGPIO(„/sys/class/gpio…, 1);

class NativeGPIO

writeGPIO(path, value)
readGPIO(path, callback)

System.loadlibrary(„gpio")

---

libgpio.so

JNI

….writeGPIO(…, value)
….readGPIO(…, callback)

C/C++

write_gpio direct access
read_gpio polling + callback

User Space

Kernel Space

Driver or Subsystem

GPIO Access Using SDK

Application

SDK ────────────────────────

System Server

Java

GPIO related service

JNI

C/C++

GPIO related library

User Space ──────────────────

Kernel Space

Driver or Subsystem
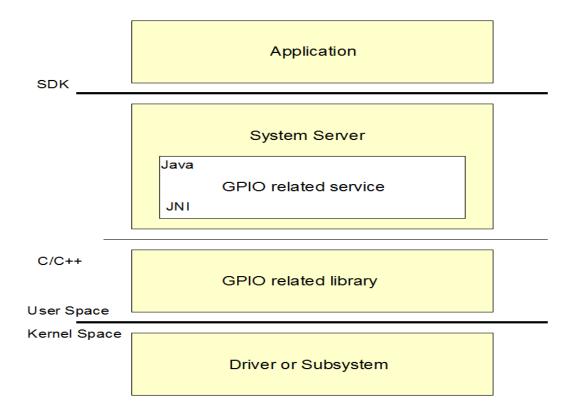
Linux :

- **Extending HAL using C/C++**
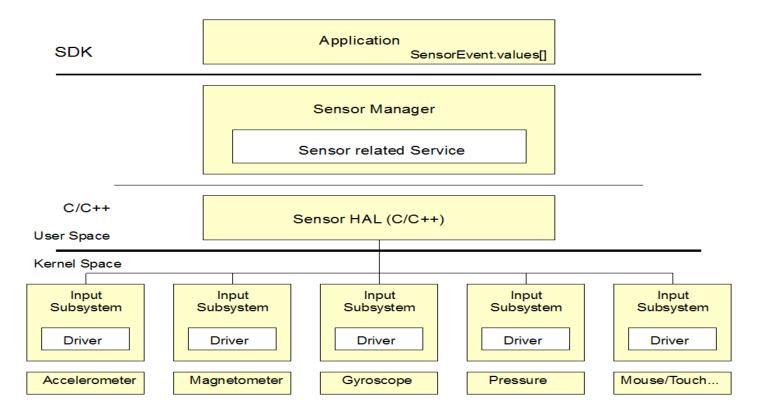- **Implementing Linux Driver**

Extra for Android :

- **Implementing System Service using Java**
- **Implementing Wrapper using JNI**
- **Calling System Service in App**
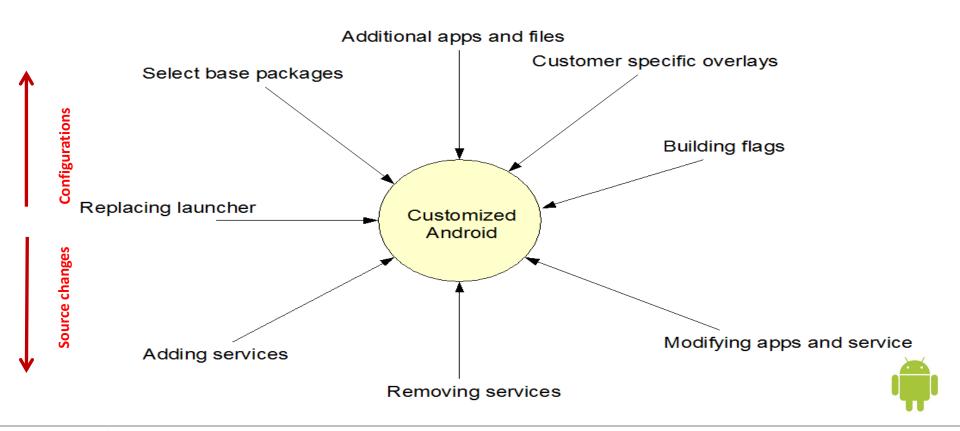- **Automatic start of Service by System Server**

Android - Sensor Framework

- **No longer Smart Phone, it's HMI now**
- **Reducing original flexibility of Android to key functions for HMI**
- **Individual look and feel**
- **Rich multimedia functionality**

http://dientutieudung.vn/o-nha/gia-dung/i15114-may-giat-samsung-wf457-ket-noi-wifi/

Play-store access required :

- **Requirement for software and services**
- **Test-Suite for checking completeness, correctness and stability of the system (CTS)**
→ **For gaining access to the App-Store or App-Play**

Summary

Android :

- **Well known usability**
- **Easy to use framework (Android Studio)**
- **Rich and well known API (Java)**
- **Good documentation (application development)**

But :

- **No realtime**
- **Missing support for industrial fieldbus interfaces**
- **Has to be tailored for HMI applications**
- **When tailored then no certification by Google**

http://www.gadgetimages.org/9-android-devices-that-must-you-know.html

- **We have available :**
  - ➢ Com's with Linux, Android, other...
  - ➢ Complete ready to start development kits
  - ➢ IP of our modules (BSP, Schematics, with direct integration support)
  - ➢ Engineering / support teams
  - ➢ Development tools
- **We can help you to convert Android -> My Android**
- **For more info Please visit our Booth (4)**

Thank you for your attention!

www.logic.nl