Mobile Measurement System

WILGA 2012
Summer Edition ;]
Warsaw University of Technology
SC-ELHEP
Presentation Outline

- **MMS? Are you nuts!?**
  - Genesis
  - Concept

- **Antonovka at Mobile**
  - IOS User End and The Black BOX
    - GUI, Discover-ability

- **Do you like LEGO?**
  - Hardware configuration(s)

- **Tux and friends**
  - Software configuration(s)

- **MMS-M2M**
  - VMAX v3
    - Why new version?, Architecture, Some ICs, PCB
Motivation

- In the era of mobile communication there is obvious need to use devices like smartphones and tablets on more professional applications ...
- Since our group is concentrated on the measurement systems we came up with new project to use those mobile devices to control, and receive data from measurement systems with embedded Linux OS
- We will focus and iOS devices (iPhone, iPad) and Android devices (Samsung, HTC)
iOS mobile client (iPhone and iPad)

- Easy to use - no configuration at all – auto-service discovery using SSDP protocol (WiFi) and discoverable mode in case of Bluetooth
- Universal – one app for every measuring device – autogenerating GUI based on the JSON specification
- Flexible – possibility to add custom actions and invoke them from the device
iOS mobile client (iPhone and iPad)

Simple interface to find new devices

Immediate display of the measured data
Hi everybody,

I am a: Functional or Measuring or Sensor Unit
I can have analog, digital or even RF back ends

I am an USB cable
I can be couple of meters not more

Hi everybody,

Hi everybody,

How do you do,

I am the thing that lasts two hours on battery.

I like sports, BlueTooth WIFI, GPRS and USB

Some use me as a phone... it hurts my feelings.

Do you like LEGO – Hardware Configuration(s)

- **Sensors ↔ SmartPhone**
  - Point – to – point
  - USB or Apple dock

FMS Unit

USB or Idock

SmartPhone

USER SIDE

BLACK BOX SIDE
Do you like LEGO – Hardware Configuration(s)

- **Sensors ↔ SmartPhone**
  - BUS

I am a HUB,

“A long time ago in a galaxy far, far away...”

a I am being used. Nowadays nobody likes me any more.

One cable, two cables three cables four.

Nobody does know which connects to what any more :]

FMS Unit

USB or Idock

HUB or Switch

USB or Idock

SmartPhone

BLACK BOX SIDE

USER SIDE
Do you like LEGO – Hardware Configuration(s)

- **Sensors ↔ SmartPhone**
  - Network
  - WIFI, BT, GPRS

I'm a Network Cloud...
looks like it's going to rain :]

No cables.
ME GUSTA

I'm a Network Cloud...
looks like it's going to rain :]
Do you like LEGO – Hardware Configuration(s)

- **Sensors ↔ Adapter ↔ SmartPhone**
  - Most likely Network solution
  - WIFI, BT, GPRS

Ups forgot to ask. What if I am a low cost unit?

What's up :],

I am an adapter but like to call myself „The thing in the middle”
Most likely I'll be a router or a switch

If you enter elgooG in Google search the Internet starts to go backwards

Still No cables.

ME GUSTA
Do you like LEGO – Hardware Configuration(s)

- **Sensors ↔ M2M ↔ SmartPhone**
  - Most likely Network solution
  - WIFI, BT, GPRS

Hurray
Now I can be operated via ie. SPI

Hey there,
Did you ever wanted to access your old printer via LAN?
I am a solution for you. Just "plug me in"

I object to use it

JAVA is an object oriented language...

Still
No cables.

ME GUSTA

BLACK BOX SIDE

USER SIDE
!!! SURPRISE SNEAK – PEEK at real Hardware !!!

- **SensorBox – Still in design**
  - GPRS M2M, Sensors connected via I2C, UART, SPI
!!! SURPRISE SNEAK – PEEK at real Hardware !!!

- Armputer system v1.32 – G. Kasprowicz, M. Lipiński
- oscilloscope with Linux
!!! SURPRISE SNEAK – PEEK at real Hardware !!!

- Iphone - 3gs with Macbook pro “HDK” and SDK
!!! SURPRISE SNEAK – PEEK at real Hardware !!!

- Armputer system v2.5.2 – G. Kasprowicz, M. Popławski
Typical boot sequence

- **ROM Code**
  - Loads about 4kb binary code into Internal ram

- **BareBox (1\textsuperscript{st} & 2\textsuperscript{nd} stage bootloader)**
  - Initializes clock and memory
  - Copy itself into RAM
  - Loads rest of binary code
  - Loads to RAM
  - Performs some additional tasks
  - Loads end executes kernel

- **Linux kernel**
  - Device drivers
  - Programs/daemons/etc
Bare Metal vs Operating System

- Program fits to the device
- Lower costs
- Better control

- No device drivers
- Wide range of device drivers
- Ethernet/WiFi/Bluetooth stacks
- Multitasking
- Userland can be used in different devices

- Increased power consumption
MMS-M2M: VMAX V3

• **Why new version?**
  • TI components for ADC
  • No WIFI in v2.5.2

• **Architecture**
  • Compatible with previous version
  • Same form factor
  • Little change in connectors placement – front panel

• **IC differences**
  • uP: ARM9E ↔ Cortex-A8 [AM335x TI]
  • SDRAM ↔ DDR3
  • Additional WIFI and BT + BLE [WLS2771L TI-RFM]
  • Higher power demand TI DC-DC Converters
  • Gigabit Phyter

• **Estimated Price 400-500 PLN ALL per piece @ 10 pcs**
MMS-M2M: VMAX V3

- **Schematic is done for version before RFM**
  - Recently RFM announced small WIFI+BLE module

- **Routing evaluation of 0.65 mm pitch BGA**
  - One less power rail than 0.8 mm pitch BGA
  - But maybe more layers – better technology

- **Routing evaluation of 0.8 mm pitch BGA**
  - Old ARM had 0.8 mm pitch – same technology apply
  - Bigger + one more power rail than 0.65 mm version

- **New schematic for TWS1271L-S**
  - exchange BT module on PCB – 1-3 days work :]


MMS-M2M: VMAX V3
MMS-M2M: VMAX V3 – Bottom
Plans

• Quick Schematic Edit
• Route 0.65 mm pitch version
• If better technology needed try 0.8mm pitch version
• Write a report for ADC in two months
• GUI “expansion”
• Configuring all the hardware into operating “black box”
THX. Questions please

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