Our group's first sponsor

ICS
Integrated Computer
Solutions Incorporated

Advertisement: who wants to bus-pool to SCALE?

Katy's shuttle bus

Automotive: new frontier for mobile Linux

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http://she-devel.com/

Outline

- Automotive software systems: IVI

- Major IVI projects and platforms

- HW platforms for IVI development

- nOBDy and ExoPC demos

100-Member auto SW alliance endorses Linux

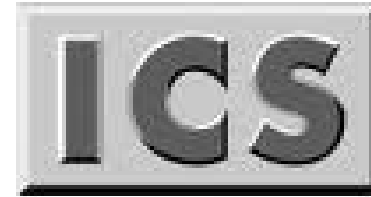**First four GENIVI compliant solutions approved**

The GENIVI alliance for In-Vehicle Infotainment
has announced a new compliance programme for
member companies and the first four companies
to offer approved compliant solutions: Canonical's
Ubuntu IVI Remix, Mentor Graphics' Embedded
IVI Base Platform, MontaVista's Automotive
Technology Platform and Wind River's Platform
for Infotainment.

All of the approved solutions run on Intel Atom
and ARM architectures, except for MontaVista's

GENIVI

GENIVI is promulgating Linux standards for auto space.
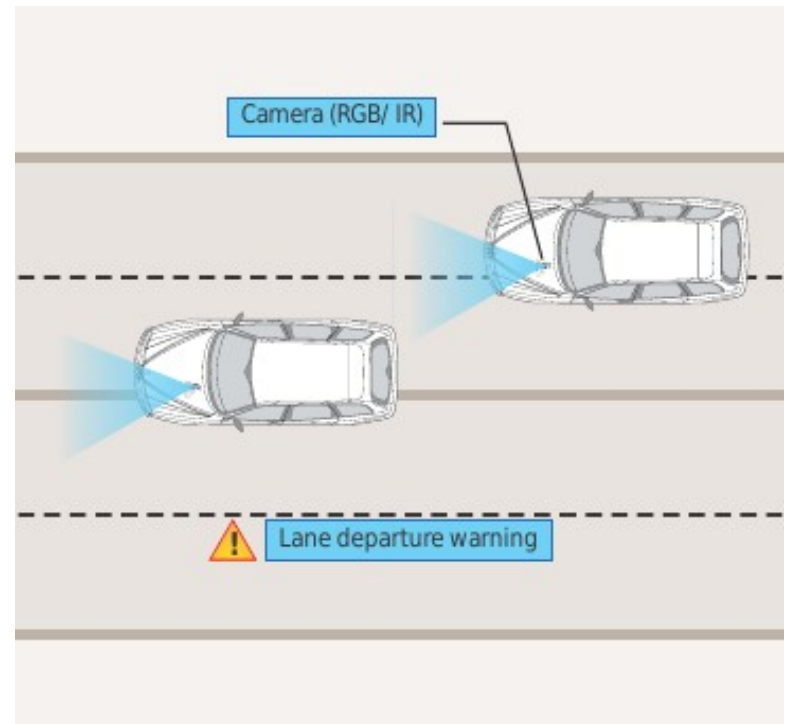
Bay Area IVI participants

New L.A. factory

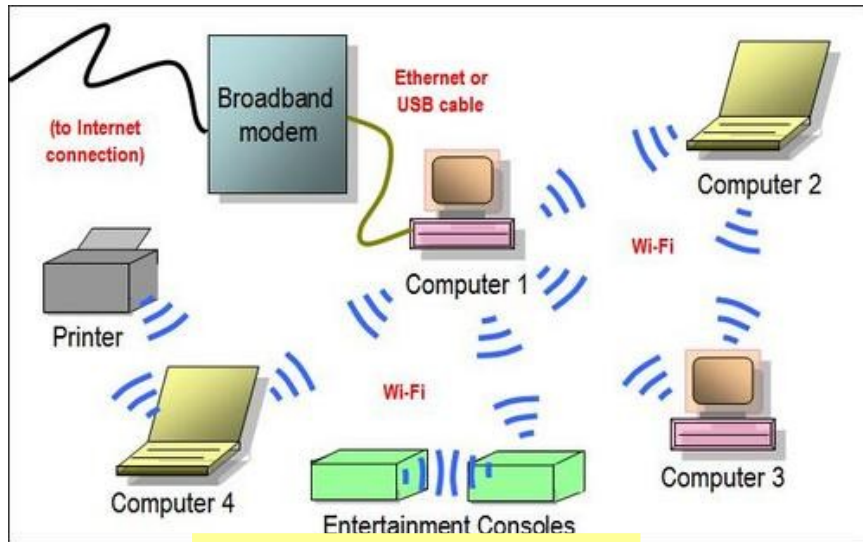# What is "in-vehicle infotainment"?

Courtesy Tata Consultancy Services

What "infotainment" calls to mind
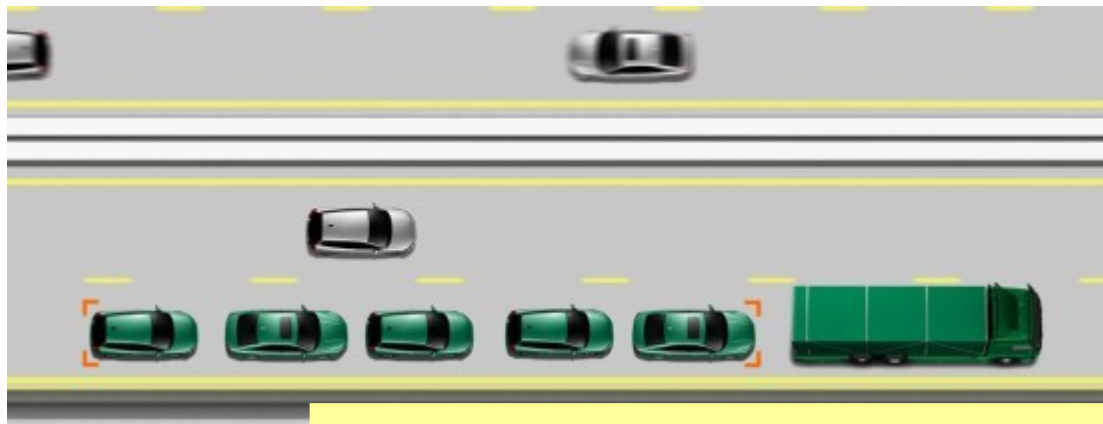
What IVI could be

Opportunity: save energy through *ad hoc* networking
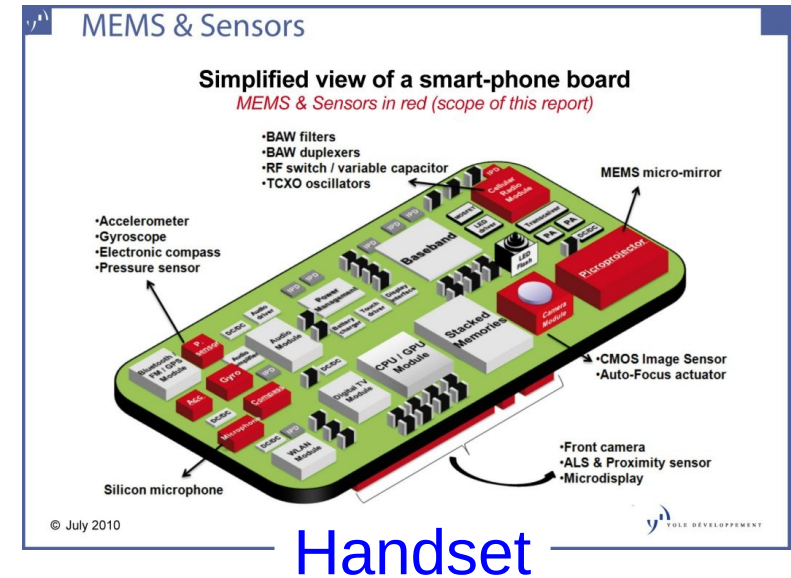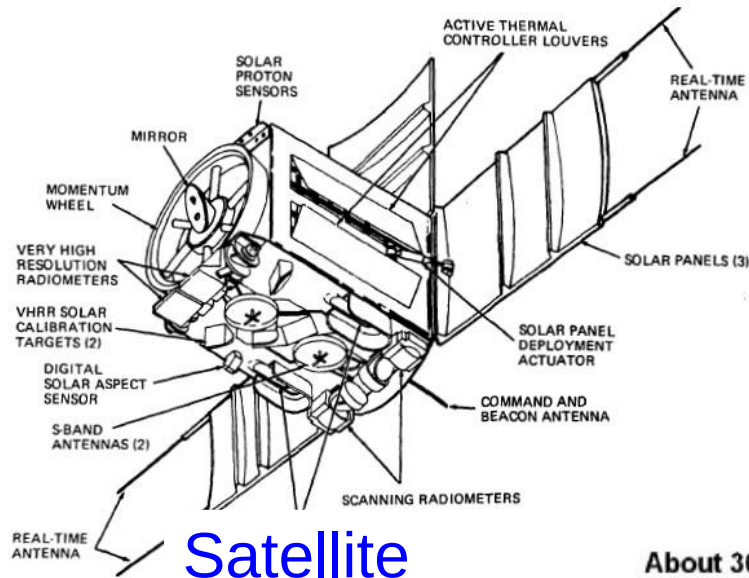

Use this . . .

to save energy . . .

with cars, too: 802.11p WAVE.

Opportunity: Mobile sensor platform data fusion/mining

Satellite

MEMS & Sensors

Simplified view of a smart-phone board
MEMS & Sensors in red (scope of this report)

Handset

About 30 electric/electronic systems and more than 100 sensors

DTR CDI AAC RCU PTS LWR ECT ESP ZV ABC TPM ABS

System	Abb.	Sensors			
Distronic	DTR	3	Common-rail diesel injection	CDI	11
Electron. controlled transmission	ECT	9	Automatic air condition	AAC	13
Roof control unit	RCU	7	Active body control	ABC	12
Antilock braking system	ABS	4	Tire pressure monitoring	TPM	11
Central locking system	ZV	3	Elektron. stability program	ESP	14
Dyn. beam levelling	LWR	6	Parktronic system	PTS	12

Figure 1: Car functions and the respective sensors (source: based on DaimlerChrysler)

Challenges for IVI

- Security in a multi-user, mobile, often unattended device

- Safety: not "kill -9" but kill dead!

- Novel hardware and architecture

- Not a phone or desktop: little-understood UI/UX

Security Challenge

Backseat kids changing nav system's destination . . . mechanic at body shop installs malware.

Safety Challenge

Driver gets alarms and has read-only access to many parameters.

Prevent entertainment system from hogging resources (incl. Driver!).

Hardware/Driver Challenge

CAN bus, MOST bus, wheel rotation sensors, oil level . . .
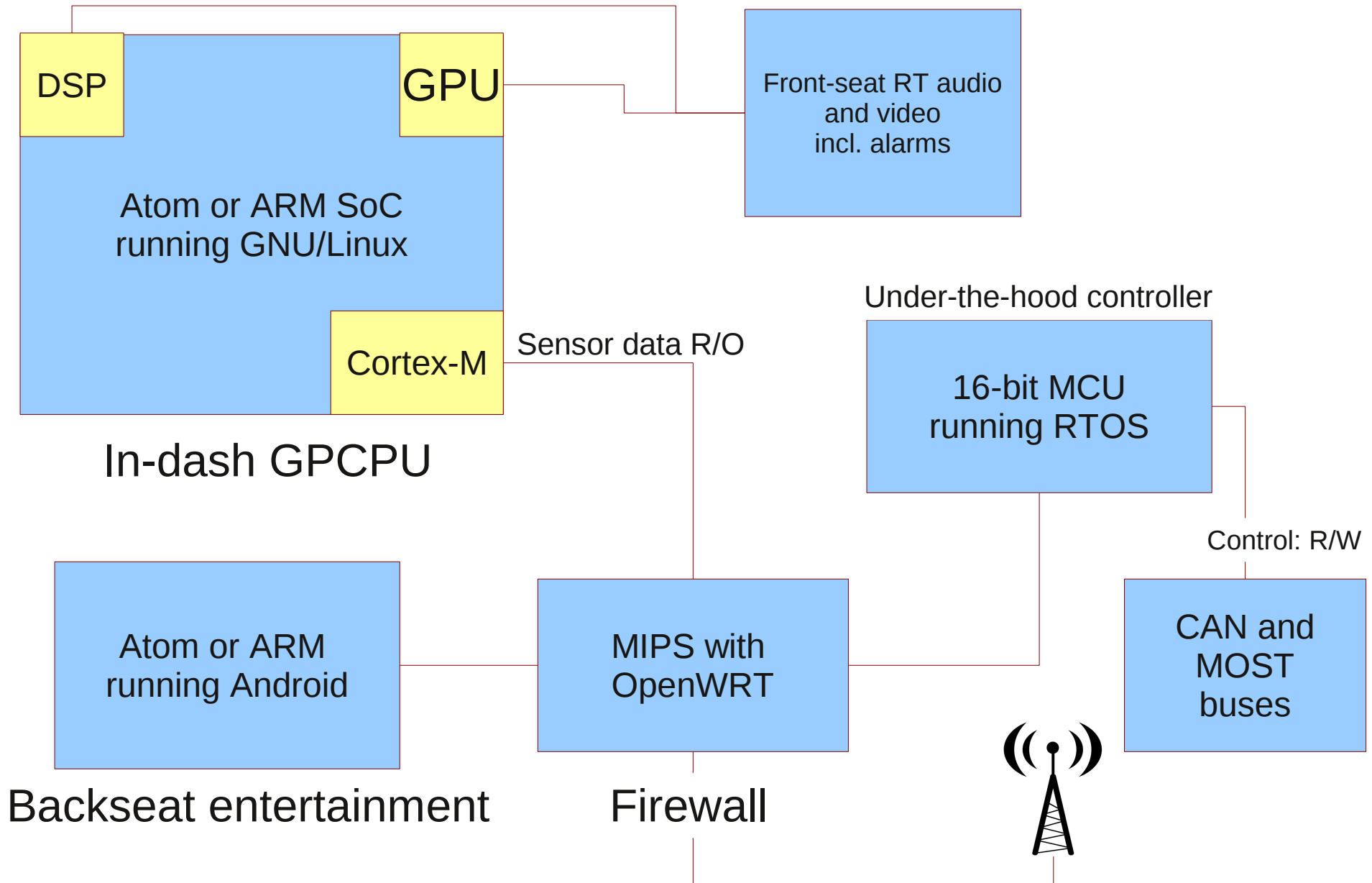

Not just RT audio, but RT video too!

UI Challenge: What kind of controls?

- Touchscreen, video gesture, joystick, voice, haptic?

http://funktion.catalystexhibit.com/2009/11/is-our-future-joystuck/

Novel architecture: my guess

DSP

GPU

Atom or ARM SoC
running GNU/Linux

Front-seat RT audio
and video
incl. alarms

Cortex-M

Sensor data R/O

In-dash GPCPU

Under-the-hood controller

16-bit MCU
running RTOS

Control: R/W

Atom or ARM
running Android

MIPS with
OpenWRT

CAN and
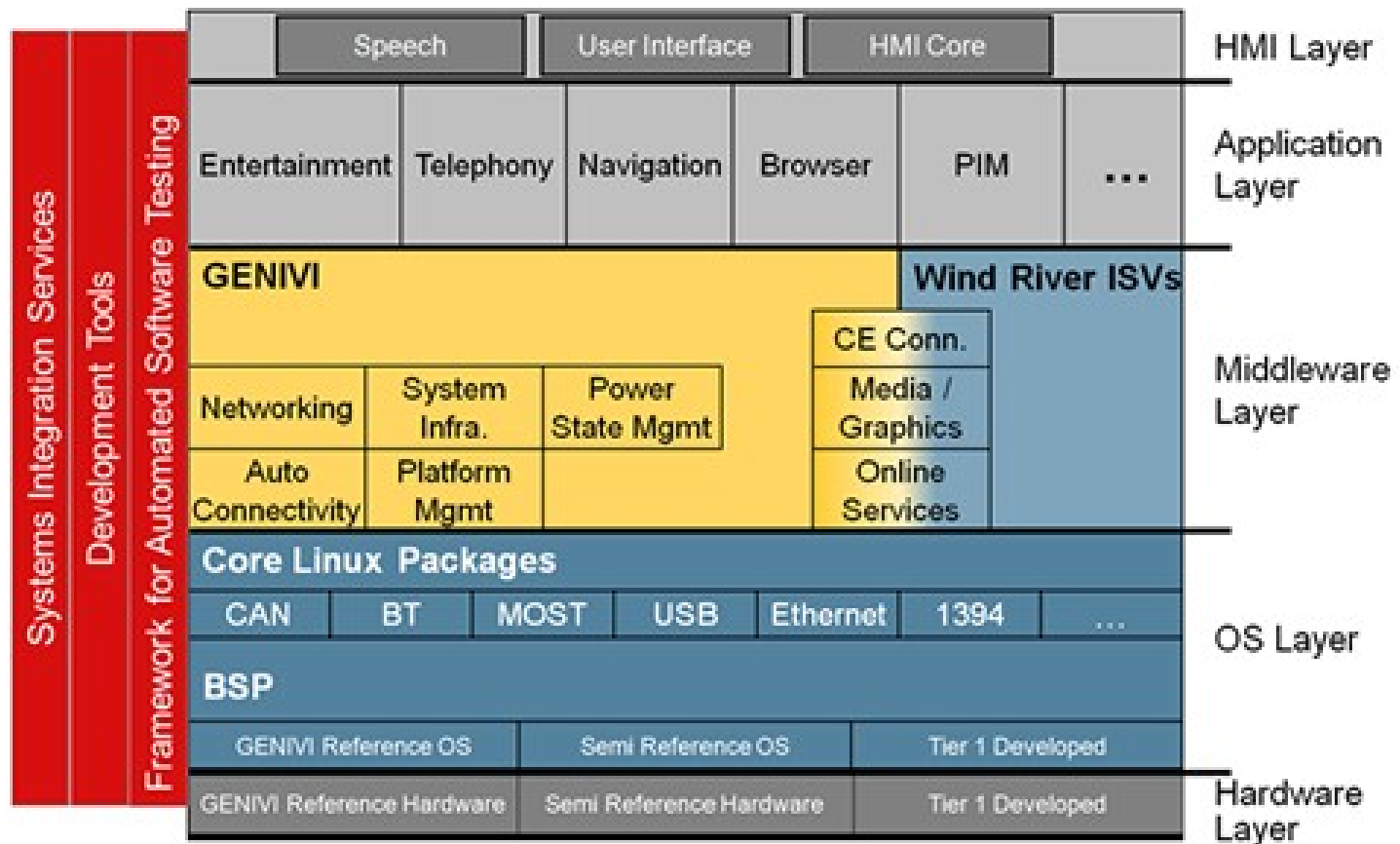MOST
buses

Backseat entertainment

Firewall

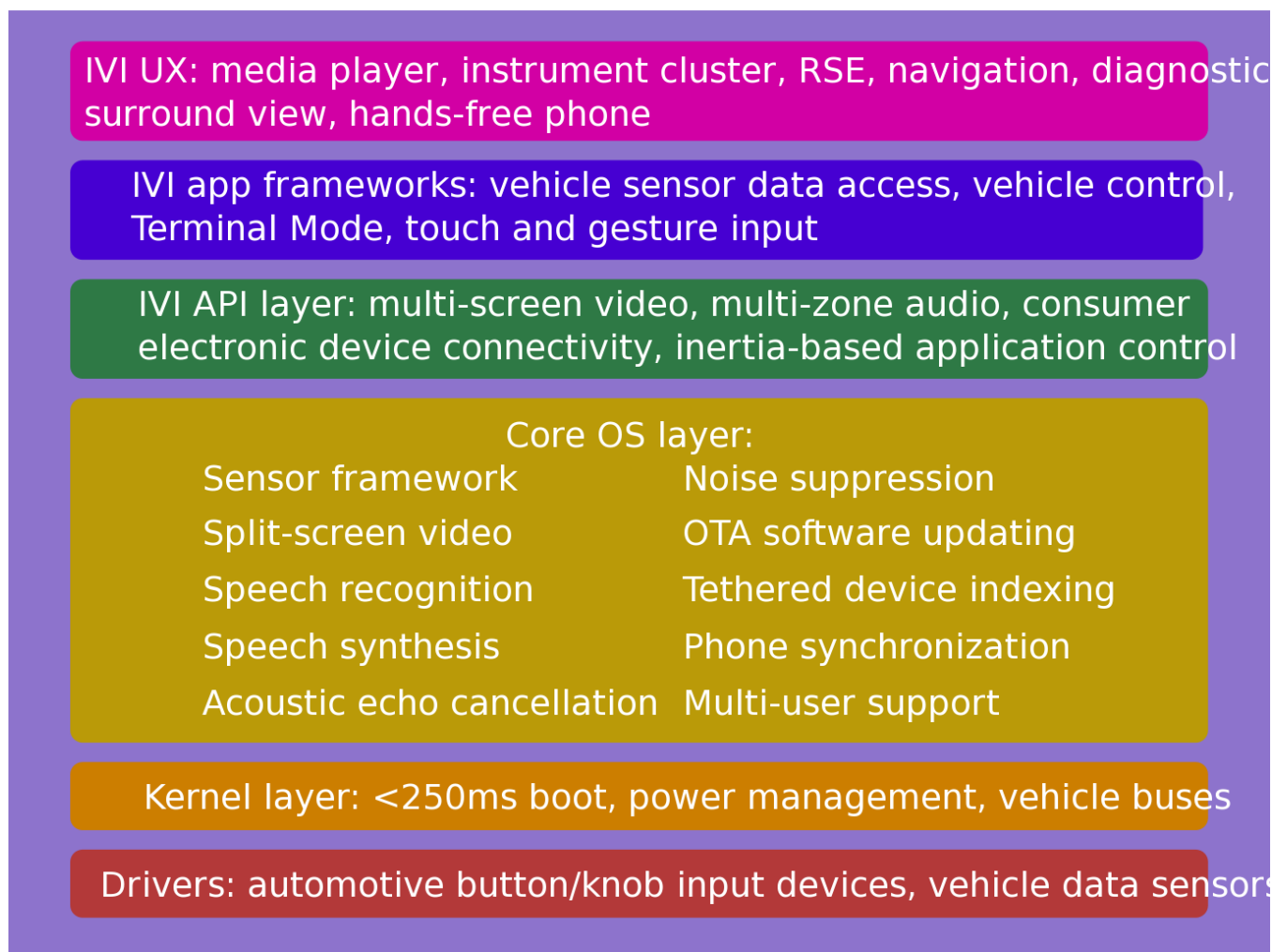# Maybe what we want is Android . . .

from the Open *Handset* Alliance?

IVI Special Features: Wind River

A traditional GNU/Linux distro, unlike Android.

IVI UX Additional Features: MeeGo/Tizen

IVI UX: media player, instrument cluster, RSE, navigation, diagnostic surround view, hands-free phone

IVI app frameworks: vehicle sensor data access, vehicle control, Terminal Mode, touch and gesture input

IVI API layer: multi-screen video, multi-zone audio, consumer electronic device connectivity, inertia-based application control

Core OS layer:

Sensor framework	Noise suppression
Split-screen video	OTA software updating
Speech recognition	Tethered device indexing
Speech synthesis	Phone synchronization
Acoustic echo cancellation	Multi-user support

Kernel layer: <250ms boot, power management, vehicle buses

Drivers: automotive button/knob input devices, vehicle data sensors

Courtesy
Nathan P. Willis,
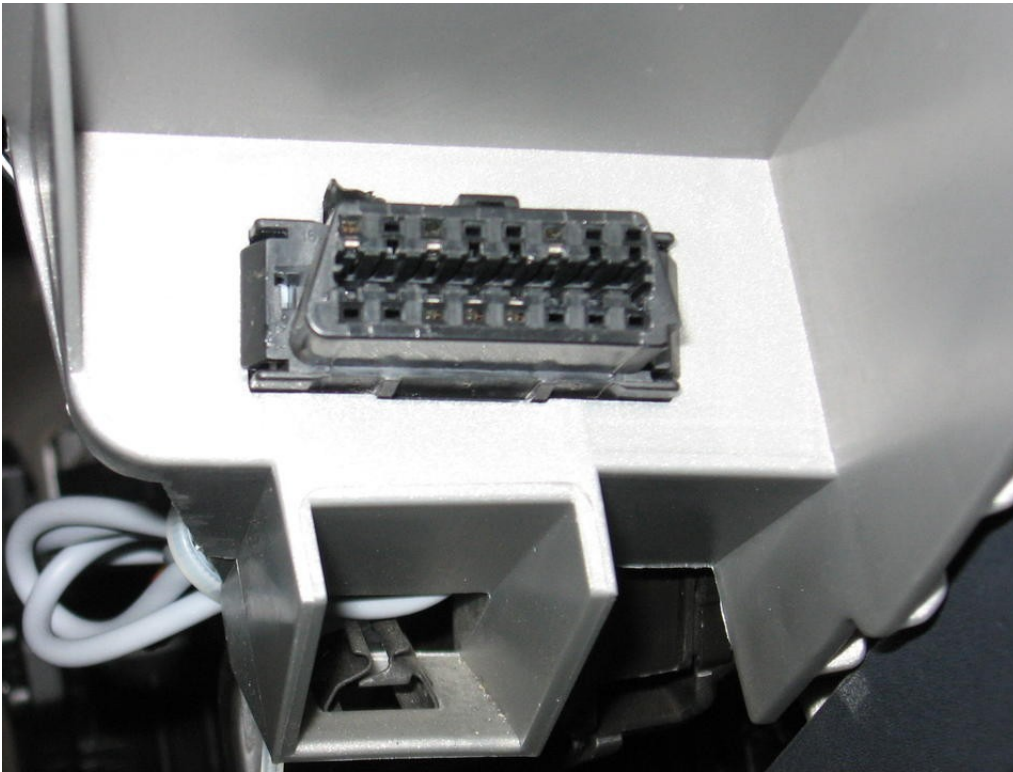http://tinyurl.com/3m4loer

Many automotive players, few public announcements.

MeeGo IVI 1.2 Home Screen

Intended to be reskinned, not as a shipping product.

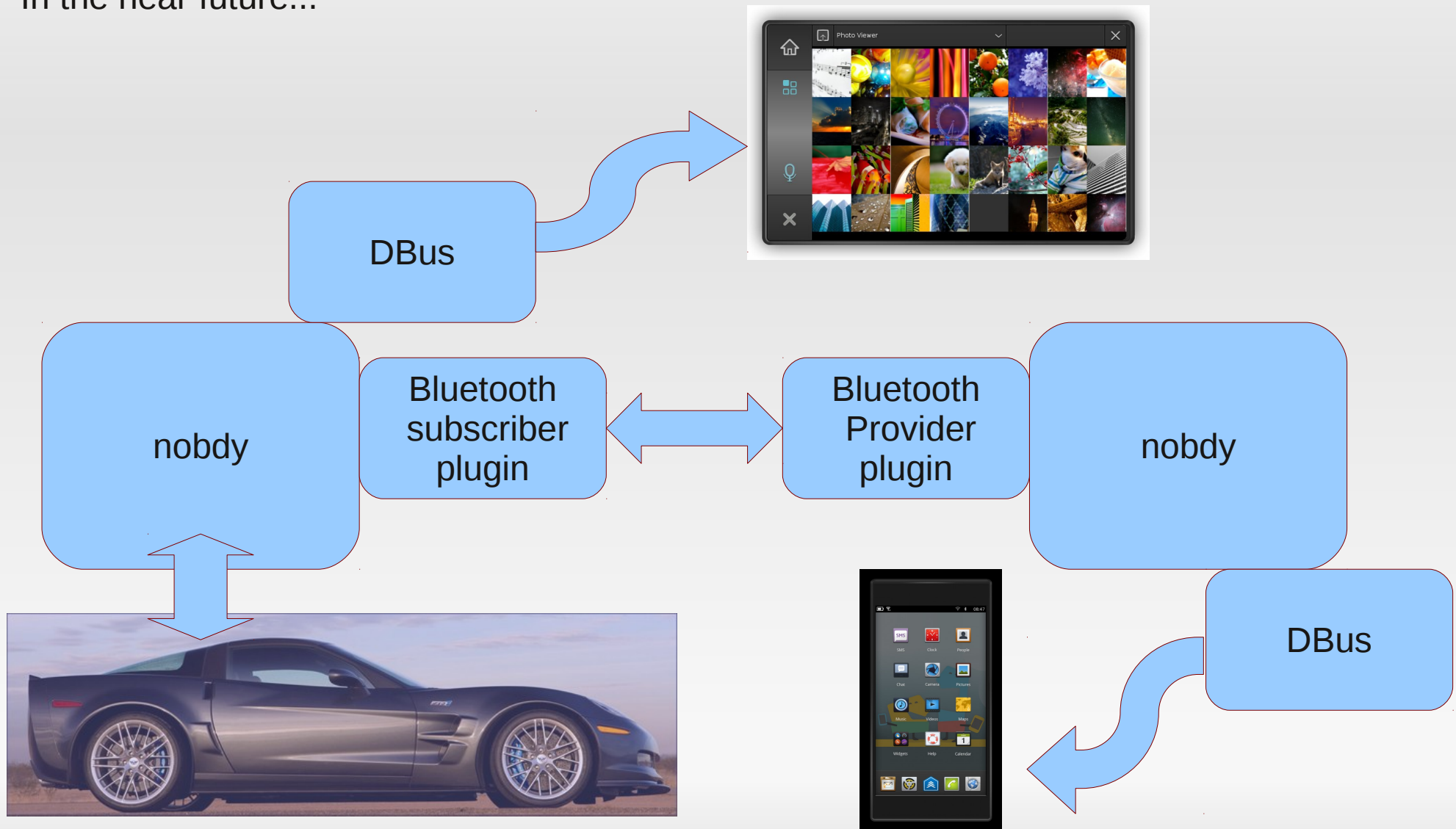# Example: tripzero's nobdy OBDII/CAN scanner

OBD-II connector on left of steering wheel

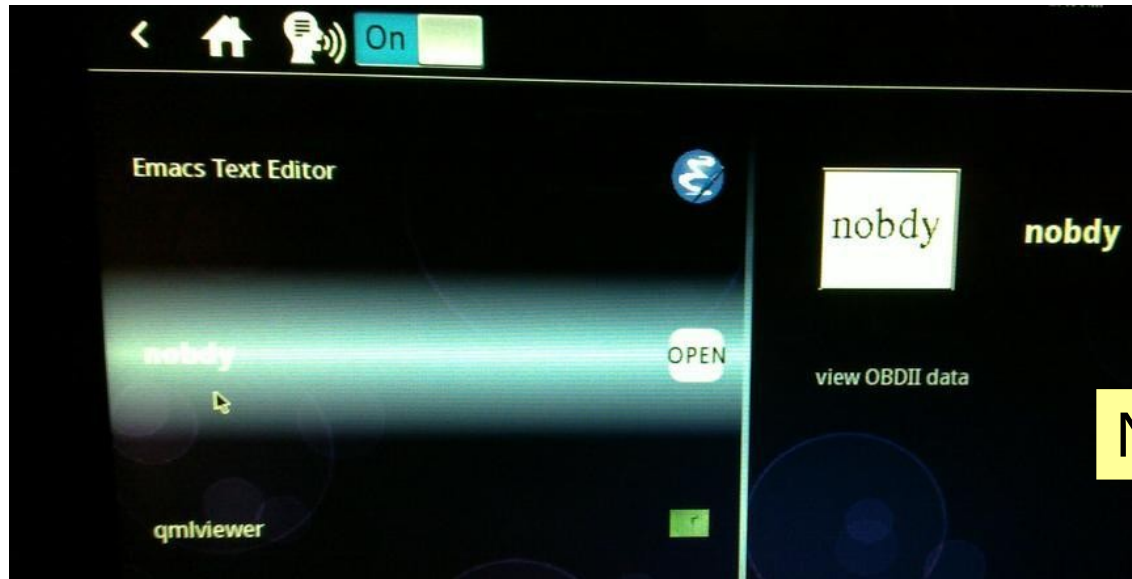Scan tool (USB to OBDII) available from Amazon, etc. about $35

GFDL

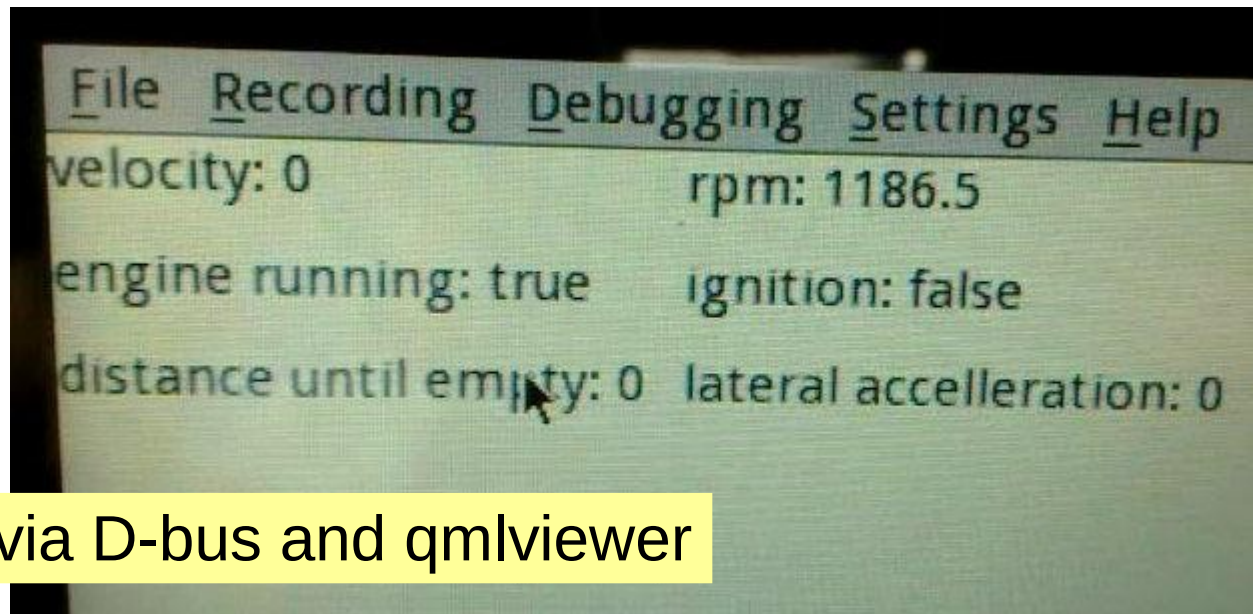# Tripzero: Handset/Tablet + meego ivi

In the near future...

DBus

nobdy

Bluetooth subscriber plugin ⟷ Bluetooth Provider plugin

nobdy

DBus

http://sf2011.meego.com/program/sessions/vehicle-communications-meego
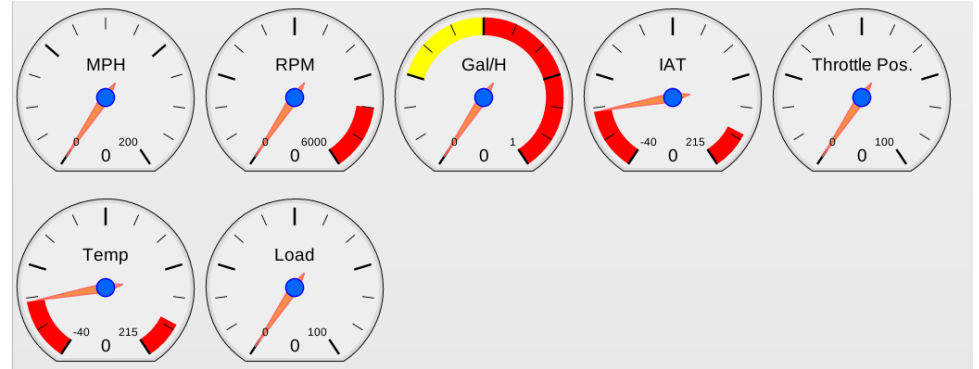
Nobdy on ExoPC

Nobdy in scrollwheel menu

Live data stream via D-bus and qmlviewer

Linux OBDII Software

New nobdy Qjson UI from tripzero

Torque from Android Market

For open-source Qt UI, see ICS IVI demo by Justin Noel

Summary

- Linux opportunities at all levels: HW, accessories, embedded, platform, apps, entrepreneurs and big companies.

- Finding HW for development remains a problem.

- *Many* local companies are participating =>> *jobs*.

- Prediction: automotive is where Linux will show most growth.

Resources 1: Hardware platforms for IVI

- ARM set-top box: Trimslice, $219 with Arch or MeeGo.

- ARM board: FreeScale i.MX QuickStart, $149 w/ Ubuntu.

- Atom/x86 slate: Ciara ExoPC Vibe, $699 w/ Windows.

- Atom/x86 board: Intel Black Sands, $149 w/ reg, Android, Ubuntu or MeeGo.

- ARM boards: T.I. BeagleBoard ($149), PandaBoard ($179), Ubuntu or Android.

- Multiple displays and controls needed.

- Touch, voice, video, joystick, haptic devices and drivers?

- GPS dongles, CAN daughter cards . . .

Resources 2

- IVI wiki: http://wiki.meego.com/In-vehicle

- Official site: http://meego.com/downloads/releases/1.2/meego-v1.2-in-vehicle-infotainment-ivi

- Mailing list archive: http://lists.meego.com/pipermail/meego-ivi

- Mp3car.com

- #linuxice and #meego-ivi IRC on freenode.net

- nOBDy: wiki.openice.org/index.php?title=Nobdy

- My notes and instructions

  - on ExoPC: http://wiki.meego.com/MeeGo_IVI_on_ExoPC

  - on Pandaboard: http://wiki.meego.com/Hardware-accelerated_graphics_on_Pandaboard_using_MeeGo

MeeGo IVI Audio Architecture
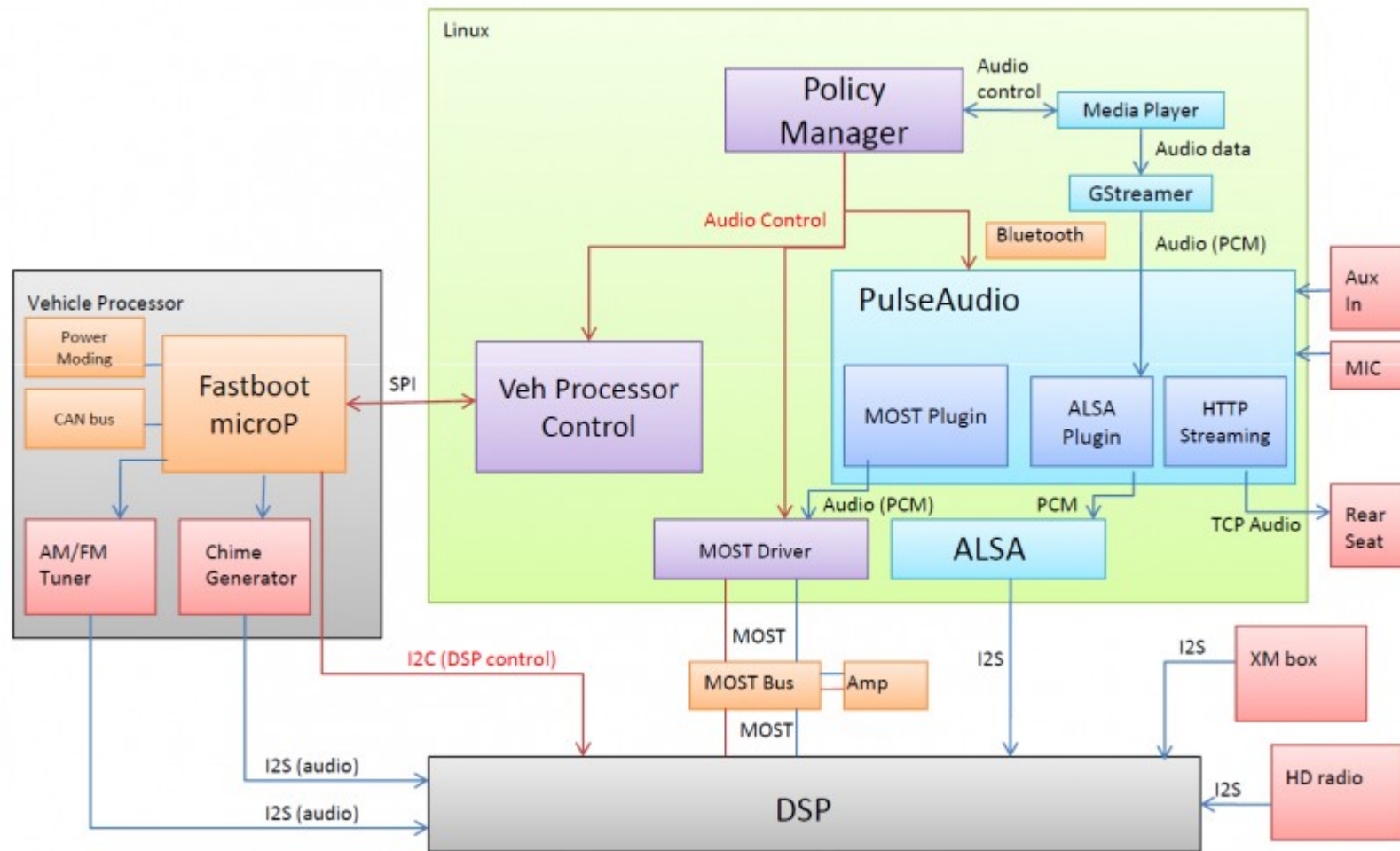
Courtesy Laci Jalics, Delphi.

How about MeeGo?
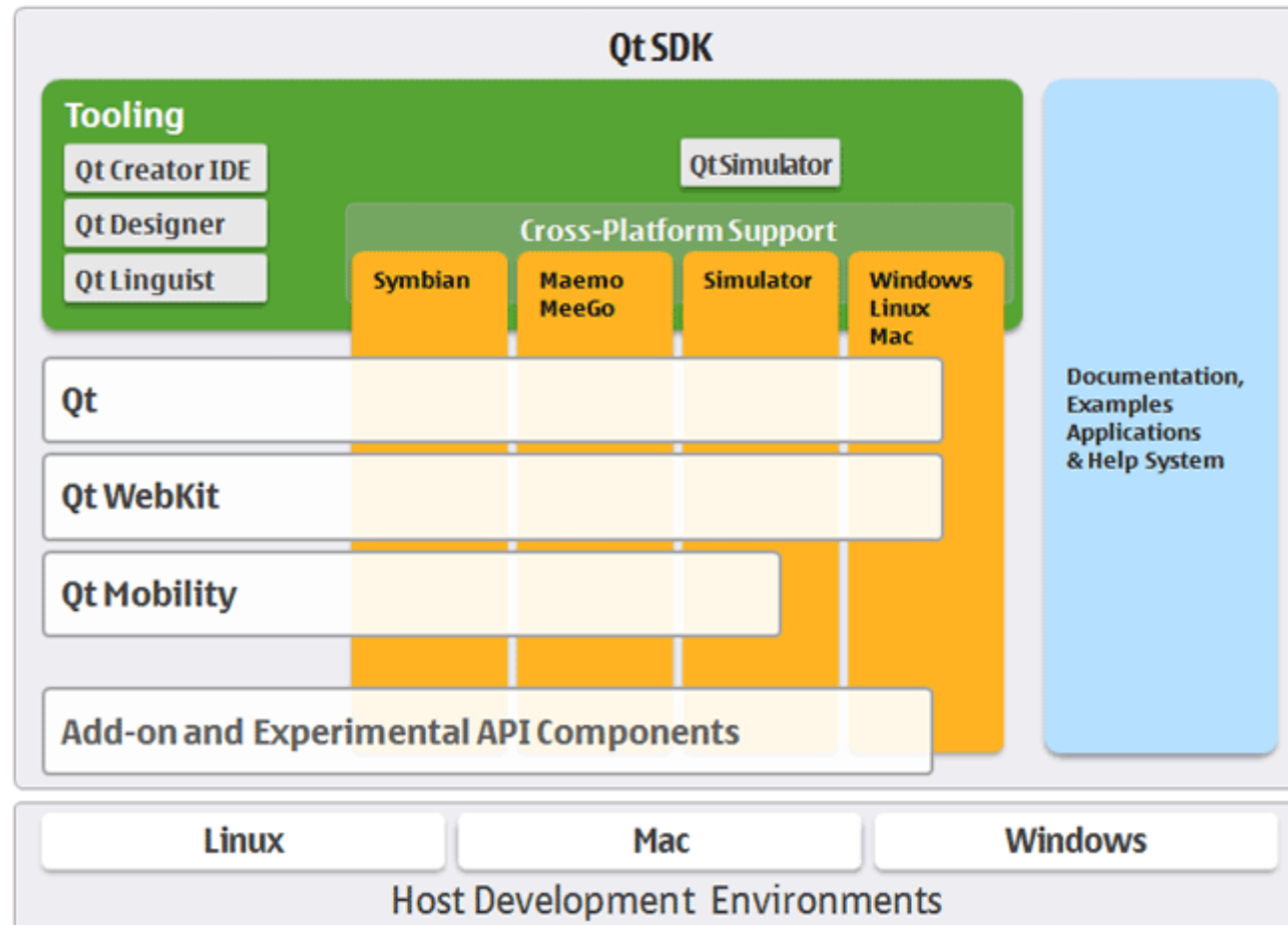
MeeGo = lightweight GNU/Linux with a Qt face.

- Elm-compatible scantool
- Any tablet/smartphone/laptop that runs meego

http://sf2011.meego.com/program/sessions/vehicle-communications-meego

MeeGo-IVI on Atom and ARM Demo HW

- No SW support for HW available to small-medium businesses.

- Running IVI on ExoPC requires a mash-up of "Tablet Preview" and IVI UXes.

- Meego-ivi repos support EMGD graphics only

  - "zypper update" auto-overwrites drivers and X11 SO libraries.

- Stopped work on ARM-based Pandaboard due to missing graphics driver.

MeeGo Hardware Adaptation Process
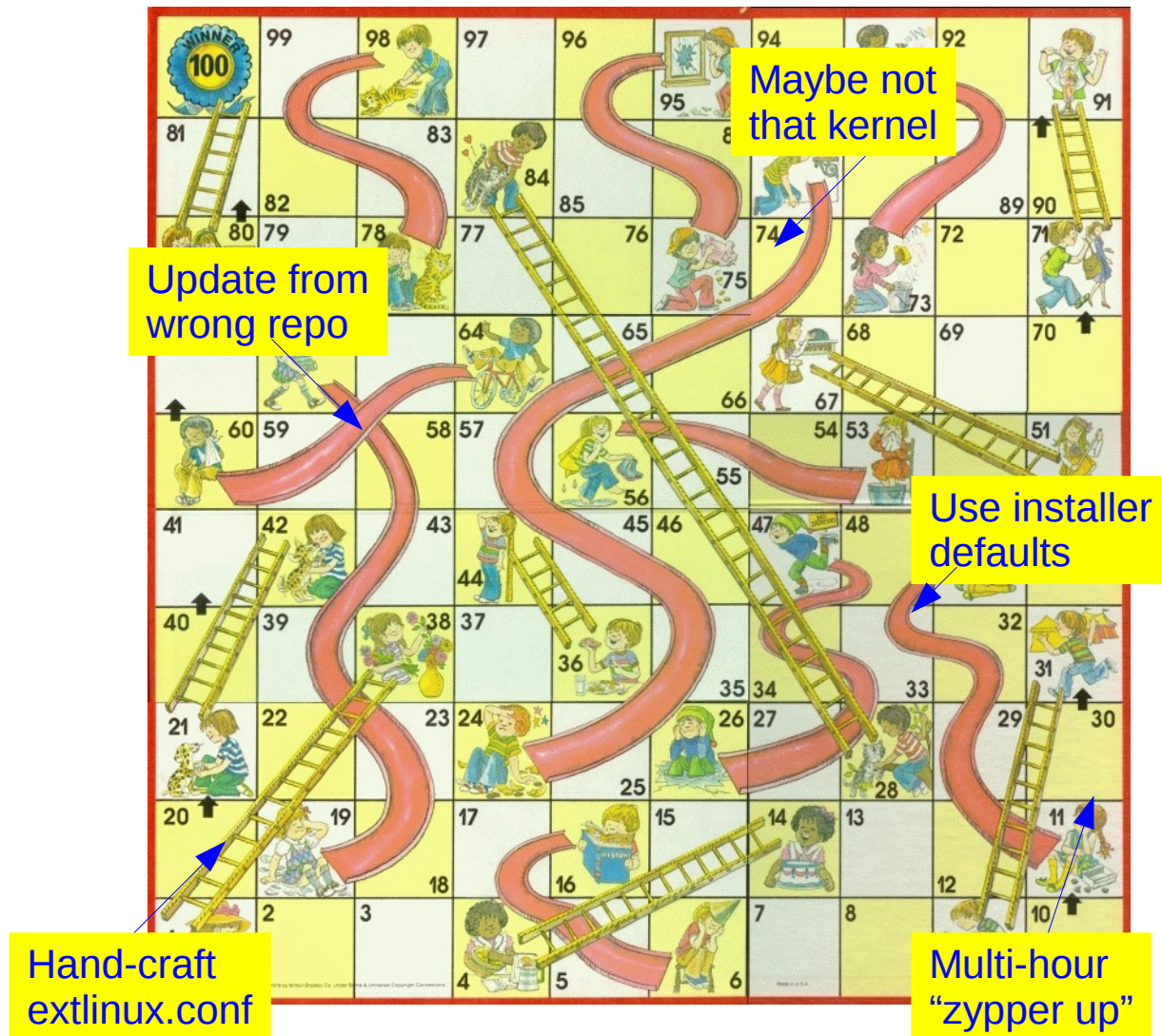
Inserting smarts into big dumb docking stations

Dock the Atrix . . .

. . . or dock the car?

Cars can tether and sync rural businesses and homes?