Our group's first sponsor
Advertisement: who wants to bus-pool to SCALE?

Katy's shuttle bus
Automotive: new frontier for mobile Linux

Alison Chaiken
alchaiken@gmail.com
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 is promulgating Linux standards for auto space.
Bay Area IVI participants

New L.A. factory
What is “in-vehicle infotainment”?

What “infotainment” calls to mind

What IVI could be

Courtesy Tata Consultancy Services
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

Handset

About 30 electric/electronic systems and more than 100 sensors
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?

Novel architecture: my guess

- Atom or ARM SoC running GNU/Linux
- Cortex-M
- DSP
- In-dash GPCPU
- Atom or ARM running Android
- Front-seat RT audio and video incl. alarms
- Under-the-hood controller
- Sensor data R/O
- 16-bit MCU running RTOS
- Firewall
- CAN and MOST buses
- Backseat entertainment
- Front-seat RT audio and video incl. alarms
- Control: R/W
- OpenWRT

Diagram:

- In-dash GPCPU
- Atom or ARM SoC running GNU/Linux
- Cortex-M
- DSP
- Atom or ARM running Android
- Front-seat RT audio and video incl. alarms
- Under-the-hood controller
- Sensor data R/O
- 16-bit MCU running RTOS
- Firewall
- CAN and MOST buses
- Control: R/W
- OpenWRT
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**

<table>
<thead>
<tr>
<th>IVI UX</th>
<th>media player, instrument cluster, RSE, navigation, diagnostic, surround view, hands-free phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVI app frameworks</td>
<td>vehicle sensor data access, vehicle control, Terminal Mode, touch and gesture input</td>
</tr>
<tr>
<td>IVI API layer</td>
<td>multi-screen video, multi-zone audio, consumer electronic device connectivity, inertia-based application control</td>
</tr>
</tbody>
</table>

**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

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
Tripzero: Handset/Tablet + meego ivi

In the near future...

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

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.
Tripzero: How do I test this in my car?

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

- Update from wrong repo
- Hand-craft extlinux.conf
- Use installer defaults
- Maybe not that kernel
- Multi-hour “zypper up”
Inserting smarts into big dumb docking stations

Dock the Atrix . . .

. . . or dock the car?

Cars can tether and sync rural businesses and homes?