A New Era – Open Innovation in the Automotive Ecosystem with Linux and Open Source Community

July 2014
Masashige Mizuyama
CTO of Automotive Infotainment Business Division, Panasonic Corp.
About Myself

• CTO of Automotive Infotainment Business since April 2013
• Architect, Director of mobile phone development ~March 2013

2005.6 Int’l Tech. Conference CELF, Yokohama

2006.4 Embedded Linux Conference, San Jose
Today’s Agenda

• Current status of IVI
• Lessons Learned from Mobile phone experience
• Challenge for Open Source
Current status of IVI
Situation is ...

- The new reference in end user’s mind: Smartphone
  IT/Cloud *Speed* of evolution, Software Explosion

- IVI is spreading over the Cockpit
  High *Reliability* is a must for Safety

*Speedy and Efficient Development* (Conflict) *Robust, Stable, Reliable System*
IVI is Expanding

Infotainment System

Cloud Services

Multi Media

Apps (Music, Navi)

HMI

Platform

IVI System
IVI is Expanding

Infotainment System

Cockpit becomes “eCockpit”

Cloud Services

Multi-Media

Apps
(Music, Navi)

HMI

Platform

IVI System
Our challenge in IVI Architecture

- Both Efficiency and Safety should be required.
## Options for Partitioning

<table>
<thead>
<tr>
<th>Options</th>
<th>Function Integrity</th>
<th>Cost</th>
<th>ASIL</th>
<th>Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separated Units</td>
<td>×</td>
<td>×</td>
<td>○</td>
<td>ECU -- MM</td>
</tr>
<tr>
<td>Dedicated Multi-Core</td>
<td>△</td>
<td>△</td>
<td>○</td>
<td>ECU -- CPU</td>
</tr>
<tr>
<td>Hypervisor</td>
<td>○</td>
<td>○</td>
<td>△</td>
<td>ECU -- CPU, Linux</td>
</tr>
<tr>
<td>Linux</td>
<td>○</td>
<td>○</td>
<td>?</td>
<td>ECU -- CPU, Linux</td>
</tr>
</tbody>
</table>
Issue still remains

Even if we partition the software on the CPU,
How about the other shared resources?
Lessons Learned from Mobile phone experience
Exploding Growth of Applications

- History of Mobile phone

![Graph showing the growth of software code size (MB) from 1990 to 2015 with milestones such as RTOS, Linux, Android, and features like i-mode, Java, Video-phone, Graphic menu, Camera, EC, and GPS.](Reference: Based on Panasonic Products)
Races for Ecosystem

Esteemo
- 2006/11
- 2006/10
- 2005/11

LiMo
- 2007/1
- 2008/7 merged

Lips
- 2005/11

Moblin
- 2007/7

MeeGo
- 2010/2

Tizen
- 2011/9
History says...

Global market share held by the leading smartphone operating systems in sales to end users from 1st quarter 2009 to 4th quarter 2013

(Reference: The Statistics Portal
Challenge for Open Source
Infotainment looks like…

- Infotainment System
- Smartphone
- Touch interface
- Modem
- GPS
- Movie
- FOTA
- Music
- Graphics
- Sound
- Voice Recognition
- Voice Call
- SMS

CAN
Dead Reckoning

...
Shifting Gear to IT Speed

IVI can no longer be developed by a single company.

Can

Open Innovation
Open Source Development

be the remedy?

To Use Existing Open Source Software

To Grow YOUR Assets in Open Source Proj.
Does Open Source Work for Automotive?

Successful Open Source Projects:

- Their Own HW to Enjoy Improvements
- Source Code First
- Simple Objective --- Solving Single Problem Area
Automotive Specific Area – Open Source?

Co-development among stakeholder companies

Area for Competition

Automotive Specific

GUI Toolkit
Web Runtime
CODECs ...

OS Kernel & Common Libs.

Device Drivers

Mainstream Open Source Development
By developer’s community
Automotive Specific Area – Collaboration?

Core part of unique value of your product

Important pieces for whole system to work.
Still, Why Open for “Joint Development”?

Closed Party, Closed Project
- Commitment for quality, schedule
- Project reliability
- No Free Riders

Open Source Project
- More Chance to have various partners
- Many eyes & hands for Quality, Schedule
- Motivation!
Path to the “Off-the-Shelf” Platform

System Integrator, BSP Supplier, Total Solution Vendor

Usable In Every Stage
Conclusion

Now, Standard in End User’s Mind is Smartphone.

Our Progress Is Too Slow in Most Cases.

If IVI Ecosystem doesn’t Get Working in 3-4 Years, Smartphone, Dongle or Arbitrary Extension Unit (or Some Other Ecosystem) will do it.

Speed is Critical.

Let’s Implement the Source Code and Make It Work!
Thank You !!
Appendix: References of images in this presentation

http://pixabay.com/ja/%E8%BB%8A-%E3%83%9F%E3%83%A8%E3%83%BC%E6%A9%8B-%E3%83%90%E3%83%A9%E3%82%AF%E3%83%9F%E3%83%A9%E3%83%BC-172876/

http://pixabay.com/ja/%E3%83%9F%E3%83%A9%E3%83%BC-%E8%BB%8A-%E3%82%AC%E3%83%A9%E3%82%B9-%E3%83%AA%E3%82%A2%E3%83%93%E3%83%A5%E3%83%BC-%E3%83%9F%E3%83%A9%E3%83%BC-%E9%A7%86%E5%8B%95-171418/

http://pixabay.com/ja/%E3%82%B9%E3%83%BC%E3%83%94-%E3%82%B9%E3%83%BC-%E3%83%89-%E3%82%BB%E3%83%BC-%E3%83%90%E3%83%BC-%E3%82%BC-%E3%83%A5-%E3%83%9C%E3%83%BC-%E7%B6%9B-%E3%82%BF%E3%82%B3%E3%83%BC-%E3%82%BF-253650/

http://news.panasonic.net/images/01ELUGAWATER.jpg

http://panasonic.jp/car/navi/products/Lseries/PRD/design/index.html#01