

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

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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

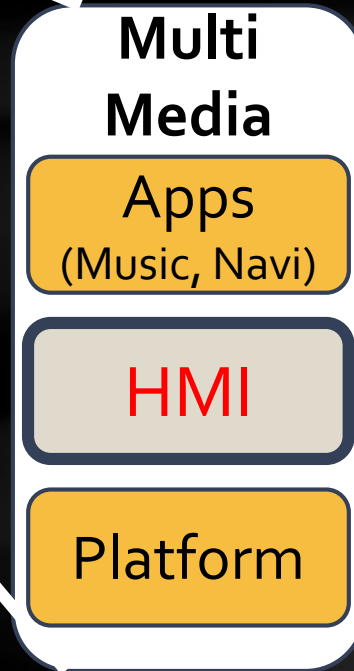


(Conflict)

Robust,
Stable,
Reliable
System

IVI is Expanding

Infotainment System



IVI System

IVI is Expanding

Infotainment System



Cockpit becomes "eCockpit"

Cloud Services

Multi-Media

Apps
(Music, Navi)



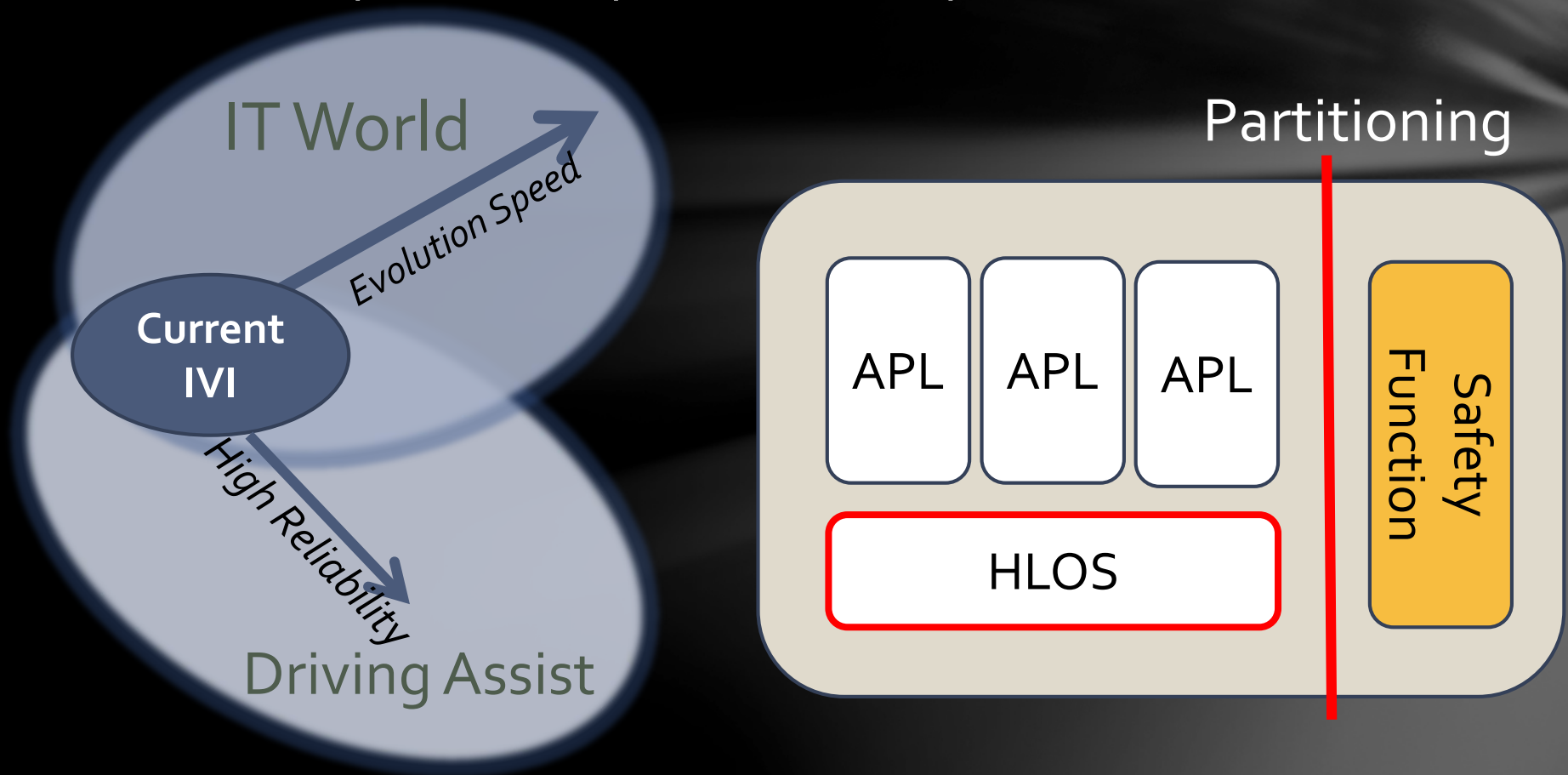
HMI

Platform

IVI System

Our challenge in IVI Architecture

- Both Efficiency and Safety should be required.

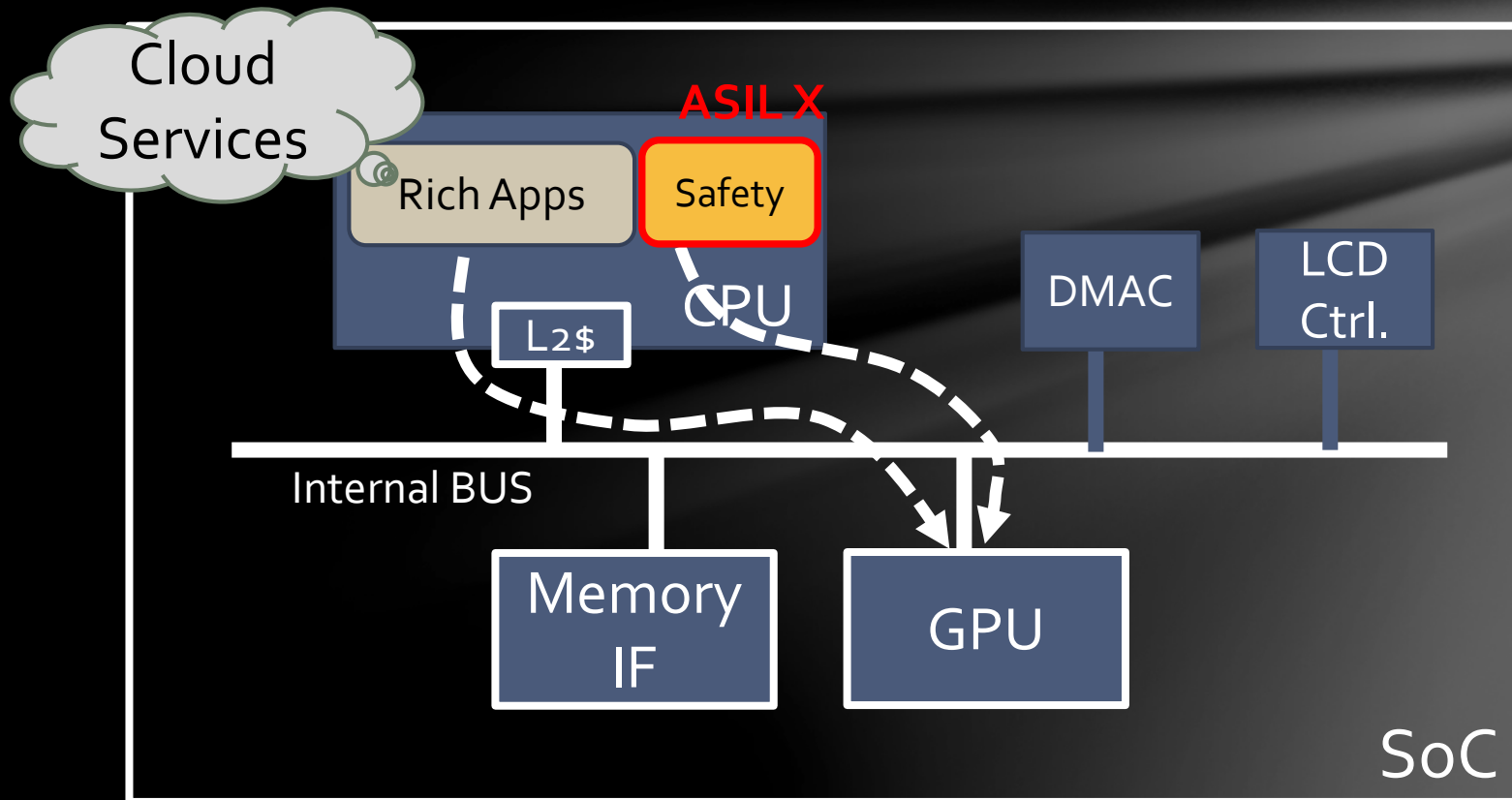


Options for Partitioning

	Options	Function Integrity	Cost	ASIL	Architecture
①	Separated Units	×	×	○	<p>Diagram showing three separate ECUs. Each ECU has its own MM, Meter, and HUD components connected to it.</p>
②	Dedicated Multi-Core	△	△	○	<p>Diagram showing a single ECU with three dedicated CPU cores. MM, Meter, and HUD are connected to their respective CPU cores.</p>
③	Hypervisor	○	○	△	<p>Diagram showing a single ECU with a hypervisor layer. MM, Meter, and HUD are connected to the hypervisor, which manages CPU, Linux, and RTOS.</p>
④	Linux	◎	○	?	<p>Diagram showing a single ECU with a Linux OS layer. MM, Meter, and HUD are connected to the Linux OS, which runs on a CPU.</p>

Issue still remains

Even if we partition the software on the CPU,
How about the other shared resources?

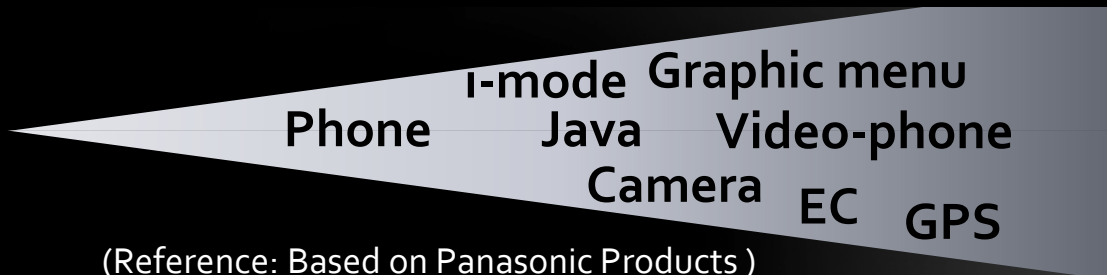
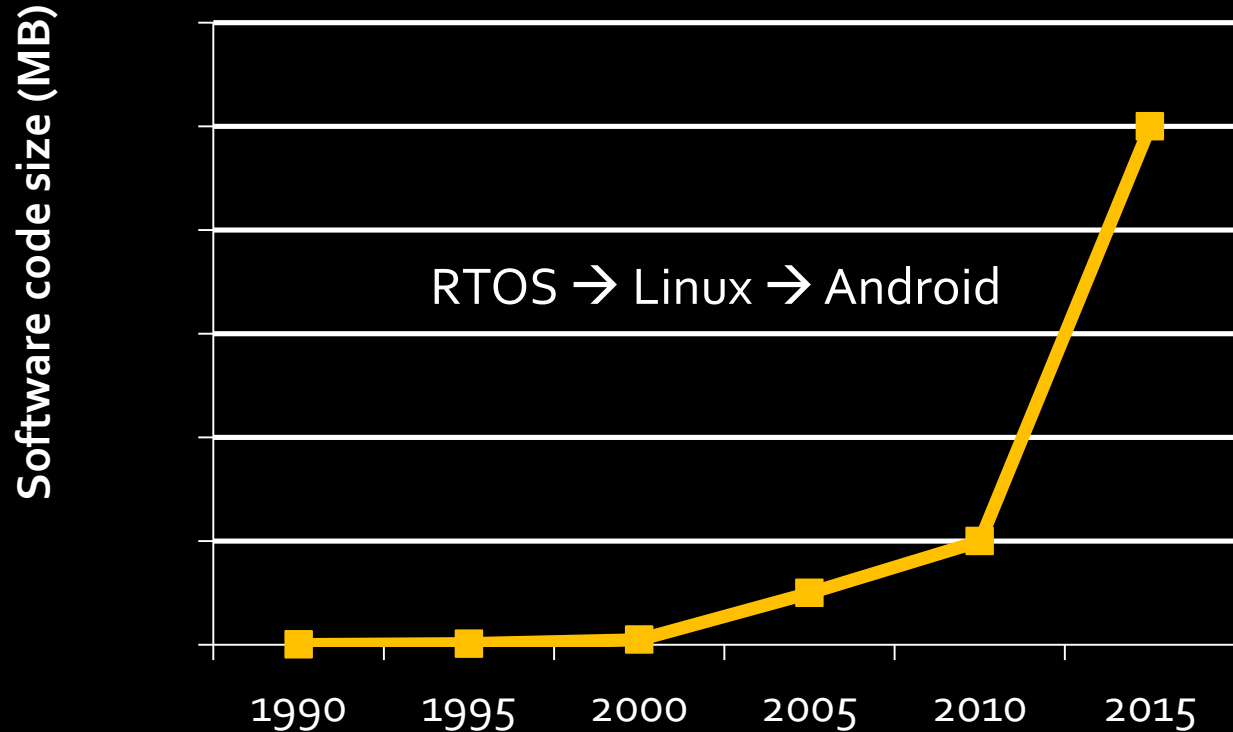


Lessons Learned from Mobile phone experience



Exploding Growth of Applications

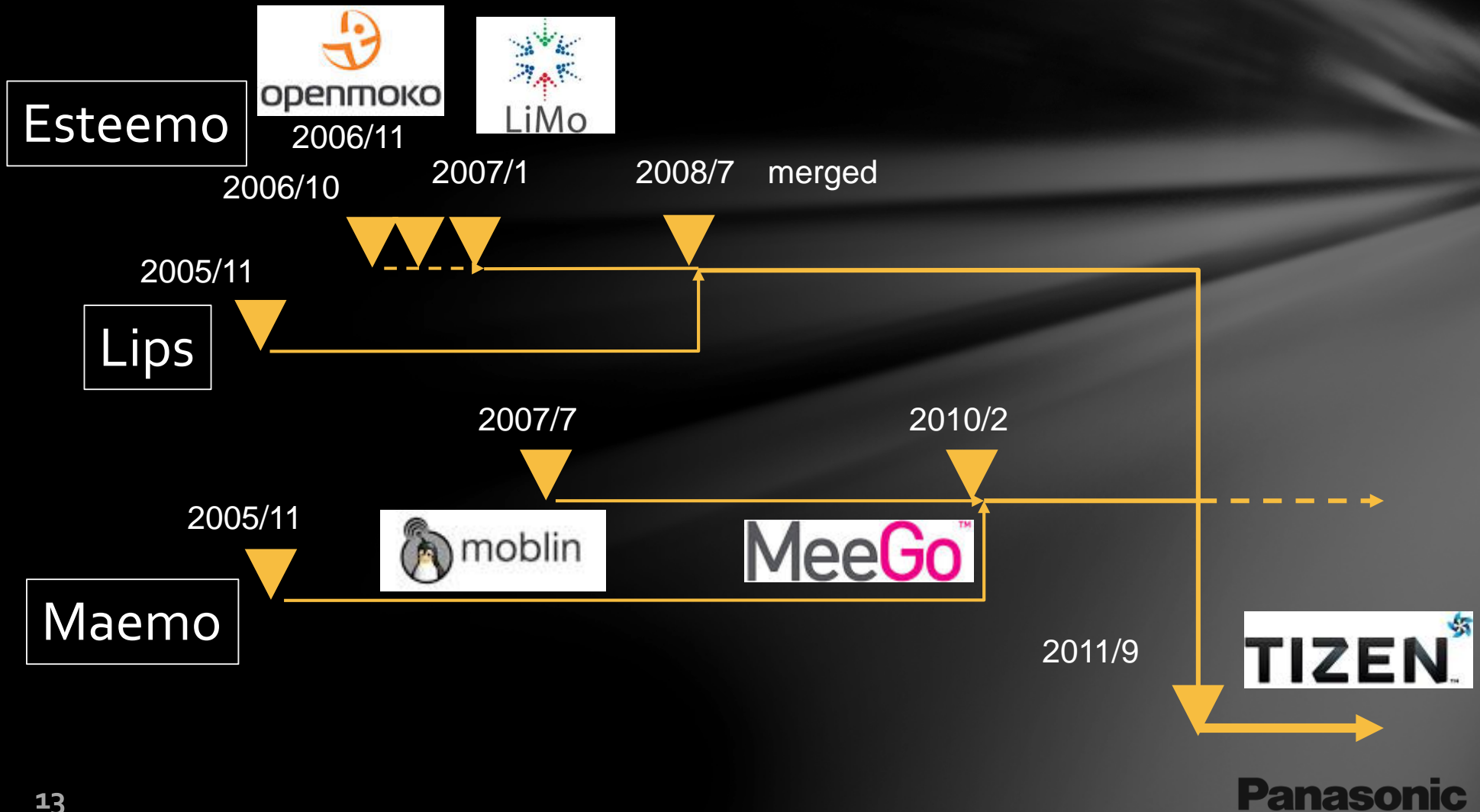
- History of Mobile phone



(Reference: Based on Panasonic Products)

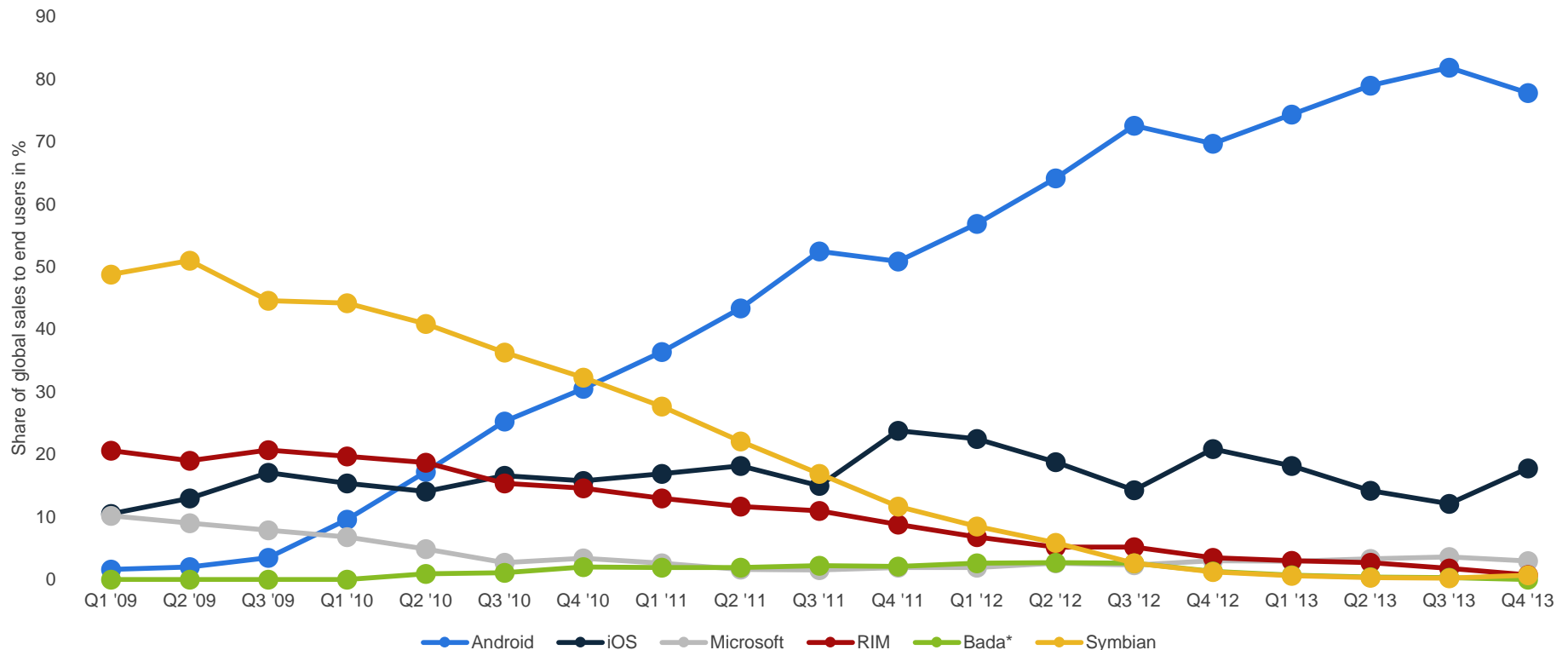


Races for Ecosystem



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

<http://www.statista.com/statistics/266136/global-market-share-held-by-smartphone-operating-systems/>)

Challenge for Open Source

Infotainment looks like...

Infotainment System



CAN

Dead
Reckoning

...

Smartphone



Voice
Call

SMS

...

Touch interface

Modem GPS

Movie FOTA Music

Graphics Sound

Voice Recognition

...

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?

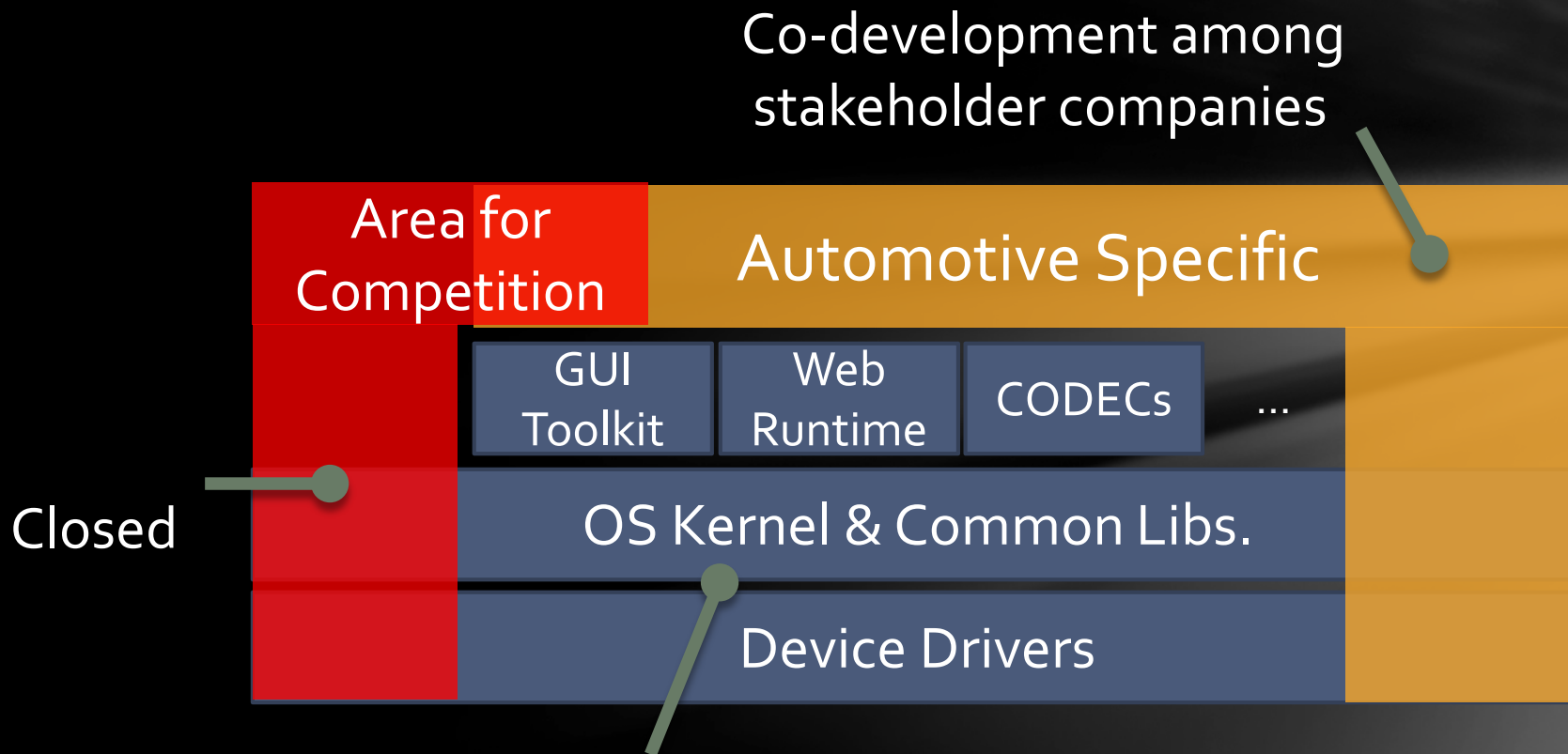
Successful Open Source Projects:

Their Own HW to Enjoy Improvements

Source Code First

Simple Objective --- Solving Single Problem Area

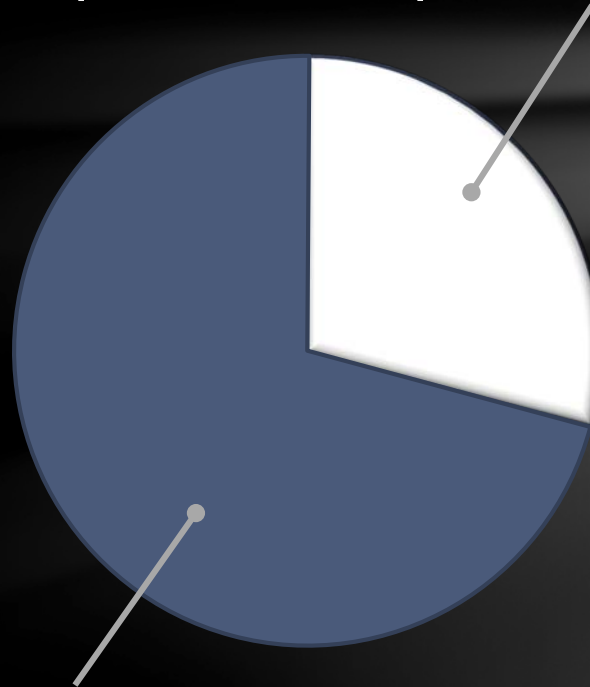
Automotive Specific Area – Open Source?



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” ?

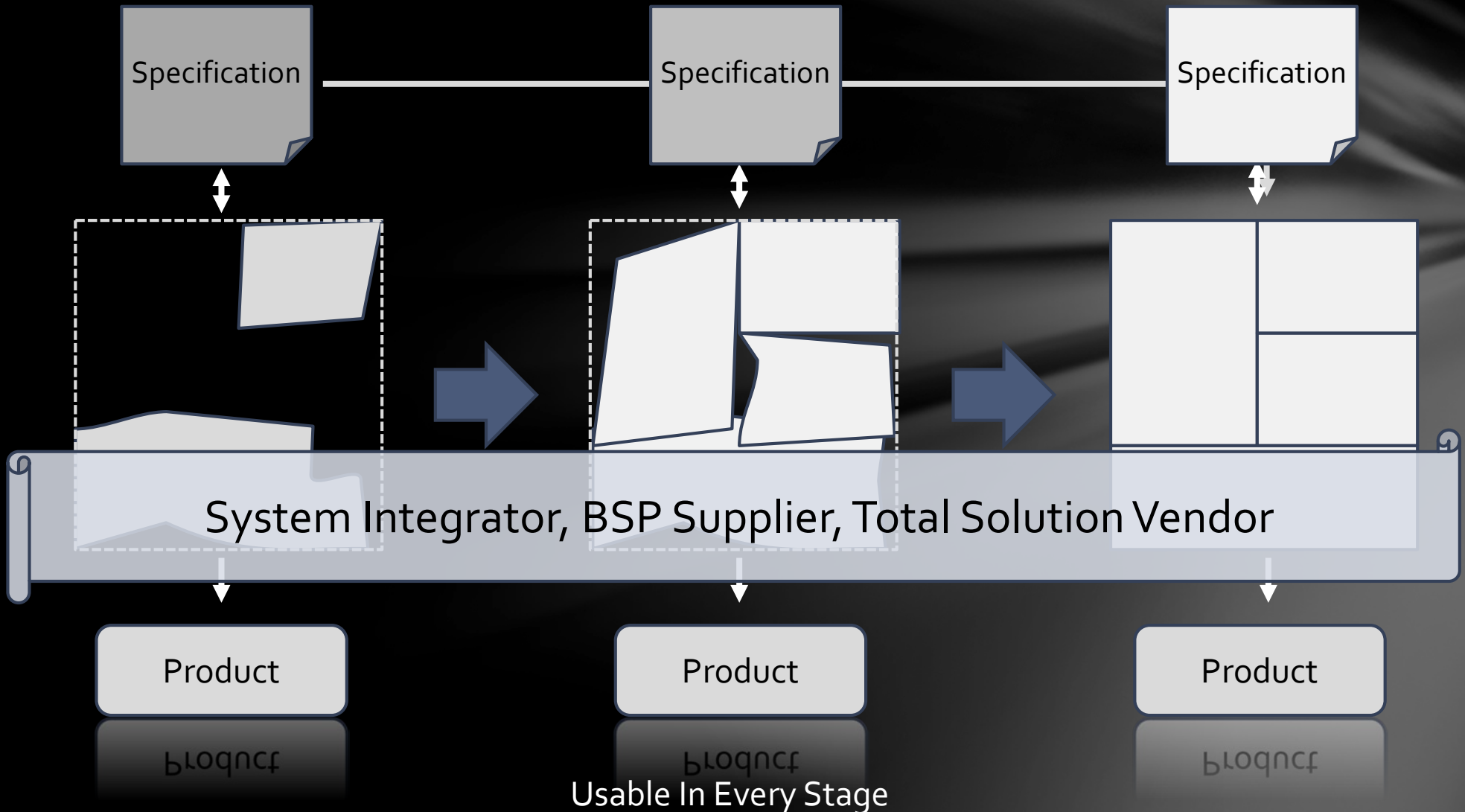
Closed Party, Closed Project

- 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



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%83%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%95-71418/>

<http://pixabay.com/ja/%E3%82%B9%E3%83%94%E3%83%BC%E3%83%89-%E3%82%B9%E3%83%94%E3%83%BC%E3%83%89-%E3%82%BB%E3%83%B3%E3%82%B5%E3%83%BC-%E3%83%80%E3%83%83%E3%82%B7%E3%83%A5-%E3%83%9C%E3%83%BC%E3%83%89-%E7%B6%99%E6%89%8B-%E3%82%BF%E3%82%B3%E3%83%A1%E3%83%BC%E3%82%BF-253650/>

<http://news.panasonic.net/images/o1ELUGAWATER.jpg>

<http://panasonic.jp/car/navi/products/Lseries/PRD/design/index.html#o1>