Open Source Lessons Learned From GENIVI

28th November 2011

Automotive Linux Summit 2011

Graham Smethurst
GENIVI President
BMW Group
The Infotainment Challenge Facing The Automotive Industry.

- The need for change
- A new mindset
- Lessons Learned
  - Community
  - Empowerment
  - Value add
  - Collaboration vs competition

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<table>
<thead>
<tr>
<th>Costs</th>
<th>Revenues</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>Market Revenue</td>
</tr>
<tr>
<td>0</td>
<td>Development Costs</td>
</tr>
<tr>
<td></td>
<td>Market Revenue</td>
</tr>
<tr>
<td></td>
<td>Development Costs</td>
</tr>
</tbody>
</table>

- Shorter Product Life in the Market
- Rising costs of innovation
Headunit prices have plateaued. New development / business model needed.

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![Chart showing headunit prices from 2000 to 2015]

Architectural integration

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Continuing to meet customer infotainment expectations demands a fundamental shift.

In the 20th century, the automobile redefined the very concept of mobility. In the 21st century the automobile industry is finding it increasingly difficult to keep pace with consumer mobility trends.

The infotainment functionality its possible to offer and sustain from within an isolated automotive eco-system is reaching its limits.

The key to meeting customer expectations in future is inheritance and interoperability with consumer eco-systems.
The need to control development costs and increase innovation demands software inheritance & re-use across the automotive industry.

“Groundhog day” in head unit development:

- Development of commodity content x3.
- OEM specifics re-implemented x3.
- Product validation x3
- Problems solved with one supplier re-occur with others.
- Limited time for innovation and new customer features.
- HMI x1

Customer value add
The search for the IVI General Purpose OS. Technical and Supply chain considerations.

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Functionality

Software scalability across the full product portfolio is a must.

- In product development multi-sourcing and customisation is a must.
- Competition / alternatives stimulate innovation and results in a fair / sustainable price.

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Open source code in the car, are you crazy?
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The need for change
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Re-alignment of automotive infotainment.
Lessons Learned from adjacent industries.

- 1998
- 2002
- 2007

**Telecom**

Vertical Point Solutions
- Vendor Lock-in
- Hard to Innovate
- Expensive Development
- Long Dev. Cycle
- Lack of Standards
- Some Differentiation at all levels —> outside core competency

Experiments
- Choice is fragmented
- Some innovation, still costly
- Few middleware or HW standards
- Differentiation outside core competency

Solution Creation
- Architected, structured
- Common OS – Linux
- Common Middleware (e.g. CGL)
- Common HW Standard (e.g. ATCA)
- Differentiation in core competencies

Widespread Adoption
- Cost optimization
- Revenue maximization
- Innovation and differentiation

**Automotive**


Widespread Adoption
- Cost optimization
- Revenue maximization
- Innovation and differentiation
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Community
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Membership Summary
Common mission drives continued growth

- The need for change
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<table>
<thead>
<tr>
<th>Region</th>
<th>Oct 2011</th>
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<tbody>
<tr>
<td>Asia/ Pacific</td>
<td>36 (23%)</td>
</tr>
<tr>
<td>Europe/ Middle East/ Africa</td>
<td>75 (49%)</td>
</tr>
<tr>
<td>North/ South America</td>
<td>46 (28%)</td>
</tr>
<tr>
<td>Total Member Companies</td>
<td>157</td>
</tr>
</tbody>
</table>
### The GENIVI Alliance Membership (www.genivi.org)

#### OEMs

- BMW Group
- HONDA
- HYUNDAI
- JAGUAR
- LAND ROVER
- NISSAN
- PSA PEUGEOT CITROEN
- GM
- RENAULT
- SAIC MOTOR

#### First Tiers

- AISIN AW CO., LTD.
- ALPINE
- ALPS
- BOSCH
- CLARION
- CONTINENTAL
- DELPHI
- DENSO
- FUJITSU TEN
- HARMAN
- Johnson Controls
- LG Electronics
- MAGNETI MARELLI
- MOBIS
- Panasonic
- PATEO
- PIONEER
- Visteon

#### OSV, Middleware, Hardware, and Services Suppliers

- Accenture
- ACCESS
- Advanced Driver Information Technology
- Airbiquity
- akhela
- AKKA Technologies
- AllGo
- ALTRAN
- ANALOG DEVICES
- ARICENT
- Arkorus
- AutoNavi
- bertrandt
- Blackduck
- Bouygues Telecom
- CANONICAL
- CENTRAFUSE
- CHLEON
- CloudQuest Technologies
- CSR
- CTAG
- CYBERCOM GROUP
- CINEMO
- DTS
- E-GITS
- ETRI
- EUCENTRE
- ESG
- Fraunhofer
- Garmin
- HCL
- HTC
- Hi-Corp.
- IBM
- Infosys
- Intecs
- INTRINSIC
- Itemis
- Green Hills Software
- jambit
- SK2L
- KG
- KPI Cummins
- Larsen & Toubro
- LUXSOFT
- HUMAX
- Mahindra Satyam
- Mapscape
- McAfee
- Mentor Graphics
- MITAC
- NOKIA
- NOVERO
- NOMOVOK
- Pi SHURLOK
- Profusion
- QAM
- RTI
- Recaro
- Rightware
- SPANION
- SECUNET
- SEGULA
- Silicon Wireless
- SIRIUS
- Suresoft
- SYBASE
- symbio
- TATA
- TATA ELXSI
- TATA shadow
- TECHNOLOGIE
- TELECA
- Telemotive AG
- telenav
tomTom
T-Systems
TUXERA
UNIWIRE
Value Technographics
Vtuner
Wind River
WiPro

#### Silicon

- ARM
- Freescale
- Intel
- ISSI
- MICREL
- Netlogic
- NXP
- ROHM
- Samsung
- Renesas
- ST
- Texas Instruments
- Viter
- Xilinx
- NXP
- ROHM
- SAMSUNG
- Renesas
- ST
- Texas Instruments
- Viter
- XILINX
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  • Collaboration vs competition
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GENIVI Alliance March 2009 – October 2010
“You learn by your mistakes”

Board

Council

Strategy Council
Frederic Bourcier (PSA)

Technical Council
Markus Boje (BMW)

Marketing Council
Joel Hoffman (Intel)

Work Group

Legal
Planning

System Infrastructure
CE & Multi Media

Out-reach
Comms

Process
Internet Office
Automotive
Reference System

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GENIVI Alliance activities
How it works.

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**Alignment**
- Aligned IVI requirements across a broad base of OEMs.
- Identified software interfaces / components that meet the agreed requirements.

**Execution**
- Modification / creation of software components
- A code baseline that "demonstrates" the requirements and "proves" the compliance spec

**Maintenance**
- GENIVI originated code
- GENIVI development baselines
- A compliance specification & assessment program against which commercial offerings can be certified.

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GENIVI Working Model.
Structure vs. Activities.

Alignment
Programme Management Office
System Architecture Team
Expert Group
Expert Group
Expert Group

• Aligned IVI requirements across a broad base of OEMs.
• Identified software interfaces / components that meet the agreed requirements.

Execution
Project Team
Project Team
Project Team

• Modification / creation of software components
• A code baseline that “demonstrates” the requirements and “proves” the compliance spec

Maintenance
Project Maintainer
Project Maintainer
Project Maintainer

• GENIVI originated code
• GENIVI development baselines
• A compliance specification & assessment program against which commercial offerings can be certified.

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Knowing your value add
An open source based automotive headunit.
Determining the pre-competitive content.

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**GENIVI Focus**

**Conventionally purchased code**
(e.g. Navigation, speech recognition)

**Automaker Code**
(e.g User Interface, USPs)

**Community Code**
(e.g. PersistencyMgr, PwrMgr, Layer Mgr, AudioMgr, UserMgr, Lifecycle Mgr…)

Automaker Code
(e.g. Flashing, Diagnostics, Provisioning/Coding, software update)

Module and interface standardisation
(e.g. Autosar, IP-based Vehicle Networking)

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The GENIVI Operating Principal
Enabling automotive on an open source base.

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Upstream projects and compliant free distributions

Solution Stack

User

Interface Apps

Hardware

GENIVI Code

GENIVI Development Baselines

Create

Adapt

Adopt

80%

15%

5%
The relationship between GENIVI and product development

GENIVI Alliance

- Specification of non-differentiating requirements.
- Architecture / Component definition.
- Component selection, modification, code implementation.
- Development baseline
- Compliance programme

Product Development

- Product definition.
- Commercial partner contracts.
  - Mandated GENIVI compliance
  - GENIVI code re-use.
  - Implementation & integration of OEM specifics.
  - Upstreaming of enhanced / bug fixed code.
- Donation of new code.
- Product delivery
The relationship between GENIVI Alliance activity, a member reference and product.

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GENIVI Development baseline

<table>
<thead>
<tr>
<th>User Interface</th>
<th>Apps</th>
<th>Hardware</th>
</tr>
</thead>
<tbody>
<tr>
<td>80%</td>
<td>15%</td>
<td>5%</td>
</tr>
</tbody>
</table>

GENIVI compliant member reference

<table>
<thead>
<tr>
<th>User Interface</th>
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<th>Hardware</th>
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<tbody>
<tr>
<td></td>
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GENIVI compliant product

<table>
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<tr>
<th>User Interface</th>
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GENIVI Compliance

- Optimisation / functional showcase
- Optimisation / customised OEM product

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OEM open source based product.
Evolved development model based on GENIVI.

Product Development

Entry Product
- IVI product Validation
- IVI Systems Validation
- IVI Product Integration
- IVI Systems Integration
- HMI
- Applications
- GENIVI Middleware
- BSP
- Reference Hardware Development(s)

Mid Product
- IVI product Validation
- IVI Systems Validation
- IVI Product Integration
- IVI Systems Integration
- Applications
- OEM middleware extensions
- Middleware & Operation System with Automotive Industry Extensions
- BSP
- Product Hardware Development

Profi Product
- IVI product Validation
- IVI Systems Validation
- IVI Product Integration
- IVI Systems Integration
- Applications
- OEM middleware extensions
- Middleware & Operation System with Automotive Industry Extensions
- BSP
- Product Hardware Development

Reduced validation cost
Reduced integration cost
OEM re-use
Application re-use
OEM re-use
Community re-use
Middleware
Hardened / customised

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Summary.

The role of Open Source in Automotive IVI.

- The consumer sector continues to increase in functionality and decrease in price increasing the competitive pressure on the automotive OEM.

- The infotainment functionality its possible to offer and sustain from within an isolated automotive eco-system is reaching its limits.

- To confront the challenge, the automotive industry is re-aligning to take full advantage of “open source”.

- GENIVI has provided the community within which the automotive industry is transitioning to an open source approach in infotainment product development.
  - Involvement of the entire supply chain, worldwide.
  - New mind set around identification, development and delivery of the pre-competitive components
  - A desire to understand and willingness to contribute to a broad community effort

- GENIVI`s continued success depends on increased collaboration with established open source projects and a willingness to consider automotive needs within their scope.
Thankyou

Differentiation based on a strong community platform.

Join us: http://www.genivi.org/