Auto Embedded Software: Infotainment

- **Hardware**: Infotainment system design is following PC model
- **Software/OS**: Standardized software/OS’s will dominate in the future
- **Apps**: Future features will be enabled using software/apps rather than dedicated hardware blocks

Standardization favors low-cost providers: European software (and hardware) suppliers will need to innovate and demonstrate their value-add to reduce the effects of commoditization, and competition from low-cost regions

**European Commission Project**: IPTS-2009-J04-17-NC JRC/IPTS
Agenda

- Hardware: Infotainment Architecture Evolution
  - System Development Frontier
- Software: The OS Evolution
  - Open and Closed platform elements
  - Regional trends by task
- Applications (Apps’)
  - Taking development beyond hardware and OS
  - Apps store and Trends
  - Infotainment to Smartphone Apps Trends
- EU Embedded Infotainment Software SWOT
- Business Upheaval
Infotainment Architecture Evolution

First Gen
⇐ 1997

Simple Radio, CD, Cassette

Distributed Architecture
MOST, Separate ECUs

Second Gen
1998 - 2008

Instrument Cluster

Headunit Integration

‘Open’ Architecture

Third Gen
2006 - 2011

Instrument Cluster

Fourth Gen
2010 →

Headunit

Source – iSuppli Corporation Automotive C&D Service
System Development Frontier: OEM vs. Consumer

First Gen ← 1997
OEM
Consumer

Second Gen 1998 - 2008

Third Gen 2006 - 2011

Fourth Gen 2010 →

Application Support
Mass Storage Device
CD/DVD Phone

CD/DVD Digital Radio Bluetooth/USB Wi-Fi Audio X.1 Telematics Voice Navigation (APP) Apps Support Mobile TV

First Gen

Consumer

Cassette CD

Cassette Audio Radio

CD Phone

CD

CD Phone AM/FM Basic Audio

Digital BUS: Navigation ECU CD Changer Sat Radio ECU Phone ECU

6 CD in Dash AM/FM Radio Bluetooth USB Navigation Audio 5.1

Second Gen

OEM

Third Gen

Fourth Gen

CD/DVD Phone MP3

Mass Storage Device

Application Support

Voice

Navigation (APP) Apps Support

Mobile TV

Fourth Gen

??

First Gen

1997

Second Gen

1998 - 2008

Third Gen

2006 - 2011

Fourth Gen

2010 →
Infotainment OS Evolution

Multiple, proprietary OS’s ➔ Single, standard OS

Instrument Cluster
- Proprietary OS
- Proprietary vs. QNX
- Genivi vs. MS Auto vs. QNX

Audio Head-Unit
- Genivi vs. MS Auto vs. QNX vs. Others

Telematics Systems
- QNX vs. ?
- MS Auto vs. QNX

Navigation Systems
- Proprietary OS
- Windows Auto vs. QNX vs. Wind River
- Genivi vs. MS Auto vs. QNX vs. Others
- Wind River to Genivi
# Auto Infotainment Platforms: What’s Open?

<table>
<thead>
<tr>
<th></th>
<th>Genivi/ MeeGo*</th>
<th>QNX (RIM)</th>
<th>Microsoft Auto</th>
<th>Continental AutoLinQ</th>
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</thead>
<tbody>
<tr>
<td>Applications</td>
<td>Open</td>
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<td>Native Apps</td>
<td>Open</td>
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<tr>
<td>User Interface</td>
<td>Open</td>
<td>Open</td>
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<td>Java</td>
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<td>APIs</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
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<td>Middleware</td>
<td>Open</td>
<td>Semi-Open</td>
<td>Semi-Open</td>
<td>Open</td>
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<tr>
<td>OS Version</td>
<td>Moblin 2.1</td>
<td>Neutrino 6.4.1</td>
<td>MS Auto 4.1</td>
<td>Android 2.1</td>
</tr>
<tr>
<td>OS Kernel</td>
<td>Linux</td>
<td>Closed</td>
<td>Win CE 6.2</td>
<td>Android</td>
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<td>Device Drivers</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
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<tr>
<td>HW Interfaces</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
<td>Open</td>
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<tr>
<td>MPU</td>
<td>ARM, 8086</td>
<td>ARM, 8086, SH-4, PowerPC</td>
<td>8086, ARM, SH-4</td>
<td>ARM</td>
</tr>
</tbody>
</table>

*GENIVI use Moblin; Will move to MeeGo

Open Source:  
Open:  
Closed:  

iSuppli Corporation – 6

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## Infotainment: OS trends by task

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<tbody>
<tr>
<td>QNX, Windows, Linux</td>
<td>Linux, Windows</td>
<td>Linux, Windows</td>
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<thead>
<tr>
<th>Spec/Design Region</th>
<th>EU</th>
<th>N. America/EU</th>
<th>N. America/EU</th>
<th>N. America/EU</th>
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<tbody>
<tr>
<td>Coding Region</td>
<td>EU</td>
<td>N. America/EU</td>
<td>USA/EU</td>
<td>USA/EU/LCC*</td>
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<tr>
<th>Driver Layer</th>
<th>Proprietary/Custom</th>
<th>Standard by OS</th>
<th>Standard by OS</th>
<th>Standard by OS</th>
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<tbody>
<tr>
<td>Coding Region</td>
<td>EU</td>
<td>EU/A-P</td>
<td>EU/A-P</td>
<td>LCC/A-P**</td>
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<th>Application Layer</th>
<th>Proprietary/Custom</th>
<th>Proprietary/Custom</th>
<th>Re-usable apps</th>
<th>Re-usable apps</th>
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<tbody>
<tr>
<td>Coding Region</td>
<td>EU</td>
<td>EU/Japan</td>
<td>EU/Japan</td>
<td>EU/Japan</td>
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</table>

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<tr>
<th>HMI Layer</th>
<th>Proprietary/Custom</th>
<th>MS AUI, Flash SW</th>
<th>MS AUI, Flash SW</th>
<th>MS AUI, Flash SW</th>
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</thead>
<tbody>
<tr>
<td>Coding Region</td>
<td>EU</td>
<td>EU/IUSA/A-P</td>
<td>LCC/EU</td>
<td>LCC</td>
</tr>
</tbody>
</table>

*Reduces EU Advantage*  
**EU Advantage lost?**

*LCC = Low Cost Countries  
**A-P = Asia pacific*
Automotive App Store: Beyond hardware and OS

**STEP 1**
- **Hardware**
  - 2010: 4th Gen Introduction
  - 2013: Commoditization

**STEP 2**
- **Software/OS**
  - 2010: 4th Gen Development
  - 2015: Commoditization

**STEP 3**
- **‘Apps’**
  - 2010: Innovation
  - ?: Commoditization
The App Store Concept for Automotive

- **What are Apps?**
  - Internet-based application store, similar to Apple iPhone App Store
  - Originated in the Smartphone space
  - Run on standardized software platforms: Windows/QNX/Genivi/Android

- **What function do ‘Apps’ serve?**
  - Enable new features using software on existing hardware
  - Developers can ‘keep the platform alive’ with feature innovations after launch

- **Who will provide the apps?**
  - Mostly 3rd party software developers
  - OEM’s and Tier 1 suppliers will provide a basic set of ‘starter’ apps

- **How do ‘Apps’ effect the supply chain?**
  - Rewards innovation and developers who are first to market
  - Provides easy scalability and distribution
  - Enables feature and service development which will encourage e-commerce
  - Shifts development/revenue opportunity from Hardware to Software
Infotainment to Smartphone Apps Trends

Functionality

- **Smartphone-Infotainment Coop Apps**
  - Joint IVI & Smartphone applications
  - OBDII apps, cloud computing apps

- **Smartphone Apps Rendering**
  - IVI HMI for Smartphone, tethering,
  - Remote control, navigation, music, RSE video

- **Smartphone-Aftermarket Device Apps**
  - Aftermarket device-based apps
  - OBDII apps, driver assist apps (camera)

- **Smartphone as Communication Link**
  - Infotainment OS Platform, Bluetooth profiles, tethering, WiFi link
  - HMI, multimedia services, telematics services, native apps
  - Examples: Fiat Blue&Me, Ford Sync, Hyundai UVO

2005 2010 2015 2020
# Automotive OEM App Trends

<table>
<thead>
<tr>
<th>OEM</th>
<th>Key Information</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BMW</strong></td>
<td>▶ First Smartphone app integration</td>
<td>▶ Favors iPhone &amp; iPod</td>
</tr>
<tr>
<td><strong>Audi</strong></td>
<td>▶ Audi Metro Project</td>
<td>▶ Smartphone concept project</td>
</tr>
</tbody>
</table>
| **Ford** | ▶ Furthest along with apps plans  
▶ Has 3 popular apps integrated  
▶ Sync to be open to future apps | ▶ Defined 3<sup>rd</sup> party APIs; SDK now  
▶ Pandora, Stitcher & OpenBeak  
▶ Planned for any Smartphone |
| **GM** | ▶ OnStar remote control demo  
▶ Chevy Volt iPhone app demo | ▶ Volt intro; likely on others later  
▶ EV functions; iPhone, Droid |
| **Kia** | ▶ Talked about future apps  
▶ Sync-like solution | ▶ Called “Car widgets”  
▶ Mobile phone based apps |
| **M-B** | ▶ Smartphone apps via mbrace  
▶ Requires subscription | ▶ iPhone, BlackBerry compatible  
▶ Hughes Telematics system |
| **Mini** | ▶ Mini Connected is iPhone integrated  
▶ Includes Internet radio via iPhone | ▶ iPhone content on AVN display  
▶ Operated via Mini Connect HMI |
| **Nissan** | ▶ Leaf Smartphone EV & eco apps  
▶ Requires subscription | ▶ Demo at auto shows  
▶ Future Infiniti expansion likely |
| **Scion** | ▶ Currently in R&D phase | ▶ To be entertainment-based |
| **Smart** | ▶ Smart Drive app at NY Auto Show  
▶ $10 app price online; 2Q’10  
▶ Vehicle app price online; 2Q’10  
▶ Vehicle finder, roadside assistance | ▶ Internet radio, iPod, maps, more  
▶ Full navi, traffic & search: $50/yr  
▶ Future services/features coming |
**EU Region - Embedded Infotainment Software SWOT** (update at workshop)

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Opportunities</th>
</tr>
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<tbody>
<tr>
<td>Introduction of Global standards:</td>
<td>Introduction of Global standards:</td>
</tr>
<tr>
<td></td>
<td>Local designers have good knowledge of EU consumer and infrastructure requirements</td>
</tr>
<tr>
<td></td>
<td>Premium vehicle development region</td>
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<tr>
<td></td>
<td>Currently the leading Infotainment feature innovation region</td>
</tr>
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<table>
<thead>
<tr>
<th>Weaknesses</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction of Global standards:</td>
<td>Introduction of Global standards:</td>
</tr>
<tr>
<td></td>
<td>Current market focus is on hardware rather than OS/software and Apps development</td>
</tr>
<tr>
<td></td>
<td>High-cost development region</td>
</tr>
<tr>
<td></td>
<td>Currently behind in Telematics software authoring and deployment</td>
</tr>
<tr>
<td></td>
<td>Lacks ‘home-grown’ OS and API standards</td>
</tr>
<tr>
<td></td>
<td>Software and Apps development is not well funded in the EU</td>
</tr>
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</table>
Conclusion: Infotainment Business Upheaval

- **Hardware level – After Platform standardization:**
  - **Demand side:** OEM’s will be looking to reduce cost and add value
  - **Supply side:** Profitability is reduced as Infotainment design follows the PC design model, and the rise of Standardized platforms
  - **Supply side:** Tier 1 suppliers will need to demonstrate their value add

- **Software/OS level – After standardization:**
  - **Demand side:** OEM’s/Tier 1’s can leverage OS’s standards to reduce development costs
  - **Supply side:** Commoditization puts pressure on EU based suppliers to outsource development to low-cost regions
  - **Supply side:** Commoditization widens the supplier base in low-cost/non-EU regions

- **Apps/Application level:**
  - **Demand side:** New feature roll-outs: Consumer and Auto apps development will converge
  - **Supply side:** Ongoing revenues opportunities will be created for the life of the vehicle
  - **Supply side:** Opportunities exist to export innovation and new feature development