Mentor Graphics Organization

**Embedded Software Division**

- **Mentor Graphics**
  - Founded 1982
  - 4800 Staff
  - Fiscal Year 12: $1.015m
  - HQ Oregon
  - Global Organization

- **Electronic Design Automation**
- **Hardware Design**

**Customer Product**

- **SW Insight**
  - >400 Staff
  - Founded 1995
  - Global Organization
  - Dedicated Sales Channel

**HW Insight**
Automotive Solutions from Mentor Graphics

- Embedded Software
- Simulation and Analysis
- Mechanical Design
- Component Design & Manufacture
- Cluster
- Infotainment
- Service, Diagnostics Intelligence
- Product Planning
- Vehicle Architecture
Overall Objectives: Mentor Embedded

#1 Supplier of Linux-based Infotainment & Instrument Cluster Solutions

Market leader in innovative Automotive Embedded Software Solutions

- Autosar / ECU
- Mixed-Domains – Android, RTOS, Linux, Autosar

Supporting Design Tools and SoC integration
Car Makers are changing the way they work:

- Open Source Software
- High rate of Innovation: Car is a CE Product

**Old Systems**
- Cluster
  - Mechanical gauges
  - Limited system data
  - Some phone, audio management
- IVI
  - Navigation (offline)
  - CD/DVD
  - Limited voice recognition

**New Systems**
- Cluster
  - LCD displays
  - Reconfigurable
  - Skinnable
  - Connected to IVI
  - Navigation cues
  - HUD
  - Rear camera
  - Trip information
- IVI
  - Web-connected
  - Haptic touchscreen
  - Natural voice recognition
  - Media devices connectivity (iPhone)
  - Internet applications (Pandora, etc.)
  - Navigation with real-time traffic
  - Rear seat displays
  - Multimedia playback
Moving away from older, proprietary Operating Systems

Linux to Obtain 30% IVI Market Share in 2018
“ADIT, a joint venture of Robert Bosch Car Multimedia GmbH and DENSO Corporation, has selected Mentor Graphics as one of their OSV partners to develop a GENIVI 2.0-compliant software platform. We chose to work with Mentor due to their active participation in GENIVI and availability of GENIVI-based standard product portfolio, plus Mentor’s extensive experience in Open Source consumer electronics software product development.”

Dr. Wilhelm Grabow, managing director at ADIT
Mentor Embedded Automotive Technology Platform

**In-Vehicle Infotainment (IVI) Option**
- GENIVI Compliance
- Large Scale Integration Services
- Security
- Fast Boot
- Multicore Linux
- Virtualization
- Multimedia
- CE Device Connectivity
- Performance Optimization
- 3rd Party Integration
- Test and Validation
- Long Term Support

**Telematics Option**
- Custom Hardware Support
- Security
- Fast Boot
- Intelligent Vehicle Technologies
- Wireless Integration
- Cloud Services Integration
- Test and Validation
- Long Term Support

**Cluster Option**
- Fast Boot
- Security
- Digital Dashboards
- Advanced 3D Graphics
- User Profiles
- Performance Optimizations
- Test and Validation
- Long Term Support

NXP
### Automotive Technology Platform for IVI

#### Applications

<table>
<thead>
<tr>
<th></th>
<th>Navigation</th>
<th>Rear-Seat Video</th>
<th>Open Table</th>
<th>3rd-Party Apps</th>
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<td>HVAC</td>
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<tr>
<td>Phone</td>
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<td>Web Browser</td>
<td>Back-Up Camera</td>
<td>Diagnostic Display</td>
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#### Middleware

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<th>Qt</th>
<th>Echo Cancellation</th>
<th>iPhone / iPod</th>
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<tr>
<td>HMI</td>
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<td>Media Engine</td>
<td>Bluetooth</td>
<td>MirrorLink</td>
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<tr>
<td>Speech Engine</td>
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<td>POI Service</td>
<td>Persistence Manager</td>
<td>Noise Suppression</td>
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<tr>
<td>Audio &amp; Layer Manager</td>
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<td>System Health Monitor</td>
<td>Event Recorder</td>
<td>Downloadable Application Manager</td>
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</table>

#### OS

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<thead>
<tr>
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<th>File System</th>
<th>Networking</th>
<th>Database</th>
<th>Package Manager</th>
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<td>Linux Kernel</td>
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<td>Fast Boot</td>
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<td>Drivers</td>
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<td>Accelerated Graphics</td>
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<td>MOST / CAN</td>
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</table>
# Mentor ATP GENIVI Compliant Platforms

<table>
<thead>
<tr>
<th>GENIVI Compliant 1.0</th>
<th>GENIVI Compliant 2.0</th>
<th>GENIVI Compliant 3.0</th>
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<tr>
<td>Freescale i.MX53 Sabre</td>
<td>Freescale i.MX6</td>
<td>Freescale i.MX6</td>
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<tr>
<td>Freescale i.MX53 QSB</td>
<td>Freescale i.MX6q Sabre</td>
<td>Boundary Devices</td>
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<td>Intel Atom</td>
<td>Freescale i.MX6q Sabre-light</td>
<td>Sabre-lite board</td>
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<td>Intel Crossville</td>
<td>Freescale i.MX53 QSB</td>
<td>Renesas R-car H1 Reference</td>
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<tr>
<td>NVIDIA Tegra 2 &amp; 3</td>
<td>Intel Crossville</td>
<td>Board</td>
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<td>Texas Instruments Jacinto</td>
<td>NVIDIA Tegra 2 &amp; 3</td>
<td>ARM Cortex A9 Architecture</td>
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<td>DaVinci_DM8148_EVM</td>
<td>Renesas R-car H1 (Marzen)</td>
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<tr>
<td>Renesas R-car M1</td>
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</table>

GENIVI Alliance Participation

Mentor is active across the organization
- GENIVI Board of Directors
- Marketing Council
- Compliance Lead
- Expert Group Participation
  - GPLv3 Task Force
  - System Infrastructure (Loaders, Initialization)
  - Automotive (Diagnostics, Software tools)
  - Media and Graphics (Tuners, Broadcast, DVD)
  - Location Based Services (Positioning, Navigation)
  - Networking, Franca IDL
  - Consumer Electronics, Social Media, Connectivity, Bluetooth, iPad,..
  - Mobile Office
  - Application Framework (Speech Recognition, HMI, Text to speech)
Embedded Domain Separation Options

Safety Systems
Airbags, ABS, Stability, etc.

Powertrain
ECU, HEV/EV, Air-fuel analyzers, etc.

Body Electronics
Keyless, seat memory, etc.

In-Vehicle Infotainment (IVI)
Navigation, Multimedia,

Telematics
Connected car, Web Services

Instrument Cluster

ADAS
Parking / Reversing

Secure

Less Secure

Single MCU
CPU Core

Separate Cores
CPU Core

Hardware Zones
ARM TrustZone
CPU Core

Software Zones
Hypervisor
CPU Core

Containers
OS1
CPU Core

OSS
Android Linux
CPU Core
Hypervisor Embedded Virtualization Platform

Tools

- Sourcery CodeBench
- Mentor Embedded Linux (MEL)

Runtime

- NUCLEUS
- Mentor Embedded Linux (MEL)
- GENIVI
- Android
- AUTOSAR

Mentor Embedded Hypervisor

SERVICES
Secure Linux Container

- Automotive Experience
- OEM Branding
- Compliance & Ecosystem
- Security
- Ultra High Quality
- Multicore Support
- T1/OEM Custom Apps
- GENIVI Compliant Stack
- Android HTML 5 Apps
- Android HTML 5 Browser
- Linux Container
- Security Layer
- ATP (Automotive Linux)
- SoC (ARM, ATOM)
- Mobile Consumer Experience
- Double Security
- Multicore Resource Control
AUTOSAR Tool development flow

**Function Requirements**
- Software Design
- Model Driven Development
- Integrated Requirements Tracking

**System Architecture**
- SW Behavior definition
- HW Architecture definition
- Topology Allocation

**System and Component Development**
- Communication Design
- Mechatronic Simulation
- EDS Design
- ECU design & config

**Software Validation**
- SW Validation
- Behavior (code)

**BridgePoint**
- Behavior (code)

**VSI**
- SWC desc
- Timing

**VSA**
- SystemVision
AUTOSAR & Instrument Cluster

- Cluster 3D graphics hosted on Linux
- Feeds from Autosar ECUs

![Diagram of AUTOSAR & Instrument Cluster]

- HMI Management Middleware GENIVI Linux
- SWC 1 Speed Sensor
- Autosar RTE
- Communication Stack (LIN, CAN, FR AVB/Ethernet)
- OS BSW
- MCAL
- Software Hypervisor or TrustZone
- SoC
- Bus: CAN, LIN, FlexRay, AVB, MOST

Hardware (Speed Sensor)
Automotive Services & Solutions
BSP and Driver Development

- Create drivers for all on-board peripherals
- Harden existing vendor-supplied BSP
  - Performance Optimization
- Support for custom / non-standard boards
  - Boot-loader development
  - OEM adaptation layer (OAL) development
  - Board-specific peripheral device drivers
Linux Fast Boot

Allow critical automotive functions to start quickly

- Rear-Camera feeds
- Driver information screens

Boot-process optimization

- Re-ordering boot process
- Delay / Disable non-critical functions
- Phased start-up
HMI Design and Development

Conceptual through to Production

Open Source and Proprietary

- Qt, HTML5, Android
- Inflexion
- Concept design, run-time optimization

Graphics Layer Management

Graphics Engines / Environments

- Chromium Webkit
- QtCore
Open Source Adoption and IP Protection

Open Source package modification

Upstreaming Contributions/Modifications

  Mentor employees contributing/moderating in GENIVI, Yocto, QEMU

GPLV2 / V3 license management

Contribution License Agreements
IVI Project & Process Management

Automotive Infotainment Requirements
Definition

Supplier profiling

Interface with GENIVI / WWG

Process Management

Stack Component Tradeoff Analysis

Hardware

Operating Systems

Architecture Analysis / Benchmarking