

Intel® In-Vehicle Solutions

Product family is designed and optimized specifically to help automakers more quickly and cost-effectively deliver in-vehicle technologies across their entire automotive portfolio.

Exceptional level
of integration
greatly simplifies
IVI system design

Product Overview

In-vehicle infotainment (IVI) design complexity along with consumer demand for the latest technology features make it extremely challenging for automakers and their suppliers to keep pace. Integrating the many informational and entertainment features is an enormous task, but one that is made much easier by automotive-grade Intel® In-Vehicle Solutions. The portfolio includes a hardened, application-ready, Linux*-based hardware platform and a uniquely-comprehensive, pre-integrated set of automotive middleware that comprises core features such as two-second fast boot, power management, persistency, connectivity, graphics, audio/video functions, and more. Using these highly-integrated solutions, automakers and their suppliers can speed up time to market, in comparison to traditional solutions, and liberate resources to focus on creating compelling user experiences.



Intel In-Vehicle Solutions, shown in Figure 1, offer optimized system choices in hardware-only or as a complete, application-ready platform with an integrated software foundation:

Compute modules: Providing a fully-validated, automotive-grade design, Intel® In-Vehicle Solutions Compute Modules support a full complement of IVI features.

Software foundation: Delivering a comprehensive middleware package, the Intel® In-Vehicle Solutions Software Foundation is pre-integrated and pre-validated to speed up development time over traditional solutions.

Application-Ready IVI Platform: Integrating the compute module with the software foundation yields an application-ready IVI platform that greatly reduces development effort and time to market for advanced IVI systems in comparison to traditional solutions.

IVI Use Cases

Addressing today’s and tomorrow’s requirements, Intel In-Vehicle Solutions were designed to support a wide range of IVI use cases, including:

- **Entertainment**
 - Multi-zone audio and video
 - Multimedia processing
 - DVD playback
 - Distributed audio/video management
 - Distributed playback
 - Ethernet audio/video bridging (AVB)
- **User Interface Technologies**
 - Speech recognition
 - Text to speech
 - Gesture recognition
 - Touch screen
- **Navigation and GPS**
- **Internet and Cloud Connectivity**
- **Accident Avoidance (i.e., cameras)**
- **Advanced Driver Assistance**
- **Graphics Display**

Software Foundation

The Intel In-Vehicle Solutions Software Foundation offers a comprehensive middleware package that is optimized and pre-validated with our compute module to enable faster time to market compared to traditional solutions. This spares system developers from having to design and integrate these components themselves, thereby enabling them to cut months off the typical development time for IVI systems.

The software foundation is a standards-based software platform consisting of hardened components that are based on the Linux operating system and support a two second fast boot. The components are delivered in three separate modules: essential features, advanced entertainment, and premium entertainment, as shown in Figure 2.

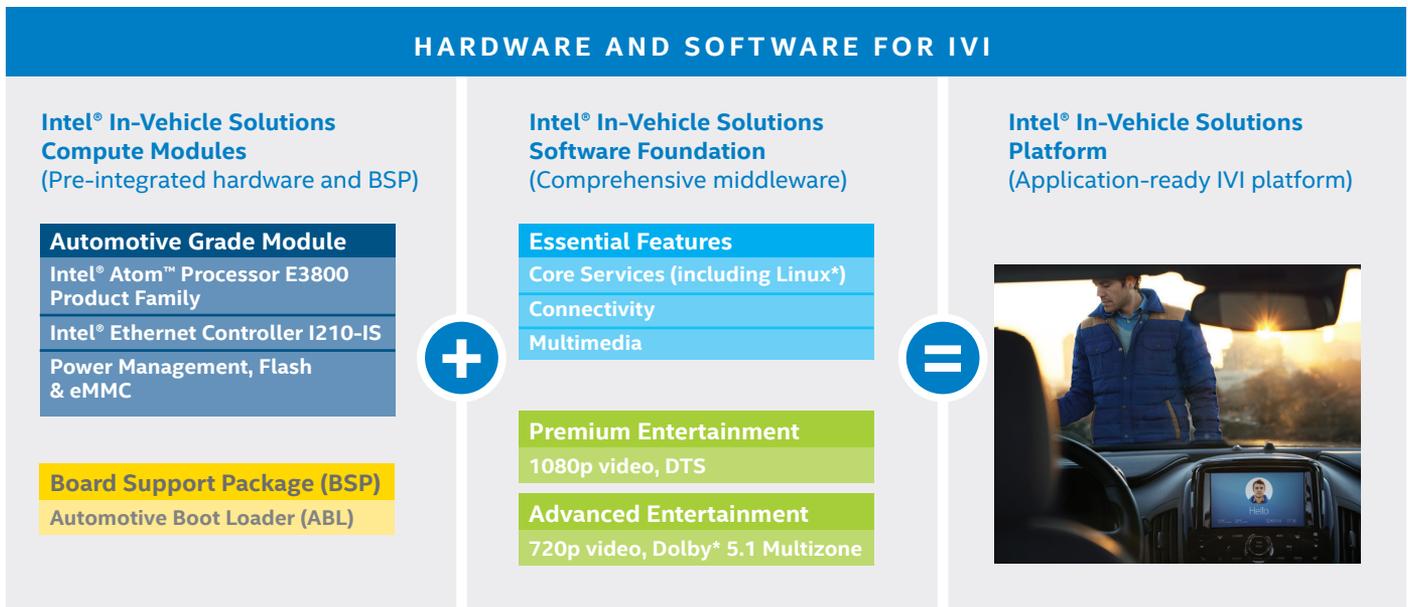


Figure 1. Intel® In-Vehicle Solutions Combine Key Hardware and Software Components for IVI.

Moreover, this fully-supported middleware is hardened and optimized for speed and memory footprint, thus enabling the high performance needed to power innovative automotive experiences. It is also designed for maximum code reuse, allowing it to run on future generations of Intel® processors and eliminating the need to design next-generation systems from scratch, which is often the case today.

Making it straightforward for auto-makers and their suppliers to customize solutions, the Intel-supplied middleware is flexible and extensible, providing a well-defined API for adding additional compatible functions, applications from various ecosystems, etc.

Open and Flexible

Since the Intel In-Vehicle Solutions Software Foundation takes advantage of many open-source components, IVI system developers can easily incorporate new applications and additional middleware from the Linux community. The software framework shares a large number of features with the GENIVI* platform as well as being highly aligned with the emerging AGL specification and the Linux Foundation. Together, this facilitates the adoption of further open-source extensions and processes, resulting in shortened development cycles, faster time to market, and reduced costs for companies developing IVI equipment and software¹ compared to traditional solutions.

Security and Data Protection

Today's connected devices need to be secure, and the Intel In-Vehicle Solutions Software Foundation safeguards IVI systems in a number of ways. The secure boot feature helps prevent malware that may have infiltrated the system from executing before the operating system starts up and launches security software. High-bandwidth Digital Content Protection (HDCP) helps

ESSENTIAL FEATURES		
BASIC SERVICES	CONNECTIVITY	MULTIMEDIA
Fast Boot	Bluetooth* Handsfree	Audio
Power Management	USB	SD Video
Persistency	Vehicle I/O Controller	Media ID
System Monitoring	Ethernet/AVB	Basic Multimedia Management
Mass Storage	Software Update/Download	
Basic Input	PIM	
Graphics	Data Stream Support for Radios and TV Tuners	
ADVANCED ENTERTAINMENT OPTION		
HD Video (720p), Dolby* 5.1 Multizone		
PREMIUM ENTERTAINMENT OPTION		
HD Video 1080p, DTS		

Figure 2. The Intel® In-Vehicle Software Foundation packages range from essential features to premium entertainment. A “super connected” option is also available.

prevent unauthorized monitoring of digital data sent to the display. Key value access secures downloads, and digital rights management (DRM) functions protect the copyrights of data circulated via the Internet.

Intel In-Vehicle Solutions Development Kit

Supporting the Intel In-Vehicle Solutions Platform, the kit includes a chassis and development tools needed to quickly bring up IVI systems. [Read more](#)

Automotive-Grade Compute Modules

Automakers and suppliers also have the option of purchasing the compute modules separately, which allows them to reduce IVI research, design, engineering, and manufacturing costs by offloading the complexities of computer design and production to Intel. Intel In-Vehicle Solutions Compute Modules are fanless, automotive-grade, production-ready hardware platforms (Figure 3) that enable price/performance-optimized IVI systems across an entire automotive

portfolio. IVI developers can choose from five module SKUs, featuring four different Intel® Atom™ processors, up to 4 GB of DDR3L memory, and up to 32 GB of non-volatile memory on an embedded multimedia card (eMMC). The compute modules also include a power management solution and the Intel® Ethernet Controller I210-IS, which support IEEE 802.1Qav audio-video bridging (AVB) for tightly-controlled media stream synchronization, buffering, and reservation.

Module Boot Loader

The modules include a board support package (BSP) and fully-validated I/O and graphics drivers that are optimized for Intel Atom processors. Reducing development time for future IVI projects, the modules enable software compatibility to next-generation Intel Atom processors.

The modules also integrate an automotive boot loader that enables full functionality, including video, in two seconds and supports general Linux-based operating systems. They quickly boot from a production kernel that can

be stored in the eMMC, or in the case of system failures, can recover by booting from an emergency kernel stored in SPI Flash memory. The boot loader also supports system diagnostics.

Power-Efficient Processors

The Intel In-Vehicle Compute Modules integrate the Intel Atom processor E3800, which delivers outstanding compute, graphics, and media performance while operating within a 5-10W thermal design power (TDP).² This system on chip (SoC) family has built-

in security and hardware-assisted virtualization, and supports an industrial temperature range, which all help improve IVI system reliability.

Connecting the car, consumer devices, and the cloud together requires a robust and flexible computing foundation, which the Intel Atom processor E3800 product family provides in a number of ways:

- Industrial temperature range
- Full HD video acceleration
- Video management, storage, and streaming
- Secure, measured booting

Faster IVI Development than Traditional Solutions

Intel In-Vehicle Solutions are helping automakers and suppliers greatly reduce IVI design complexity by offering optimized compute modules as well as application-ready platforms with an integrated software foundation. These components are supported by the [Intel® In-Vehicle Solutions Development Kit](#), complete with chassis and development tools; enabling in-vehicle testing of IVI features soon after application software is loaded. By providing solutions with pre-integrated hardware and software components, Intel will significantly reduce the time needed to bring next-generation IVI systems to market.

For more information about Intel in-vehicle technologies, visit www.intel.com/content/www/us/en/intelligent-systems/automotive/automotive-overview.html.

For more information about the Intel In-Vehicle Solutions Development Kit, download the [product brief](#).



INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. A "Mission Critical Application" is any application in which failure of the Intel Product could result, directly or indirectly, in personal injury or death. SHOULD YOU PURCHASE OR USE INTEL'S PRODUCTS FOR ANY SUCH MISSION CRITICAL APPLICATION, YOU SHALL INDEMNIFY AND HOLD INTEL AND ITS SUBSIDIARIES, SUBCONTRACTORS AND AFFILIATES, AND THE DIRECTORS, OFFICERS, AND EMPLOYEES OF EACH, HARMLESS AGAINST ALL CLAIMS COSTS, DAMAGES, AND EXPENSES AND REASONABLE ATTORNEYS' FEES ARISING OUT OF, DIRECTLY OR INDIRECTLY, ANY CLAIM OF PRODUCT LIABILITY, PERSONAL INJURY, OR DEATH ARISING IN ANY WAY OUT OF SUCH MISSION CRITICAL APPLICATION, WHETHER OR NOT INTEL OR ITS SUBCONTRACTOR WAS NEGLIGENT IN THE DESIGN, MANUFACTURE, OR WARNING OF THE INTEL PRODUCT OR ANY OF ITS PARTS. Intel may make changes to specifications and product descriptions at any time, without notice. Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined". Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The information here is subject to change without notice. Do not finalize a design with this information. The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request. Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order. Copies of documents which have an order number and are referenced in this document, or other Intel literature, may be obtained by calling 1-800-548-4725, or go to: <http://www.intel.com/design/literature.htm>

Intel's compilers may or may not optimize to the same degree for non-Intel microprocessors for optimizations that are not unique to Intel microprocessors. These optimizations include SSE2, SSE3, and SSE3 instruction sets and other optimizations. Intel does not guarantee the availability, functionality, or effectiveness of any optimization on microprocessors not manufactured by Intel. Microprocessor-dependent optimizations in this product are intended for use with Intel microprocessors. Certain optimizations not specific to Intel microarchitecture are reserved for Intel microprocessors. Please refer to the applicable product User and Reference Guides for more information regarding the specific instruction sets covered by this notice. Notice revision #20110804

¹ Source: <https://www.genivi.org>. This reference does not imply Genivi* endorsed this solution, but rather the solution is in keeping with the solutions currently proposed by Genivi.

² The TDP specification should be used to design the processor thermal solution. TDP is not the maximum theoretical power the processor can generate.

Copyright © 2014 Intel Corporation. All rights reserved. Intel, the Intel logo, and Intel Atom are trademarks of Intel Corporation in the United States and/or other countries.

*Other names and brands may be claimed as the property of others. 0514/RH/HBD/PDF ♻️ Please Recycle 330593-001US

