

Accelerate Time to Market with Flexible Architecture for Digital Cockpits and Clusters

The Intel® development platform for in-vehicle experiences (IVE) speeds prototyping and reduces complexity with prequalified, optimized modules and development tools.

With products specially designed for next-gen in-vehicle experiences, automakers and suppliers can accelerate development, consolidate systems, and maximize profits.



In-vehicle experiences take shape

Automakers are creating exciting new experiences in the vehicle to differentiate their brands and win market share. Consumer demand for more digital features, interactive displays and surfaces, and driver assistance means the number of pixels in a vehicle could reach 38 million by 2020, the equivalent of 19 full HD TV panels.¹ This places an enormous burden on compute and graphics performance and creates the need for headroom for platform longevity.

Driven by cost efficiencies and the need to simplify increasingly complex systems, the automotive market is also consolidating multiple electronic control units (ECUs)—infotainment, instrument clusters, heads-up displays, rear seat entertainment, camera modules, and more. This requires advanced technology, such as virtualization, higher GPU throughput, and greater CPU performance.

The Intel development platform for IVE is designed to bring next-generation features to market faster, including:

- In-vehicle infotainment (IVI)
- Digital instrument clusters
- Advanced driver assistance systems (ADAS) visualization
- Rear seat entertainment

The platform offers Intel Atom® automotive processors, prequalified automotive modules, an automotive reference board, and a development kit. With products specially designed for IVE, automakers and suppliers can accelerate the development of cross-fleet solutions and consolidate systems while maximizing profit margins.

Power-optimized compute performance

Based on the same silicon used in numerous IVE design wins, Intel Atom® A3900 automotive processors deliver substantial compute in a compact, low-power package, impressive graphics, and advanced security. They integrate an energy-efficient quad-core CPU, a powerful GPU, and dedicated audio, video, and image processors. This results in new levels of image and video processing to support critical real-time video analytics, all in a compact form factor. In addition to the ability to handle more sensors and tasks, these processors offer excellent memory speeds, fast graphics, HD video acceleration, and support for 4K video.

Built into a compact flip chip ball grid array (FCBGA) and featuring 14 nm silicon technology, Intel Atom automotive processors offer a new image processing engine, greatly expanding video capabilities. Intel® Real Time Compute capabilities can coordinate and synchronize peripherals and networks of connected devices, achieving improved determinism and resolving latency issues.

With advanced protection at the hardware level, Intel Atom automotive processors can help reduce vulnerabilities. An integrated Converged Security Engine (CSE), a dedicated security coprocessor, dynamically adapts the security level to function criticality. Processors also offer secure boot and fast cryptographic execution with Intel® Advanced Encryption Standard New Instructions (Intel® AES-NI).

Flexible architecture that scales across SKUs

The Intel development platform for IVE delivers one flexible architecture for a wide range of system designs. By building on scalable Intel® architecture, automakers and suppliers get an interchangeable platform they can use for many model years to come. Developers can save time and resources by optimizing apps once, including those for graphics and video, and then deploying across SKUs, from midrange to premium vehicle models.

Platform and human-machine interface (HMI) consolidation

As ADAS gives way to autonomous driving, the HMI will become critical. The Intel development platform for IVE gives system designers an easy way to add HMI design to their autonomous driving work.

Intel Atom automotive processors deliver the performance headroom to combine IVI, digital instrument clusters, and ADAS visualization features to one platform, which can then be scaled across a range of SKUs. But they also offer the sophisticated virtualization technology needed to integrate the HMIs for all systems, delivering seamless, intuitive experiences that win the trust of drivers and passengers. Intel® Virtualization Technology for Directed I/O (Intel® VT for Directed I/O) provides hardware support for isolating and restricting device access and I/O device assignment. This ensures key safety functions get priority in terms of access to the processor when consolidating IVI and instrument clusters.

Prequalified, optimized modules

Intel Atom® automotive modules can speed time to market and dramatically reduce the complexity and efforts of prototyping through the integration and validation of core components. A total of nine optimized, prequalified modules combine an Intel Atom A3900 series processor with an LPDDR4 memory configuration and power management integrated circuit. This offers a range of performance levels to meet different price points, all on a common module.

Automotive-qualified modules meet the Automotive Electronics Council AEC-Q100 standard for stress test qualification for integrated circuits, with SKUs that offer a -40°C to 110°C temperature rating. Modules are prevalidated with Intel® automotive software tools and multiple operating systems, so suppliers can build simpler printed circuit board solutions.

Reference board and development kit

To accelerate solution development, the Intel development platform for IVE offers a reference board with common automotive connectors, including USB, Ethernet, and HDMI.

This reference board can also come as part of a development kit to enable faster in-vehicle testing after loading application software. The full development kit includes:

- Baseboard with soldered Intel Atom automotive module
- Open chassis integration
- Power brick and cables
- Main cable harness for in-vehicle integration
- Bluetooth*, Wi-Fi, and AM/FM antennas
- Microphone
- CVBS camera
- Reference board support package (BSP) that includes IVI middleware, automotive boot loader, and reference OS support for Linux* and Android*
- Removable debug card for optional hardware ingredients
- Sample user interface
- Development collateral (technical documentation)



Figure 1. The Intel® development platform for in-vehicle experiences powers a wide range of solutions for in-vehicle infotainment, digital instrument clusters, and advanced driver assistance systems (ADAS) visualization

A REVOLUTION IN DRIVING

Today's consumers expect more from their driving experiences. The Intel development platform for IVE powers a wide range of exciting new experiences, such as next-generation navigation systems, augmented reality heads-up displays, and visualization of ADAS technologies like surround-view parking assist.



Digital instrument clusters and heads-up displays

By digitizing behind-the-wheel instrument clusters, automakers can provide a more engaging and flexible experience that adapts to driving situations. In some cases, instrument clusters can even project images on the windshield, with alerts for low fuel, low tire pressure, and other notifications.

Advanced driver assistance systems (ADAS)

For semiautonomous vehicles, detecting and reacting to dangers on the road require highly coordinated efforts between an array of sensors and imaging devices. The same module used for IVI or digital instrument clusters can also be used for visualizing ADAS features by connecting to other cameras and sensors on the vehicle. The module can support backup and surround-view parking assist, lane departure warning, collision warning, and other ADAS visualization features.

Infotainment and navigation

More consumers are comparing vehicle models based on features like built-in navigation and entertainment, touch and voice control, connectivity to mobile devices, and upgradeability throughout the life of the vehicle. With high-performance compute, visually stunning graphics, and support for ultrahigh-definition 4K video, Intel Atom automotive processors enable an exciting variety of IVI systems.

Rear-seat entertainment systems

Happy passengers make for safer drivers. Intel Atom automotive processors can support entertainment solutions, such as DVD players mounted in the ceiling or the headrests. Entertainment systems can be linked with mobile devices or the front IVI system so passengers can see navigation, control the radio, or even change directions from the back seat. Giving passengers access to more capabilities can ultimately help the driver stay focused on the road ahead.

Driver awareness

The determinism made possible by Intel Real Time Compute capabilities helps achieve the accuracy and synchronization needed for today's driver awareness systems. Meanwhile, improved video and image-processing capabilities allow the analysis of visual data to determine safe courses of action much more quickly.

INTEL® DEVELOPMENT PLATFORM FOR IN-VEHICLE EXPERIENCES

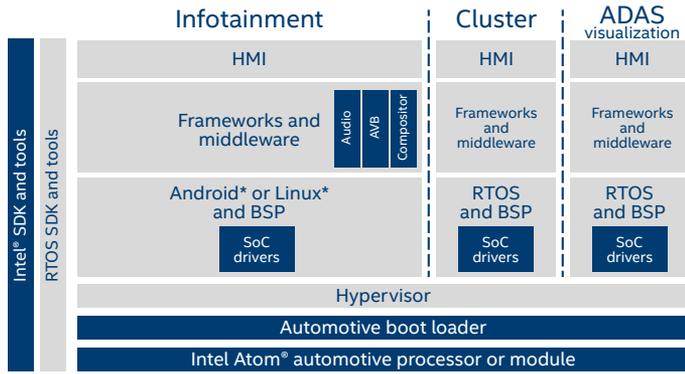


Figure 2. The Intel® development platform for in-vehicle experiences drives the consolidation of systems in the vehicle

Developer tools

To speed development, Intel and its partners provide third-party OS support and a comprehensive set of developer tools, including:

- The Intel® C++ Compiler, Intel® VTune™ Amplifier for Systems, and Intel® Graphics Performance Analyzer
- Reference stacks, including an IVI middleware and automotive boot loader
- Reference OS support for Linux*, Android*, Green Hill Integrity*, QNX CAR Platform for Infotainment*, and Wind River Helix*
- Hypervisors for multi-operating systems from QNX, Green Hill, and Mentor Graphics
- Performance-tuning tools for the Intel® architecture-based CPU and GPU and complete hardware development vehicles

Intel Atom automotive processor and module SKUs²

Key features	Entry		Mid			High		Premium	
Processor	Intel Atom® x5-A3930		Intel Atom® x5-A3940			Intel Atom® x7-A3950		Intel Atom® x7-A3960	
LPDDR4 capacity	1/1A ⁶ GB	2 GB	2A ⁶ GB	4 GB	6 GB	2 GB	4 GB	4 GB	8 GB
CPU cores and clock	2 cores @ 1.8 GHz		4 cores @ 1.8 GHz			4 cores @ 2.0 GHz		4 cores @ 2.4 GHz	
GPU cores and clock	12 cores @ 550 MHz		12 cores @ 600 MHz			18 cores @ 650 MHz		18 cores @ 750 MHz	
CPU DMIPS	18,972		37,944			42,160		48,484	
GPU GFLOPS³	106		115			187		216	
LPDDR4 MT/s⁴	2133					2400			
Memory bandwidth⁵	17.1 GB/s		34.1 GB/s			38.4 GB/s			
TJ (min–max)	-40° to 110°C								

Powering next-gen experiences

Supported by the Intel development platform for IVE, automakers and suppliers can bring new IVI concepts, ADAS visualization features, and digital instruments to market faster, while maximizing power efficiency and driving consolidation. By building these systems on scalable Intel architecture, the industry can prepare to accommodate new concepts as the market evolves.

Learn more

For more information about the Intel development platform for IVE, create an account at the Intel Resource and Design Center at intel.com/content/www/us/en/forms/design/registration-privileged.html.

To learn more about Intel® automotive solutions, visit intel.com/automotive.



1. Source: Intel Automotive.

2. As products are in development, all facts, figures, and dates are subject to change without notification. This list of SKUs is intended for budgetary cost calculations. Intel may limit the number of SKUs it will productize based upon feedback.

3. GFLOPS is not a representative metric to specify Intel Atom® 3900 series graphics performance as the device has graphics acceleration silicon on top of EUs.

4. Theoretical maximum bandwidth (sustained bandwidth at ~70 percent of theoretical maximum bandwidth).

5. Memory bandwidth and capacity based on draft road-map information from memory vendors and subject to change.

6. 1A/2A = AAT memory configuration supports ambient temperature up to 105°C.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer, or learn more at intel.com.

Tests document performance of components on a particular test, in specific systems. Differences in hardware, software, or configuration will affect actual performance. Consult other sources of information to evaluate performance as you consider your purchase. For more complete information about performance and benchmark results, visit intel.com/performance.

Intel, the Intel logo, Intel Atom, and VTune are trademarks of Intel Corporation or its subsidiaries in the U.S. and/or other countries.

The Bluetooth word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by Intel Corporation is under license.

*Other names and brands may be claimed as the property of others.