BUSINESS BRIEF

Automotive
In-Vehicle Experiences

Next-Gen Experiences for Tomorrow's Autonomous Cars

By creating intuitive, trusted experiences in the vehicle's cabin today, automakers will ease the transition to fully autonomous driving in the near future

38 MILLION
pixels in a vehicle by 2020[1]

... the equivalent of

19 FULL-HD TV PANELS

Figure 1. Compute demands will increase as more displays are added to the vehicle's cabin

Designing the cabin of the future

In the coming years, society will experience a paradigm shift in driving. As advanced driver assistance systems (ADAS) give way to completely self-driving cars, automakers will need to ease the transition and win consumer trust by creating intuitive, enjoyable experiences inside the vehicle. The cabin of the autonomous car will have natural voice recognition, interactive displays embedded into every glass surface, augmented reality features, and seamless connectivity with personal mobile devices—all of which will increase the demands on in-vehicle compute, sensors, and software.

As vehicles progress toward full autonomy, there will be a greater need for cockpit awareness—the car's ability to sense its occupants and efficiently communicate with them. Most analysts agree that self-driving cars will not gain widespread adoption until they win the trust of drivers and passengers. The job of building that trust falls to the vehicle's human-machine interface (HMI), which must relay messages clearly, quickly, and with purpose.

Consolidating in-vehicle systems

With these new features come additional complexity and cost. The automotive market is already trending toward the consolidation of digital instrument clusters, heads-up displays, cameras, and mirrors—a strategy that can help control costs and simplify design. These systems will run on safety-critical clusters that can handle ISO 26262 ASIL-B use conditions. Running non-safety-critical systems on the same cluster will require virtualization technology for graphics, audio, and imaging to ensure priority for safety-critical workflows.

To support an increasing number of displays and sensors, designers are looking to maximize compute performance and power efficiency in systems. They're also considering the benefits of scalable architecture, which allows them to reuse hardware and software investments across fleets and brands. This helps reduce development costs as well as speed time to market for new solutions.

Personalized and secure experiences

The need for personalization is becoming more important as ride- and car-sharing networks gain traction. The vehicle should have an immediate way to identify the passenger and call up his or her favorite destinations, content, playlists, and settings. As more screens become available to more passengers, the vehicle should be aware of who is sitting in which seat. Finally, any personal details must be secured and kept private from other riders who use the vehicle.

Safer, more enjoyable, and productive trips

With high performance, power-efficient compute in the vehicle, automakers can add a wide range of exciting new experiences to the cabin. Natural language recognition will allow passengers to communicate with the vehicle's HMI through casual, everyday speech and enable vehicle "personal assistants." An interactive, high-definition dashboard can stretch across the entire front of the vehicle. A full-color heads-up display will show maps, alerts, and other information intuitively on the windshield. Rear-seat entertainment becomes an extension of the passenger's mobile device or serves as a virtual office.

Sensors in the vehicle can trigger actions when an occupant has spilled a drink, left something behind, or is within reach of a control. The more the vehicle knows about what is happening inside its cabin, the better it can provide instructions or react when making emergency maneuvers. All of this leads to safer, more enjoyable experiences for drivers and passengers.

Technology to power new experiences

Intel is powering the experiences that will redefine the vehicle's cabin. We're developing technologies that will enable natural voice interaction, making communication between a vehicle's HMI and its occupants seamless. Each year, Intel invests millions on research to understand and improve HMI design. For example, we're exploring how to best convey information to passengers in various situations, finding the right blend of screens, mobile devices, and voice. These insights inform our product road map, which in turn helps the automakers and suppliers we work with stay ahead of market trends.

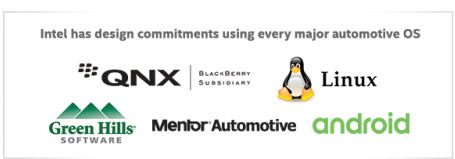
IN-VEHICLE COMPUTE REQUIREMENTS INCREASING

	2017	2021
In-vehicle experiences	Heads-up displays Rearview cameras Smartphone compatibility Rear-seat entertainment	Natural voice interaction Vehicle personal assistants Augmented reality Interactive glass surfaces Pervasive cabin awareness
Teraflops	0.5–10	50–100
Pixels	Millions	Billions
Embedded storage	Gigabytes	Terabytes
In-vehicle network bandwidth	Tens of megabits per second	Hundreds of gigabits per second
Electronic control units (ECUs)	150+ microcontrollers	Fifty consolidated, virtualized ECUs

Figure 2. As vehicles become more autonomous and new features are added to the cabin, the need for in-vehicle compute will surge

THE FUTURE OF DRIVING IS WRITTEN IN SILICON

Maintaining your edge in automotive requires enough compute per watt to power compelling in-vehicle experiences.



Scalable, flexible Intel® architecture

A platform based on Intel architecture delivers several components that are key to enabling the best experiences with in-vehicle infotainment (IVI), digital instrument clusters, and ADAS.

Intel® processors are power efficient and offer the substantial compute needed to support the next-generation cabin. Intel architecture-based platforms are highly scalable and can accommodate a wide variety of designs while offering impressive graphics capabilities and hardened security features. They include Intel® Virtualization Technology, which drives the consolidation of systems while ensuring key safety functions get priority access to the processor.

Today, we offer the Intel® GO™ development platform for in-vehicle experiences, based on the Intel Atom® processor A3900 series for automated driving. Future iterations of the platform based on our next-generation processors will deliver the smoothest experiences for IVI and ADAS in the cabin.

For fast and reliable connectivity to the cloud, Intel offers a full-featured wireless communications platform with an LTE modem, as well as the industry's first 5G-ready platform for autonomous driving.

Together, these technologies deliver an industry-leading platform that positions automakers and suppliers to support the cabin of the future.

Where to get more information

For more information about Intel-powered in-vehicle experiences, please visit **intel.com/automotive**.

Intel® technology foundation

- Intel® GO™ development platform for in-vehicle experiences
- Intel® Virtualization Technology
- Intel Atom® x3-M7272 processor for wireless communications
- Intel® GO™ automotive 5G platform

1. Intel automotive data.

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