

Autonomous driving comes with a unique set of technologies—and its own vocabulary. When it comes to recognizing the difference between CPUs and GPUs, or understanding the ascending levels of driving automation, there are some important distinctions to make. Here, we've summarized the key terms you should know in the world of autonomous driving.

**5G:** Fifth-generation mobile networks, an upcoming telecommunications standard expected to deliver 10 Gbps and ultra-low latency. *See also* over-the-air (OTA) updates; vehicle-to-everything communications (V2X).

**Accelerator:** A computing component that performs hardware acceleration, speeding certain tasks over what is normally possible on a CPU alone. *See also* field-programmable gate array (FPGA).

**Advanced driver assistance systems (ADAS):** Vehicle systems designed to improve driving safety; for example, adaptive cruise control and forward collision warning. *See also* Intel Atom® automotive processors.

**Application-specific integrated circuit (ASIC):** An integrated circuit customized for a specific use; for example, a computer vision accelerator.

**Artificial intelligence (AI):** Intelligence and decision-making that come from a machine, such as an autonomous vehicle. *See also* deep learning; machine learning.

**Automotive data center:** The development of autonomous vehicles starts in the data center. An automotive data center is designed specifically to handle the workloads associated with the development of autonomous vehicles, such as deep learning training and cloud services. *See also* deep learning.

**Autonomous vehicle:** A vehicle that is capable of driving itself, typically classified at levels 3, 4, or 5 for driving automation. *See also* levels of driving automation (SAE).

**Central processing unit (CPU):** The electronic circuitry in a vehicle's computing system that performs programming instructions; for example, Intel Atom® and Intel® Xeon® processors. *See also* in-vehicle compute; Intel Atom® automotive processors; Intel® Xeon® processors.

**Computer vision:** The systems that are responsible for the autonomous vehicle's ability to "see" its environment; for example, the technologies developed by Mobileye and Itseez.

**Decision-making (*decide*):** The third and final of the three stages of in-vehicle compute required for autonomous driving (*sense, fuse, decide*). In this stage, the vehicle must decide how to proceed based on the model it has created of its environment. *See also* perception; sensor fusion.

**Deep learning:** A subset of machine learning that involves many layers of processing, massive amounts of data, and enormous compute capacity. Deep learning algorithms can facilitate computer vision, natural language processing, driving strategy, personalization, and even decision-making. *See also* artificial intelligence (AI); automotive data center; machine learning.

**Digital instrument cluster:** A digital panel or dash that includes instruments such as a speedometer, fuel gauge, and odometer.

**Electronic control unit (ECU):** An embedded unit in the vehicle that controls one or more electrical systems, such as the engine control unit or the human-machine interface.

**Field-programmable gate array (FPGA):** An integrated circuit that can be configured after manufacturing, offering more flexibility than CPUs or GPUs. It is often used as an accelerator and excels at parallel processing. *See also* accelerator; in-vehicle compute; Intel® Arria® series FPGAs.

**Functional safety:** The components and systems responsible for the safe operation of a vehicle; it is critical that this equipment operates reliably, even in the event of hardware failures or driver errors.

**Graphics processing unit (GPU):** A specialized electronic circuit designed to accelerate image and graphics processing. GPUs excel at parallel processing. *See also* in-vehicle compute.

**Heterogeneous architecture:** A combination of multiple types of compute—such as CPUs, FPGAs, and ASICs—working together in a complementary fashion.

**Human-machine interface (HMI):** The interface responsible for two-way communication between a vehicle and its occupants. An HMI may incorporate touchscreen displays, voice recognition, or integration with mobile devices. *See also* natural language processing.

**In-vehicle compute:** Any or all computing systems inside the vehicle that power autonomous driving, advanced driver assistance systems (ADAS), or in-vehicle experiences. *See also* application-specific integrated circuit (ASIC); central processing unit (CPU); field-programmable gate array (FPGA); graphics processing unit (GPU); Intel Atom® automotive processors; Intel® Xeon® processors.

**In-vehicle experiences (IVE):** The intuitive experiences inside the vehicle that provide driver assistance, information, and entertainment, while often enhancing safety. These are delivered by a range of systems, including in-vehicle infotainment (IVI), digital instrument clusters, and advanced driver assistance systems (ADAS).

**In-vehicle infotainment (IVI):** A collection of hardware and software that provide entertainment in the vehicle; for example, navigation systems, radio, video players, and Wi-Fi.

**Intel Atom® automotive processors:** A generation of Intel Atom processors that power in-vehicle experiences and advanced driver assistance systems (ADAS). These processors offer substantial compute in a low-power package. *See also* ADAS; in-vehicle compute; IVE.

**Intel® FPGAs:** Field-programmable gate arrays (FPGAs), formerly owned by Altera and acquired by Intel, that offer flexible in-vehicle compute and power-performance-efficient acceleration to support autonomous driving. These FPGAs deliver a combination of high performance and power efficiency for acceleration. *See also* FPGA.

**Intel® GO™ automotive solutions:** A portfolio of solutions designed for autonomous driving and in-vehicle experiences. Ranging from car to cloud, these solutions include development platforms for in-vehicle computing, a 5G connectivity platform, a software development kit (SDK), and data center technologies.

**Intel® Xeon® processors:** CPUs that deliver high-performance in-vehicle compute for level 4 and 5 driving automation. *See also* in-vehicle compute.

**Levels of driving automation (SAE):** The six levels of driving automation as defined by SAE International.<sup>1</sup> They include:

**Level 0:** No automation. A human controls all driving tasks, even when aided by warning systems.

**Level 1:** Driver assistance. A human controls most driving; the vehicle performs either specific steering or acceleration/braking tasks.

**Level 2:** Partial automation. The vehicle performs both specific steering and acceleration/braking tasks; a human controls all other driving.

**Level 3:** Conditional automation. The vehicle performs driving in some modes; a human intervenes when requested.

**Level 4:** High automation. The vehicle controls specific driving modes without human intervention.

**Level 5:** Full automation. The vehicle controls all driving, full time, without human intervention.

See *also* autonomous vehicle.

**Machine learning:** A subset of artificial intelligence (AI) that gives machines the ability to learn on their own, resulting in algorithms that make data-driven decisions. See *also* AI; deep learning.

**Natural language processing:** A form of artificial intelligence (AI) that enables the vehicle to understand and respond to natural human speech. See *also* human-machine interface (HMI).

**Over-the-air (OTA) updates:** Software or firmware updates to a vehicle that are downloaded from the cloud. 5G will enable faster, lower-latency OTA updates. See *also* 5G.

**Perception (*sense*):** The first of the three stages of in-vehicle compute required for autonomous driving (*sense, fuse, decide*). In this stage, the vehicle collects data from dozens of sensors, including lidar, radar, and cameras. See *also* decision-making; sensor fusion.

**Sensor fusion (*fuse*):** The second of the three stages of in-vehicle compute required for autonomous driving (*sense, fuse, decide*). In this stage, the vehicle correlates and fuses sensor data to create a model of its environment. See *also* decision-making; perception.

**Software-defined cockpit (SDC):** The trend of analog components giving way to digital instrument clusters, advanced driver assistance systems (ADAS), and in-vehicle infotainment (IVI). As a result, vehicles rely on software as much as mechanical components to operate.

**Software development kit (SDK):** A set of tools—such as performance libraries, leading compilers, performance and power analyzers, and debuggers—that speeds the time it takes for developers to build software.

**Vehicle-to-everything (V2X):** The communication between a vehicle and the cloud, other cars (vehicle-to-vehicle, or V2V), and infrastructure (vehicle-to-infrastructure or V2I). See *also* 5G.

**Vision processing:** The technologies used to provide image-based analysis (also called machine vision).

1. "Automated Driving: Levels of Driving Automation Are Defined in New SAE International Standard J3016." SAE International, 2014, [sae.org/misc/pdfs/automated\\_driving.pdf](https://www.sae.org/misc/pdfs/automated_driving.pdf).

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