Tough truck environment means autonomy reliant on tougher computers

Self-driving trucking will require immense computing power, but the trucking environment is a world away from the data centre. By Xavier Boucherat

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The industry has great expectations of tomorrow's trucks: smart routing and logistics, internal and external monitoring and advanced driver assistance systems (ADAS) are just some of the requirements that could become standardised. Long-term, autonomous technology could hand over the driving task to the vehicle itself: the use-case has long been thought favourable, with predictable highway routes offering reduced complexity compared with built up urban environments. Figures from Allied Market Research suggest that by 2025, the self-driving truck market could be worth US$1.67bn, as developers look to reduce accidents, relieve congestion, lessen environmental impacts and improve supply chain efficiency.

But to realise this, truckmakers and developers must now consider the immense computing requirements autonomy will demand. Space is already at a premium inside the truck, where conditions are harsh. What's more, the sheer size of heavy duty trucks—and their propensity to deal more damage in a collision, regardless of whether a driver is at fault or not—means more sensors are needed, meaning more sensor fusion to build an accurate picture of the world outside.

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Ruggedness and innovation are the order of the day, and two companies now considering this are Advantech, an embedded computer developer, and Crystal Group, a specialist in high-reliability computing which frequently works with the military. Toni Hogan is Director of Program Management, Industrial and Commercial at Crystal Group. She stresses the importance of getting this right: according to McKinsey, 65% of the consumable goods in the US moved to market on trucks. Long-term, self-driving trucks could cut carrier operating costs by up to 45%, but not if these machines are perceived as unsafe, or incapable.

“The size of a heavy duty truck means that autonomous operation needs more radar, more cameras and more LiDAR,” says Hogan. “What’s more, if a truck needs to stop, it needs to do it sooner than later, as it requires more distance. And all of this requires a tremendous amount of computing power.”

Never too early to start

Of course, the industry continues to struggle with self-driving vehicle timelines, which are more uncertain than ever in the wake of the novel coronavirus disease (COVID-19) and its potential impact on spending for research and

development. Research from McKinsey has previously suggested that two-truck platooning could arrive on US highways by 2025, and that by 2027 the driver pick up and drop-off model, in which manual drivers perform the first and last mile of a journey, could become reality by 2027.

But regardless of just how long it will be before the self-driving truck hits the road, says Hogan, the industry is already in the initial phases of autonomy, and appropriate computing needs to be put in place from the start: “One of the things Crystal Group sees is that companies across the mobility sector, from trucking to robo-taxis, are trying to mature their software. This introduces new computing requirements, and this software is only going to evolve as time goes on. Right now things are somewhat in flux.”

Road ready

Companies like Crystal Group need to produce solutions that tackle the environmental aspect of the trucking-computing challenge. Shocks and harsh vibrations are inevitable on trucking journeys, as are extreme temperatures and humidity.

“Crystal Group specialises in taking consumer electronics and making them rugged,” she says. Much of what the mobility sector is now looking for is built for static, controlled environments such as data centres. “Suddenly, customers want to put a computer in the cab, which lacks the cooling a data centre environment would have,” she explains.

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The complexity of the self-driving task–virtualisation, sensor fusion and inference algorithms–will likely require server-class processors and acceleration hardware, including graphics processing units (GPU). Unlike central processing units (CPU), these can perform multiple tasks in parallel, working with multiple sets of data and of immense use for data-heavy applications such as machine learning.

The leaders in this field, such as Nvidia, have not necessarily built with the road in mind: but nor should they have to. As Hogan explains, the nascent nature of autonomy means that solutions are still being perfected, and future upgrades are inevitable. “They need what works in the lab to work in the field,” she says. “Everybody is collecting road miles right now.”

In such a nascent space, where no one company is yet to truly solve the puzzle, this could accelerate the arrival of autonomy through packaging that rules out errors on the road that are the result of a bumpy ride, or overheating: liquid cooling solutions provide stability like air conditioned rooms in a data centre keep supercomputers cool.

“What Crystal Group is doing allows self-driving developers to focus on what they do best, and not have to worry about the hardware,” concludes Hogan, “and self-driving is the ultimate goal of the trucking companies.” The

Advantech/Crystal Group's collaboration hopes that a rugged commercial off-the-shelf (COTS) platform will prove perfect for the self-driving truck space, allowing for fast development of systems, easy upgrades, and quicker, cheaper life cycles.