

Interview with CTO of Stellantis: “Relying solely on cloud processing is impractical”

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Q&A with the chief engineering and technology officer (CTO) of Stellantis.

Stellantis is a global automotive leader formed from the merger of Fiat Chrysler and PSA Group, encompassing 14 brands such as Jeep, Peugeot and RAM. The company focuses on electrification, connected technologies and operational efficiency, aiming for a sustainable future while addressing diverse consumer needs across major markets.

The image shows the Stellantis logo, which consists of the word "STELLANTIS" in a bold, black, sans-serif typeface. The letters are widely spaced, giving the logo a modern and clean appearance.

Source: Shutterstock

The original equipment manufacturer is committed to achieving a 100% zero-emission lineup in Europe by 2030, focusing on affordability and technological innovation. It is leveraging its multi-energy platforms to accommodate diverse powertrains, which include battery-electric vehicles (BEVs), hybrids and hydrogen fuel cells.

In the realm of connected technologies, Stellantis emphasizes seamless connectivity and user-friendly interfaces, catering to both older and younger customer demographics. The development of its Smart Car Platform illustrates this commitment, designed for high adaptability and integration of various propulsion systems.

Autonomous driving remains a priority, with Stellantis investing in advanced driver-assistance systems to enhance safety and user experience. The company recognizes the importance of brand trust and customer expectations in this rapidly evolving landscape.

Additionally, Stellantis is expanding its electric vehicle offerings, aiming to double its BEV models from 30 to 60 within three years. This expansion includes competitive pricing strategies, targeting entry-level markets with vehicles like the Citroen C3, which offers affordability and quality.

To learn more, we spoke to Ned Curic, chief engineering and technology officer of Stellantis.

Ned Curic was appointed chief technology officer and a member of Stellantis' top executive team Aug. 30, 2021. As of July 2023, his scope of responsibility was expanded to include research and development activities, and he was named chief engineering and technology officer. From June 2017, He was vice president at Alexa Automotive at Amazon spearheading Amazon's efforts in the automotive industry. He started his career in 1996 in the field of engineering systems at Northrop Grumman, an American multinational aerospace and defense technology company. After a short stint in the financial industry, in 2000 he joined Microsoft where he held various roles in consulting, product, security and advisory. He entered the automotive sector in 2013, as group vice president and chief technology officer at Toyota Motor North America and, in 2015, became co-founder and executive vice-president, technical director and board member at Toyota Connected. He studied informatics and computer science, and received a Master's in Business Administration from Pepperdine University in 2012.



Key takeaways:

- Generative AI is a double-edged sword: Its vast potential is matched only by the challenge of defining and deploying it effectively. As Stellantis embraces hybrid systems and democratizes access, the key will be mastering decision-making and adaptability to unlock the future of autonomous technology.
- Relying solely on cloud processing for vehicle electronics is impractical. Stellantis advocates for a hybrid approach that combines cloud training with local execution to optimize performance and reduce latency.
- Stellantis is evaluating the viability of modular swappable battery systems, investing in startups like Ample to explore this technology. This could allow customers to purchase vehicles with fewer batteries, enhancing convenience and sustainability.
- The company is committed to achieving cost parity between BEVs and mild hybrids by optimizing every vehicle component, particularly through advancements in power electronics and battery structure.

The following is an edited transcript of the conversation.

S&P Global Mobility: What is Stellantis' comfort level with using generative AI to provide information and entertainment for occupants, compared to using predictive AI for enabling the vehicle to make real-time driving decisions?

Ned Curic: As technology evolves, we're continuously learning about generative AI and exploring its vast potential. New tools emerge daily, enhancing both spoken language processing and multimedia applications. The challenge lies in determining what works effectively and what doesn't. Generative AI encompasses a broad spectrum of meanings, leading to some confusion in its definition.

However, advancements like large language models enable the creation of hybrid systems that combine traditional supervised approaches with innovative methods, resulting in sophisticated autonomous systems. The race to deploy these technologies will likely lead to a democratization of AI capabilities, as access to computing power, techniques and data increases. Ultimately, the focus remains on decision-making: how much autonomy we grant systems, the quality of inputs provided, and the balance between predictive and learned outcomes. The future is promising, with significant opportunities for organizations willing to adapt swiftly.

In what year do you anticipate that most processing for vehicles will transition from being embedded within the car to being conducted in the cloud?

It makes zero sense to move all compute in the cloud. While I've made bold predictions in other areas, I firmly believe that relying solely on cloud processing for electronics is impractical. The cost of silicon is plummeting, allowing for substantial processing power and storage to be integrated directly into vehicles. This enables real-time decision-making at the edge, which is significantly faster than cloud-based solutions.

Although cloud processing offers cost advantages at scale, it introduces latency and bandwidth challenges that can hinder performance. A hybrid approach is essential: training models in the cloud while executing them locally. This balance allows us to optimize resources, adapting the distribution of compute power based on needs and capabilities. The notion of a "dumb" device relying entirely on the cloud is unrealistic. From both engineering and physics perspectives, a more integrated and intelligent system design is the way forward.

Following the rise of software-defined vehicles, some industry players, particularly in China, are now advocating for the concept of the AI-defined car. Is Stellantis also embracing this new concept, and what does it entail?

I must admit, I'm unclear on what the term "software-defined car" truly means, and even more so with "AI-defined car." Technology industry often categorizes concepts in ways that can be confusing, as these terms can signify different things to different people, much like how "metaverse" has been used to describe a wide range of virtual experiences.

While AI will undoubtedly play a significant role in various aspects of vehicle design, manufacturing and customer interaction, the specifics of an "AI-defined car" remain ambiguous to me. The car itself is a complex machine with numerous components, and AI will enhance many of these, incorporating traditional methods alongside advanced generative AI and machine learning models.

Despite the uncertainty surrounding these definitions, I firmly believe we are on the cusp of significant advancements in AI deployment within the automotive industry over the next decade. The potential for innovation in this ecosystem is immense. We are on top of it, and I look forward to seeing how it unfolds.

Many innovations were presented in the Centoventi EV Concept at the 2019 Geneva Motor Show, including modular swappable batteries. Do you expect such a modular swappable battery system to achieve mass-market application, and if so, when?

At the Geneva Auto Show, we introduced concepts that have now been incorporated into the Fiat Grande Panda, launching today. Fiat and its associated brands focus on fun, utility, usability and customer-centric designs, ensuring that our vehicles offer enjoyable and practical experiences. The innovations showcased will not only appear in the Grand Panda, but also extend to other Fiat models and brands like Citroën and Jeep.

Sustainability remains a priority for us, particularly in terms of weight and materials. We're currently evaluating the viability of swappable battery systems. To this end, we've invested in Ample, a startup specializing in battery swapping technology. In Madrid, we're conducting a large-scale prototype where vehicles can swap batteries automatically in just five to 10 minutes.

This system could optimize capital by allowing customers to purchase vehicles with fewer or no batteries, renting additional modules based on their range needs. While the concept is promising on

paper, our challenge lies in scaling it for customer convenience and developing a viable business model. Our investment in Ample will help us explore and refine these ideas.

Regarding some recent fluctuations in battery prices, we have seen an initial rise followed by a significant decline, particularly with the democratization of LFP-based technologies and a notable drop in lithium prices. Does this shift your perspective or outlook on emerging battery technologies?

The weight issue remains a significant challenge. Currently, many vehicles carry excessive weight, which impacts efficiency. If we reach a point where we can achieve a 200-kilometer range with a five-minute charge while reducing battery weight by half, that could be a game changer.

In Europe, new tax regulations based on vehicle weight highlight the growing importance of this issue. Swappable battery technology could provide a solution, allowing customers to purchase a vehicle with a single module and add more as needed.

However, even with advancements in battery chemistry, weight and charging speed will continue to be critical factors. If we see significant reductions in both weight and cost, the business model could shift dramatically. Yet, until we have more clarity on these developments, we must remain open to exploring various options, as the landscape is likely to change unpredictably. While lithium prices have dropped, there's no guarantee they won't rise again.

Has anything in the past five years altered your belief in the premise and functionality of the small electric vehicle concept?

Not much has changed in our perspective. From Stellantis' viewpoint, we feel confident in our smart car platform, which remains highly competitive. While some competitors face challenges, we're excited to launch the Citroën e-C3 this year, along with several other affordable models — like the C3 Aircross and the Opel Frontera that exceed customer expectations and deliver a fun driving experience.

I regularly test drive these vehicles, including the Fiat Grande Panda, which shares the same platform. It's an incredibly enjoyable and practical car that meets customer demands at a price point that allows us to remain profitable without the high costs typically associated with electric vehicles.

We believe we've struck a solid balance with the smart car platform and are committed to further enhancing charge times and optimizing electronics to reduce costs. Our partnership with Leapmotor also adds another strategic advantage. Overall, we're optimistic about competing effectively with Chinese manufacturers in this market, offering a range of options that fit customer budgets, from the Wagoneer S to our compact smart cars.

Stellantis has had success with plug-in hybrid applications previously, with models like the Pacifica. Given the recent wobble in sentiment toward battery-electric vehicles, do you see market potential for a clean-sheet plug-in hybrid electric vehicle platform?

We have a robust portfolio of hybrid propulsion systems, ranging from mild hybrids to plug-in hybrids. We're also exploring advanced Generation 4 and 5 hybrid technologies to identify any gaps in our offerings and ensure we're prepared to integrate new innovations. Our ability to own and manufacture these technologies positions us well to adapt to customer demand across global markets, including Europe and North America.

Whether it's luck or smart decision-making, our choice to develop multi-energy platforms has proven to be successful. A prime example is the recently launched Peugeot 3008. It's one of my favorite vehicles in our lineup, offering a fantastic driving experience. Customers can choose between electric or internal combustion engine available in hybrid or plug-in hybrid options, all while maintaining a consistent design.

The electric variant is the most expensive, while the hybrid is the most affordable, yet all options remain equally enjoyable to drive. This flexibility allows us to meet diverse customer needs and preferences. Overall, we're confident in our technology portfolio and our ability to deliver a variety of convenient choices to our customers.

How does Stellantis envision the configuration of the propulsion system (including battery, motor and power electronics) for an affordable, mass-market battery electric vehicle, and how do you manage fluctuations in key battery commodity prices while planning your future portfolio?

We have communicated our strategy regarding material supply, and our purchasing organization has reiterated this. Their statements reflect our commitment to securing the necessary materials for the next decade. We have hedged across various regions, locations, and suppliers to ensure a reliable supply chain.

Our approach encompasses everything from upstream sourcing to downstream manufacturing, including the integration of these materials into modules and packs. We feel confident in our supply chain security. While it's impossible to anticipate every challenge, our traditional hedging strategy effectively mitigates risks. Overall, we believe this approach positions us well for the future, and there's little more to add at this time.

How do you evaluate progress in achieving cost parity between BEVs and internal combustion engine vehicles while managing fluctuations in commodity prices? As a business, what strategies do you employ to maintain a balanced perspective on whether BEVs are becoming cost-competitive or even cheaper?

We have established clear targets for our hybrid and electric vehicles, allowing us to track progress toward cost parity. By manufacturing both vehicle types on the same production line, we have a comprehensive understanding of material costs and transformation processes. For instance, we aim for our electric vehicles to achieve cost parity with mild hybrids by a specific year, and we assess the necessary steps to reach that goal.

Our analysis focuses on every component of the vehicle, particularly the battery. We explore various aspects, including chemistry, packaging and power electronics. Recently, our team made significant advancements in power electronics, specifically in our IBIS (Intelligent Battery Integrated System) initiative, which has the potential to reduce the weight of the power inverter module by 50% while maintaining performance. This innovative technology will likely appear in our vehicles before the end of this decade.

Additionally, we are working on optimizing battery structures to minimize weight and costs by removing unnecessary components. This detailed optimization process requires careful analysis and strategic capital investment, as simply investing large sums without consideration can lead to higher amortization costs per unit. We remain diligent in balancing these factors to ensure our electric vehicles become cost-competitive while maintaining quality and performance.

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