What I Learned About Self-Driving Cars At CES (Psst ... They're -- Almost -- Here)

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FULL BIO ⌄

An attendee checks out Navya's Autonom Cab, a robotic taxi with no steering wheel or pedals at CES 2018 at the Las Vegas Convention Center on Jan. 9, 2018.

It's tough to pull meaning from the crush and cacophony of CES, the sprawling tech extravaganza that's curiously well-suited to the sensory overload experience that is Las Vegas. But here's a big takeaway from the 2018 edition: The future of mobility has left the "Gee, wouldn't it be cool if..." phase. It's now firmly in the "Here's how it starts" mode.

After three days of wandering through hundreds of displays inside and outside the cavernous Las Vegas Convention Center and around the city, dozens of interviews, background chats, media briefings and a few test rides, four things are clear to me:

1. You're not about to own a self-driving car; but on-demand ride services, deliveries and some commercial transportation will soon deploy autonomous vehicles; they'll arrive courtesy of major brands like Lyft, Uber, Waymo, Toyota, Volkswagen and BMW, among others;

2. The rivalry between Nvidia and Intel for dominance in computing systems for autonomous vehicles is intense;

3. China's Baidu is now a formidable new force in autonomous tech and AI;

4. 2018 will see a battle among makers of laser LiDAR vision sensors for self-driving vehicles for meaningful partnerships they need to survive

A notable change from 2017 when just a handful robotic vehicles were available for parking lot rides: There are lots roaming Las Vegas this year. The biggest fleet was operated by Lyft, featuring elegant BMW 5-Series sedans loaded with self-driving gear from Aptiv, the autonomous tech company spun off from auto parts giant Delphi last year.

I caught a ride to Caesars Palace from the convention center, and though a human driver was at the wheel for safety, we snaked through jammed Las Vegas streets in fully autonomous mode. The journey was completely uneventful. Which is exactly the point: The software and hardware have limitations, but are approaching the stage where, within another year or so, they'll be ready for use in controlled applications — in well-mapped, limited areas of big cities. Just ask Waymo, which this year will start picking up passengers in driverless Chrysler Pacifica Hybrid minivans in and around Phoenix.

Jada Tapley, Aptiv's vice president for advanced engineering, showed me a modified version of the Lyft app she's using at CES to summon a robotic ride (befitting the premium BMW brand, bulky LiDARs, cameras and other sensors are so elegantly integrated into these cars that they're not immediately noticeable when one pulls up). That version of Lyft's app isn't available to the public yet, but when it is, access to the company's driverless fleet will come through nothing more than an update.

This is what's now called Mobility as a Service, or MaaS, and along with robotic delivery/ commercial vehicles, it's the first big step for AI-enabled driving technology. Even Akio Toyoda, president and CEO of Toyota Motor, showed up at

CES to make it crystal clear that the famously conservative auto company founded by his grandfather intends to enter the fray with a highly flexible, purpose-built autonomous vehicle platform that can ferry urban commuters, deliver pizzas or Amazon purchases. Of all the global automakers, Toyota is among the first to announce plans to supply a base vehicle for other companies' MaaS and delivery operations.

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Toyota's President unveiled the e-Palette concept vehicle and a new alliance the company has formed with Amazon, [+]

The boxy e-Palette pod he showed off at CES, a rolling rectangle on wheels, probably won't be exactly what hits the streets, but given that Toyota has already enlisted Amazon, Uber, Pizza Hut and Didi, China's ride-hailing giant, as partners, it's a safe bet we'll see something like it in action in a few years.

"Around the world, clearly Toyota is a well-known maker of reliable automobiles. We hope to become just as well known for the mobility service company we've built," Toyoda told a packed Las Vegas audience, before concluding by taking a group selfie from the stage.

The chip war

CEOs of the top two suppliers of chips and computing systems powering most of the world's autonomous vehicles were on hand to wow audiences with the leaps they're making in terms of jaw-dropping performance, smaller packaging and energy reduction.

"To make autonomous vehicles possible you have to solve this incredible computing problem, the largest-scale computing problem of its kind, from the bottom all the way to the top," Jensen Huang, Nvidia's garrulous, black-leather-jacket-clad CEO, told an audience of more than a 1,000 attendees at a nearly two-hour presentation kicking off CES at the MGM resort's conference center.

Nvidia's solution is the Drive Xavier processor, which is specifically designed to power robot taxis, and a partnership with powerhouse autonomous tech startup Aurora to perfect a new computing platform. Oh, and Huang also added Uber and Volkswagen to the lengthy list of auto and tech players Nvidia is working with.

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Nvidia founder and CEO Jensen Huang discusses the company's partnerships with Uber, Volkswagen, Baidu and Aurora at CES 2018 in Las Vegas.

The following night, Intel CEO Brian Krzanich fired back, unveiling the Intel AV compute platform. It's made up of two new EyeQ5 sensor processing chips from recently acquired Mobileye and the new Intel Atom 3xx4 CPU that provide 60%

more performance than Nvidia's Drive Xavier while using less power — 10 watts versus 30 watts for its competitor.

The level of processing power and lower energy consumption is "the best on the planet," Mobileye CEO Amnon Shashua told Krzanich onstage at the Monte Carlo casino. Like the Aptiv and Lyft cars, the BMW sedan Shashua arrived in featured vision sensors that were seamlessly embedded throughout the chassis.

China's Baidu barrels full-speed ahead

Baidu, typically known as the Google of China, is becoming a major new player in autonomous vehicle technology and made its presence known in a big way at CES. After losing its autonomous team leader last year, Baidu pivoted to a curious open-source approach to developing self-driving software and AI, called Apollo. This week it rolled out a big upgrade to its platform with Apollo 2.0 and set a goal refining autonomous driving at "China speed."

Since its creation in April 2017, the initiative has lined up more than 320 partners including 90 auto and tech firms.

"Honest to god, the pace of innovation, the growth, exceeded our wildest imagination," Qi Lu, a former top Yahoo and Microsoft executive who is now Baidu Group president and COO, told an audience of several hundred in a ballroom at the posh Mandarin Oriental hotel. "Apollo is an example of 'China Speed,' demonstrating the rapid pace of China's innovations and development in the global autonomous driving industry."
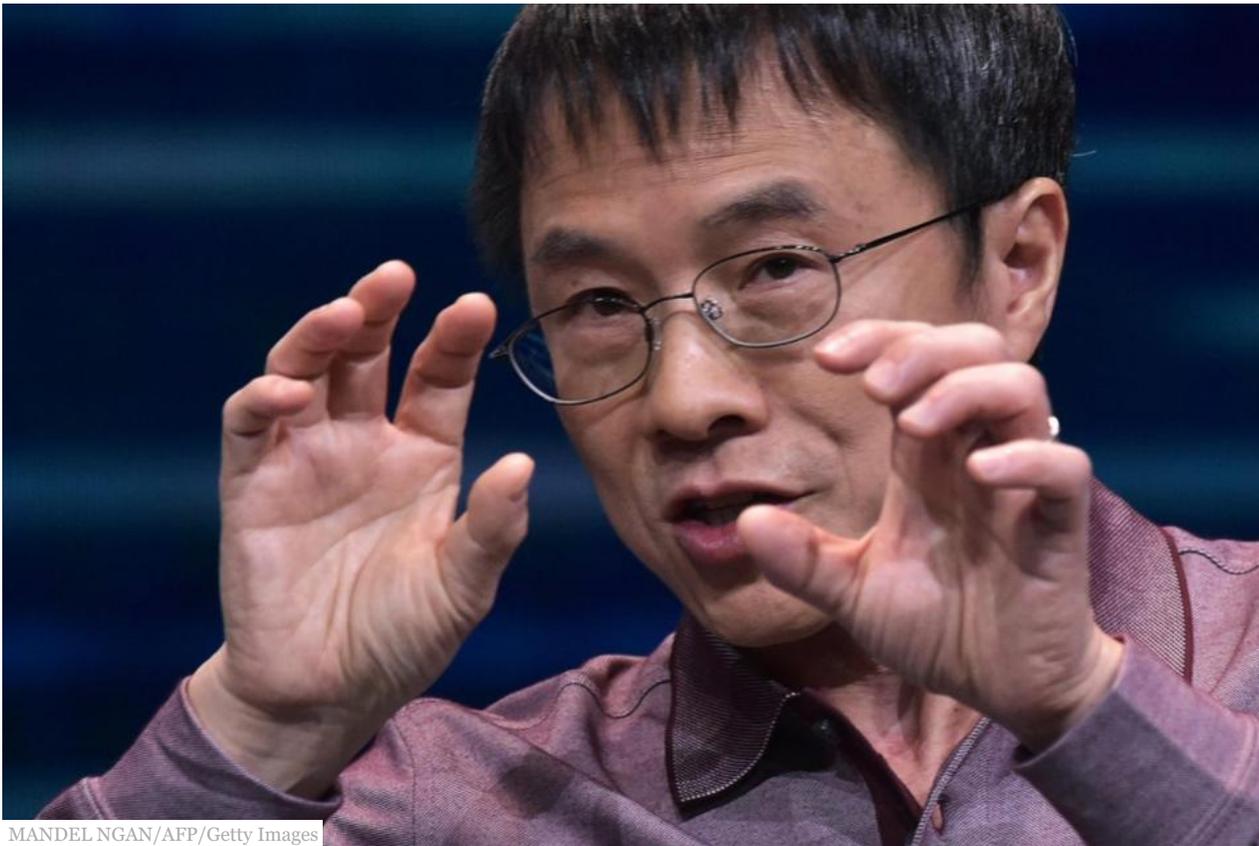
Baidu Vice Chairman, Group President and COO Qi Lu speaks discusses 5G and mobile innovation at CES 2018 in Las Vegas.

This year Chinese bus maker King Long will begin operating autonomous L4 shuttles (that look a lot like Toyota's e-Palette) with Apollo software. A slew of Chinese carmakers that are also part of the Apollo alliance will follow in 2019, 2020 and 2021 with a range of robotic cars, vans and commercial vehicles that will operate *sans* human driver in the People's Republic.

"The Chinese government understands what AI can do," he said. It doesn't hurt that Baidu's Apollo was also designated as the national self-driving platform by China's government.

Selling the industry's equivalent of "picks and shovels" is bound to be a good business

The surge in LiDAR makers at CES this year also makes clear the battle to supply vision systems for robotic vehicles is at a fever pitch, with new players seeking funding and attention and established ones racing to lock down big partnerships.

Ghostly "point cloud" 3-D images generated by LiDAR, short for "light, distance and ranging," give self-driving cars an ability to see that's superhuman detecting road conditions and hazards 200 meters away or further, and under any lighting conditions. Combined with cameras, radar and even small sonar sensors, the

technology is generally seen as essential for autonomous vehicles to function safely — assuming cost and performance requirements are met.

Velodyne, which dominates the LiDAR space with its spinning, multi-laser beam sensors, slashed the price of its base model unit by half to a few thousand dollars just before CES. And late last year it showed off a 128-beam version it described as the most powerful automotive LiDAR ever created. Led by inventor David Hall, Velodyne's CES pavilion was appropriately positioned in the heart of the convention center's North Hall, the hub of autonomous vehicle activity.

Lower-cost competitors including Quebec City-based LeddarTech and Silicon Valley's Quanergy had big displays at CES showing off their single-laser solid-state LiDARs. While Velodyne's units, typically with longer range and better image quality, cost thousands of dollars each, the solid-state device makers promise costs in the hundreds of dollars and better ability to withstand the demands of daily wear and tear from driving.

Luminar, a curious new LiDAR player with operations in Silicon Valley and Orlando, Florida, that came out of stealth mode last year, is showing off its technology at the show this week. Austin Russell, it's founding CEO at just 22 years old, is supremely confident that his startup, which has an initial tech partnership with Toyota and may soon will be one of the winners.

In 2017, there was "an absurd amount of claims and a lot of different approaches," he said during a demonstration of Luminar's sensor amid an unexpected downpour that added to the CES chaos.

"There's a bunch of core different product requirements you have to have if you want to be successful in the automotive industry…. One is on the performance side; the other is scalability on the manufacturing side. The last is cost," Russell said excitedly. "Look, let's just say there were a huge amount of breakthroughs we had to get through before we came out of stealth."

Luminar CEO Austin Russell demonstrates the LiDAR sensor he designed during a test ride in the rain at CES 2018 in Las Vegas.

Alan Ohnsman covers technology-driven changes reshaping transportation. Follow him on Twitter. Have tips to share with Forbes anonymously? Click here.