Why edge computing may be the key to reducing vehicles' reliance on network connectivity and bringing autonomous cars to the roads

July 2018

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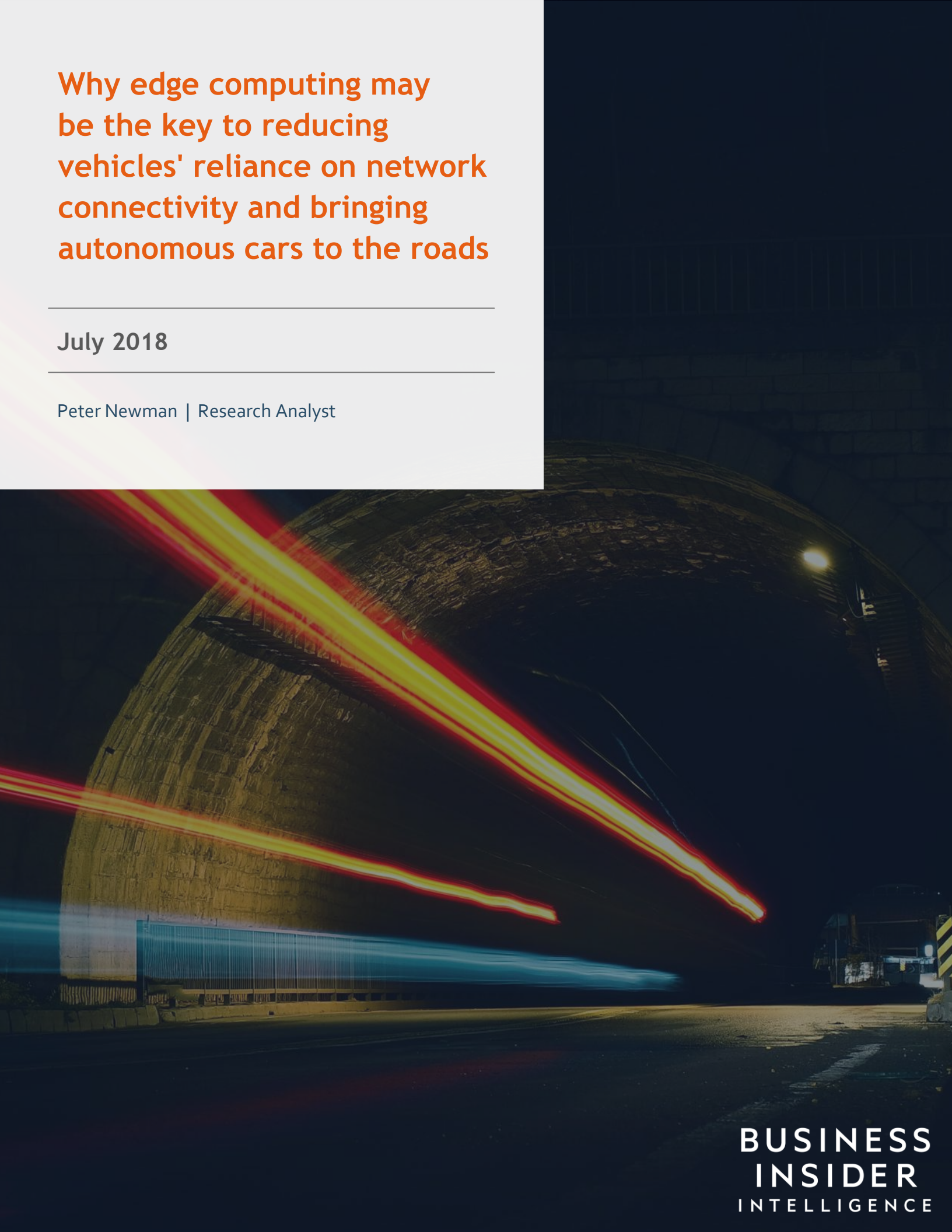

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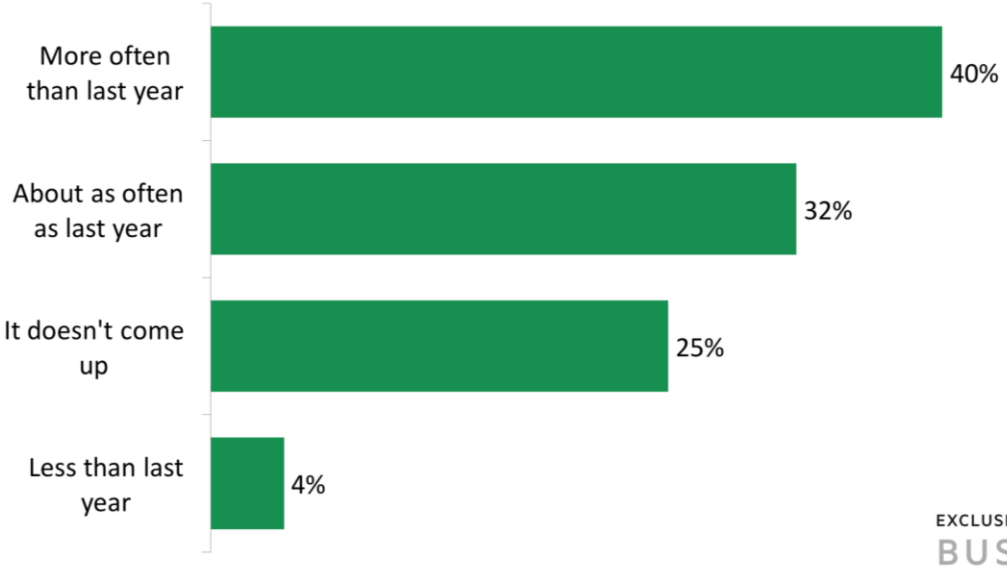
INTRODUCTION

Edge computing — also known as fog computing — is a data processing model that uses sensors and connected devices transmit data to a nearby computing device for processing, instead of sending it back to the cloud or a remote data center. This model can offer users an alternative to cloud-based IoT data management, but it can also work in tandem with such systems, allowing users to reduce data transmission and cloud storage costs. And it's becoming a more sought-after part of the wider IoT ecosystem — 40% of companies that provide IoT solutions reported that edge computing came up more in discussion with customers in 2017 than it did the year before, according to Business Insider Intelligence's 2017 Global IoT Executive Survey.

In a series of three notes, Business Insider Intelligence examines how edge computing is improving data collection and processing for companies across industries. In the first installment, we focused on the healthcare industry, where providers are turning to edge computing solutions to secure and and more efficiently process the growing troves data they generate. In the second note, we delved into the seemingly paradoxical interest that telecommunications companies have in edge computing solutions and the steps they're taking to bolster offerings. Finally, this third note will focus on the role of edge computing solutions in vehicles, and how these systems will be crucial in reducing logistics costs and enabling autonomous cars.

Edge Computing Becoming A More Sought-After Part Of IoT Solutions

Q: Does edge computing — processing data from devices where it's created rather than in the cloud — come up more with your customers than it did last year?



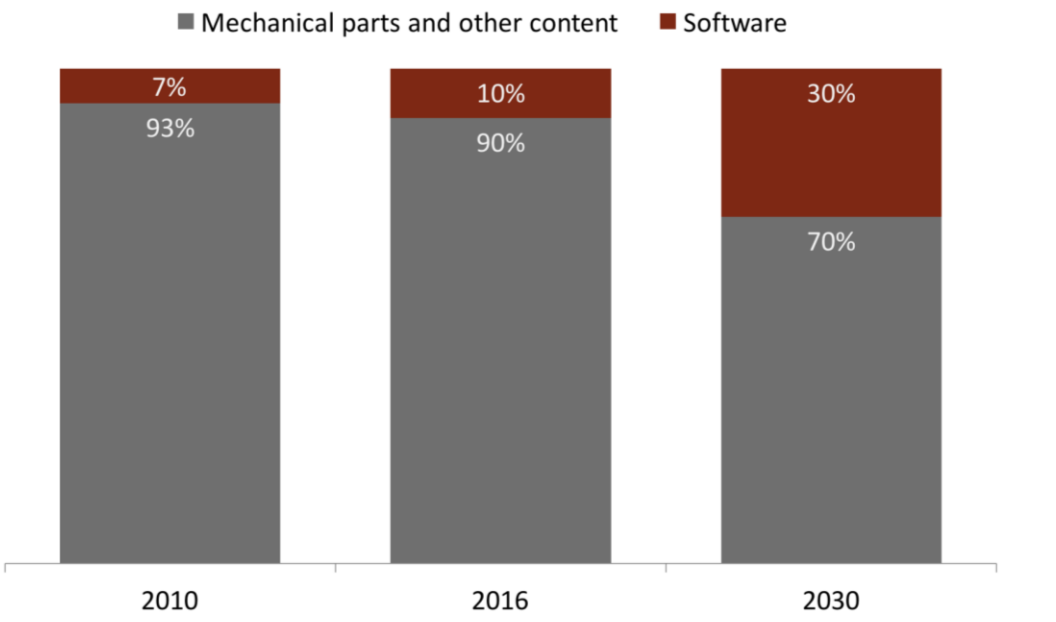
EXCLUSIVE DATA FROM BUSINESS INSIDER INTELLIGENCE

Source: Business Insider Global IoT Executive Survey, n=85 IoT providers, 2017

VEHICLES ARE MORPHING INTO LARGE-SCALE COMPUTING PLATFORMS

Vehicles are growing more complex with each new model and turning into full-scale computing platforms. A typical high-end passenger vehicle could feature $6,000 of computing equipment by 2022, according to IHS Markit. By 2021, semiconductors for the automotive sector alone will make up almost 10% of global fabrication, per IC Insights estimates. And software will be nearly a third of the overall content in a vehicle by 2030, according to McKinsey.

Software As A Percentage Of The Total Content Of An Average Vehicle



Source: McKinsey, 2017

Vehicles are using this hardware and software to create huge amounts of data for drivers, fleet operators, and manufacturers to use to make their cars and trucks more efficient. Line-haul trucks record operational data, for example, for regulatory purposes and to help fleet managers improve efficiency. More automakers are also building monitoring systems into consumer vehicles that provide feedback on operation to the owner and record data to send back to the manufacturer. Beyond gathering data, vehicles are adding advanced driver assist systems (ADAS) and autonomous driving capabilities. These systems shift part of the driving to the vehicle itself, but they rely on powerful computing systems and AI to accomplish it. Business Insider Intelligence estimates that there will be more than 2.5 million semi- and fully autonomous vehicles on US roads by 2023.

As vehicles come to rely connectivity, many manufacturers are using cloud systems to relieve the rising computing burden that's falling on their cars and trucks. But performing data processing and analysis in the cloud won't be sufficient to meet emerging needs in the automotive space, especially as autonomous cars take to the roads. Below we take a look at how the three problems most commonly associated with reliance on the cloud could impact the auto industry.

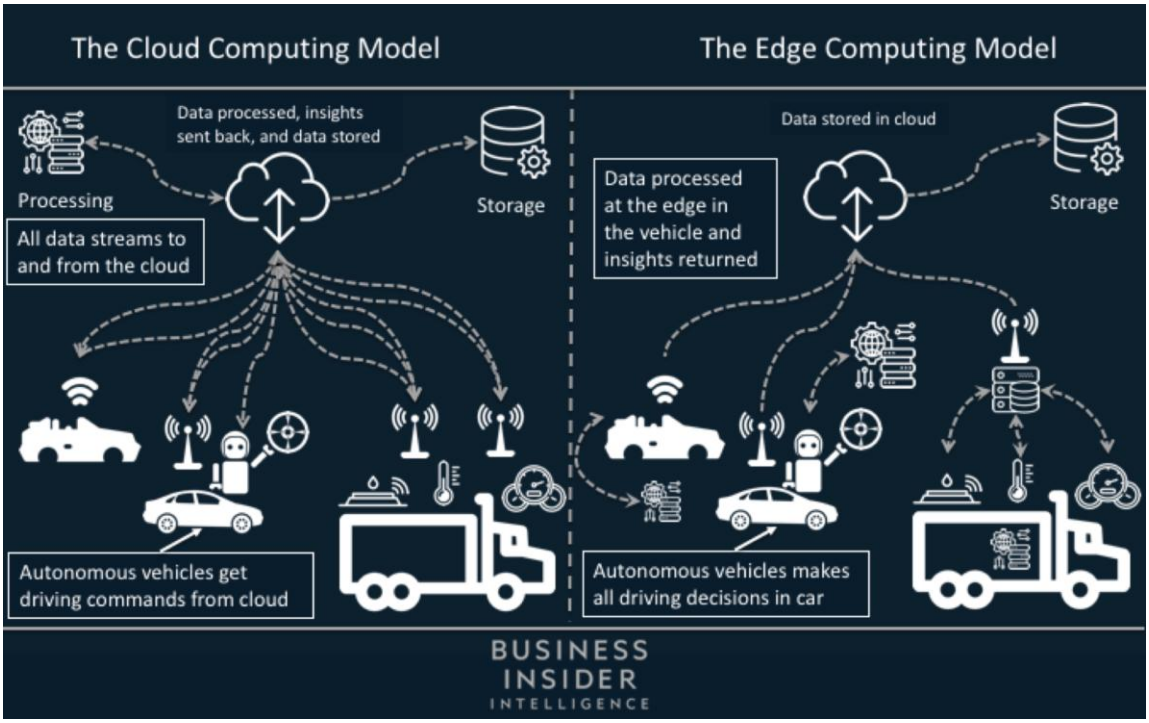
- **Security issues**. Adding connectivity and utilizing cloud computing systems in vehicles creates access points for potential hackers to bypass security remotely. From there, they can access data or even take control of a vehicle. This threat has led to criticism of automotive cybersecurity practices. And, as vehicles get more self-driving capabilities, the potential for hijacking will become an even bigger concern for automakers to reckon with. As a result, vehicles won't be able to securely rely on external sources for critical data and systems.

- **Access issues.** Automakers and fleet operators are leveraging cloud resources to store and analyze data from their vehicles, primarily using cellular connectivity. And some executives have discussed using cloud computing for autonomous vehicle guidance and data processing once faster 5G networks are widely deployed. However, that would likely limit where autonomous driving systems could be used, especially given some of the limitations of 5G technology, which won't work as well without direct lines of sight and could be impacted by inclement weather.

- **Transmission efficiency.** The introduction of myriad sensors to vehicles is generating massive quantities of data — one autonomous vehicle could generate 4,000 GB of data every day, according to Intel's estimates. Moreover, total data exchanged between vehicles and the cloud could reach 10 billion GB per month, based on Toyota's forecasts. This raw data streaming to the cloud can be critical for improving autonomous driving capabilities, but the volume is staggering and could overwhelm both cloud systems and cellular networks.

WHY EDGE COMPUTING CAN HELP

Using edge computing to shift data processing and analysis to the vehicle and away from the cloud can help automakers, autonomous vehicle developers, and fleet operators address the issues noted above. Below we examine how each of these problems can be mitigated by employing an edge model.

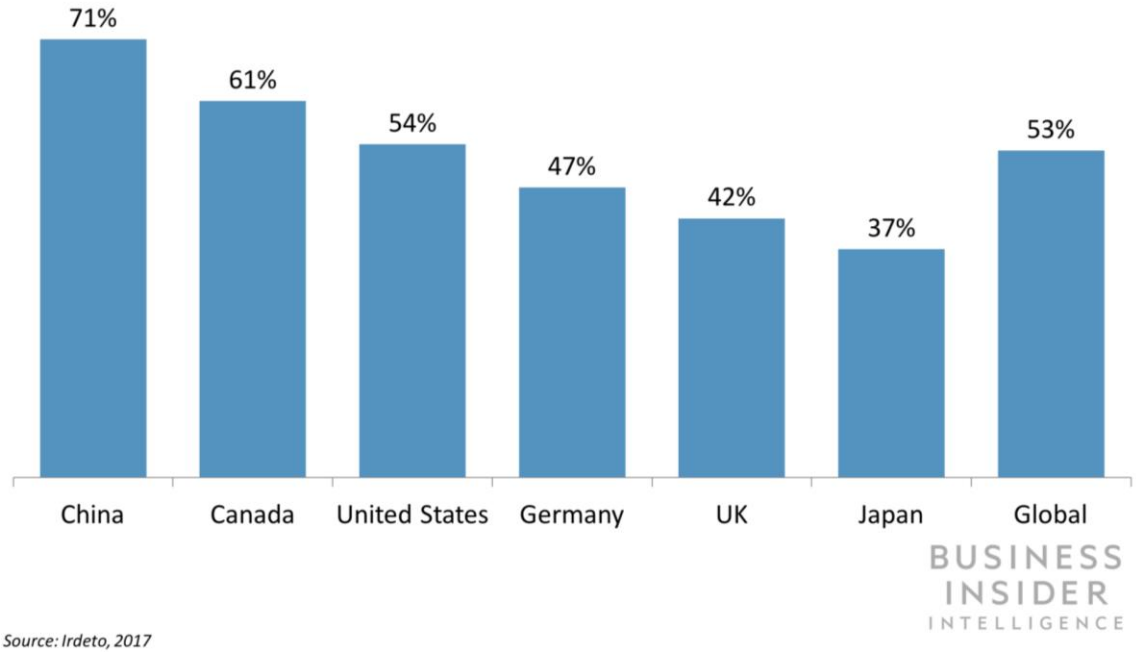


Security

Vehicles traditionally needed only a good lock to remain secure. But now they generate massive amounts of personal and private data about users and the vehicles themselves. Moreover, automakers, along with their tech partners, are trying to turn the car into a digital platform where passengers consume media, communicate, and work, meaning they're logged into services that transfer even more data to the vehicle's computer.

Consumers Are Concerned About Connected Car Security

Q: Are you likely to research your car's ability to protect itself from a cyberattack?



Source: Irdeto, 2017

Edge computing solutions can allow vehicle operators and fleet managers to increase control over how and when cars and trucks connect to the cloud. Relying on an edge system adds a buffer between the car's core systems and the cloud, resulting in another layer where security measures can be incorporated to make penetrating a vehicle's defenses more difficult.

Additionally, storing data locally for critical functions like maps helps to improve security by ensuring that no third parties can spoof a signal, impersonate a trusted source, and provide inaccurate information to the vehicle. While this would be a nuisance for a driver trying to get turn-by-turn navigation, it would be a far greater issue for a delivery driver being sent to the wrong address or made unable to locate a depot, and it would be a critical danger for an autonomous vehicle that is supposed to make its way to a certain set of coordinates.

Some manufacturers are already taking steps toward the edge. Cadillac has mapped out more than 130,000 miles of US highways for its Super Cruise system — the only places where its semi-autonomous system can operate. The data is stored in the vehicle's trunk and the onboard computer systems combine the stored data with the vehicle's sensors to control the car — under driver supervision — on those stretches of highway. This task would be much harder and less secure if Cadillac tried to rely on cloud systems to supply this data.

Access

Automakers plan to equip their vehicles with Level 5 autonomous capabilities, meaning the cars will be able to drive themselves in all environments without human intervention. In a cloud model, that would require near-constant connectivity, but roads can often go through areas where signals will drop out, whether that's underground or in rural areas. And, even with the growth of high-speed, low-latency 5G networks, many vehicles will spend significant amounts of time beyond the reach of these networks. That can be due traveling through urban areas where signal quality could drop between skyscrapers, driving through rural locations where towers are spaced far apart, or entering areas where telecoms haven't deployed 5G yet.

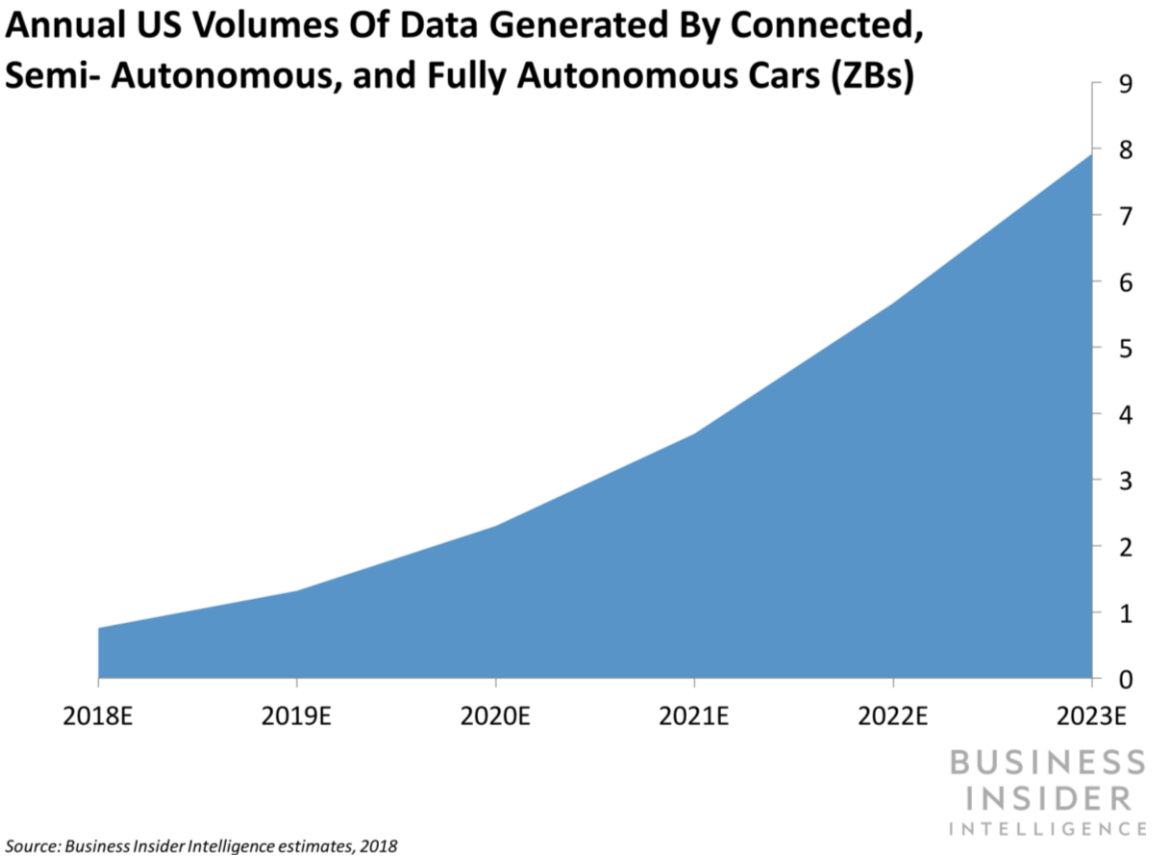
Automakers and suppliers are collaborating to develop more powerful edge computing hardware to serve as the brains of an autonomous vehicle. Companies from the computing market like Intel and Nvidiaare fast becoming key partners in the automotive space.

- Intel developed the EyeQ5 deep learning platform to allow autonomous vehicles to process data created by sensors observing road conditions. The chipset allows vehicle-routing AI to continuously improve by using this data to virtually review decisions.
- Nvidia continues to iterate on its Drive vehicle platform by offering a range of autonomous driving options led by the Pegasus computing system. These leverage Nvidia's graphics processing origins to interpret the sensor data the car uses.
- AMD is using its graphics processing experience to work with Tesla on specialized processors based on its Ryzen chip design to allow the automaker to incorporate autonomous technologies into its vehicles.

These companies' systems provide vehicles with extensive local computing and edge processing capabilities, so they can operate independently of network connectivity.

Transmission Efficiency

The increasing complexity of vehicles and the amount of data they record pose a problem for automakers and operators looking to process that data. Trying to use all of that data by sending it to the cloud will overwhelm both mobile networks and cloud systems; a single car generates thousands of GBs of data every day, and that's before the addition of autonomous features. By 2023, vehicles in the US will generate 8 zettabytes (ZB) annually, up from 0.72 ZB in 2018, according to Business Insider Intelligence estimates.



Source: Business Insider Intelligence estimates, 2018

Technology partners have edge computing solutions that can reduce the amount of data moving back and forth to cloud storage for both logistics fleet managers and companies developing autonomous vehicles. For line haul trucks, operators or manufacturers can include edge gateways that can monitor various systems, coordinate communication, ensure regulatory compliance, and perform advanced data analytics, all from within the truck. One leading vendor of this type of system is Dell, which offers advanced gateways with native analytics capabilities, ELD compliance tools, a range of connectivity options, and numerous sensors — this is all a part of Dell's $1 billion push into edge computing. These systems provide drivers with real-time information on performance while reducing the data that needs to be relayed to fleet managers through pre-processing on the edge system.

Vehicles with ADAS or autonomous capabilities need to incorporate powerful computing systems like those described above to perform numerous tasks, such as routing and object recognition, without a constant connection to the cloud. These systems are able to perform tasks like machine learning and AI training and development within the vehicle. They're able to distill the multitude of data to behaviors for the AI to consider and engage in based upon observed circumstances, rather than storing massive quantities of data from sensors and monitors in the vehicle. These findings will generally be communicated to the cloud over 5G networks, so that the autonomous driving systems can continue to improve across the board, but the amount of data being sent will be cut down drastically, saving the developers in network transmission costs.

Download the charts and data in Excel »

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