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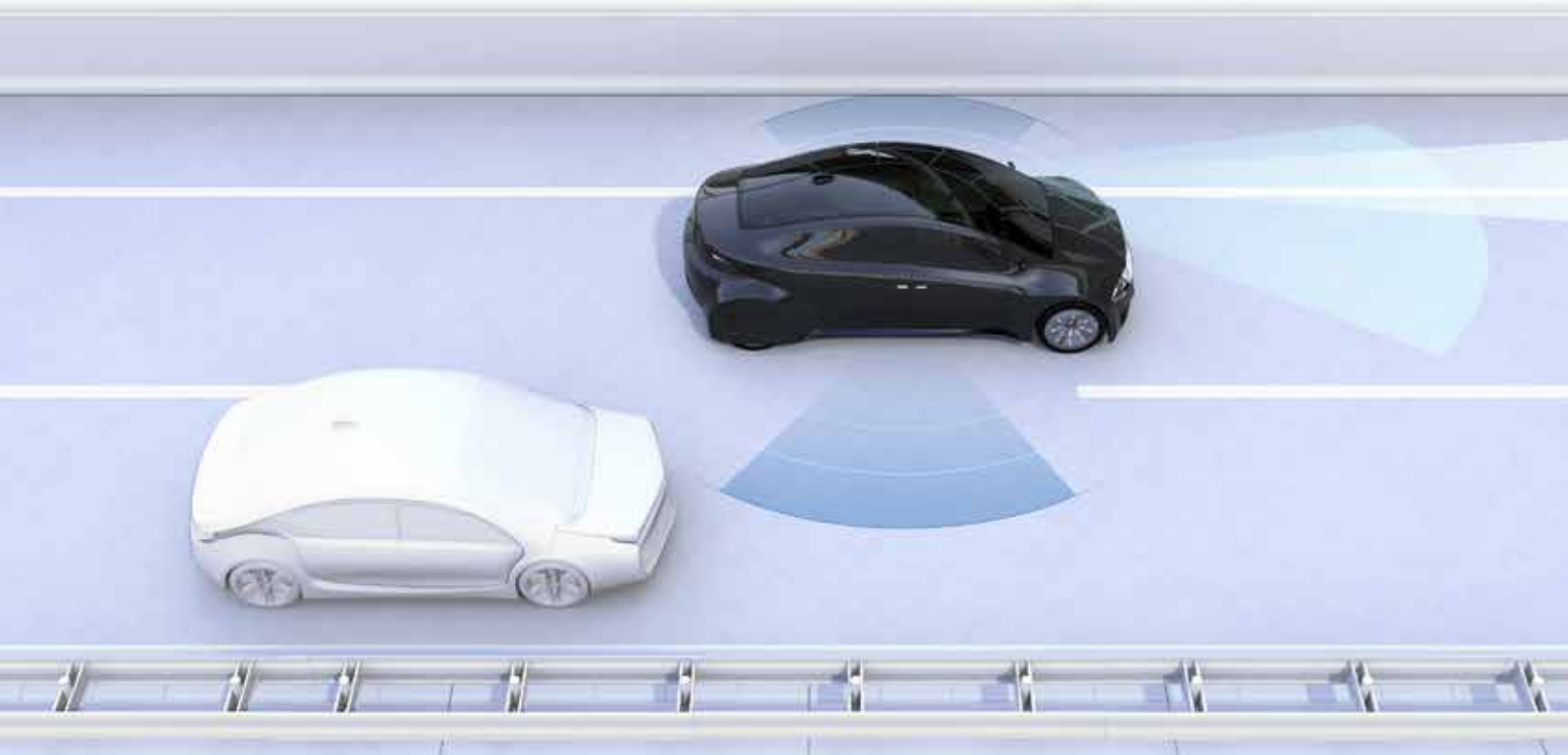
VALUE OF DATA

HOW EDGE PROCESSING MAY SAVE YOUR LIFE, AND YOU WOULDN'T EVEN KNOW IT

How edge processing prevents car accidents and could revolutionize car safety



Edge data processing in automobiles underpins significant advancements in human safety and is generating substantial cost savings. A tremendous number of accidents are being prevented as cars can increasingly process real-time data from onboard systems enabling advances in digitally driven safety features ranging from driver assistance notifications to autonomous control inputs (such as automated braking). As this technology improves, further improvements in accident reduction can be expected. Yet, the pace of innovation is broadly limited by the pace of vehicle development in multi-year model cycles tied down by significant investment in plant and equipment tooling.

What if the pace of innovation was digital – software defined – rather than locked into physical product lifecycles? Installing onboard computers – which are designed to run a variety of general applications – in today's cars will enable this software defined pace of innovation. This paper explores how edge computing is propelling safety in vehicles and how safety technology, along with onboard computers, could generate substantial benefits for both consumers and industry.

PROCESSING DATA IN-VEHICLE INCREASES SAFETY, BUT ADOPTION HAS BEEN SLOW

Most humans can't process and react to information as quickly as they need to avoid accidents. While the automotive industry has made clear strides to improve safety, results have been relatively slow to materialize. For instance, the number of fatal motor vehicle accidents per 100,000 people fell only 25% in 24 years, from 15.4 in 1992 to 11.6 in 2016.[1] This incremental change in more than two decades shows that there is still a big safety issue on the road. To compound this issue, drivers are increasingly distracted on the road due to the pervasive use of smartphones, which raises the need for alternative solutions. A powerful solution to this issue is to increase the edge computing capabilities of automobiles to help drivers avoid accidents. Unfortunately, while the technology is currently being implemented in modern cars (e.g., with automatic brakes and lane departure warning), the majority of automobiles don't have these safety features. With its power to translate raw data points into a reduced number of accidents and increased safety, there is a sense of urgency to bring edge processing safety features to all automobiles.

Edge processing is having a big impact, but its true potential is being held back

The use of edge processing in automobiles is underpinning significant advancements in human safety – in 2018 alone, edge-enabled car safety features will prevent 276,000 accidents. But there is an even larger opportunity to cut down on millions of human-caused accidents by installing onboard computers – if all cars had onboard computers and edge-enabled safety features this year, there would be 4.7 million fewer accidents. That's a 75% reduction in total accidents.

Slow Safety Improvements: The amount of fatal motor vehicle accidents per 100,000 people was 15.4 in 1992 and 11.6 in 2016, a 25% decrease in 24 years.

EDGE PROCESSING DEFINED

Edge processing is computer processing that occurs outside of the data center.

Gartner defines it as "solutions that facilitate data processing at or near the source of data generation."[2] Autonomous car safety systems need these capabilities to make quick decisions that are based on the processing of huge data volumes. For example, lane departure detection systems use edge processing to conduct complex analysis and warn passengers in real time, without having to send the data to the cloud and wait for a response. Car safety systems also constantly take in massive amounts of data that need to be used for quick calculations. Video data from the backup camera, for example, needs to be processed in the car because it would not be feasible to quickly send that much data to a data center for analysis.[3]

The edge today – common features that prevent accidents

The following features are some of the most widely available in today's 35 million cars with advanced driver-assistance systems:

- Automatic braking
- Lane departure warning
- Backup cameras
- Blind spot notifications

In order for lane departure detection systems to warn passengers they are leaving their lane, the systems must make calculations very quickly. There isn't time to send the data to the cloud and wait for the response.

General edge-enabled safety features were introduced in the early 2000s, and today there are 35 million vehicles on the road with advanced driver-assistance systems.[4] The Insurance Institute for Highway Safety has studied the following four edge processing-enabled safety features for their significant impact in preventing accidents.[5]

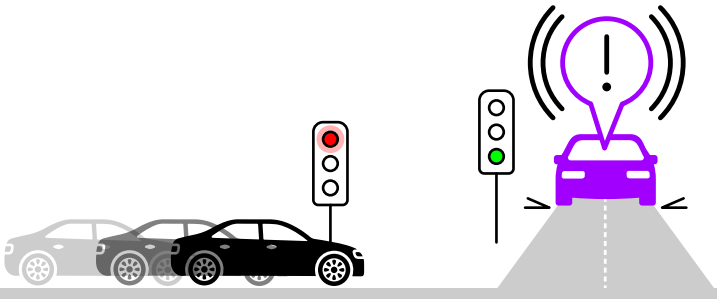
Automatic braking: car automatically brakes if it gets too close to a car in front of it.

Lane departure warning: warns drivers if they are veering out of the lane, and in some versions, veers the car back in place.

Backup cameras: shows drivers what is behind the car and can send a warning if the car is going to hit an object behind it.

Blind spot notification: warns drivers when there is a car in their blind spot.

For the safety features to work, the car safety systems take in volumes of sensor data (e.g., camera, ultrasonic, and radar), process that data, perform calculations, and then perform an action. This is all done through edge processing in fractions of a second.



A smart car prevents a possible accident by quickly edge processing and analyzing its own speed, the speed of the upcoming car, and both of their locations, and hitting the automatic brakes.

EDGE SAFETY FEATURES ELIMINATE HUNDREDS OF THOUSANDS OF ACCIDENTS

Edge processing will prevent 28% more accidents in 2019 compared to 2018, but its true safety potential is hamstrung.

Our analysis explores the impact that all edge processing-enabled safety features would have in terms of accidents prevented and insurance cost savings. Findings show that edge processing will prevent 276,000 accidents in 2018. That's 32 accidents prevented every hour and it translates to a total savings of $1.9 billion dollars in avoided insurance claims. In 2019, an average of 41 accidents will be prevented each hour – that's a 28% increase in accident prevention in just one year. The impact of edge processing will only increase over time, too, as more cars are equipped with safety features. In 2030, 2.5 million accidents will be prevented by edge-enabled safety features – that's 285 accidents avoided per hour, which not only represents benefits for the consumer in avoided out-of-pocket costs for car repair and medical bills, but also translates to total savings of $22 billion for the insurance industry.

In 2018, 32 accidents will be prevented per hour thanks to edge processing. By 2030, this number will rise to 285 accidents prevented per hour.

What do these improvements mean over time? From 2018 to 2030, we predict that there will be a cumulative total insurance savings of $75 billion dollars from accidents avoided thanks to the processing of car data at the edge.

While 32 accidents prevented per hour in 2018 is impressive, this year there will be 718 accidents per hour. What is preventing this technology from realizing its full potential? One issue is that edge-enabled safety features are not widespread enough to realize their full impact – in 2016, only 5% of cars had advanced driver-assistance systems.[6] However, another major issue is the difficulty of quickly updating cars with the latest safety features.

Edge processing prevents many accidents now, but there is still a long way to go

Edge processing-enabled safety features will prevent an impressive 32 accidents per hour in 2018, but this number represents only 4% of the predicted total 718 accidents per hour in 2018. What's keeping this technology from realizing its true potential?

From 2018 to 2030, we predict that there will be a cumulative total insurance savings of $75 billion dollars from accidents avoided thanks to the processing of car data at the edge.

WHAT IF YOU COULD UPDATE YOUR CAR LIKE YOUR PHONE?

One reason why there are still many accidents is because new edge-enabled technology is only available in the latest models of cars. But what if you could update your car wirelessly and get that feature?

The concept is similar to how today's smartphones receive software updates to upgrade their capabilities. "Dumb" cars (or the vast majority today that can't receive updates) can be compared to older model mobile phones (flip phones) that couldn't be upgraded. If consumers wanted new features, they had to buy new phones. However, cars with onboard computers can download new features that use the car's existing hardware. In this scenario, the car's hardware needs to have the capability to support the software update, otherwise the hardware would need an update as well. While the concept seems far-fetched, this technology already exists. Take Tesla as an example: in April of last year, the automaker rolled out an automatic braking feature for cars that had their Autopilot 2.0 software.[7]

Onboard computers are designed to run a variety of general applications and can receive and use software updates.

With onboard computers installed, cars will be able to receive quick updates and use predictive models to engage automatic safety features that help human drivers prevent accidents. As machine learning occurs in the cloud and the algorithms get smarter, upgrades are pushed to the car's onboard computer. Cars can then better predict when an accident will occur and can trigger the edge-enabled crash-avoidance features in real time that brake or divert the car from crashing. It's the classic combinatorial effect at work: onboard computers combined with the edge-based features that are constantly getting smarter boosts safety beyond what all the features working alone can accomplish.

Slow car updates are stifling safety potential of edge processing

Imagine you bought a car right before a new model with automatic brakes was released. If you had a common car model you would be out of luck. With onboard computers, cars can download new features that use the car's existing hardware to improve the capabilities of their safety features.

With onboard computers, cars can then better predict when an accident will occur and can trigger the edge-enabled crash-avoidance features in real time that brake or divert the car from crashing.

EDGE SAFETY FEATURES WITH ONBOARD COMPUTERS ELIMINATE MILLIONS MORE ACCIDENTS

The potential impact from equipping all cars with onboard computers and edge safety features is staggering.

Our analysis shows that if all cars in the US had been equipped with onboard computers and edge safety features, they could have avoided an additional 540 accidents per hour in 2018. That's an additional 4.7 million accidents avoided in 2018, or 75% reduction in total accidents, and a whopping $33.5 billion in savings for the insurance industry from avoided claims in one year alone.

If we extrapolate this scenario, and measure the savings between 2018 to 2030, there will be an estimated $240 billion dollars in cumulative savings for the insurance industry.

From 2018 to 2030, there will be an estimated $240 billion dollars in cumulative savings for the insurance industry.

The numbers represent the additional benefit in a scenario where all cars have onboard computers and edge features. As time goes on and the predicted number of cars that have safety features goes up, the additional benefit of having onboard computers will decrease. Given there is a large window of time for these benefits to materialize, forward-looking stakeholders in the transportation industry could capture the potential benefits described above.

If the technology for onboard computers and automatic safety features exist, and there is a large untapped opportunity, why don't we see more cars with this technology?

Onboard computers unleash the power of edge-enabled safety features

There would be 540 fewer accidents per hour if all US cars were equipped with onboard computers in 2018. That's an additional 4.7 million accidents avoided, or 75% reduction in total accidents, and $33.5 billion in savings for the insurance industry in one year.

ROADBLOCKS AND REVENUE OPPORTUNITIES

Some chip companies have worked with car manufacturers to create onboard computers, but use of these systems is not widespread across the industry.[8]

Therefore, even with improved connectivity to receive over-the-air updates for crash-avoidance statistical models, for example, without onboard computers there's not enough processing power to fully unlock the value of the data generated. Two roadblocks stand in the way: cost and industry life cycle.

Cost: Installing onboard computers is more expensive than installing traditional embedded processors.[9]

Life cycle: Manufacturers profit from selling slightly updated vehicles every year and brand-new generations of cars every four to seven years. It is many times the desire for new features that drives consumers to purchase new automobiles, and therefore the push for continuous and potentially significant software updates will disrupt this lifecycle and could affect new car sales over the long run. Alternative business models exist, however, as auto manufacturers are already considering pay-per-use or ride-swap subscription services like Cadillac's Book that charge drivers a monthly rate to drive any car that is available.[10]

While these competitive dynamics are understandable, onboard computers also present an opportunity for auto manufacturers to monetize the platform. Having onboard computers on board opens potential revenue-generating channels for advertisers, content creators, media firms and telecoms to compete for access to car riders, increasing return on investment for automakers.

> Driven by costs and operations, automotive OEMs may not immediately see the incentives that promoting a wider adoption of cars with onboard computers can yield.

THE ROAD AHEAD

Eventually, the technology of cars and edge processing of data will further evolve until autonomous vehicles and society will hit a tipping point of adoption of autonomous vehicles.

For the tipping point to be reached, vehicle-to-vehicle communication and vehicle-to-infrastructure communication, which are both edge-enabled, will be needed to manage the network of autonomous vehicles traveling the roads.

Standards created by the Society of Automotive Engineers (SAE International) measure the self-driving capability of a car on a scale of zero to five, where zero represents no automation and five is a car with fully autonomous driving under all conditions.[11] The Audi A8 is the world's first car with level three automation as the autopilot can assume full control under certain conditions.[12] Given the pace of connected car innovation, Stevens Institute of Technology predicts that there will be 23 million level five autonomous cars on the road in 2035.[13]

With the rise of autonomous cars, passengers will realize time savings. Our estimates show that by 2035, each former driver in the US could save the equivalent of 19 days per year as passengers in fully autonomous cars equipped with dependable autonomous safety features. Whether this saved time is redirected in ways that increase productivity or expand leisure time is yet to be determined. However, the potential to redirect this capacity in ways that impact the economy is substantial.

Autonomous cars will give American drivers 19 days back a year. What will you do with that time?

What happens between now and before we realize the future of autonomous vehicles? Which road will we take? Will we continue along the current road where edge processing of data is helping keep us safe, or, will we take a road that realizes the full potential of existing edge data processing via onboard computers that increases the safety profile of vehicles, further reduces injuries and provides additional cost savings from accidents?

The people involved in the accidents and the insurance companies who pay the insurance claims have a large opportunity to prevent the vast societal loss that we accumulate every year from accidents. There is also a large profit opportunity not just for the auto industry, advertisers, and content providers, but also for telecoms who can offer a 5G network that allows vehicles to quickly communicate with other vehicles and the infrastructure.

Stakeholders should consider the benefits of onboard computers

The following stakeholders should consider if pushing for onboard computers is in their interest:

1. Insurance companies
2. Auto manufacturers
3. Component manufacturers
4. Telecoms
5. Content providers

To help the relevant stakeholders as they begin thinking deeply about how onboard computers will affect them, we have the following suggestions:

1. Insurance companies should investigate if it would be in their interest to push for onboard computers in cars, given that onboard computers would significantly lower the amount of insurance claims.
2. Auto manufacturers should re-frame the use of onboard computers from a cost-driver to one with potential upside. They should investigate the potential new revenue streams that open up if they place onboard computers in all new cars.
3. Consumer groups, insurance companies, auto manufacturers, telecoms, content providers, component manufacturers and other stakeholders should engage in existing consortiums or form their own to accelerate the benefit of onboard computers.

The number of potential accidents avoided and potential insurance savings make a compelling case for quickly adding onboard computers in cars. While edge-enabled safety features will continue to improve, edge data processing in the form of onboard computers will truly unlock the full power of these features.

LEARN MORE

To learn more about technologies impacting autonomous cars, visit Data Makes Possible.

To learn more about digital disruption in the automotive industry, visit Accenture Strategy's Latest Thinking.

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APPENDIX A

UNDERLYING ASSUMPTIONS AND METHODOLOGY

- Only US vehicles were studied.
- The four features included in the analysis (automatic braking, lane departure warning, blind spot notification and backup cameras) are assumed to represent 60% of the accidents prevented by edge processing enabled features.
- For the time valuation, it is assumed that there will be 23,000,000 fully autonomous vehicles in 2035, and that the amount of traffic in 2035 is about the same as the amount of traffic in 2009.

VALUATION CALCULATIONS

FACTOR	CALCULATION				
Accident prevention rate of car with safety feature	Total accidents prevented by safety feature	÷	Number of cars with safety feature		
Total number of accidents prevented by safety feature	Accident prevention rate of car with safety feature	×	Number of cars with safety feature		
Total money saved in insurance claims for accidents prevented by safety feature	Total accidents prevented by safety feature	×	Average accident insurance claim		
Number of accidents prevented that would have led to injury by safety feature	Total accidents prevented by safety feature	×	Percentage of accidents that lead to injury		
Money saved in bodily injury insurance claims for accidents prevented by safety feature	Accidents prevented that would have led to injury by safety feature	×	Average bodily injury insurance claim		
Total potential number of accidents prevented by onboard computers and safety features	Total number of accidents	×	80%		
Total potential money saved in insurance claims for accidents prevented by onboard computers and safety features	Total potential number of accidents prevented by onboard computers and safety features	×	Average insurance claim for accidents		
Potential number of accidents that lead to injury prevented by onboard computers and safety features	Total potential number of accidents prevented by onboard computers and safety features	×	Percentage of accidents that lead to injury		
Potential money saved in bodily injury insurance claims for accidents prevented by onboard computers and safety features	Potential number of accidents that lead to injury prevented by onboard computers and safety features	×	Average bodily injury insurance claim for accidents		
Total time savings per year	Average time a person spends driving every day	×	365 days	×	Total number of autonomous vehicles in 2035

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