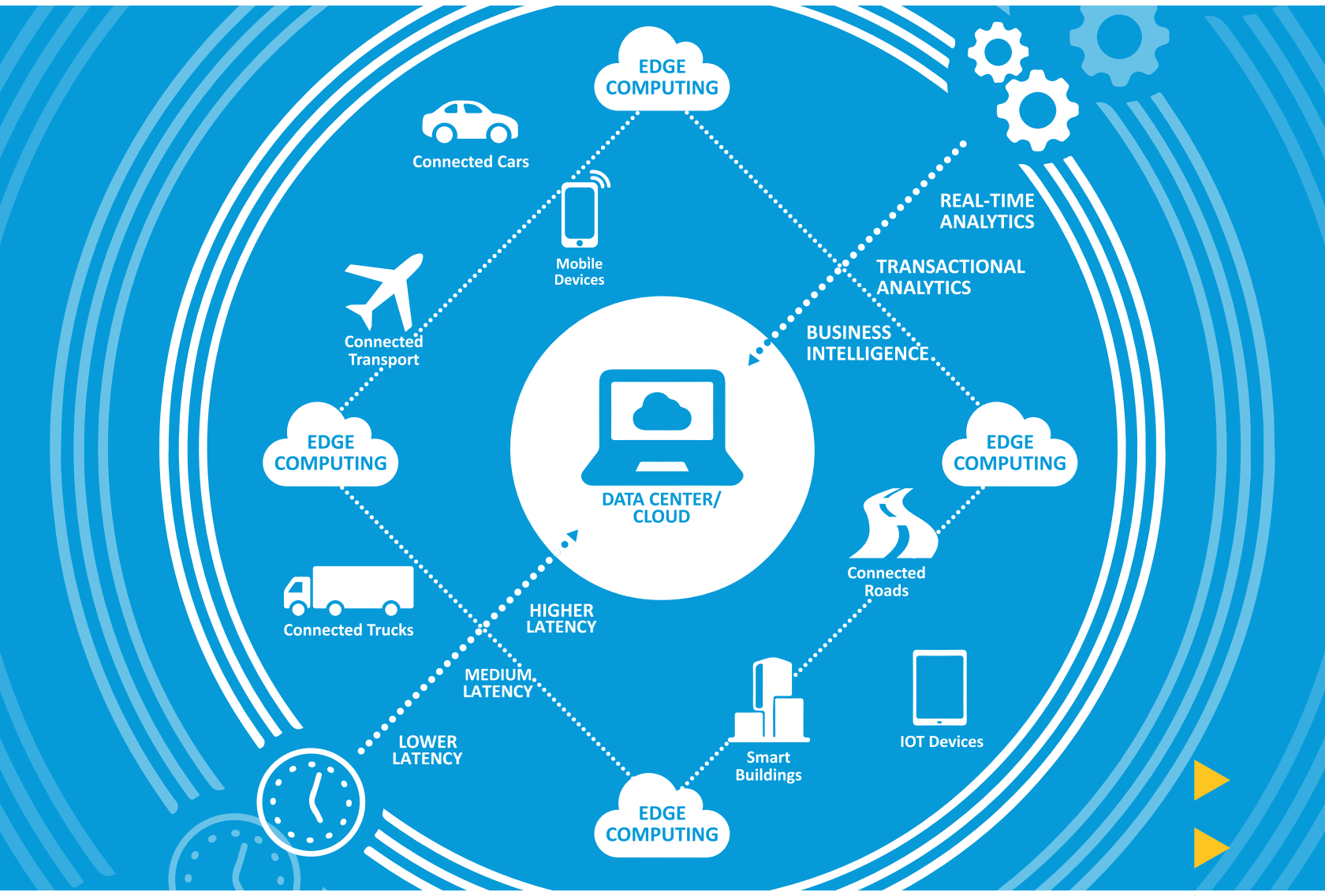
Edge Analytics



Real-Time Insights from the Source

This white paper provides an overview of edge computing, and how edge analytics will impact and improve the trucking industry.

Trimble

What Is Edge Computing?

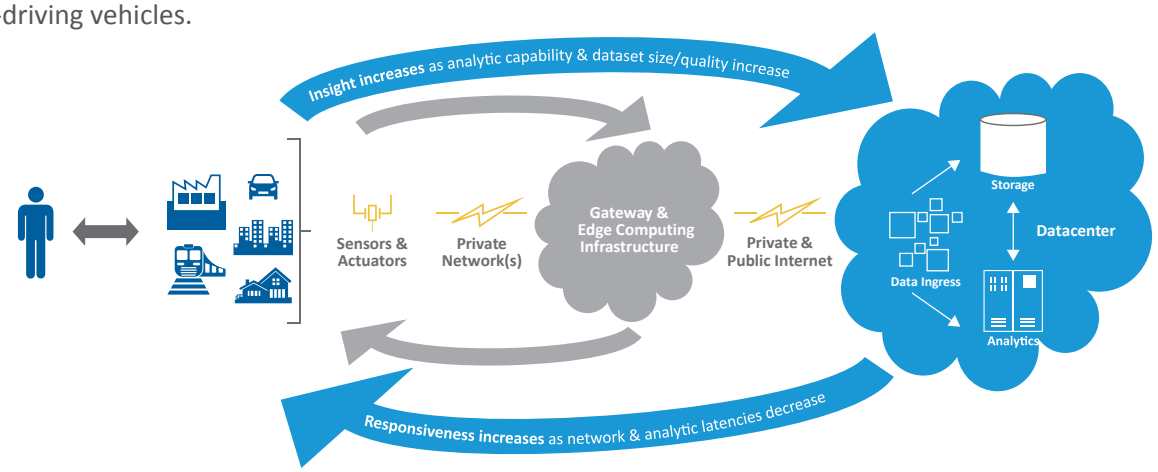
Edge computing, in its simplest definition, is a method of analyzing data. According to Gartner, edge computing is defined as a computing model that enables data processing as close as possible to the data source. In traditional models of data analysis, data is captured from a source and then transmitted to a data center or to "the cloud" where it is analyzed. How edge computing differs from the traditional model is that the analysis is instead completed at or near the data source, saving time in the analysis stage to quickly perform its intended function.

Edge computing is a rapidly-growing field in the technology sector as Internet of Things (IoT) devices become more prevalent in every aspect of people's lives. For example, if you've installed a smart thermostat in your home that uses your location and tracks your preferences, automatically adjusting the temperature when you're home or away, you've benefited from edge computing. The thermostat gathers location data from your phone, analyzes it immediately, or on the edge, and takes action to increase or decrease the temperature based on that information.

EDGE COMPUTING AT WORK

While this concept has been around for a while in industries such as manufacturing to streamline operations like quality assurance, we are just now beginning to realize the potential that edge computing has to advance many emerging technologies, particularly in the arena of self-driving vehicles. In order to be fully autonomous, these vehicles will need to make countless on-the-spot (on the edge) computations during each trip for considerations like changing lanes, weather and road conditions, avoiding accidents and much more. Sending these data points to the cloud or a data center to be analyzed would be too slow for the split-second analysis and decision-making necessary to successfully and safely navigate the roads, making edge computing an essential part of self-driving vehicles.

Edge analytics brings the "intelligence layer" closer to the source of machine-to-machine data, providing real-time intelligence and reducing the amount of data sent back to the cloud. The result of this method is a larger amount of "smart" data that leads to data-driven insights. Instead of trucks being programmed to send data packets to the cloud for processing and analysis on a regular basis, edge computing uses machine learning , statistical methods or even basic logic to process the data in real-time and only send back the most relevant and interesting data to be processed in the cloud.

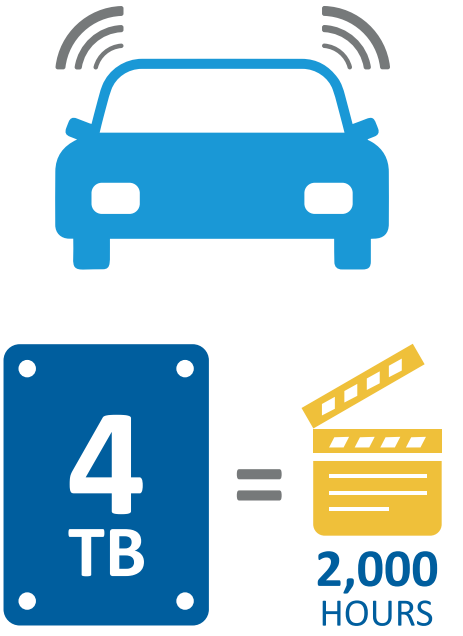


Another application of edge computing in the transportation industry could be collecting data from a truck's electronic control module (ECM) or directly from sensors and analyzing it on an in-cab device, where it could provide real-time, practical insights to the driver. Insights could be provided in real time on the edge rather than waiting for the data to be sent to the cloud or to a centralized data center to be analyzed, sent to the back-office and then back to the driver as actionable information.

An increasing number of vehicle sensors monitor key performance metrics and alert drivers to issues such as low tire pressure, lane departures and back-up obstacles. While this has allowed many advances in safety technologies, it also generates a massive amount of data that needs to be processed quickly in order to be useful in real time.

If self-driving cars become more commonplace across the globe within the next several decades, trillions of data points will be generated each day, creating a large load of data that needs to be processed. In fact, already today the engine data elements collected just from the Trimble customer base generate more than 10 billion data points a day. And that's just the start: some estimates say that just one self-driving car will produce about four terabytes of data per day, or about the same amount as roughly 2,000 hours of movies (that's like watching Smokey and the Bandit 1,300 times in a row).

In order to keep up with all that data coming in, centralized data centers would need to have the computing power to receive and process hundreds of thousands of data points or more per second – a massive undertaking. This is where edge computing becomes even more necessary – analyzing data on the edge reduces the processing load on data centers, the cloud and wireless network infrastructure, since the work can be distributed across devices where the data is being captured.

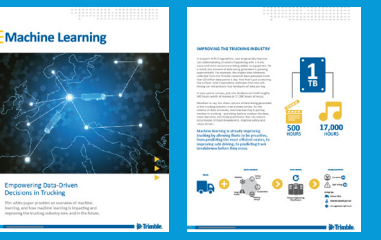


To be clear – edge computing will not replace the need for centralized data processing centers or cloud computing, but rather will supplement them by providing more real-time insights to drivers on the edge, prior to sending select data to a traditional processing method. Back-office staff who are not on the road with the driver will still need to have access to some of that data as well, which cannot be transmitted on the edge – it needs to go through the cloud or data center.

One thing to keep in mind is that data shouldn't be collected simply for the sake of having data – it should provide some sort of insight that can be used to take action. One way to analyze this data on a broad scale is through machine learning, which looks at a large data set and detects patterns that can be used to make predictions.

Machine Learning and Edge Computing

For more information about machine learning and how it's being used in the trucking industry to create efficiencies, save fleets time and money, and improve safety, read the recent Trimble whitepaper on the topic here.



BENEFITS FOR FLEETS

Although edge analytics are yet to be widely implemented across the trucking industry, there are many benefits and potential applications of edge computing to look forward to now. Some applications of edge computing already in play in the industry are predictive maintenance and autonomous vehicles. However, new ideas are rising to the surface and will likely continue gaining market momentum.

Predicting breakdowns. Imagine if a truck was able to tell a driver immediately if a part was going to fail, not predicted based on aggregate or average fleet data but based on individualized data from his or her truck, driving conditions and driver behavior. The driver could quickly plan for that repair and get it fixed before it became a problem. In traditional computing methods, the information would first go to the back-office staff, who would then communicate the need for a repair to the driver. In a situation where delivery schedules are of utmost importance to maintain, even just a few hours can make a huge difference.

Detecting driver fatigue and distracted driving. Video solutions are growing in popularity in the trucking industry – as is the amount of data collected from these videos. There is a growing need for the ability to quickly analyze and process videos – not just what the videos show, but what drivers should do in response. For example, edge computing could be used to detect driver fatigue or distracted driving by analyzing patterns in collected video data, such as drifting across lanes. In a scenario where major damage could be caused in just a matter of seconds, being able to analyze data in real time and provide actionable insights – such as alerting the driver to pull over to rest – is absolutely critical to the safety of everyone on the road.

Preventing collisions. Another video application could be the ability to detect and avoid potential collisions in real time, such as identifying if a driver is following too close to a vehicle and alerting them to reduce speed.

As technologies continue to evolve, the potential applications of edge computing will continue to expand. In order to stay on the cutting edge of technology and safety, it will be essential for fleets to understand how edge computing can help maximize efficiency, improve safety and streamline operations.

Real-time data, real-time insights

The sheer amount of data generated by each truck should come as no surprise to any fleet's back office. Between location data, component sensors and video capture, trucks are generating a huge amount of data in real time. Oftentimes, this data is sent straight to the cloud, aggregated as fleet data and sent to back-office staff who manage which trucks are out on the road and tracking things like faults and driver behavior.

Data being transmitted for analysis can often be "noisy" – it can contain irrelevant data points that obscure the important information. For example, if a truck has video solutions installed, a video of a potential collision might be collected that in reality happens to only be that the truck passed by a large billboard on the side of the road. This could still trigger the video capture sensor, but in context is not relevant. Edge computing can analyze this data at the source and make the determination if it is relevant or not and transmit only the important data, cutting down on the amount of "noisy" data being transmitted to a data center for analysis.

Furthermore, through edge computing, data is processed in real time throughout a network of distributed devices, which is more efficient than waiting for all of the data to be processed in bulk in one location. This streamlines operations for all fleet staff.

Cost savings

There are several ways that cost savings can be realized through edge computing. The cost savings from avoiding potential collisions or roadside breakdowns are immense, but on top of those one-time costs, fleets have the potential to save money when it comes to ongoing data transmission and storage costs.

We've discussed the massive amount of data generated by trucks, but one consideration to keep in mind is where this data will be received and analyzed, and ultimately stored. Data transmission via satellite or other methods can be expensive – and sometimes slow – but with edge computing, the data is processed right where it is collected, and irrelevant "noisy" data is filtered out and discarded.

Furthermore, storing these huge amounts of data can be costly. Edge computing helps to cut down on the amount of data storage by only sending back relevant data to be analyzed and stored.

Fleet Considerations for Edge Analytics

As your fleet prepares for edge analytics to become more widespread throughout the industry, here are some considerations to keep in mind:

- **GOALS:** What insights into your fleet are you looking to gain? What efficiencies are you hoping to create?
- **TRADITIONAL DATA PROCESSING:** Edge computing will not replace the need for centralized data processing -- there will still be a need to analyze fleet-wide data on a broader scale to help you manage operations. Edge computing is a great tool to maximize fleet efficiency and safety, but likely will not replace traditional data processing methods.
- **DRIVER TRAINING:** Edge analytics can provide real-time insights directly to drivers before the back office knows about an issue or situation, so drivers will need to be trained in how to deal with situations that may arise and be empowered to address and correct any issues as they occur.
- **SECURITY:** What are edge computing providers doing with your data? How are they protecting it? Are you prepared to manage devices on the edge, rather than in one centralized location?

The Future of Edge Analytics in Trucking

As IoT devices become even more ubiquitous across industries and in consumer markets, interest and implementation of edge analytics will continue to grow as the amount of data collected increases dramatically. The need to analyze data at the source and distribute processing power across a network of devices rather than at one centralized location is already growing, and will become even more important as advances such as autonomous vehicles hit the road in increasing numbers.

Trimble already has implemented edge computing solutions in a number of industries, including autonomous planting tractors in the agriculture industry, and using video to assess the safety of work zones in the construction industry.

Trimble is continuing to innovate through edge computing, employing a team of data and computer scientists and engineers to develop and share best practices, solutions and technologies in edge analytics across business groups. The Trimble team brings together fleet mobility data, maintenance and operational data and navigation and routing data to provide a robust data pool to provide more immediate and accurate insights to all customers. This shared expertise in the trucking industry also brings a holistic view and business knowledge to utilizing edge analytics in real-world applications, delivering solutions that help fleets become better, safer and greener.

Top Takeaways

- Edge computing provides real-time insights from the point where data is collected.
- Edge computing does not replace traditional data processing methods, but provides on-the-spot, individualized insights to drivers on the road.
- There are many potential uses in the trucking industry, such as real-time video processing, autonomous driving, predictive maintenance and more.
- Edge computing can help fleets be safer, more efficient and lower costs.

ABOUT TRIMBLE TRANSPORTATION

Trimble Transportation provides fleets with solutions to create a fully integrated supply chain. With an intelligent ecosystem of products and services, Trimble Transportation enables customers to embrace the rapid technological evolution of the industry and connect all aspects of transportation and logistics — trucks, drivers, back office, freight and assets. Trimble Transportation delivers an open, scalable platform to help customers make more informed decisions and maximize performance, visibility and safety. For more information about Trimble Transportation, visit: mobility.trimble.com.

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Trimble is transforming the way the world works by delivering products and services that connect the physical and digital worlds. Core technologies in positioning, modeling, connectivity and data analytics enable customers to improve productivity, quality, safety and sustainability. From purpose built products to enterprise lifecycle solutions, Trimble software, hardware and services are transforming industries such as agriculture, construction, geospatial and transportation and logistics. For more information about Trimble (NASDAQ:TRMB), visit www.trimble.com.