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DELL EDGE GATEWAYS FOR COMMERCIAL TELEMATICS

Driving Convergence, Application Market Places, and Edge Analytics

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EXECUTIVE SUMMARY

While branded gateways have only recently been introduced by key commercial telematics service providers like Omnitrac and PeopleNet (Trimble), other players have been offering them for a long time to resellers and integrators. With the commercial telematics landscape set for dramatic change, gateways will play an increasingly important role.

The ROI for Fleet Management: Why OEMs Should Integrate and Why Fleet Owners Should Invest

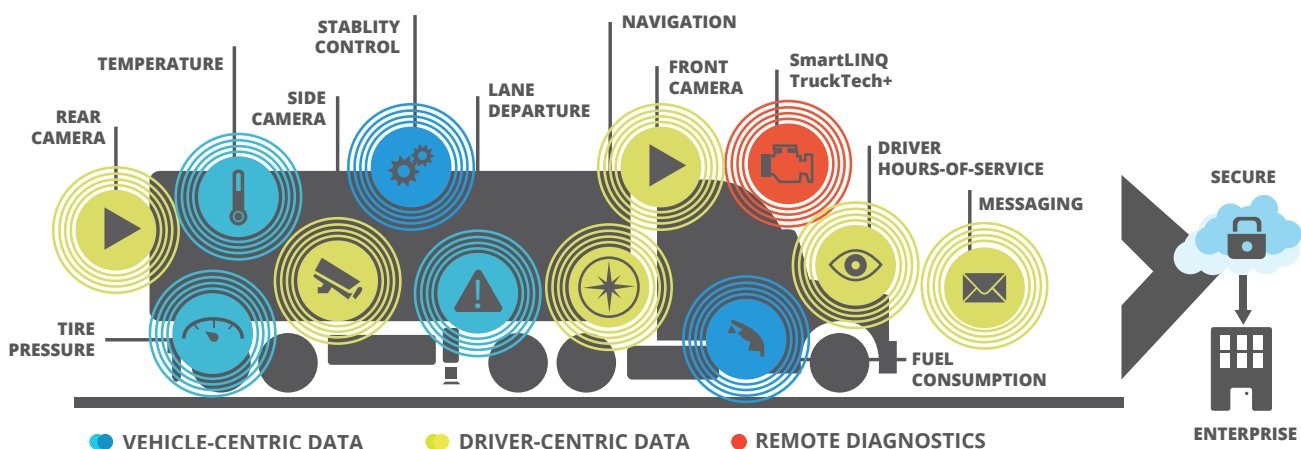
The case for telematics gateways is growing as the need for a more structured and aggregated approach toward vehicle connectivity is becoming more urgent amidst strong growth in this segment. Specifically, the opportunity for gateway solutions in the transportation and fleet management markets is driven by a number of key technology and business paradigm shifts:

- **Move towards Open Platforms, Application Marketplaces, and the Integration of Converged Devices:** Role of gateways to integrate smartphones and tablets and support application frameworks.
- **Shift to Hardware-Agnostic Fleet Management SaaS Solutions:** Opportunity to sell gateway hardware directly to fleet customers as they become decoupled from cloud-based fleet management services offered by telematics service providers.
- **Drivers Evolving to Mobile Knowledge Workers:** Consumer and enterprise mobility, telematics, and vehicle automation technologies are redefining the relationship between the professional mobile worker and his/her commercial vehicle, blending workforce management with advanced connected vehicle services and prompting the need for in-vehicle Wi-Fi networks. The professional knowledge worker of the future will be deeply embedded in the entire transportation and logistics process, leveraging smartphone and tablet applications for a seamless experience inside and outside the vehicle. Driver empowerment, quality of life, and safer driving experiences will result in improved job satisfaction and reduced turnover and job shortages.
- **Rise of Truck OEM Telematics:** Customization and integration opportunity. The emergence of embedded, on-board active safety and ADAS systems (and in the longer term platooning and autonomous technology) and their integration with telematics solutions will be enabled by gateway-based approaches.
- **Need for Advanced Capabilities for Data Analytics and Community Crowdsourcing:** Requirements for advanced, reliable on-board edge computing capabilities will be driven by a wide range of applications including diagnostics and prognostics, electronic logs, and more generally the need for real-time processing, aggregating, and interpreting large amounts of vehicle sensor data. Aggregating weather and other external data with vehicle, driver, and business data will drive optimization. While edge analytics will remain critical, the emergence of high-bandwidth and low-latency 5G connectivity will enable seamless integration of cloud-based and local applications, resulting in fog computing approaches.

Both commercial vehicle OEMs and the fleet operators themselves have a vested interest in adopting gateway solutions for faster return on investment (ROI) compared to fragmented, proprietary solutions. Vehicle gateways offer far more flexibility in supporting new use cases and applications and can support mandates like ELD and future paradigms such as freight-as-a-service.

The Role of a Gateway: Moving from Multiple-Point Solutions to an Open Platform

Intelligent gateways in transportation markets are increasingly positioned as the single, unified, and central hardware device and open platform linking external connected and cloud-based services with an expanding range of dedicated and portable in-cabin devices. They also provide the functioning as the edge analytics-embedded computing cluster for securely processing a fast-growing volume of sensor and other data generated by commercial vehicles for a wide range of applications including active safety, remote prognostics, video-based monitoring, and a growing number of machine learning use cases.



OEMs/TSPs Should Partner with a Trusted Hardware Provider Instead of Developing Their Own Solutions

Telematics service providers (TSPs) are increasingly adopting a hardware-agnostic approach, abandoning in-house developed branded hardware products in favor of software and cloud/SaaS-based service development supported on a wide range of third-party hardware solutions. However, hardware remains critical, especially for specialized asset tracking, goods tracking, and embedded truck OEM solutions. Both commercial vehicle OEMs and TSPs will increasingly rely on third-party solutions from trusted brands as the commercial telematics matures and reaches larger penetration levels.

Edge Gateway 3002: Dell's Value Proposition and Unique Differentiators

The Dell Edge Gateway Model 3002 is optimized for fleet and transportation markets, and can capitalize on the above trends, especially as it relates to both the truck OEM market and the fleet aftermarket. Other vertical target markets include transportation segments such as public transit. Dell's strengths include global supply chain efficiency improvement solutions and application developer support, more specifically its Internet of Things (IoT) partner ecosystem, which will be a key differentiator allowing customizing capabilities for an ever-growing number of telematics verticals and requirements. The Dell IoT Solutions Partner Program currently includes 65+ technology and service ISVs and SIs. Additionally, Dell's offering includes global support, flexible and fast supply chains, and project financing. The total addressable transportation gateway market is estimated to reach more than 8 million shipments in 2021 at an annual growth rate (CAGR) of 53%.

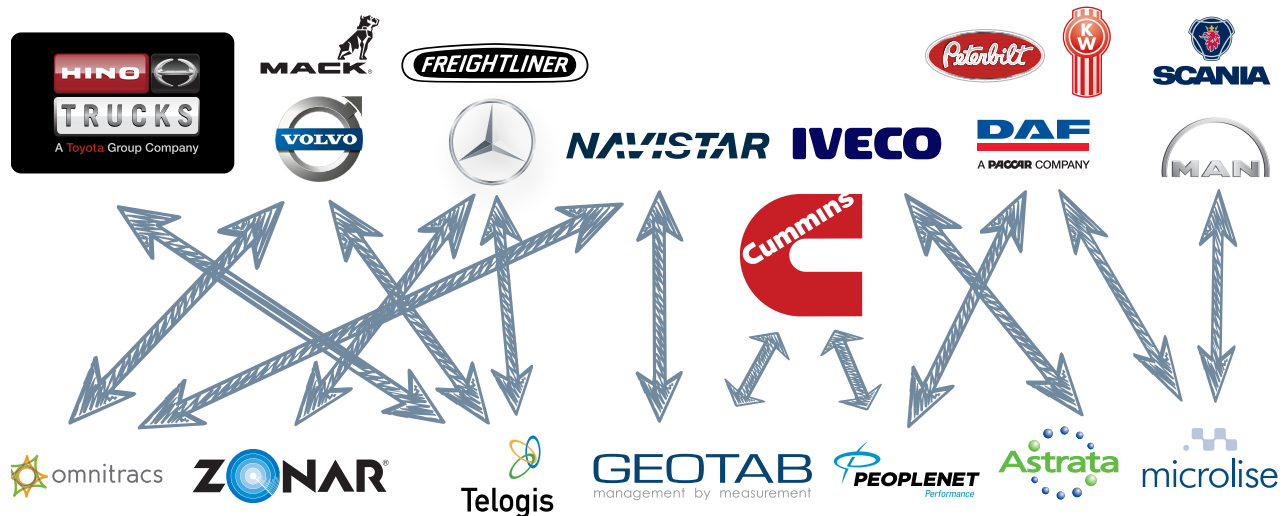
MARKET FOR FLEET MANAGEMENT

Main Fleet Management Trends

Over the past years, the fleet management and commercial telematics environment has undergone profound change:

- **New Segments and Verticals Fueling Strong Growth:** From an almost exclusive focus on long-haul trucking, the commercial telematics industry is now increasingly addressing an array of new segments and verticals including taxi, rental, construction, bus and coach, service and utilities, delivery, government, and trailer and container asset tracking. Adapting and scaling solutions to more affordable and open platforms can address this lower end of the market, often consisting of smaller fleets at lower price points.
- **New Features and Applications:** Closely linked to entering new segments but also related to an increasing focus on the driver as opposed to the vehicle or the asset are new driver-centric features. Advanced, often commercial-grade, truck-based connected navigation, platooning, two-way messaging, in-cab communication, and driver behavior monitoring and safety have become mainstream in the past years. Automated document handling, fuel, mileage, and hours of work reporting and safety compliance services are also offered by many players.
- **New Benefits:** The new features described above offer a range of new benefits including safety, driver and customer satisfaction, and increased efficiency. Allowing commercial telematics solutions to be upgraded from a tactical tool to a company-critical strategic asset encourages use by the highest management levels and at the same time shortens ROI.

- **Driver Empowerment and the Mobile Knowledge Worker:** Driven by automation and digital technology, the role of the driver will evolve from basic blue collar to an environment in which the driver takes on an increasing number of back-office tasks. Heralding the era of the “mobile knowledge worker,” the driver is upgraded to a transportation manager in office-type cockpit environments of (semi-)autonomous trucks and is assigned new tasks such as processing documents, scheduling destinations, accepting orders, and arranging breaks.
- **Rise of OEM Telematics:** From a situation of an almost exclusive focus on aftermarket systems, the adoption of factory-installed OEM solutions is now gathering momentum. Feature sets go beyond engine monitoring and diagnostics (which remains the core offer from truck OEMs like Daimler, Volvo, Iveco, Renault, DAF Trucks, MAN, and Scania) to include navigation, driver monitoring, and workforce management services offered by GM, Ford, Hino, and others. The total installed base of trucks equipped with OEM telematics is estimated at around 1 million, with Daimler, Volvo, and Scania each boasting several hundreds of thousands of connected trucks. Off-road construction, mining, and agriculture vehicle and equipment OEMs such as Caterpillar, Komatsu, John Deere, Hitachi, and Manitowoc have also adopted OEM telematics. This has resulted in a large number of partnerships between aftermarket commercial telematics service providers and truck/commercial vehicle OEMs as shown in the figure below.



- **Cloud/SaaS and Convergence:** Both the use of converged devices such as smartphones and tablets and the deployment of SaaS-based technologies are instrumental in achieving many of the ambitions and targets outlined above. Initially pioneered by Telogis, this approach is now being copied by many service providers.
- **Platformization:** Closely linked to hardware and segment trends, opening up platforms to third-party application developers *via* open APIs, often linked to convergence and cloud approaches, allows TSPs addressing specific requirements of customers in specialized segments access to timely information at low price levels by leveraging application ecosystems. Players like Geotab have launched application market places, aggregating all software available from third-party developers.
- **Big Data and Analytics:** As in many other IoT segments, data analytics has become a key technology, with vendors like Omnictracs creating dedicated data divisions. Applications include business intelligence, customer service metrics, traffic information, community feedback, driver behavior monitoring and UBI, and engine diagnostics and prognostics for predictive maintenance. In the future, this will lead to cognitive systems and the widespread deployment of AI in hybrid edge/fog/cloud-based computing environments.

- **Global Expansion:** From a main focus on North America and Western Europe just a few years ago, commercial telematics is now quickly spreading across all regions, including Latin America, the Middle East & Africa, Southeast Asia, and China, though the latter market remains challenging to address for foreign TSPs. A growing number of vendors, such as Telogis, MiX Telematics, Trimble, Digicore, Navman Wireless, and Geotab, have adopted aggressive international expansion strategies.
- **Sales and Marketing Approaches:** Addressing lower-end segments and/or smaller fleets has resulted in a shift from a predominantly direct sales model to a hybrid, multi-channel approach also leveraging resellers, distributors, and integrators to indirectly address new opportunities at a lower sales cost. In the case of integrators, this is also linked to the move towards open platforms and customization through third-party applications.
- **Pricing and Business Models:** The dominant commercial telematics business model is still overwhelmingly based on monthly subscription fees with the one-off hardware cost often covered/subsidized by the subscription in as far as hardware is still offered at all. At the same time, ultra-low-cost track-and-trace offers at monthly subscription fees of less than US\$5 and hardware prices below US\$100 are pushing vendors to the premium market, offering ever more features and services to maintain average monthly subscription fees between US\$30 and US\$35.
- **Fleet Management and Car Sharing:** While fleet management remains largely associated with commercial vehicles, future opportunities for offering similar capabilities for fleets of shared passenger cars, especially when driverless cars arrive, will be huge.
- **Commercial Telematics Mandates:** Mandates for commercial telematics are in place or being prepared in countries like Peru and the United Arab Emirates. In the United States, the ELD mandate is resulting in a surge in the uptake of telematics solutions.
- **Mergers, Acquisitions, and Partnerships:** In past years, high levels of M&A activity have been observed, often involving equity and venture capital firms. Many vendors, such as TomTom, Verizon Telematics (Telogis and Fleetmatics), Trimble, and Omnitracs, have resorted to aggressive acquisition strategies to ramp up expansion to levels not possible through mere organic growth but at the cost of lengthy and expensive integration of newly acquired companies.

Key Use Cases

Key fleet management use cases have evolved from mere “track and trace” functionality to a wide set of applications, many of which are focused on the driver. The key uses cases mentioned below illustrate this shift from vehicle to driver-centric functionality:

- Connected navigation and content increasingly based on vehicle sensor data crowdsourcing and data analytics
- Two-way messaging and communication; dispatching and work flow management
- Driver behavior monitoring, dash cam integration for critical event monitoring, and usage-based insurance
- Automated document handling including signature capturing and barcode scanning
- Compliance reporting (mileage, hours of service, electronic logs)
- Vehicle life cycle management (vehicle diagnostics, prognostics, preventive and predictive maintenance, vehicle inspection)
- Asset tracking and optimization including for reefers, containers, and goods
- Mobile resource management
- Dashboard reporting
- Productivity and operational cost reduction and management (fuel consumption, route planning optimization, driver satisfaction, and churn reduction)
- Connected infotainment
- Safety and security (emergency calling (eCall), stolen vehicle tracking, accident reduction)

Impact of U.S. ELD Mandate

The electronic logging ELD mandate in the United States is expected to drive uptake of more comprehensive telematics solutions offering a large number of applications above and beyond the logging functionality. The ELD mandate is generally considered to become one of the main growth drivers for commercial telematics in the coming years. It is also likely that other regions will move in a similar direction.

Evolving Commercial Telematics Hardware Approaches: New Form Factors

Commercial telematics hardware is offered in a large range of form factors, price levels, and feature sets. Basic track-and-trace devices merely contain a cellular module and a GPS positioning module. More advanced onboard computer solutions include displays, Wi-Fi, Bluetooth, cameras, and a range of other sensors. The shifts towards targeting non-trucking, lower-end, enterprise and SMB verticals and fleets has seen hardware approaches evolve to more flexible solutions at lower price points *via* connected personal navigation devices (PNDs), low-cost on-board diagnostics (OBD) dongles, ruggedized tablets, smartphones, and even wearables. Critically, this convergence trend is transforming the commercial telematics industry, fueling growth by harnessing third-party developer ecosystems to address new requirements such as signature capture, payments, document handling, vehicle inspection, driver behavior and health monitoring, and real-time follow-up. Additionally, dash cams are increasingly integrated for both forward- and inward-facing safety monitoring applications. The figure below provides a summary of the spectrum of commercial telematics form factors.



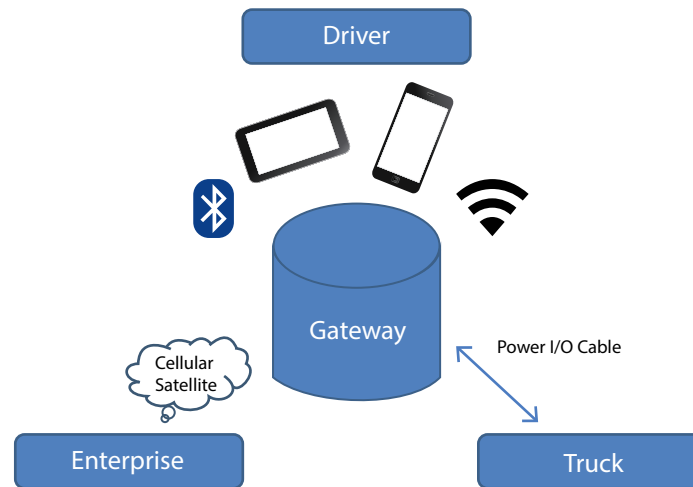
At the same time, TSPs are increasingly adopting a hardware-agnostic approach, abandoning in-house developed branded hardware products in favor of software and cloud/SaaS-based service development supported on a wide range of third-party hardware solutions. However, hardware remains critical, especially for specialized asset tracking, goods tracking, and embedded truck OEM solutions. The new category of gateways is also starting to become deployed to enable the integration and use of converged devices, including application marketplaces, while providing a more robust hardware platform capable of running native apps, performing advanced data analytics, and offering a plethora of connectivity options.

GATEWAYS IN TRANSPORTATION AND COMMERCIAL TELEMATICS

While gateways are well established in industrial and enterprise contexts, they are a relatively new concept in commercial telematics.

Gateways: Definition and Features

The term gateway is used somewhat randomly to denote advanced hardware connectivity solutions for the M2M and IoT markets, both for fixed equipment like industrial applications and mobile segments such as transportation and commercial telematics. As such, gateways function as a “bridges” between the physical vehicle and the wider IT environment consisting of cloud-based functionality running on server infrastructure. It links the driver to vehicle assets and the back office, allowing seamless access to branded and third-party applications through a single device.



What sets intelligent commercial telematics gateways apart from other connected devices can be summarized in eight critical capabilities:

- **Advanced Operating System:** Capable of running native applications locally *via* on-board application frameworks such as HTML5, including the integration of applications and/or analytics services running or performed on connected converged devices like smartphones, tablets, and smart watches
- **Resident Computing Power:** For performing edge analytics in near real-time, including predictive/ai services
- **Sensors:** GNSS, accelerometers, atmospheric pressure sensors, and gyros
- **Short-Range, Local-Wired, and Wireless Connectivity Options (Wi-Fi, Bluetooth, Zigbee):** Allowing connecting the physical object to its wider environment; support for the linking and integration of multiple smartphones and other in-cab devices like printers and scanners; local Wi-Fi hotspot network; connection to the vehicle data bus (CAN bus)
- **Wwan Connectivity (Cellular, Satellite):** Accessing cloud-based services, applications, and analytics capabilities
- **Design:** Vehicle battery-powered, ruggedized, automotive-grade
- **User Interface Components:** Display; voice recognition and text-to-speech; dedicated on-device buttons and controls
- **Security:** The centralized topology of gateways allows advanced cybersecurity management of both the wide area access connection and devices connected *via* Wi-Fi or Bluetooth, both at the device level, and part of the larger platform, network, and portfolio security

Gateway Types

Gateway solutions can be categorized as follows:

- **Black Box Systems versus Solutions with Integrated Display:** While PeopleNet offers its gateway in combination with a separate display device, Omnitracs offer a single integrated gateway/display solution.
- **TSP-Branded versus Third-party Brands:** While commercial telematics service providers typically offer branded gateway solutions, the trend towards hardware-agnostic solutions opens perspectives for third-party gateway brands.
- **OEM/Embedded versus Aftermarket Solutions:** Independent hardware vendors are able to address both the OEM/TSP branded market and the third-party market, potentially even targeting fleets directly.

Gateway Features to Focus On

While gateways offer a wide range of features, two capabilities stand out:

- **Connectivity:** Linking of wide area connectivity with in-cab and in-vehicle short range wireless and wired connection of portable devices and sensors; vehicle area network
- **Computing:** Resident open computing platform supporting edge analytics and native applications

Together these capabilities future-proof the connected vehicle, which will heavily rely on combining cloud and edge computing in fog analytics approaches. They will support new paradigms like platooning, automation, and freight-as-a-service.

Gateways: Use Cases and Benefits

The single most important benefit of gateways is their flexibility, offering virtually unlimited capabilities for vehicle and driver monitoring, intelligent navigation, fleet applications, and a host of value-added services. Commercial telematics gateways are capable of addressing complex, vertical-specific markets requiring integration with external smartphones, tablets, taxi meters, ticket machines, barcode scanners, or driver ID systems.

Among the many benefits offered by gateways can be mentioned:

- **Scalable Functionality:** Single-platform approach allows TSPs and third-party developers to add features in a scalable, cost-effective, and accelerated way
- **Integration:** Seamless integration of brought-in devices, applications, and cloud-based services
- **Safety:** Non-distractive interaction with the system through enhanced voice interfaces, intrusion switch alerts; watchdog timers
- **Efficiency:** Use of converged devices like smartphones
- **Productivity:** Optimized solutions for bringing all driver tool sets into one easy-to-use device (voice interface); improved ROI through advanced capabilities, allowing cost savings on fuel and insurance
- **Centralized Security Management:** Gateways provide opportunities for effective cybersecurity approaches with TPM chips for hardware root-of-trust, BIOS lockdown of I/O ports
- **Driver Satisfaction and Retention:** Convenience and mobile device integration
- **Easy Installation**
- **Recurring Revenue Stream From New Use Cases**

Benefits can be organized in five key categories:

- Compliance
- Business efficiency
- Vehicle life cycle
- Driver retention
- Safety and security

Vendors designing and selling their own hardware typically offer maintenance plans and extended warranties over and above the standard 1-year warranty. Hardware-agnostic approaches relieve fleet management service (FMS) vendors from offering this service, leaving hardware warranty, maintenance, and repair to dedicated infrastructure vendors.

While gateways essentially enable all possible fleet management use cases, they are especially suited for the following application areas:

- **Freight, Delivery, and Logistics:** Driver-centric applications such as connected navigation, dispatch, business planning, and HOS/ELD compliance; this applies to both the short-haul/private fleet and long-haul/for-hire segments
- **Cold-Chain Monitoring:** See Section 6

DELL GATEWAY SOLUTIONS IN THE IoT AND TRANSPORTATION

Dell's Wider IoT Play

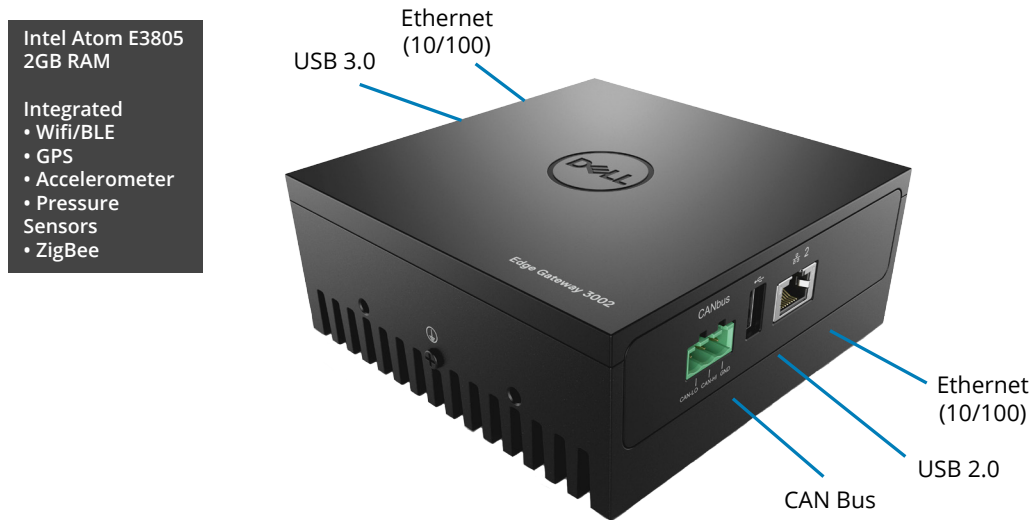
Dell has the ambition to expand its legacy PC business into the promising IoT environment, leveraging its IT expertise to unlock the potential of the unconnected by bridging IT and operations technology (OT). Dell has been involved with the IoT since 2012 in the form of developing solutions on the infrastructure cloud side around server-run sensor data. Dell EMC OEM Solutions bring strong credentials to the IoT market, with more than 30 years of IT heritage, 15 years of customizing Dell technology for OT environments through OEMs, and more than 50 partners offering OT expertise to more than 4,000 OT customers. Dell's existing line of gateways and embedded PCs for industrial markets (Edge Gateway 5000 series and Embedded PC 3000/5000) capitalizes on its role in bridging edge and fog/cloud computing and analytics, aggregating data from sensors and equipment, offering complete local analytics for near real-time decision making, and securing connected devices and data.

Extending Gateways from Industrial to Transportation Markets: Dell Edge Gateway 3000 Series

Dell is now embarking on intelligent gateways designed specifically for transportation markets, including fleet management and logistics, asset/cargo tracking, cold chain, supply chain, video surveillance, and last-mile delivery segments. The new Edge Gateway 3000 series is targeting a number of verticals with special versions optimized for general purpose automation (3001), media/retail kiosks (3003), and transportation (3002). These are ruggedized (especially for temperature, shock, and vibration), fanless, and headless devices.

The Edge Gateway Model 3002 features transportation-specific capabilities including CAN bus support; offers GPS, accelerometers, and atmospheric pressure sensors integrated into the box; and is certified for transportation verticals (Vehicle eMark Certification).

Edge Gateway 3002 (Transportation) - I/O View



12 of 12 Dell - Internal Use - Confidential

Technical features include:

- Intel Atom
- Support for Ubuntu Core Series 16, and Win10 IoT Enterprise LTSC 2016 OS
- Interfaces include I/O USB, Fast Ethernet (includes PoE), CAN, Audio
- Connectivity options include 4G WWAN in the United States, global 3G and LTE NA WWAN (optional), Wi-Fi b/g/n, BTLE 4.0, and integrated ZigBee mesh networking
- Sensors include GNSS GPS, Galileo, GLONASS, BeiDou, accelerometer, and atmospheric pressure sensors
- Security includes TPM 2.0, watchdog timer, and intrusion switch connector
- Power input is DC-IN or power over Ethernet (PoE); system power protection; enables low-power use with ignition wake or wake on LAN
- DC-IN accepts 12/24 V car power system (12 V to 57 V wide DC input); supports transient low-voltage states (battery crank) ≥ 6 VDC; ignition input supports power on/standby/hibernate at 9-32 VDC with a 5-second delay; wake-up events (alarm, LAN, USB, ignition, or direct ignition)

Accessories include:

- Mounting ecosystem (main mount, cable control bars, DIN-rail clip perpendicular DIN-rail mounting)
- Antennas sold separately (ZigBee, WWAN 4G (takes two antennas), WWAN 3G, Wi-Fi/BLE/GPS)

Over and beyond its hardware and software solutions, Dell offers some unique capabilities discussed in the next section.

Dell's Value Proposition and Unique Differentiators

While Dell's expertise in software and hardware integration is second to none, it brings additional unique credentials and capabilities to the transportation and telematics industries:

- **Global Scale, Scope, and Support:** Dell has presence in 180 countries through dedicated service centers; can assist customers with global deployments.
- **IoT Partner Ecosystem:** Dell's award-winning curated tiered IoT Solutions Partner Program, launched in 2015, enables offering complete end-to-end IoT solutions to its customers through a strong ecosystem of partners across a large number of categories including end-to-end platforms, backend platforms, big data tools, analytics, visualizations, security, device management, wide area networking, edge I/O and networking, OS/virtualization, edge platform, and sensors and endpoints. Transportation target use cases include compliance and documentation, fleet management, logistics and supply chain management, predictive maintenance, and remote asset management. Partners include independent software vendors (ISVs) offering analytics, visualizations, voice technology, big data, security and device management; system integrators (SIs); and independent hardware vendors (IHVs), such as manufacturers of sensors, satellite connectivity, scanners, printers, and accessory I/O. Current SI partners include Action Point, Datatrend Technologies, L&T Technology Services, and Mobiliya. Dell's program has grown to around 67 members over the past year. Dell's program "de-fragments" the fragmented IoT landscape and allows customers to find the solution that works best for them. Dell partners benefit from market awareness, co-selling opportunities, and incremental business opportunities.
- **Dell Project Financing Support:** Dell is already financing hardware projects to the tune of US\$4 billion yearly as well as providing leasing options, primarily with its own in-house bank.
- **Trusted Brand:** Dell's track record of offering reliable and secure solutions provides it with credibility to supply mission-critical OT applications to its customers. The company has existing relationships with 98% of Fortune 500 companies.
- Expertise in edge, fog, and cloud analytics.

Product Positioning and Go-to-Market Approach

Dell's Edge Gateway Model 3002 is ideally suited to address both OEM and aftermarket fleet opportunities. As a trusted brand, Dell's products appeal to the medium- to high-end transportation and fleet telematics markets, avoiding competition with low-cost gateway providers. Moreover, Dell is able to leverage its IoT partner ecosystem and global support organization to provide complete end-to-end solutions including software and hardware peripherals, hereby successfully competing with smaller, more specialized vendors in a fragmented marketplace looking for strong leaders guaranteeing long-term commitment and proven market credibility.

This open platform and ecosystem approach also allows Dell not to alienate potential partners by avoiding competing across the entire value chain with end-to-end proprietary solutions. While Dell's brand has the strength to target fleets directly, key partnerships with truck and bus OEMs would solidify its position in the transportation and fleet markets. The total addressable transportation gateway market for Dell is estimated at around 8 million shipments by 2021, of which the fleet market represents more than half.

Key Transportation Use Cases for Dell Gateways

Key gateway use cases for Dell's Edge Gateway 3002 include:

- Cargo tracking
- Cold-chain monitoring
- HOS/ELD compliance
- **OEM Telematics and Embedded Safety Integration:** Dell's hardware and extensive IoT partner ecosystem allows advanced customization of truck OEM telematics solutions requiring high levels of hardware, software, and data analytics integration for both enhancing embedded ADAS, safety, and autonomous capabilities, and aggregating and processing data from a wide range of sensors and systems including tire pressure monitoring, active braking and steering, blind spot detection, lane departure warning, adaptive cruise control, video monitoring, and diagnostics solutions.
- **Public Transport Passenger Services:** Dell's gateway solution is ideally suited to address a range of new passenger requirements and services offered on buses, trains, and other forms of public transport. These include automated payments, real-time scheduling and timing information, and in-vehicle Wi-Fi access.

CONNECTED TRANSPORTATION TRENDS

Connectivity is driving next-generation paradigms like freight brokerage and freight-as-a-service (the "Uberization" of trucking), not just for road-based haulage, but also for air, rail, and maritime cargo. On a lower level, connectivity enables over-the-air updates for vehicle life cycle management, keeping system functionality up to date and critical systems safe and secure through remotely applying firmware and cybersecurity fixes (virtual recalls and cybersecurity management). Predictive and AI-based services include prognostics that can have a direct impact on the transportation services' bottom line and reputation. Active safety ADAS systems based on image and radar sensors allow preventing accidents and avoiding fatalities, in turn decreasing costs and improving margins. Beyond transportation, connected logistics including smart cargo and smart contracts are key market trends, as illustrated by recent announcements such as the deployment of Blockchain-based contract management in the United Arab Emirates by 2020.

Autonomous and Platooning

While a lot of the debate around vehicle automation is centered on passenger vehicles, semi-autonomous use cases for trucks and other commercial vehicles like delivery vans will be critical to improve efficiencies, reduce costs, and improve the quality of service offered to customers.

Cold-Chain Logistics

The complexities of cold-chain logistics in terms of reliably monitoring and communicating critical environmental parameters will require capable and trusted hardware solutions.

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