PRESIDIO™

Practical thinking for a connected world.

# SMART TRANSPORT

## KEEPING STUDENTS CONNECTED AND SAFE WITH THE SMART SCHOOL BUS

## PRACTICAL THINKING FOR A TRULY CONNECTED WORLD

We have an unprecedented opportunity right now to improve our communities and our quality of life, through more relevant connections between networks, systems, and devices—from new service models to data-driven decision making. But connectivity also brings new challenges, whether securing data, complying with regulations, or integrating diverse protocols. Presidio brings expertise, proven deployments, and vision to the combination of connectivity and big data we call the Internet of Things (IoT).

Our smart school bus solutions bring together educational, safety, and civic agendas. They are changing the ways school districts and cities function. Here we'll take a brief look at the possibilities and some of the key factors for consideration when redefining how transport can operate in your community.

### Delivering a Holistic Solution

Extending the education environment via Wi-Fi and student safety are top priorities for many communities. But an effective smart school bus solution accomplishes more than this. By integrating previously unconnected systems, it can help reduce OPEX costs and increase efficiency for multiple agencies, while improving services from healthcare provision to law enforcement. Fleet managers can extend the life of vehicles, monitor fuel consumption, and improve driver safety. When networks are extended into new arenas, the resulting data can significantly impact operations.

There are solutions on the market that address discrete aspects of connected vehicles and school buses, such as GPS or Wi-Fi. Presidio takes a broader view: integrating hardware, software, data management, and connectivity to provide a richer educational experience, increased safety and security, higher quality, real-time connectivity, operational efficiency, and lower costs.

- **Extend the school day and study time:** Provide Wi-Fi on the bus, while preventing access to inappropriate sites
- **Improve student safety and security:** Connect dispatch and local law enforcement to real-time information with on-vehicle video monitoring and tracking
- **Location tracking:** Ensure law enforcement and emergency responders have insight in the case of an incident with instant location data

Presidio's Brian Feeny, Teaching Fellow at Harvard University's School of Engineering and Applied Sciences, and Presidio's Director of IoT Solutions Architectures speaks to the complexity

and the potential of a fully connected smart school bus solution, "There are a lot of solutions out there that will do the management of the GPS, tracking the bus as it goes around; some solutions provide video on the bus; and others, the in-vehicle Wi-Fi. But very few will combine all three into one platform. Presidio gives you all this, plus comprehensive analytics and the ability to tie into vehicle diagnostics. For instance, to check the temperature of the engine, the oil level, or the air pressure in the tires. There are tons of sensors on each of these sophisticated vehicles pushing out data. We take all of that data and map it to the location. For example, in certain areas, where the speed limit is 35, we can send alerts if a driver is going above a certain threshold, and provide real-time coaching to the bus driver to slow down. And we can track the flow: is the bus on time, is it running behind?"

Presidio brings 20+ years of technical expertise—including aerospace, electronic, mechanical, and software engineering—to the complexities of system-to-system connectivity. So when it comes to the connected school bus, we can ensure that vehicle devices are able to withstand environmental factors, such as potholes, dust, heat, and humidity. Devices are ruggedized and integrated into vehicles, and connected with all disparate, related systems necessary to turn data into meaningful information. Software systems are tied together seamlessly, providing a single dashboard view of vital information, such as driver behavior and coaching and fuel efficiency.

Security is multi-tiered, covering hardware and software encryption, as well as governance and policy. Industry-leading ecosystem partners, such as Intel and Cisco, deliver advanced levels of cybersecurity and encryption. In addition, Presidio's dedicated cybersecurity group manages governance, so solutions meet industry and government guidelines and regulations. A risk mitigation service ensures software and hardware are maintained at a highly secure rate.

## Connected School Bus Benefits

| | |
|---|---|
| **Education** | • Wi-Fi connectivity for studying and doing homework on the bus supports district strategies for anytime, anywhere student access and learning<br>• ISD standard content filtering to manage website access<br>• Data shows where students are spending the majority of their time on the Internet<br>• Supports districts where children daily spend extensive time riding the bus, due to long route runs |
| **Safety and Security** | • Real-time parent awareness and participation via mobile app<br>• Real-time student and driver safety monitoring<br>• Connectivity with law enforcement and emergency responders<br>• Real-time video monitoring and data sharing to speed protection and healthcare in the case of an incident<br>• Intel®-based security at the hardware and software level |
| **Fleet Management** | • Route optimization based on real-time data<br>• In-service fleet management to reduce maintenance costs<br>• Monitor and coach driver behavior to improve driver safety<br>• Increase operational efficiency with relevant analytics |

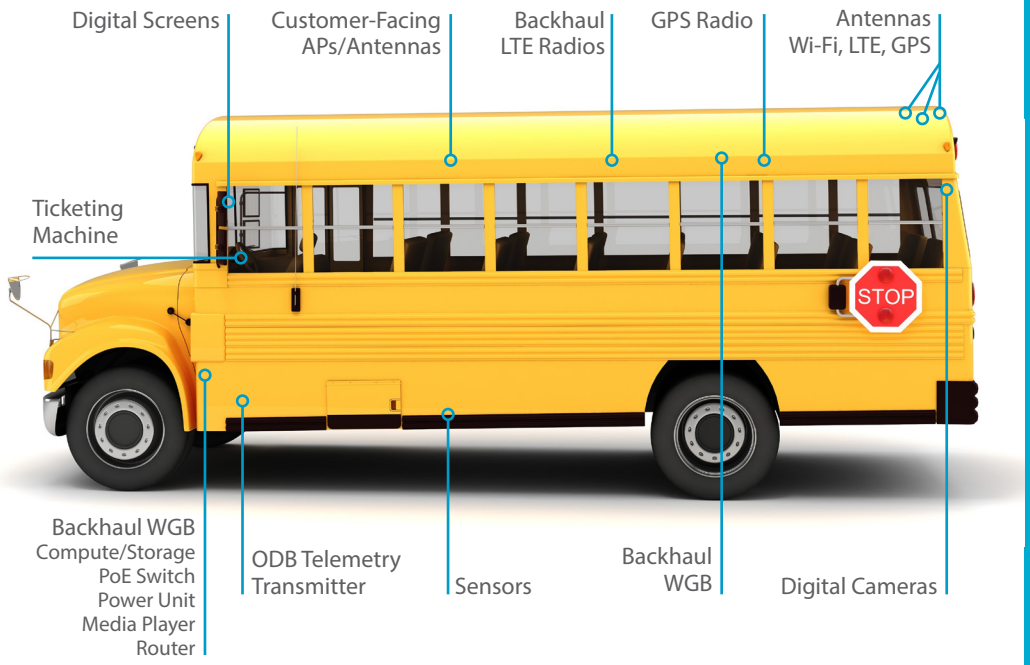
# SMART TRANSPORT

## Connected School Bus Architecture

Presidio works with school districts, communities, and cities to find the "right fit" mix of legacy and new technologies to meet their specific objectives and requirements. The connected school bus architecture utilizes standards-based technologies from Intel and other ecosystem partners to ensure school districts have a reliable, scalable foundation for evolving technologies and applications.

## Basic Components

- Integration with existing or new on-bus video systems
- Live video monitoring
- Wi-Fi access for students
- Automatic vehicle location (AVL) via GPS
- On-board vehicle telematics system
- Cellular data WAN connection
- Dispatch system
- Land mobile radio (LMR) integration of dispatch system
- Fleet management system
- Vehicle network monitoring and management




## SAMPLE SCENARIO

1. A student gets on the school bus. An Intel®-based tablet sits in the front of the bus. The driver quickly touches the tablet app to verify that the student is on board. If the student does not get on the bus, an alert is automatically sent to the school and to the student's parents.
2. The app also manages route optimization to keep the bus on schedule.
3. An Intel®-based gateway filters and helps secure information from multiple vehicle sensors, providing actionable intelligence.
4. If an incident does occur, the driver can send an immediate alert. Real-time video on the bus is tied to the dispatch center and to the law enforcement agency. This accelerates communication with the resource that's the closest to the bus to ensure the fastest possible response.
5. Medical and law enforcement professionals have data they need to address issues quickly and accurately.
6. Biometrics capabilities are the next step—providing video facial recognition to further improve safety and security.

# SMART TRANSPORT

## Monitoring and Management Functions

| | |
|---|---|
| **Vehicle Tracking** | • Real-time GPS/AVL vehicle tracking<br>• Real-time and historical tracking information for school bus trend analysis |
| **Alerts and Notifications** | • Instant alerts if the school bus travels outside of the designated route<br>• Instant alerts if the school bus violates transportation policies (e.g., idling the bus for too long, speeding on any roadway, or excessive throttling)<br>• Instant alerts indicating a potential issue with the engine<br>• Instant alerts if the school bus arrives at a designated stop before or after the designated times (e.g., some districts have a requirement that buses arrive no more than five minutes and no later than five minutes of the proscribed times)<br>• Automatic updates to Twitter* to allow parents to follow the bus and receive positive Twitter updates, as well as potential delays |
| **Safety Monitoring** | • Shows idling time and students who are at each pick-up/drop-off point<br>• Shows street view of any violation point (to determine the potential reason for the violation, such as speeding, excessive throttling in order to avoid a red light, or excessive idling in a parking lot because the bus is arriving earlier than it is supposed to)<br>• Real-time traffic analysis to estimate the time for a bus to make it to the designated spot |
| **Connected Services** | • Integration with radio dispatch operations to improve response to incidents, emergencies, and facility events<br>• Ability to integrate swipe-card technology for student attendance and tracking |
| **Reporting** | • Extensive standard reports and custom reporting capabilities |

## Case Study in Brief

A rural Southern school district in the U.S. wanted to increase student safety and services, and improve fleet management. The district supports a community of about 50,000 residents and serves 625 square miles with 150 buses.

## Challenges

- Tracking students across extensive busing system
- Improving educational opportunity by empowering mobility on buses
- Providing an integrated view of the busing system for safety and communication with all emergency responders
- Providing a highly reliable on-board network, which can withstand harsh environments such as extreme temperature changes, shock, and moisture

## Solution

Presidio conducted an envisioning assessment in collaboration with community stakeholders to determine key performance indicators (KPIs), technical requirements, and proof of concept (POC) implementation and validation. The resulting solution included:

- On-board network design, incorporating Cisco's mobile routing platform and Intel®-based gateway
- A custom on-bus mobile video service for real-time streaming
- Rugged Intel®-processor-based tablet for student tracking and driver information
- Mobile communications (LMR) for integrated emergency responder dispatch
- Telematics supporting fleet maintenance and driver behavior management
- AVL fleet tracking and route optimization
- Parent communication, via a phone application, for student tracking
- Presidio managed services for 24x7 support and warranty

# SMART TRANSPORT

## Outcomes

- **Improved Student Safety:** Integrated busing solution allows community to understand children's location and whereabouts
- **Enhanced Services:** Wi-Fi for extended bus rides enables new educational opportunities
- **Fleet Management:** Increased fuel usage management, fuel efficiency, and route optimization; bus maintenance reduced through proactive driver management and engine telematics
- **Open Platform:** Standards-based unified solution brings ongoing flexibility to enhance services and improve community interaction and experience

## Looking Ahead

Presidio works closely with local and regional clients to bring data-driven insight and connectivity to critical areas of infrastructure, creating truly smart communities. Presidio's smart transport solutions include:

- K-12 smart school buses
- Mass transit (light rail, buses, etc.)
- Emergency medical services (EMS) (fire rescue, ambulances, law enforcement, police officers)
- Public and nonpublic sector logistics (fleet management, trucking)

Feeny sums up the value of drawing on Presidio's extensive expertise, "Being connected is one thing. Turning the data that all those different devices and things are producing into meaningful information is quite another. IoT is shaping the next generation of technology and infrastructure, and we can help our clients connect the dots. Presidio is enabling clients to define and invest in an effective digital strategy that will support them today and with the inevitable changes that lie ahead."

## LET'S TALK

Presidio's 20+ years of technical experience include being the world's largest producer of covert tracking devices—one of the earliest applications of IoT. We bring a passion for driving client results with a 95 percent client retention rate and a commitment to delivering best-in-class client satisfaction. Talk to us about your smart transport and smart school bus needs.

Contact the Presidio IoT group to schedule an envisioning workshop to determine your requirements and engagement at DLIOT@presidio.com.

Learn more at: presidio.com/solutions-services/services/presidio-iot-group.