Solution Brief

Edge AI
Intel® Core™ Processors, Intel® Xeon® Processors, Intel® AI Technologies

Powering Intelligent Edge AI for a Safer and Smarter Landscape

Supermicro and Intel deliver end-to-end AI performance for faster, safer decision-making at the edge and enhance public safety across urban and remote environments.

The escalating complexities of modern urban environments and critical infrastructure necessitate advanced, real-time solutions for safety, efficiency, and operational responsiveness. Public safety is a critical priority for communities worldwide, requiring real-time, intelligent solutions to address dynamic challenges such as traffic accidents, wildlife hazards, and campus security. Public safety depends on rapid situational awareness and intelligent response across intersections, highways, campuses, and critical infrastructure.

Supermicro edge devices, powered by Intel® AI technologies, offer a robust solution for enhancing public safety. Intel's edge computing capabilities, combined with Supermicro's Edge AI devices, deliver powerful, localized AI solutions that enhance situational awareness, optimize traffic flow, and reduce accidents.

The Public Safety Challenge

Public safety encompasses a wide range of scenarios, from managing roadway incidents to protecting wildlife and securing public spaces like campuses. Incidents like traffic collisions, emergency delays, and unpredictable roadside hazards pose serious threats to urban and rural communities alike. Traditional safety systems often lack the real-time capabilities needed to address these challenges effectively, leading to delayed responses and increased risks. Additionally, deploying edge AI solutions in outdoor or resource-constrained environments poses challenges such as thermal management, cost efficiency, and performance reliability under varying conditions.

City planners, transportation departments, and public safety officials need solutions that detect risks and violations in real time, enable faster, data-driven emergency responses, automate monitoring and reduce human error, and minimize reliance on cloud bandwidth or central servers.

Real-Time Intelligence at the Edge

Supermicro edge platforms, powered by Intel, offer a scalable, efficient, and robust response to these challenges by enabling real-time processing at the edge. These platforms are deployed to play a crucial role in mitigating risks, reducing accidents, and significantly improving traffic flow by leveraging real-time data processing and communication directly at the source of data generation. By processing data locally and in real-time, these devices provide immediate insights and actions that can prevent accidents and improve traffic flow. This localized intelligence forms the core of a more responsive and safer landscape.

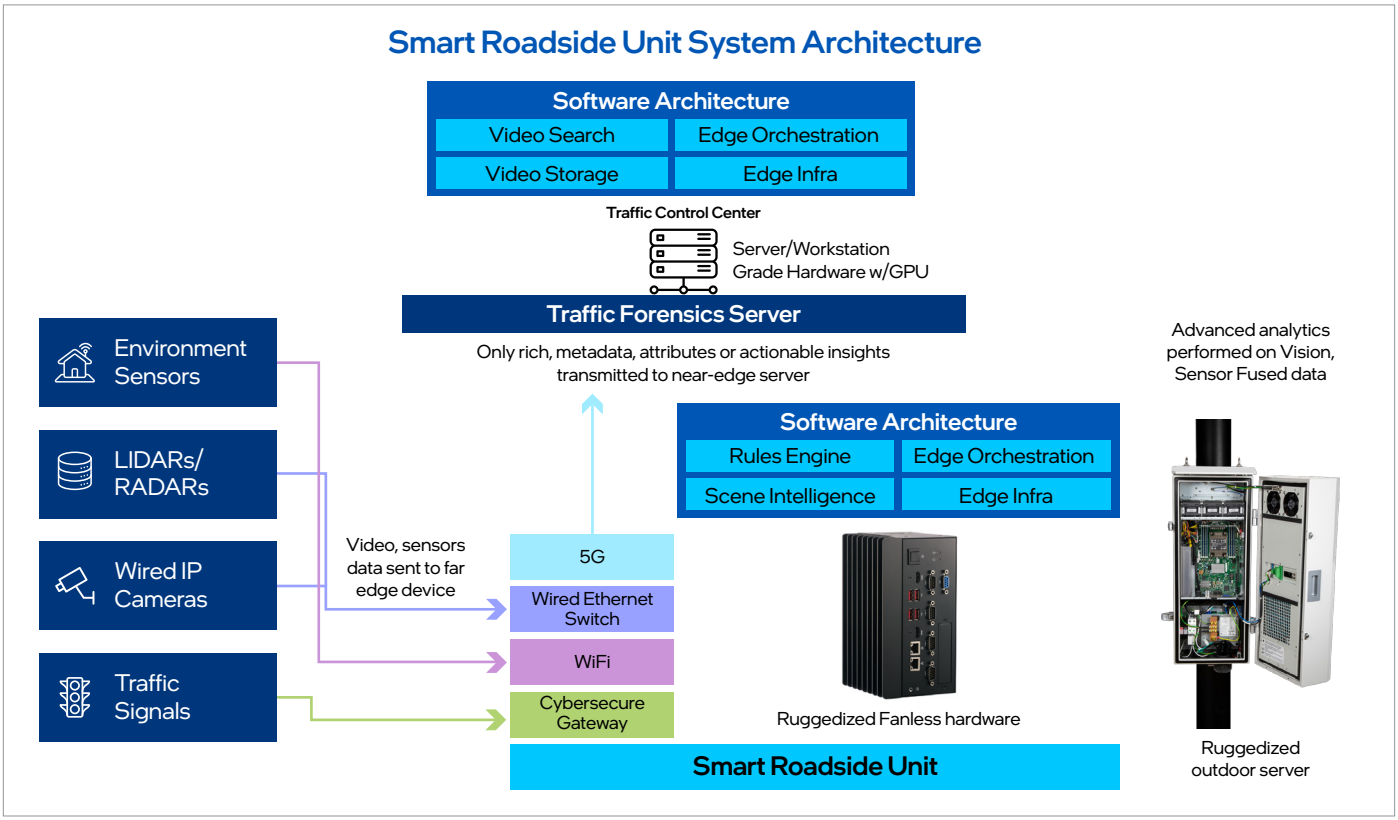


Figure 1: Private AI in Box Solution Architecture

Real-Time Monitoring for Proactive Safety Measures

Intel® Core™ based edge device, equipped with IP cameras, LiDAR sensors, and environmental sensors, continuously monitors conditions in public spaces, detecting vehicles, pedestrians, cyclists, or wildlife. Using Intel® Deep Learning Streamer (Intel® DL Streamer) and Intel® Edge Video Analytics Microservice (EVAM), it processes data locally to deliver immediate insights, while the Intel® Xeon® based Outdoor Server (IoT SuperServer SYS-E403-12P-IPA2-C) aggregates and manages data for broader analysis. These intelligent systems are designed to detect, classify, and track various road users, encompassing not only different types of vehicles but also vulnerable road users. The raw data captured by these sophisticated sensors is processed locally on the edge device itself, providing immediate and granular insights into critical metrics like traffic flow patterns, average speeds, vehicle counts, and crucially, the presence of any potential hazards. This localized, real-time processing ensures that vital information is available instantaneously, enabling rapid response to unfolding situations such as sudden congestion, unexpected obstacles, or rapidly developing adverse conditions.

Incident Detection and Prevention with Advanced Algorithms

Supermicro edge device leverages Intel® Scenescape for spatial awareness and Intel® Open AI for optimized inferencing to identify potential incidents, such as vehicles running red lights or wildlife entering roadways. In traffic scenarios, it uses advanced algorithms to alert drivers or autonomous systems within milliseconds, while the Outdoor Server ensures system-wide coordination. By leveraging sophisticated AI algorithms running directly on the edge device, these systems can analyze real-time sensor data to identify potential collision scenarios with remarkable speed and accuracy, often before human perception can register the threat. This includes the detection of critical violations such as vehicles running red lights, the identification of pedestrians or cyclists unexpectedly entering traffic paths, or the recognition of erratic or dangerous driving behaviors. Upon detection of a potential collision, the system can trigger immediate alerts to drivers through connected vehicle technologies (C-V2X radios), or even communicate directly with autonomous systems to initiate immediate corrective actions, thereby significantly reducing the likelihood of accidents and enhancing overall safety.

Dynamic Traffic Management for Safer Roadways

The edge device communicates with traffic lights via C-V2X radios, adjusting signal timings based on real-time conditions, while the Outdoor Server manages workload orchestration. On busy roads, this dynamic optimization minimizes accident risks by ensuring smoother traffic flow. These devices communicate directly with traffic signal controllers, adjusting signal timings based on real-time traffic conditions—such as vehicle queue lengths, pedestrian presence at crosswalks, and overall traffic flow across multiple lanes and directions. This adaptive control helps to significantly reduce congestion during peak hours, minimize idle time at intersections, and consequently lower the risk of accidents that frequently occur in stop-and-go traffic or during rapid acceleration/deceleration phases. The result is a more fluid, efficient, and responsive movement of traffic throughout the entire network, benefiting commuters, reducing environmental impact, and improving the overall urban experience.

Rapid Emergency Response for Life-Saving Interventions

In the unfortunate and critical event of an accident, every second is vital for minimizing harm and saving lives. The Supermicro edge devices and Outdoor Server are specifically designed to detect such incidents rapidly and automatically, often within moments of their occurrence. The edge device notifies emergency services with precise location and severity details, while the Outdoor Server ensures data redundancy and system reliability. Upon identifying a collision or other emergency, these systems can immediately notify emergency services, providing precise location data and critical details regarding the severity and nature of the incident. This automated and highly accurate reporting ensures faster dispatch of first responders, which can be absolutely critical in minimizing injuries, saving lives, and expediting the clearance of accident scenes to restore normal traffic flow. This proactive capability significantly improves the overall effectiveness and responsiveness of emergency services, contributing to a safer community.

Enhanced Situational Awareness for Informed Decision-Making

Beyond direct intervention and automated responses, the Supermicro edge platforms play a pivotal role in significantly enhancing the situational awareness of all road users. By processing and disseminating real-time information about prevailing road conditions—such as sudden congestion, the presence of pedestrians or cyclists, adverse weather conditions, or unexpected environmental hazards—these devices empower drivers to make more informed and safer decisions. This real-time intelligence can prompt drivers to proactively adjust their speed, choose alternative routes to avoid bottlenecks, or exercise increased caution in specific areas, leading to a safer, more predictable, and less stressful driving experience for everyone. The edge device provides real-time environmental information, such as pedestrians on crosswalks or wildlife crossings, through displays supporting 4K resolution, while the Outdoor Server supports centralized monitoring.

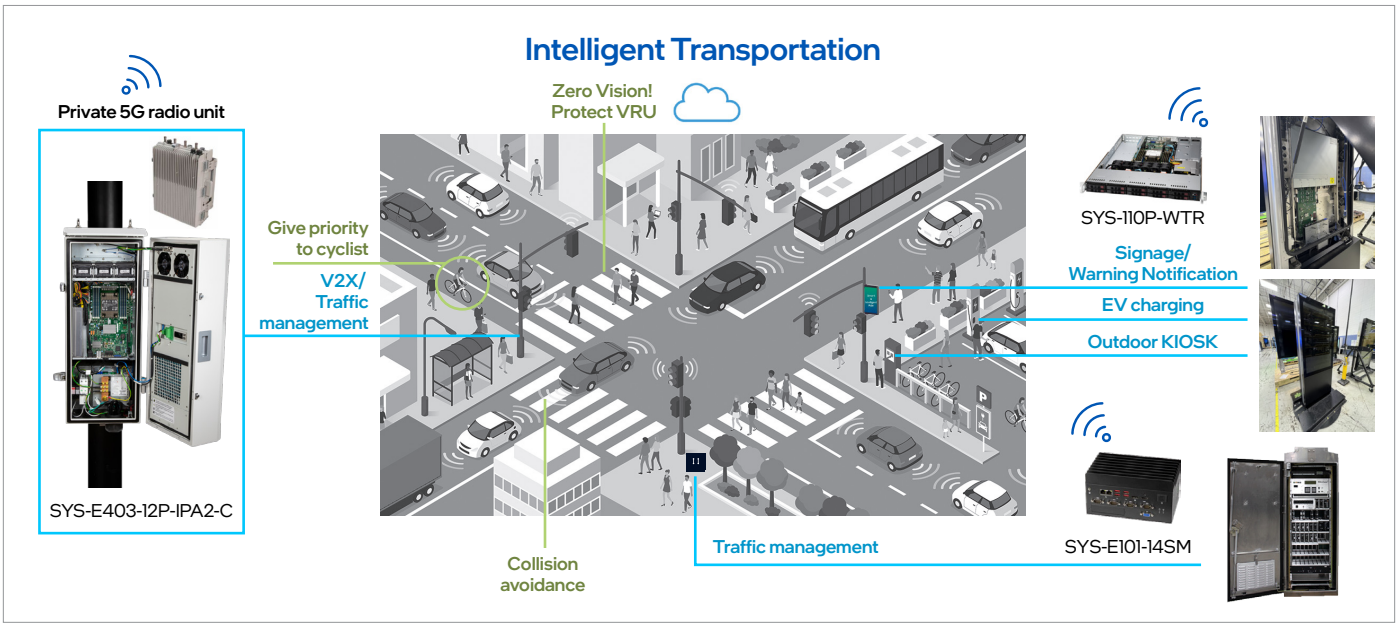


Figure 2: Supermicro Intelligent Traffic Control powered by Intel® technology

Addressing Deployment Challenges with Intel® Technology

Intel's approach to edge AI delivers a comprehensive and optimized platform that leverages integrated capabilities and a robust ecosystem. The core of Intel's approach lies in providing a powerful, efficient, and reliable foundation for intelligent edge deployments, ensuring superior end-to-end performance and a lower total cost of ownership.

Overcoming Thermal Challenges in Harsh Environments

Public safety applications often require edge devices to operate in extreme outdoor conditions, where high temperatures can lead to CPU throttling and performance degradation. Intel's industrial-grade CPUs, such as the Intel® Core™ i7-1370PE, are engineered to operate reliably in high-temperature environments without compromising performance. Featuring a 100% wide-temperature-grade design and components, these processors ensure uninterrupted service in scenarios like wildlife detection along highways or private 5G edge deployments, where consistent performance is critical for safety.

Integrated Graphics (iGPU) for Optimized Performance

Traditional edge AI solutions often require additional accelerator cards to handle intensive workloads, increasing costs and thermal risks. Intel® Core™ processors come with integrated GPU with Intel® Iris® Xe graphics, eliminating the need for external accelerators. This integration reduces costs, minimizes thermal overhead, and enhances reliability for deployments like campus safety systems. By leveraging Intel's integrated graphics, customers can achieve fast AI hardware acceleration within a compact footprint, making the solution both cost-effective and efficient for public safety applications.

Cost-effective Edge AI Deployment

The combination of Intel® Open AI, Intel® DL Streamer, and Intel® EVAM ensures an optimized end-to-end solution, from data ingestion to inferencing. This performance advantage is particularly valuable for public safety applications like traffic monitoring, where real-time processing of video feeds is essential for incident prevention. Intel's solutions enable municipalities and enterprises to achieve more with less, maximizing the return on infrastructure investments.

Maximizing AI Potential with Intel® Hardware

For the demanding and diverse requirements of edge AI in critical infrastructure applications like traffic management, Supermicro leverages robust hardware platforms built around Intel® Core™ processors and Intel® Xeon® Scalable processors. These processors offer a combination of raw performance, integrated capabilities, and industrial-grade reliability, making them ideal for challenging edge deployments that require consistent, high-speed processing.

Supermicro's edge devices feature models powered by Intel® Core™ i5-1346URE and the i7-1370PE Processors. These compact yet powerful devices support Dual Channel DDR5 4800MHz SO-DIMM, up to 64GB, providing ample memory bandwidth and capacity crucial for handling complex AI models and processing large streams of data in real time directly at the edge. Their ability to support 4 independent displays with 4K resolution is a significant advantage for comprehensive monitoring dashboards or multi-camera setups at intersections, allowing for detailed visual oversight and flexible display configurations.

Intel® Core™ powered Edge Device

Intel® Xeon® powered Outdoor Server

For deployments requiring robust server-grade performance in challenging outdoor conditions, Supermicro enables Outdoor servers, (IoT SuperServer SYS-E403-12P-IPA2-C) which is powered by Intel® Xeon® Scalable processors. The integrated Fast AI hardware acceleration within these Intel processors, including up to 96 Execution Units (EU) with Intel® Iris® Xe graphics capable of 4K60 resolution, ensures that AI inference tasks are processed with exceptional speed and efficiency. This integrated graphics capability often eliminates the need for additional, costly discrete accelerator cards, streamlining the system design, reducing overall costs, and simplifying thermal management. Robust connectivity is delivered with PCIe Gen4 x4 by SlimSAS and M.2 for high-speed storage and expansion, and high-speed connectivity through dual 2.5GbE for reliable and fast data transfer to and from the network, crucial for real-time data ingestion and output. Crucially, these components feature 100% wide temp grade design and components applied, ensuring unwavering reliable operation across extreme environmental conditions, from scorching summers to freezing winters. Furthermore, the support for 12-24V wide range power provides essential flexibility in power sourcing, simplifying deployment in diverse roadside infrastructure where power availability might vary.

Enabling Seamless Edge AI Deployment with Optimized Software

Intel's approach to the edge AI ecosystem extends significantly beyond hardware, encompassing a comprehensive suite of software tools and libraries that are designed to streamline development and deployment. These technologies are crucial for building highly optimized, production-grade edge AI solutions that can be rapidly brought to market and scaled effectively.

Intel® Distribution of OpenVINO™ Toolkit

The Intel® Distribution of OpenVINO™ Toolkit enables developers to deploy pre-trained deep learning models through a unified API, ensuring maximum efficiency and minimal latency. For applications like real-time traffic monitoring, Intel® Distribution of OpenVINO™ Toolkit ensures that AI models for object detection, classification, and tracking run with exceptional performance on edge devices, translating raw video feeds into actionable insights in real time. Its flexibility allows for rapid iteration and deployment of AI models tailored to specific edge use cases.

Intel® Deep Learning Streamer (Intel® DL Streamer)

Intel® DL Streamer simplifies the development of complex video analytics applications by providing a rich set of GStreamer elements that seamlessly integrate with OpenVINO™ models. In the context of smart intersections and other video-intensive edge applications, DL Streamer allows for the efficient processing of multiple high-resolution video streams concurrently. This capability enables robust object detection, tracking, and event analysis without dropping frames or incurring significant latency, which is absolutely critical for real-time safety applications and operational insights. Its modular design facilitates rapid prototyping and deployment of sophisticated video analytics solutions, accelerating time-to-market.

Intel® Edge Video Analytics Microservice (EVAM)

Intel® EVAM provides pre-built, highly optimized components for common video analytics tasks, abstracting away much of the underlying complexity while developing Edge AI solutions. EVAM is mainly utilized to quickly deploy modules for specific functions such as vehicle counting, pedestrian detection, queue length estimation, or even more advanced behavioral analytics. This significantly accelerates the time-to-market for intelligent traffic applications and ensures that the solutions are production-ready, scalable, and highly performant in real-world edge environments.

Real-World Impact: Case Studies

Traffic Monitoring with AI: Enhancing Roadway Safety and Mobility

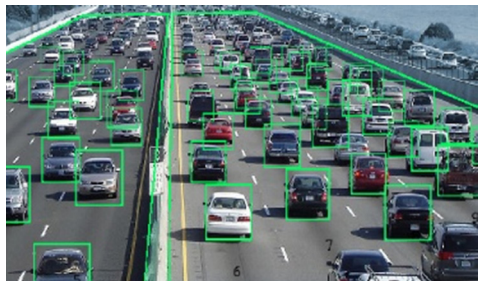
In a Phase 1 rollout across four key locations in one of the US states—Intel-powered Supermicro edge devices are being deployed to enhance roadway safety and mobility. The overarching objective of this initiative is to provide heightened spatial awareness and significantly improve roadway safety and mobility within these high-traffic areas, which are prone to congestion and accidents.

This initiative considers a comprehensive suite of integrated hardware and software solutions, working in concert to achieve its ambitious goals:

- **Edge Computing:** Utilizing Supermicro edge devices, powered by Intel, for localized, real-time processing of massive streams of sensor and video data, minimizing latency and ensuring immediate insights.
- **IP Cameras:** High-resolution IP cameras for continuous visual data capture, feeding raw footage to the edge devices for immediate AI-driven analysis.
- **LiDAR Sensors:** For precise 3D mapping and object detection, offering robust performance even in challenging lighting conditions, adverse weather, or situations where traditional cameras may struggle.
- **Environmental Sensors:** Monitoring vital parameters such as temperature, humidity, and air quality to provide crucial contextual data that can influence traffic management decisions and alert to potential hazards.
- **C-V2X Radios:** Enabling cutting-edge vehicle-to-everything communication, which facilitates direct, low-latency alerts to drivers and seamless data exchange between vehicles and intelligent infrastructure.
- **In-Road Sensors:** Providing additional layers of data for precise traffic flow measurement, vehicle presence detection, and classification, complementing visual and LiDAR inputs.

The system integrates various data sources, including existing Traffic Signal Data (for current signal states and historical patterns) and Crowd-Sourced Data (e.g., WAZE) (for real-time congestion and incident reporting), to create a holistic and dynamic view of traffic conditions. By combining these diverse inputs and processing them at the edge, the system can achieve unparalleled spatial awareness, predict potential hazards with high accuracy, and dynamically manage traffic flow, leading to a substantial reduction in accidents and improved overall mobility across the network. This integrated approach ensures that traffic management is proactive rather than merely reactive, adapting to real-time conditions.

- Vehicle Count
- Vehicle Heading
- Vehicle Classification
- Vehicle Speed
- Object Detection
- Pedestrian & Cyclist Detection
- Pedestrian Road Crossings (Count/Time in Crosswalk/Jaywalk)
- Near Misses
- Crashes / Collisions
- Hard Brakes
- Red Light Runs



Conclusion: Building the Future of Intelligent Infrastructure with Supermicro and Intel

The integration of advanced edge AI solutions is no longer a futuristic concept but a present-day imperative for modernizing critical infrastructure across various sectors. Supermicro's portfolio of edge devices, powered by Intel's foundation of hardware and software, provides a platform for developing and deploying intelligent, real-time edge AI systems that effectively address pressing challenges of today's dynamic environments.

From reducing roadway incidents through dynamic traffic management to protecting wildlife and securing public spaces, Intel's technologies create a safer, more responsive safety ecosystem. By addressing key deployment challenges—such as thermal management, cost efficiency, and performance reliability—Intel ensures that customers can deploy edge AI solutions with confidence.

Learn More

Supermicro Intel Solutions

Intel® Xeon® Scalable Processors

Intel® Core™ Processors

Intel® Iris® Xe Graphics

Intel® Deep Learning Streamer

Intel® Distribution of OpenVINO™ Toolkit

Intel® Industry Solutions Builders

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