ADLINK
LEADING EDGE COMPUTING

# ADLINK's Automotive Solution: Steering the Autonomous Vehicle Industry Into Next-Generation Success

Solution Brief

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# Steering the Autonomous Vehicle Industry Into Next-Generation Success

## Today's Autonomous Vehicle Market

Autonomous vehicles (AVs) have evolved gradually for decades, but the force that will reshape tomorrow's transportation — truly driverless cars — remains elusive and fraught with technical challenges. Today, the industry has mastered advanced driver assistance systems (ADAS, levels 0 through 2), but autonomous driving (levels 3 through 5) demand the most powerful, innovative, and efficient platforms possible. Despite marketing statements to the contrary, most developers still struggle with advancing from level 3 to level 4. They need the right AV computing hardware to cross this divide.

Mordor Intelligence shows the AV market expanding at an incredible rate throughout this decade, sustaining roughly 25% growth annually. Verified Market Research puts this number above 37%, reflecting a market just under $92 billion in 2021 skyrocketing to over $1.2 trillion by 2030. This aggressive trajectory includes the first level 3 vehicles reaching mass production in 2023. McKinsey might offer the most compelling projections of all, showing essentially no level 4 market in the present (the report's 2022 release) expanding to $15 to $25 billion by 2030 — and increasing to $170 to $230 billion in 2035.

However, these decade-long projections depend on the market continuing its steady march toward fully autonomous driving (level 5). Right now, most AV developers remain frustrated just trying to reach level 4 due to a range of technical challenges.

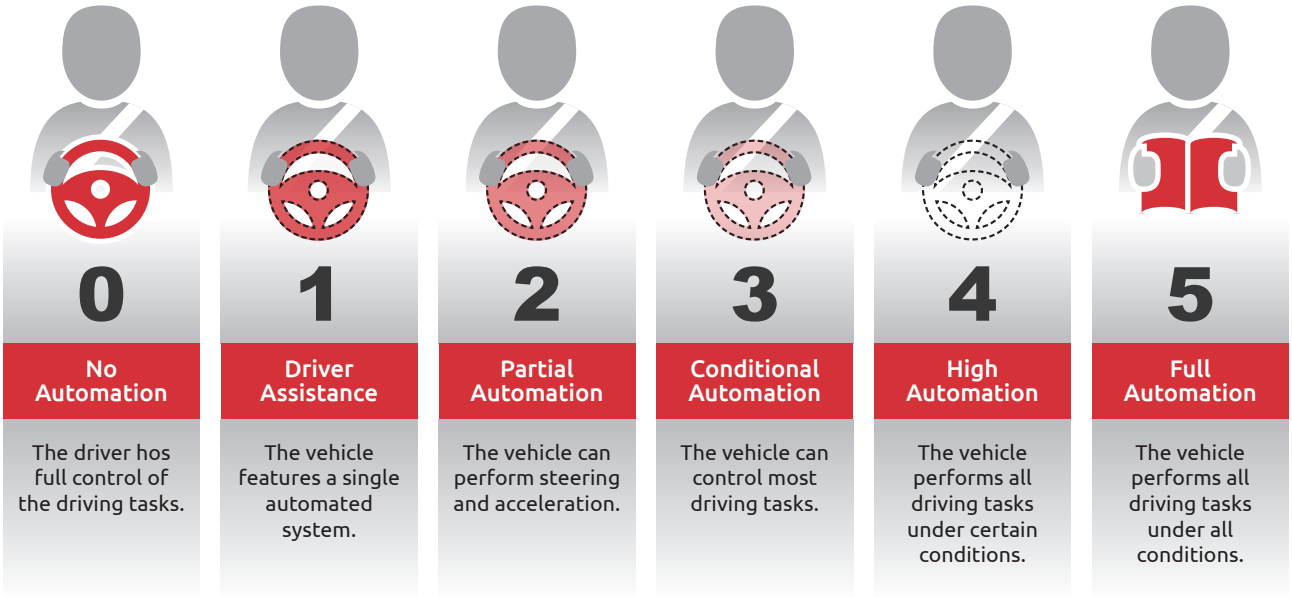
## The Rocky Road Beyond Level 3

- The terabytes of data generated daily by an AV's cameras, LiDAR, radar, and other sensors can prove overwhelming from a processing perspective given the criticality of accurate, real-time analysis.
- AVs must achieve reliable, 360-degree environmental perception and object detection. Because every sensor type has its own limitations, combining these modalities (known as sensor fusion) can greatly enhance an AV's perception range and accuracy. However, sensor fusion carries a particularly high computational burden, especially given the critical need for reliable, real-time results. Up to now, most solution designers have struggled to devise a performant, cost-effective AV platform for sensor fusion.
- Handling the infinite variety of complex, real-world driving scenarios, from inclement weather to construction zones, remains beyond most AV systems.
- Regulatory approval remains particularly difficult for AV manufacturers due to insufficient redundancies and fail-safes across both hardware and software.

Still, the global AV market keeps expanding. The sector promises vast improvements in personal safety, productivity, environmental benefits, and smart city development. Today's imperative is to realize these benefits by conquering the above challenges.

Embedded and industrial computing stalwart ADLINK now provides a groundbreaking AV platform that embodies years of R&D, refinement, and proven market success. This is the solution needed for developers to bridge the AV gap between levels 3 and 4.

### Levels of Autonomous Driving



## Compelling Comments

ADAS will yield "a 15% reduction in the number of accidents in the four main European markets … by 2030." — ICDP

"AVs could free as much as 50 minutes a day for users, who will be able to spend traveling time working, relaxing, or accessing entertainment." — McKinsey

"Autonomous Vehicles can reduce travel times by up to 40 percent, reclaim up to 80 billion hours lost in commuting and congestion, and reduce fuel consumption by up to 40 percent." — Verified Market Research

## ADLINK & TIER IV: Merging Hardware and Software Into a High-Octane Solution

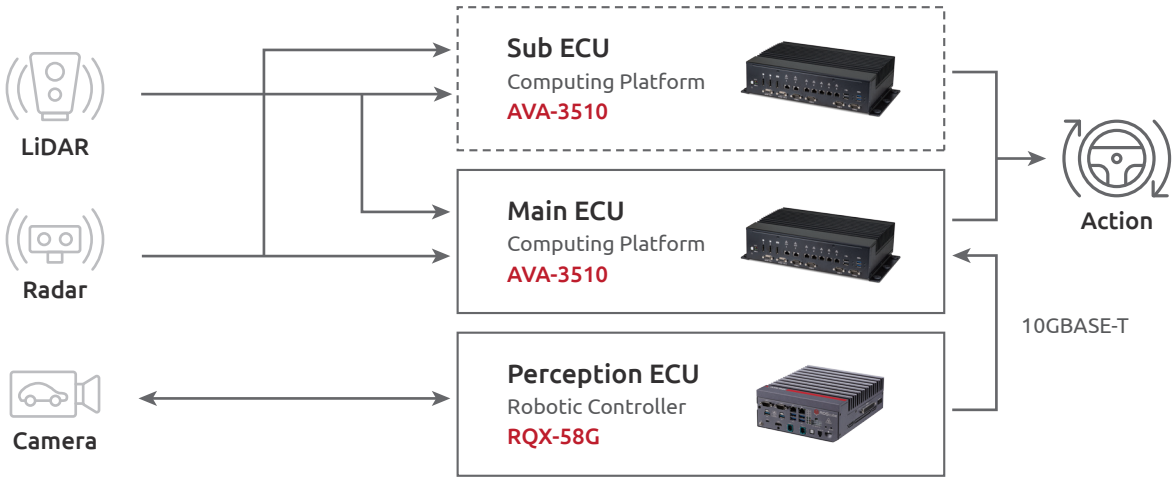
Like ADLINK, Japanese automotive software developer TIER IV has proven itself as a champion of open solutions and industry standards. The company's autonomous driving software now fuels over 30 vehicle designs across more than 500 companies worldwide. However, TIER IV needed a solid answer when customers asked for a complete AV computing solution rather than software alone.

Given ADLINK's decades of success in embedded computing and reputation for rugged designs spanning from military craft to autonomous vehicle racing, TIER IV's choice was easy: the ADLINK Automotive Solution, based around two ADLINK systems optimized for AV needs.

First and foremost, TIER IV needed a general vehicle computing platform to handle processing, prediction, and decision making. The firm selected ADLINK's AVA-3510, a compact system designed specifically for autonomous driving applications across levels 3 and 4. By pairing an Intel® Xeon® E processor with an NVIDIA Turing™ (Quadro RTX 5000) GPU, ADLINK delivered an AI-centric platform ideal for real-time analysis and split-second decision making. Other key features for AV applications include lockable USB connectors; a customizable ignition setting; NVMe M.2 storage; two Mini PCIe slots for LTE, 5G, and Wi-Fi modules; isolated CAN buses; five Gigabit Ethernet ports; and dual 10 GbE ports.

With its strong focus on multimodal input, TIER IV also gravitated to having an "Edge Perception Development Kit" based on ADLINK's ROScube-X RQX-58G. Powered by NVIDIA's Jetson™ AGX Xavier module, which integrates a 512-core graphics engine, the ROScube-X RQX-58G offered the performance necessary to process eight GMSL2 cameras. This is significant, because very few rugged, compact systems accommodate GMSL2. (Common Ethernet-based cameras carry compressed video. GMSL2 cameras carry native-quality raw video, which can make an acute difference in visual analysis and risk detection.) GMSL2 technology incorporates the maximum cable length, bandwidth, and device counts needed for AVs, which typically integrate eight cameras.

### Autonomous Driving Architecture




(Component diagram of one possible TIER IV Edge.Auto configuration)

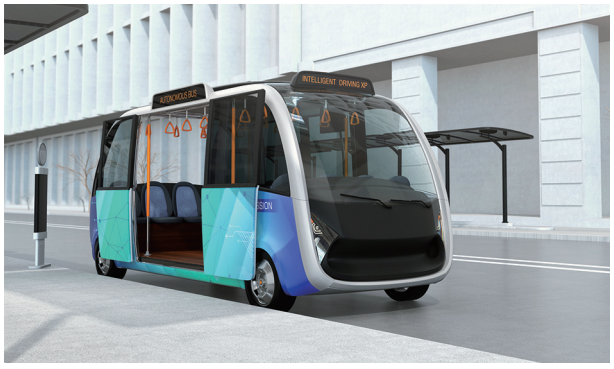
Taken as a combined AV development kit, the ADLINK solution addresses the industry's key challenges.

- Processing bandwidth: Operating in tandem, the two ADLINK systems deliver ample processing capacity for the multimodal input streams demanded by tomorrow's AV designs.
- Sensor fusion: High data rate, low-latency connectivity accommodates all modern input devices while still leaving headroom for further fidelity and load scaling.
- Communication bandwidth: With ample provisions for 1 and 10 Gig Ethernet along with high-speed Wi-Fi and cellular networking capabilities, ADLINK's ROScube-X platform can handle the considerable data loads demanded by sensor fusion, with plenty of bandwidth to spare.
- Faster processing: Cutting-edge CPUs and GPUs provide better ability to run the best possible AI-driven algorithms for complex, real-time pattern detection. Hardware will not be the bottleneck in object recognition and safety.
- Safety and fail-over: TIER IV builds hardware and software redundancy into its platform. In the event of error or functionality loss, the solution can seamlessly switch to AVA-3510 or similar system with no loss of control to the vehicle or user.

## Cruising From Pilot to Production

TIER IV logged its first on-road autonomous driving test in 2017. Ever since, the company has continued to score design wins while constantly pushing the boundaries of AV functionality, accuracy, and reliability. Its Edge Auto solution, built on ADLINK system foundations, offers the architecture developers need to reach success in their pilot programs.

For one pilot program in Japan, TIER IV harnessed the ADLINK Automotive Solution to help their customer design and build an autonomous "nano-bus." Within the solution, ADLINK's AVA-3510 system enables timely, data-driven decision making at the edge while the ROScube-X performs real-time processing from a host of sensors around the vehicle. The customer was pleased when the pilot passed verification. The customer's current plan is to enter mass production in 2024 and 2025 with an initial order of hundreds of vehicles.



TIER IV leveraged the ADLINK Automotive Solution (comprised of the AVA-3510 and ROScube-X RQX-58G) to assist its customer in designing an autonomous "nano-bus."

In a separate trial, another customer used TIER IV's Edge.Auto perception kit to develop a "robo-taxi" prototype. Again, the ROScube-X RQX-58G for sensor data collection and the AVA-3510 for AI planning and decision making proved to be a winning combination. The use case has now been successfully verified by the customer, which is now moving forward with the next phase of its robo-taxi fleet development plan.

"Worldwide, we continue to see autonomous vehicle developers achieving success with our software platforms," says TIER IV Product Owner, Kazunari Kawabata. "Naturally, software is only as useful as the hardware running it, which is why we depend on having the world's top AV hardware suppliers at our side. In case after case, ADLINK proves to be dependable on the road as it is working with us to design custom solutions to unique application requirements."

## Shift AV Development Into High Gear

Level 3 autonomous driving efforts may draw most of today's industry attention, but it's clear that level 4 is on everyone's radar. Verified Market Research data shows that the 2023 level 4 vehicle market is roughly one quarter the size of the level 3 market, in part because level 4-ready platforms are so much more demanding and difficult to execute. Nevertheless, level 4 is clearly the market's next development target. Today's strategic AV designers see the wisdom in working on platforms that enable (relatively) easy level 3 wins while offering the performance and headroom to scale into level 4 without requiring all-new systems investment. The potential opportunity for those who compete effectively in this race will be substantial.

ADLINK built its multi-system AV platform from the ground up specifically to enable this level 3-to-4 transition with exceptional ease and value. The company continues to prove this point through a combination of road-tested designs and industry leadership. For example, ADLINK contributed an edge platform to every competitor in the 2021 Indy Autonomous Challenge. In March 2023, ADLINK obtained ISO 26262 Automotive Functional Safety Certification, which "applies to all activities during the safety lifecycle of safety-related systems comprised of electrical, electronic and software components" within road vehicles.

Beyond the successful pilot cases mentioned earlier, ADLINK is also working with developers on freight truck and even autonomous mining vehicle designs. The company's systems are as broadly applicable as they are robust and performant for projects across the AV market. For any developer working toward level 4 excellence, ADLINK races ahead as today's clear choice.

For developers wanting to capitalize on this decade's AV market, ADLINK's AV solution, currently comprised of the AVA-3510 and ROScube-X RQX-59 Series, offers best-of-breed advantages beyond what most competing platforms can deliver. For instance, the ADLINK Automotive Solution recently incorporated NVIDIA's Jetson AGX Orin 32GB processor. This marks a generational advance beyond most similar solutions' prior-gen Jetson AGX Xavier. Similarly, some AV solutions offer Intel® Core™ i7/i9-class CPU performance. ADLINK goes the extra mile by offering that performance with server-grade Intel® Xeon® E processors.


(ADLINK provides rugged edge AI for the Indy Autonomous Challenge)

Offering the latest chip advances helps ADLINK give developers a strong competitive edge, but plenty more goes into crafting a best-of-breed platform. To pick just a couple more examples, most AV platforms have yet to make the jump to GMSL2 camera support while ADLINK's edge systems can accept four cameras in each of their GMSL2 ports. And note how ADLINK's adoption of 10 Gigabit Ethernet for outstanding sensor bandwidth and room to scale remains unique in the market. Many competitors will take two to three years to catch up to ADLINK's networking and camera support.

ADLINK offers AV developers the solution foundations they need, backed by experience, worldwide support, industry leadership, and exceptional partner depth. Make sure your AV efforts find traction in tomorrow's market. Contact ADLINK support to get started.

## Product Information

### AVA-3510

NVIDIA GPU and Intel® Xeon® AI Computing Platform for Autonomous Drive Applications

**Key Features**

- Intel® Xeon® E processor
- NVIDIA Turing™ (NVIDIA Quadro RTX 5000) GPU module
- Customizable ignition setting
- 2x isolated CAN; 2x 10GbE, 5x GbE
- 2x USB 3.0 lockable, 2x USB 2.0; 2x 2.5" drive trays
- 1x M.2 NVMe 2242 B+M, 2280 M (PCIe)
- 2x Mini PCIe for LTE or Wi-Fi module
- 9-36 VDC input

### RQX-580/58G

Expandable ROS 2 Robotic Controller powered by NVIDIA® Jetson™ AGX Xavier

**Key Features**

- Powerful AI computing for intelligent robotics development
- Power consumption with Jetson Xavier module as low as 30 W
- Ruggedized, secure connectivity with locking USB ports
- Comprehensive I/O for connecting a wide range of devices
- Time synchronization with GMSL2 cameras

(We also recommend the ROScube-X RQX-59 Series as the latest version for your consideration.)

## Head Office


### ADLINK Technology, Inc.

No. 66, Huaya 1st Road, Guishan District
Taoyuan City 333411, Taiwan
Tel: +886-3-216-5088

www.adlinktech.com


## Worldwide Offices


### Ampro ADLINK Technology, Inc.

6450 Via Del Oro, San Jose, CA 95119-1208, USA
Tel: +1-408-360-0200
Toll Free: +1-800-966-5200 (USA only)
Fax: +1-408-600-1189
Email: info@adlinktech.com

### ADLINK Technology (China) Co., Ltd.

上海市浦东新区张江高科技园区芳春路300号 (201203)
300 Fang Chun Rd., Zhangjiang Hi-Tech Park
Pudong New Area, Shanghai, 201203 China
Tel: +86-21-5132-8988
Fax: +86-21-5192-3588
Email: market@adlinktech.com

### ADLINK Technology Beijing

北京市海淀区上地东路1号盈创动力大厦E座801室 (100085)
Rm. 801, Power Creative E, No. 1 Shang Di East Rd. Beijing, 100085 China
Tel: +86-10-5885-8666
Fax: +86-10-5885-8626
Email: market@adlinktech.com

### ADLINK Technology Shenzhen

深圳市南山区科技园南区高新南七道数字技术园A1栋2楼C区 (518057)
2F, C Block, Bldg. A1, Cyber-Tech Zone, Gao Xin Ave. Sec. 7 High-Tech Industrial Park S., Shenzhen, 518054 China
Tel: +86-755-2643-4858
Fax: +86-755-2664-6353
Email: market@adlinktech.com

### ADLINK Technology Singapore Pte Ltd.

1008 Toa Payoh North, 07-17/18
Singapore 318996
Tel: +65-6844-2261
Fax: +65-6844-2263
Email: singapore@adlinktech.com

### ADLINK Technology Singapore Pte Ltd. (Indian Liaison Office)

#50-56, First Floor, Spearhead Towers
Margosa Main Road (between 16th/17th Cross)
Malleswaram, Bangalore - 560 055, India
Tel: +91-80-42246107, +91-80-23464606
Fax: +91-80-23464606
Email: india@adlinktech.com

### ADLINK Technology Japan Corporation

〒101-0045 東京都千代田区神田鍛冶町3-7-4 ユニゾ神田鍛冶町三丁目ビル4F
Unizo Kanda Kaji-cho 3 Chome Bldg. 4F,
3-7-4 Kanda Kajicho, Chiyoda-ku,
Tokyo 101-0045, Japan
Tel: +81-3-5209-6001
Fax: +81-3-5209-6013
Email: japan@adlinktech.com

### ADLINK Technology Korea Ltd.

경기도 용인시 수지구 신수로 767 A동 1503호 (동천동, 분당수지유타워) (우) 16827
A-1503, U-TOWER, 767 Sinsu-ro, Suji-gu,
Yongin-si, Gyeonggi-do, Republic of Korea, 16827
Toll Free: +82-80-800-0585
Tel: +82-31-786-0585
Fax: +82-31-786-0583
Email: korea@adlinktech.com

### ADLINK Technology, Inc. (Israel Liaison Office)

MIXER Herzliya (Building B, 9 Floor)
3 Arik Einstein st., Zip code 4610301
Herzliya, Israel, P.O.Box - 351
Tel: +972-54-632-5251
Fax: +972-77-208-0230
Email: israel@adlinktech.com

### ADLINK Technology GmbH

Hans-Thoma-Straße 11
D-68163 Mannheim, Germany
Tel: +49 621 43214-0
Fax: +49 621 43214-30
Email: germany@adlinktech.com

### ADLINK Technology SARL (French Liaison Office)

Bâtiment Thalès - Parc des Algorithmes,
Route de l'Orme des Merisiers,
91190 SAINT AUBIN, France
Tel: +33 (0) 1 60 12 35 66
Fax: +33 (0) 1 60 12 35 66
Email: france@adlinktech.com

### ADLINK Technology, Inc. (UK Liaison Office)

First Floor West Exeter House,
Chichester fields Business Park Tangmere,
West Sussex, PO20 2FU, United Kingdom
Tel: +44-1243-859677
Email: uk@adlinktech.com