



Apex.AI

Automated Static Analysis with best AUTOSAR C++14 Results

software communication layer for self-driving applications, and Apex.Middleware, a complete and integrated solution for both intra- and inter-ECU communication, Apex.AI was looking for a tool for automated static analysis which fulfills strict requirements customary in the automotive industry.

THE CHALLENGE ++ Apex.AI can count numerous big names among its supporters and customers: Strategic investors like Toyota Ventures, Volvo Group Venture Capital, Jaguar Land Rover's InMotion Venture, Airbus Ventures, and Hella Ventures have put their money in the company. In early 2021, Toyota's Woven Planet announced its cooperation with Apex.AI for developing and deploying a production-ready autonomy stack for Toyota's vehicle development platform Arene. The expectations of investors and customers regarding the future viability of Apex.AI's products are high – and the company is positioning itself to actively shape the future of mobility.

Apex.AI's software products are based on proven open-source software: The award-winning Apex.OS has been forked from ROS 2 and has been developed into

a real-time, reliable, and deterministic safety framework and middleware for safety-critical applications for all mobility systems from autonomous vehicles to robo-taxis and automated trucking. Apex.Middleware is based on Eclipse iceoryx, another open-source solution resulting from a collaboration between Bosch and Apex.AI engineers in Germany and serves all applications from power train over ADAS to automated driving.

Apex.OS and Apex.Middleware are the backbone for many automotive software platforms which need to meet highest standards especially in software-defined and autonomous vehicles. Therefore, Apex.AI had been looking for a tool to support their product development and their efforts to build safe algorithms.

Automated static analysis is the best way to safeguard the software's quality on the

Their goal is nothing less than to revolutionize the software in the automotive industry: Apex.AI, a Palo Alto, Munich, and Berlin-based company, is developing breakthrough safe, certified, developer-friendly, and scalable software for mobility systems. For the development of Apex.OS, a safe, secure and reliable

long run – but it must become a natural part of the developers' daily work routine by fully integrating the tool into the established developer environment CLion

"We have evaluated several static analysis tools, and Axivion Suite clearly stood out in our tests. The tool performed best in terms of AUTOSAR C++14 coverage and convinced us through its ease of use, control flow, and data flow analysis, and report generation. Axivion Suite has already become a mainstay component in our development workflow and a valuable component of our DevOps pipeline."

Dejan Pangercic, CTO and Co-Founder of Apex.AI

and the continuous integration infrastructure at Apex.AI. Furthermore, a fully suitable tool must be on top of the industry standards in the automotive sector: Being compliant with the latest AUTOSAR C++14 style guides is decisive for success as well as the tool's certification for the ISO 26262 standard up to ASIL D.

THE SOLUTION ++ Apex.AI thoroughly evaluated several static code analysis tools in a detailed proof of concept, and soon was convinced to have found the perfect match with the Axivion Suite. The proven tool suite helps to improve software quality and to maintain software systems implemented in C, C++ and C#. Axivion's MISRA checker covers 100 percent of all automatically testable rules of MISRA C:2004, MISRA C:2012, and MISRA C++:2008. The tool also supports the CERT® programming rules for secure software development and rules for C Secure Coding (ISO/IEC TS 17961) and CWE.

Apex.AI especially valued Axivion Suite's broad coverage of the AUTOSAR C++14 standard for the development of critical and safety-relevant automotive software, which is a continuation of the MISRA C++:2008 rule set. On top of that, the Static Code Analysis (SCA) package of Axivion Suite is certified for its suitability in safety-critical systems according to ISO 26262 up to ASIL D. This made the tool suite an important cornerstone in the Apex.AI's own safety certification process for Apex.OS and Apex.Middleware.

Another important argument in favor of Axivion Suite was its ease of integration: The tool suite is designed to fit seamlessly into an existing IDE and customer-specific Continuous Integration processes and DevOps environments. The integration at Apex.AI was accompanied by Axivion's experienced Professional Services Team, which helped to make the tool suite an immanent part of Apex.AI's workflows and to teach the developers how to effectively use the tools.

In the end, Axivion Suite performed best in the trials in which it was rigorously

compared to other static analysis tools: It was scoring highest for AUTOSAR C++14 coverage, ease of use, control flow and data flow analysis, and report generation.

THE SUCCESS ++ From day one after integration, Axivion Suite fulfilled its new role at Apex.AI: By monitoring the compliance of the code with the AUTOSAR C++14 rules, by providing the developers with analyses on their control and data flow and by allowing them to easily add exceptions and suppressions to rule violations in C++.

The developers especially appreciate the tool's ease of use and its seamless integration with the cross-platform IDE CLion, the company's build system and the overall continuous integration workflows. Axivion Suite helps the Apex.AI engineers to continuously analyze their source code in the build process and ensure their code quality.

The biggest initial success of Axivion Suite at Apex.AI, however, was its role in the certification of Apex.OS and Apex.Middleware. Axivion was single handedly responsible for many of the artefacts submitted to TÜV Nord as part of the certification process. Furthermore, they helped to prove that Apex.AI developers were writing AUTOSAR C++14 compliant code, with no control or data flow issues. So thanks in part to Axivion, Apex.OS is the world's first certified open-source operating system that has been certified to ISO 26262 ASIL D, the highest level of automotive risk management.

ABOUT APEX.AI ++ Apex.AI (www.apex.ai) is a Palo Alto, Berlin, and Munich-based company developing breakthrough safe, certified, developer-friendly, and scalable software for mobility systems. The company's flagship product is Apex.OS, a robust and reliable meta-operating system that enables faster and easier software development for vehicles and safer autonomous driving solutions. Their software development kit targets two main customer groups, the OEM developers who

need to implement complex AI software integrated with the entire vehicle and the autonomous driving developers who can now implement safety-critical applications with ease and reliability.

ABOUT AXIVION ++ Axivion, based in Stuttgart, Germany, is a provider for innovative software solutions for static code analysis and for protection from software erosion. The core product of Axivion is the Axivion Suite, a tool suite for the improvement of software quality and maintainability of software systems implemented in the programming languages C, C++ and C#. In addition to static code analysis, the tool suite includes innovative software tools for architecture verification and clone management. Moreover, the tool suite detects software erosion factors such as cycles, dead code and violations of programming rules.

Axivion's MISRA checker covers 100% of all automatically testable MISRA rules for the standards MISRA C:2004, MISRA C:2012, and MISRA C++:2008. Furthermore, the AUTOSAR C++14 styleguide as well as the CERT® programming rules for secure software development, rules for C Secure Coding (ISO/IEC TS 17961), and CWE (Common Weakness Enumeration) are supported. The static code analysis package of Axivion Suite is certified for its suitability in safety systems according to ISO 26262 up to ASIL D, IEC 61508 up to SIL 4 and IEC 62304 up to Class C. The Professional Services Team of Axivion supports customers with comprehensive service and advice on the configuration and integration of the tools.

Axivion's customers are companies that develop innovative technical software across different industries, e.g. industrial automation, automotive, railway, electronics, information and telecommunication, avionics, medical, mechanical engineering, as well as measurement, control and regulation technology.

More information is available at www.axivion.com

Image rights: © Apex.AI