



SuperTest – helping bring AI edge computing to next-generation Intelligent Connected Vehicles

Shanghai-based Banma, a joint venture between China's Alibaba Group and SAIC Motor company, develops and supports an Intelligent Connected Vehicles operating system called Cyber OS and Drive OS. Cyber OS is designed for smart cockpit and Drive OS for smart driving. These operating systems facilitate human centric capabilities such as augmented reality navigation, human-machine interaction, and internet connectivity, as well as vehicle-related functionalities such as engine starting, vehicle diagnosis, lighting, and seat adjustment. With many of these AI-enabled applications being safety-critical, it was important for Banma to certify the toolchain it uses to develop Banma-based applications for ISO 26262 functional safety requirements. The company uses a GCC cross-compiler to compile its source code, Solid Sands' SuperTest Compiler Test and Validation suite was selected to qualify it.

Banma's advanced AI-based solutions are designed to run on Horizon Robotics' AArch64 64-bit ARM architecture JOURNEY™ 5 hardware platform, which was itself designed under certified standards including ISO 26262 Automotive Safety Integrity Level (ASIL) B. To compile C/C++ source code to AArch64 object files and link them to AArch64 executables and libraries, the company uses the open-source GCC 9.3 cross-compiler. Running SuperTest once a month immediately identifies regression issues associated with the latest GCC compiler and library version, ensuring that Banma's use of the compiler remains consistent with ISO 26262 functional safety requirements.

If a SuperTest test fails, it indicates a potential issue with the cross-compiler, therefore, Banma issues a coding constraint so that its software development team can avoid using C-language constructs that could compromise the safety of the company's software applications. The process has also given the team a much better understanding of the compiler in specific use cases.

"Running SuperTest made us realize that many of the GCC -W warning switches affect whether or not the syntax compiles through to the end. It also focused us on standardizing the use of C/C++ syntax in our programming, using standard POSIX syntax and avoiding the use of GNU extensions, which are less rigorously defined,"

Advanced Driver Assistance Systems (ADAS), augmented reality navigation, and autonomous driving put major demands on software latency, which means Banma makes extensive use of compiler optimizations. It is therefore reassuring that one of SuperTest's major strengths is its ability to maximize code coverage for a wide range of optimizers.



Implementing AI-based edge computing and internet connectivity adds an additional layer of complexity and security. Banma uses SuperTest to perform an ISO 26262 compliant compiler safety qualification of GCC 8.6 as part of a major functional safety certification project. This ensures its software meets the highest possible safety standards as it delivers a next-generation driving experience – one that combines internet connectivity, AI and edge computing to optimize and humanize the driving experience, automatically learn and adapt to user moods and preferences, and seamlessly deliver situational and location-based services.





Banma provides an intelligent automobile operating system, intelligent automobile solutions as well as digital transportation solutions for both autos and the entire transportation industry. Banma fully cooperates with Alibaba Group's technical and ecological advantages in voice, vision, chips, IoT, cloud computing, maps, payment, e-commerce, etc., and redefines cars together with auto companies, to create smart travel space for users, offering them smart driving services and enriching their car lives. Banma Intelligent Automobile Solution is based on self-developed AliOS, and currently collaborates with many auto companies including SAIC, FAW, North and South Volkswagen, being installed on more than 1 million vehicles of 40+ models from about a dozen auto brands. In the future, Banma will promote transportation digitalization by providing man-machine co-driving and vehicle-road collaboration scenarios. Banma, intelligence your way.



Solid Sands is the leading provider of compiler and library testing and qualification technology in North-America, Europe and Asia. Our mission is to put quality into C. We do that by improving the quality of C and C++ compilers, libraries and analysis tools, and by enabling their safe and secure use. With the quality level of our test suites, we stay at the forefront of software testing and qualification to help you achieve ISO compliance and functional safety standard requirements. Founded in 2014, Solid Sands is headquartered in Amsterdam, The Netherlands. With partners all over the world we serve both leading innovative companies in the semiconductor, IP and security industries as well as safety-critical companies in automotive, robotics, railway and medical. Our SuperTest Compiler Test and Validation Suite provides a complete validation environment which enables customers to achieve the software quality level demanded by the ISO language and functional safety standards. Meanwhile, our SuperGuard Library Safety Qualification Suite is a requirements-based test suite for the standard library with full traceability between the requirements derived from the language definition and the individual library tests.

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C and C++ compiler and library testing,
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