

Boston Scientific and GrammaTech Streamline Analysis of Medical Device Software

Boston Scientific knew it could spare no time or expense in developing its cardiac rhythm management products. The medical device company – one of the world’s largest – performed lengthy manual static analysis because no automated tool provided the checks they needed. This changed once they started working with GrammaTech.

Boston Scientific

Industry: Medical Instruments & Supplies

Headquarters: Natick, MA

Website: www.bostonscientific.com

Challenge: Automate manually-intensive analyses on safety-critical firmware.

Solution: Custom, domain-specific extensions to GrammaTech CodeSonar.

- Specialized analyses.
- Additional reporting.

Benefits:

- Analyses that took weeks now take hours.
- Development team has complete picture of shared data use.
- Continuous feedback on adherence to design constraints as the code base evolves.

Boston Scientific has more than 13,000 products worldwide. Among these offerings are many safety-critical medical devices, including implantable cardiac rhythm management products. Recognizing the importance of static analysis as a complement to dynamic analysis and traditional software testing techniques, Boston Scientific has for many years included static analysis in their product development lifecycle.

During this time, many of their static analyses were carried out manually. Manual analysis is labor-intensive, but was the only option: commercially available analysis tools did not offer the complex analysis functionality needed. In large part this was because the analyses covered specific product design constraints alongside more general software quality checks.

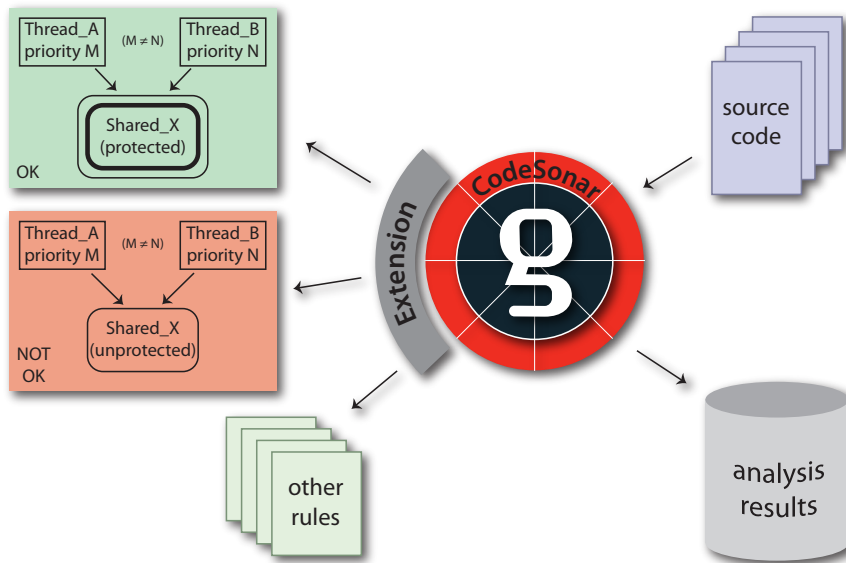
Eager to automate more of their static analysis activities, Boston Scientific engineers explored various options. They were not satisfied by the prospect of adopting an “off-the-shelf” tool and using its general-purpose analyses while waiting for the state of the art in domain-specific analysis to evolve. Investigations with one analysis tool seemed to suggest that it would be suitable if certain enhancements were made, but its vendor was not interested in making those changes.

A solution came in 2009, when they commissioned GrammaTech to develop a customized analysis suite. “Instead of waiting for the future to come, we recommend active participation in making it happen,” explains Boston Scientific Software Engineering Fellow Gerald Rigdon. “We part-

nered with GrammaTech because they combine a focus on innovation in static analysis with the expertise needed to turn innovation into workable reality”.

Boston Scientific elected to automate the analyses that were most manually intensive, and whose reliability and repeatability were most important. One of the highest-priority analyses for automation was their Shared Data Analysis (SDA), a meticulous examination of global data usage within the devices’ pre-emptive, multi-threaded operating environment.

A number other static checks were also automated, including stack usage analysis and recursion identification. GrammaTech delivered the customized analyses, together with supporting reporting mechanisms, as extensions to GrammaTech CodeSonar®.



"We were very impressed by GrammaTech's ability to deliver a tool that met our particular needs."

– Gerald Rigdon,
Fellow, Software
Engineering

The automated static analyses run in mere hours, compared to the person-weeks they took previously. "The automated analysis provides a huge amount of leverage in a cost-effective way," notes Rigdon. "It doesn't just free up engineers' time, it also means we can analyze our entire code base more often to ensure that our standards are continuously upheld, and to receive more frequent feedback on our code quality."

Learn More About the Automation Project

Rigdon, G., Static Analysis Considerations for Medical Device Firmware.

In *Proceedings of the Embedded Systems Conference* (Boston, Sept. 20-23, 2010).

URL: http://www.grammatech.com/research/papers/2010/ESC-423_Rigdon.pdf

About Boston Scientific

Boston Scientific (NYSE: BSX) is a worldwide developer, manufacturer and marketer of medical devices with approximately 25,000 employees and revenue of \$7.806 billion in 2010. For more than 30 years, Boston Scientific has advanced the practice of less-invasive medicine by providing a broad and deep portfolio of innovative products, technologies and services across a wide range of medical specialties. The Company's products help physicians and other medical professionals improve their patients' quality of life by providing alternatives to surgery.

Boston Scientific's Cardiac Rhythm Management (CRM) Group is a leading developer of implantable devices used to treat cardiac arrhythmias (abnormal heart rhythms), sudden cardiac arrest, and heart failure.

About GrammaTech and CodeSonar

GrammaTech manufactures CodeSonar, a static-analysis tool that performs whole-program, interprocedural analysis on source code. CodeSonar identifies programming bugs that can result in system crashes, memory corruption, and other serious problems. The tool is used worldwide by startups, Fortune 500 companies, educational institutions, and government agencies. GrammaTech's staff includes thirteen PhD-level experts in programming languages and program analysis.