Coverity Case Study

Frequentis

Frequentis Standardizes on Coverity® Static Analysis for Development Testing

Business Benefits

- Product safety assurance
- Quality process improvement
- Quick time to value
- Developer efficiency improvements
- Adoption of coding best practices
- Developer satisfaction

Business Overview and Challenge

Frequentis develops highly reliable communication and information systems for safety-critical applications. Its market leading control centre solutions, products and services are used by customers in a variety of mission critical public and private fields such as air traffic control (civil and military), emergency services (police, fire departments, and ambulances), maritime systems, and railways and public transport. Safety and freedom of failure is the single most important objective for Frequentis. In fact, safety is so engrained in Frequentis' brand that its company mission is "Communication and Information Solutions - For a Safer World!"

Air traffic management is the core of Frequentis' business. Frequentis' voice communication systems, used for communication between pilots and ground personnel, catapulted it to a global market leader position for air traffic control. This complex system is a combination of both hardware and software, and because of its safety-critical nature, Frequentis has a zero tolerance policy for any type of system failure.

Frequentis has also expanded its air traffic management product offering in recent years with innovations such as an electronic flight strip system, which has helped fuel the transformation from paper to digital flight information. This system displays real-time information on the flight to the air traffic control centre, such as flight number, flight levels, speed, and direction. High availability of this system is essential—any system disruption which restricts information and communication could be catastrophic.

Given the criticality of product safety and quality, Frequentis' development organization and processes are based on a variety of quality and safety related compliance regulations and standards, such as:

- IEEE12207 - Standard for Information Technology - Software Life Cycle Processes: a standard that establishes a common framework for software life cycle processes for a software system, from initial conception to retirement. In 1998, this standard officially replaced MIL-STD-498 for the development of Department of Defense software systems.
- IEC 61508 - Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems: an international safety standard covering the complete safety lifecycle, relating to equipment under control and the control system itself.
- ISO 9000 – A family of standards for Quality Management systems.

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Andreas Gerstinger
Software Quality and Software Safety Engineer

Some of these standards provide general guidelines but leave the interpretation and implementation up to the development organization, while some standards are very prescriptive in nature and mandate tools and techniques such as static analysis to ensure quality and safety. Compliance with safety standards are audited by Frequentis' internal audit team, customers, and external auditing bodies such as the Austrian Quality Society.

Given its commitment to quality and safety, Frequentis established a centralized software quality organization, directly reporting to the CTO, to oversee the seven development teams across the company. The centralized software quality team is now chartered with monitoring product quality and safety for each of the development teams, comprised of approximately 10 developers per team. Although Frequentis has a top-down corporate initiative and commitment to quality, the demand for investing in static analysis was driven by the development organization from the bottom-up. The development teams approached the software quality organization to invest in an automated solution to help them find defects in their code during the development cycle that may impact quality and security. Frequentis' development organization had experience using productivity tools in the past, but developer adoption was never realized. According to Andreas Gerstinger, Software Quality and Software Safety Engineer, who drove the evaluation and introduction of Coverity Static Analysis into the organization," We had used other analysis tools in the past but they did not go as deep as Coverity—they only provided metrics such as complexity measurement—but did not go as far as finding faults and pinpointing where they reside in the code. Developers didn't want a tool that only showed them abstract metrics, but would instead show them exactly where they made a coding error."

Solution Evaluation

Gerstinger and team researched and identified a short-list of companies that were best suited to meet Frequentis' stringent safety and quality standards, and were also the most likely to gain mainstream adoption by the development teams. A key requirement was a robust analysis engine to not only find safety-critical defects but also provide actionable information to the developers on the type of defect and where it resided in the code. Multi-language and platform support was also critical for Frequentis, as its products were developed in a variety of programming languages, including C, C++, C#, and Java. Additionally, the solution had to work on both the Linux and Windows operating system. Implementing a single solution that supported all of these languages and platforms was critical for developer adoption.

Frequentis included Coverity and two other vendors in its evaluation. The Coverity evaluation encompassed four development projects and 350,000 lines of code. Coverity's solution produced a 10% false positive rate, significantly less than that of the other vendors in evaluation. By surfacing real, relevant defects the developers immediately saw value in Coverity's solution. Coverity analyzed code that was already considered to be of high quality, identifying defects such as memory leaks which had previously gone undetected. In a single project, 80 critical or high priority defects were identified, with overall defect density measured at one fault per 3,000 lines of code. Due to the nature of the defects identified and the low false positive rate, Frequentis development teams overwhelmingly selected Coverity as their solution of choice.

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Coverity Deployment and Benefits Realized

Since initial deployment in 2007, five of the seven development teams have introduced and are actively using Coverity Static Analysis as part of their daily work. Adoption has not been an issue within Frequentis, as the developers view Coverity as a tool to help them increase their productivity and enhance their coding skills. After evaluating the benefits realized by the five development teams using Coverity, the two remaining development teams were astonished by the results and are now in the process of introducing the solution into their development cycle.

According to Gerstinger, "It's hard to quantify the cost of a single defect, but we do know that it was less expensive to purchase Coverity's software than not to purchase it. It may take six months for critical defects to be identified and resolved if identified in the field, so if Coverity can find even one of these defects it reduces the cost to Frequentis."

Frequentis is not able to provide quantitative ROI metrics but has realized the following qualitative benefits, such as:

- **Product safety assurance:** Coverity Static Analysis continually finds defects that are hard, if not impossible, to find in other testing and code review processes.
- **Quality process improvement:** With Coverity, quality enforcement has been moved to the individual development teams, so by the time the code arrives to the centralized software quality team the code is already clean.
- **Quick time to value:** After only six months of setup and implementation time across five development teams, Coverity was fully built into the development process; including integration with their IDE's and nightly builds.
- **Developer efficiency improvements:** By providing accurate analysis with less than a 10% false positive rate, developers are able to focus their triage efforts on the real, potentially crash-causing defects, as well as spend more time on innovation projects.
- **Adoption of coding best practices:** Coverity has helped the developers improve their coding skills by highlighting where they are most susceptible to error, and in the process teaches new techniques and best practices which have reduced the number of defects which occur in the first place.
- **Developer satisfaction:** Coverity's technical support team has been responsive

About Coverity

Coverity is the trusted standard for companies that have a zero tolerance policy for software failure, problems, and security breaches.

Coverity's award-winning portfolio of software integrity products enables customers to prevent software problems throughout the application lifecycle.

Frequentis has built Coverity's software into its audit process to demonstrate compliance with internal and external standards. It has also mandated that each development team must provide a Coverity report to all internal customers with every product release. Frequentis has an internal supply chain whereby internal customers order software from one or more development teams, which is then integrated into a larger project for release to external customers. Upon receipt of the Coverity report, the internal customer has the option of accepting or rejecting the project status based upon the quality criteria set in their contract with the software development project. This not only provides Frequentis' development teams with objective metrics and a quantifiable goal to work towards to ensure product quality and safety, but also increases customer confidence and satisfaction.

According to Gerstinger "It's not so much that Coverity is our only safety net—we have other means to ensure safety such as code reviews and testing. But the real benefit of Coverity is that it can find specific defects which are very hard, if not impossible, to find by other means. These defects are also the ones that rarely occur, and in the worst case are identified in the field, but are the most expensive and highest risk defects to Frequentis and our customers. Coverity is a good compliment to our existing processes and tools to ensure the highest levels of product safety and quality."

Conclusion

Frequentis' mission and commitment to safety is engrained into every part of the company, and the software quality organization is a direct reflection of this commitment. Coverity Static Analysis has helped Frequentis ensure a high level of software integrity to support its product mission of freedom from failure, while continually improving the productivity of its developers.

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