



Thales Technology Centre Singapore

Zeligsoft provides consulting and automation solutions to Thales Singapore for key Software Defined Radio R&D project

Thales is a world leader in mission-critical information systems for the aerospace, defense and security markets. Building on proven capabilities in large and complex software systems, Thales steps up to the security challenges of its customers in an increasingly interconnected, technology-driven world.

When Thales Technology Centre Singapore received a contract to develop a Software Communications Architecture (SCA)-compliant waveform, they turned to Zeligsoft for their proven consulting and automation solutions.

SuccessStory

Thales Technology Centre Singapore

Civil and military systems benefit from many of the same technologies and innovations. Developing these dual technologies has been a long tradition for Thales, with its global network of 68,000 employees, 22,000 high-level researchers and operations in 50 countries.

Thales Technology Centre Singapore (TTCS) was created in 2002 as the first Thales R&D centre in Asia. Focusing on dual technologies in the three core domains of sensors, communications and systems, TTCS enables their customers to rapid prototype advanced technology concepts, from advanced study to proof-of-concept demonstrations. As Software Defined Radio (SDR) is a transforming concept in battlespace communications, TTCS invested heavily to master this technology for the benefit of its Singapore customer.



Software Defined Radio (SDR) Waveform Research and Development

Seeing that SDR was strongly influencing the future of wireless and mobile communications, TTCS's customer approached them with a research and development project that would fuel a centre of SDR technical competency in Singapore. It was believed that a centre of SDR competency should include proficiency in the US DoD's standard for the Joint Tactical Radio System (JTRS). This standard — the Software Communications Architecture (SCA) — specifies rules on how to develop, deploy and configure SDRs. The SCA allows radios to be interoperable, as they can be reconfigured in real-time

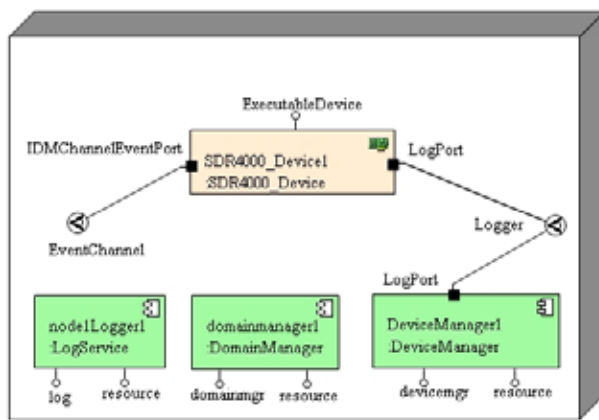
“When good tooling solutions are present, component-based software engineering makes waveform development straightforward. The integration between Zeligsoft’s code generator and our functional coding tool was a big time-saver.”

— Shaw Ping Lee, Project Manager, TTCS



to use different communications protocols and frequency bands. The SCA also serves to reduce radio terminal costs by enabling the use of commercial off-the-shelf (COTS) hardware.

The project began in 2005 with a requirements definition phase for an SCA-compliant waveform. The waveform to be developed was an Internet Protocol (IP)-based waveform, operating in the Very High Frequency (VHF) spectrum band, designed to provide ad-hoc mobile networking. The waveform's propagation characteristics are ideal for short-distance terrestrial communication. With this undertaking, TTCS was well on their way to becoming a centre of SDR excellence in Singapore.



SDR-4000 platform model

TTCS was very keen to take on this project. They had deep experience in signal processing technology which could be readily applied to the functional logic of the waveform. However, at the time TTCS did not have experience with the SCA standard needed to make the radio functionality work within an SCA operating environment.

Deploying an SCA-compliant Waveform with Zeligsoft

Deployment on Host

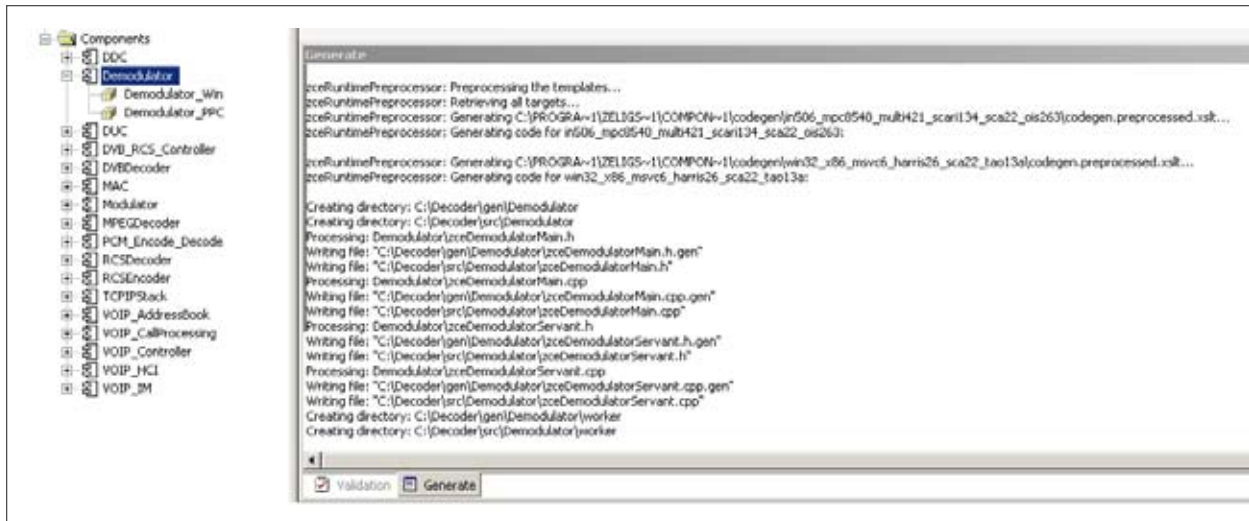
After requirements definition, TTCS successfully simulated the radio's functionality in a non-SCA environment. TTCS then brought in Zeligsoft, with their deep SCA and component-based software development expertise, to jump-start the SCA element of the project.

Zeligsoft delivered a combination of training, professional services and tools (Zeligsoft CE and Code Generator) to TTCS.

Within just half a day, the on-site Zeligsoft consultant had TTCS's waveform running on the SCA-compliant host platform, proving that the right SCA development tools can be invaluable to engineering teams without prior SCA expertise.



Spectrum Signal Processing's SDR-4000 configured with an SCA operating environment composed of GHS' Integrity RTOS, CRC SCARI++ Core Framework and OIS' ORBexpress



Without modifying the SCA code generated for the host, an implementation was compiled and executed for the SDR-4000 build environment (platform).

The Zeligsoft consultant did this by first modeling TTCS's waveform in Zeligsoft CE, a UML-based tool that supports a modeling methodology specific to the SCA. This model was then paired with the host model, which is also available for the CE development environment. The result was a comprehensive model of the waveform deployed to the sample host environment. This process showed the TTCS team how to apply component-based software development to SCA-based SDRs.

“At the time we did not have to be SCA experts to develop an SCA-compliant radio. Zeligsoft’s professional services and tools imparted SCA knowledge on us so that we could focus on the value our signal processing expertise brings, and leave the SCA element to Zeligsoft.”

— *Steven Poh,*
Project Manager, TTCS

Deployment to Target

TTCS then moved on to selecting their SCA-compliant radio platform and SCA operating environment. After careful consideration, TTCS selected Spectrum Signal Processing's SDR-4000 Tactical Military Communications System. The SDR-4000 was configured with an SCA operating environment composed of GHS' Integrity RTOS, CRC's SCARI++ Core Framework, and OIS' ORBexpress.

Without modifying the generated code, the waveform was re-compiled and executed on the SDR-4000. With the radio system modeled, TTCS used Zeligsoft CE's automatic SCA validation to ensure that all SCA constructs met the standard and that the waveform would deploy within this specific SCA operating environment. With the model validated, TTCS used CE's SCA descriptor file generation feature to automatically generate the complete, correct-by-construction set of XML descriptors for the waveform.

Zeligsoft Code Generator was then used to automatically produce the SCA component “wrapper” code required for the waveform running on GHS' Integrity with SCARI and ORBexpress. TTCS's functional logic (signal processing and control code) was compiled and linked with the component wrapper code into a single executable with Zeligsoft's build environment. Zeligsoft's directory structure and makefile system ensured TTCS maximum flexibility, code portability and safety when making changes to code. The ease of which functional logic was incorporated into SCA-compliant component code benefited the project significantly.

A methodical progression from non-SCA waveform, to host-based SCA-compliant system, to complete SCA-compliant radio was made seamless by Zeligsoft's tooling, training and professional services solutions.

Iterative Workflows

A fundamental technique used by the TTCS team was iterative development. Starting with a part of their system, they modeled the functionality needed. From the model, they generated, compiled and executed this specific functionality and evaluated it for correctness and performance. Only when satisfied with the part in question did they continue to add functionality in the same manner (model, validate, generate, execute, and test). At any point in the project, TTCS had the ability to execute the partially implemented components on host or target platform.

Iterative development — fully supported by Zeligsoft CE and Code Generator with their build-a-little, test-a-little approach — is a proven best-practice as it allows development teams to gradually increase the complexity of the software that they are building thus reducing the risk of significant integration problems at the end of the project.

Multi-site Team

An interesting twist to the project: TTCS worked with Thales Defence Deutschland (TDD), the engineering group developing the physical layer of the waveform. This team, located in Europe, used Zeligsoft CE to integrate the work done in Singapore with the software layers developed in Europe. The use of a high-level modeling tool made it easier for the different teams to work together and define the interfaces and connections that separated them.

“This is one more excellent example of how Zeligsoft can accelerate customer entry into the SDR/SCA market. The knowledge and drive of the Thales team, combined with Zeligsoft’s tools and extreme customer focus, made the difference here.”

— *Mark Hermeling*
Director of Applications Engineering
Zeligsoft

TTCS and SDR in the Future

TTCS benefited greatly from Zeligsoft’s automated solution. They were able to prove their concept in the requisite amount of time, impress their customer and gain valuable experience in SDR, the SCA and component-based software development.

With close ties to Asia Pacific, European and North American research and commercial centres, Singapore is poised to take a leading position in SDR research and development with TTCS at the helm.