CAREL

stone

The new benchmark in HVAC/R programming

The ecosystem where innovation meets efficiency

STone is the ideal tool for managing every stage of HVAC/R application development, offering complete support for the daily challenges of software programmers.

- **Standardised ST programming language:** IEC 61131-3 ed.3.
- **Optimised team working:** integration with the main versioning systems available on the market.
- **Advanced debugging:** through software simulator, I/O virtualisation and automatic testing.
- **Wide range of libraries:** predefined libraries available, possibility to create custom libraries.

Programming skills are becoming increasingly important compared to thermodynamic skills, as algorithms become more complex and development times are reduced to speed up unit time-to-market.

Driven by technological innovation, CAREL has designed STone, an advanced development environment designed to optimise the entire application development cycle. STone accelerates time-to-market, facilitates team work, and allows programmers to focus on the implementation of high-added-value algorithms and features.

Planning for the future cannot ignore the latest emerging technologies. STone anticipates this need, offering integrated support for the use of advanced solutions such as artificial intelligence and virtual simulation.

With STone, high-quality software solutions can be developed efficiently and without compromise.

Flexibility

Development platform for use on c.pCO and pYc hardware. Programmers can develop logic that can be used across multiple CAREL devices, maximising the investment.

Modular structure

Object oriented programming (OOP). Multitasking for simultaneous execution of multiple processes, improving efficiency and the use of system resources.

Quality and reliability

Software tested through:
- unit testing;
- automatic tests;
- non-regression tests.

Advanced programming features and optimised integration

Features for agile development

STone's new testing, debugging and validation capabilities revolutionise the way software is validated, making it faster, more continuous and more agile. Unit, automatic, and non-regression testing reduce development time, eliminating waste and allowing programmers to focus on tasks with higher added value.

Cybersecurity

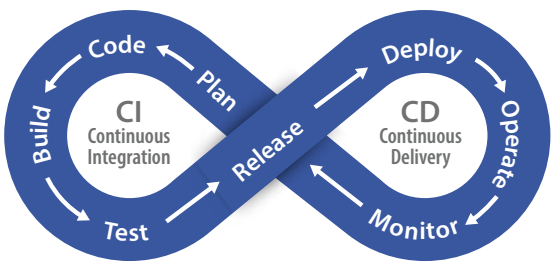
Cybersecurity is one of the main priorities for industry today. STone responds to this through integration of advanced technologies to protect CAREL programmable controllers against unauthorised access, manipulation and risks, guaranteeing the integrity of industrial processes and operational safety.

Integration with third-party software

Easy integration with CI/CD tools makes it possible to automate many of the tasks that are currently managed manually.

STone includes an API package that allows programmers to create a project, add files, compile and debug without needing to open the development environment.

Furthermore, STone can import code generated by modelling systems such as Matlab - Simulink.



CAREL app integration

The intuitive and easy-to-use interface of CAREL's apps simplify commissioning, monitoring and maintenance of HVAC/R units. There is no longer the need for cumbersome wiring, rather all that is needed is a mobile device connected via Bluetooth to the display.

Support throughout the unit's life cycle

The new platform supports users throughout the entire unit life cycle. From testing, to commissioning and maintenance, both local and remote. Every operation is managed simply and efficiently, optimising times and costs, improving the user experience and customer satisfaction.

SPARKLY

After creating the application software, SPARLKY is used in production; this is a command line tool ready to be integrated with other production tools.

It loads the application software onto the controller, reads and writes the variables, and can carry out end-of-line tests.

STone Virtual Loop

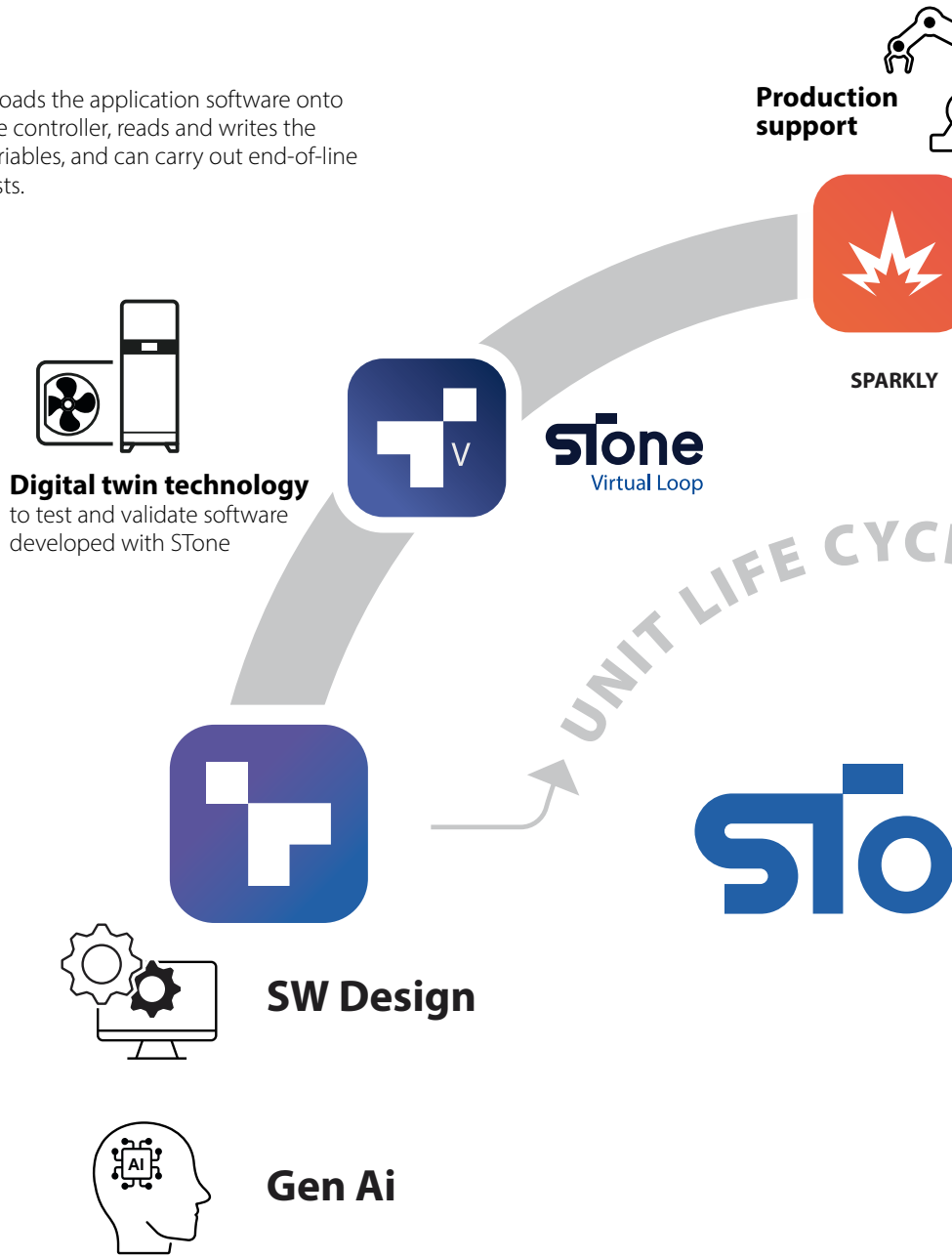
Advanced CAREL emulator used to test the software application through virtual models of real thermodynamic units, using digital twin technology.
Unit tests are performed directly at the programmer's desk, rather than needing to use physical prototypes in the lab or in the field, reducing development times and guaranteeing high quality.

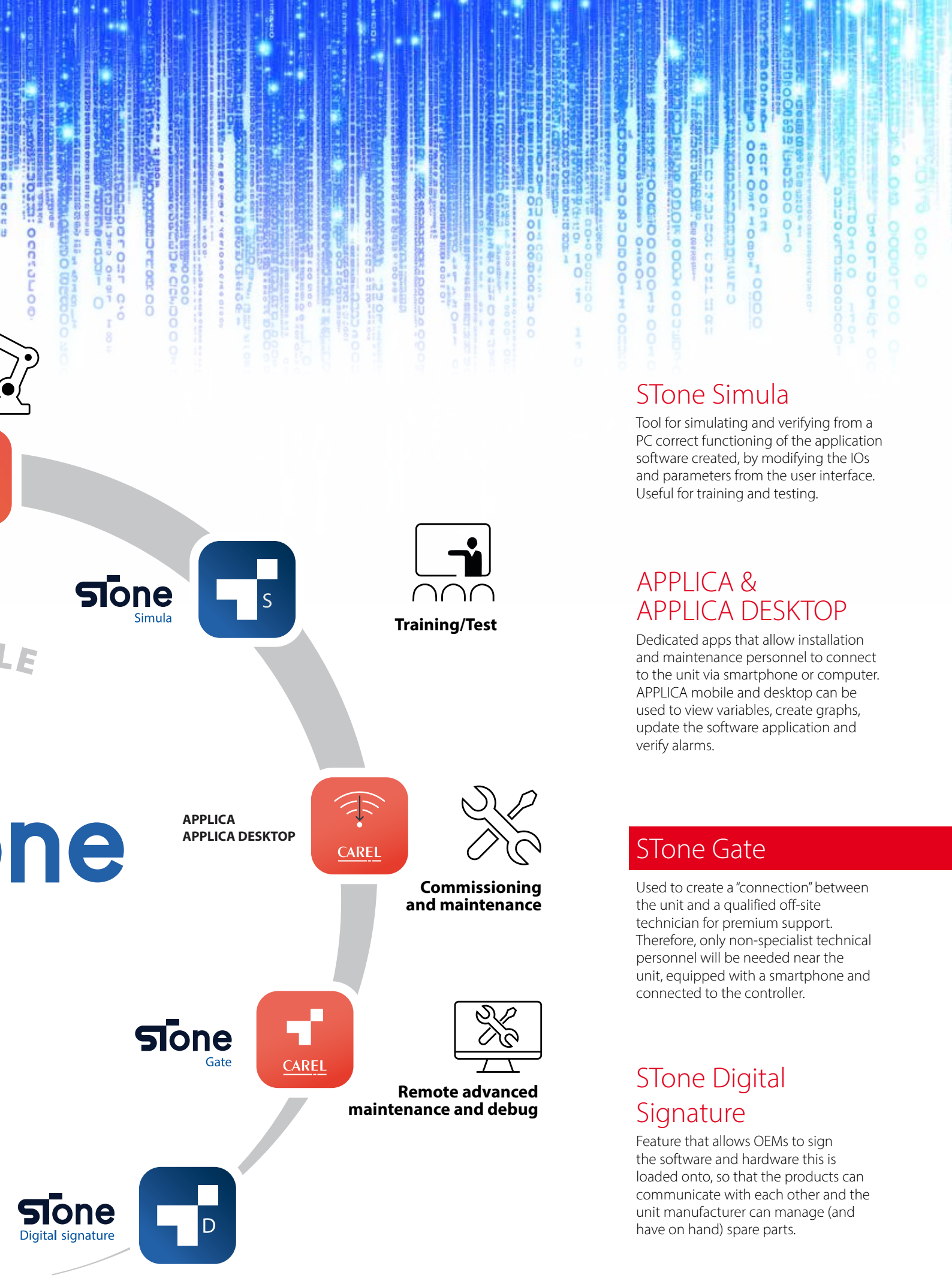
STone - SW design

This is the actual development environment where the control software application is built.
STone facilitates development by enabling multitasking, conditional compilation, and provides advanced CI/CD support to automate the integration and continuous release of software, improving development quality and speed.

Generative AI

Generative AI can help speed up code development and reduce the time it takes to complete projects.
This application in STone is a code completion/optimisation and automatic programming tool, and can assist developers while writing code, proposing suggestions and completions in real time.
Thanks to the integration of generative AI, STone can understand the operational context and consequently act directly on the software application source code.





STone Simula

Tool for simulating and verifying from a PC correct functioning of the application software created, by modifying the IOs and parameters from the user interface. Useful for training and testing.

APPLICA & APPLICA DESKTOP

Dedicated apps that allow installation and maintenance personnel to connect to the unit via smartphone or computer. APPLICA mobile and desktop can be used to view variables, create graphs, update the software application and verify alarms.

STone Gate

Used to create a "connection" between the unit and a qualified off-site technician for premium support. Therefore, only non-specialist technical personnel will be needed near the unit, equipped with a smartphone and connected to the controller.

STone Digital Signature

Feature that allows OEMs to sign the software and hardware this is loaded onto, so that the products can communicate with each other and the unit manufacturer can manage (and have on hand) spare parts.

STone Virtual Loop, a competitive advantage in the era of digitalisation

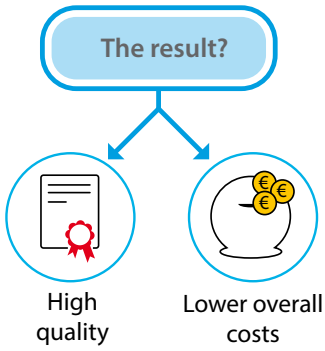
CAREL's advanced emulator creates virtual models of real thermodynamic units, replicating their behaviour and interactions within a digital system, using digital twin technology.

- **Flexibility and agile development:** iterative software editing and validation,
- **Cost optimisation:** reducing the need for physical laboratories and prototypes;
- **Simplified learning and onboarding:** real-time display of changes to the system;
- **Immediate support for personnel in the field:** quickly check for malfunctions due to incorrect configurations.

STone Virtual Loop integrates natively into STone and adds to the many benefits already offered by the ecosystem. It provides the most realistic simulation environment for testing and validation of residential heat pump, commercial chiller and air conditioner, without the need for real working units.

The ability to test the software in a virtual environment speeds up the development cycle, reduces the risk of errors and malfunctions that would otherwise only emerge during field testing; furthermore, the tool is fully compatible with CAREL's programmable electronic controllers, both physical units and virtual devices such as STone Simula.

Operation is simple: the built-in simulator generates physical outputs using advanced mathematical models. Based on the inputs, the software code processes the response, managing the actuators in accordance with the control logic; STone Virtual Loop then dynamically updates the system parameters to generate a continuous simulation loop.



Simple operation and easy-to-understand results

Operation is simple and intuitive, ensuring structured operation.

The process is divided into four main steps:

1. Select the unit model to emulate
2. Enter the parameters and value mapping
3. Create the initial and boundary conditions
4. Run the simulation and verify the results

Additional benefits

In addition to software verification during design and support in the learning phase, STone Virtual Loop is used to check the correct response of the control system (software) in response to typical anomalies:

- **Mechanical problems**
  to check system behaviour in the event of malfunctions (e.g. blocked valve);
- **Incorrect configuration**
  to easily identify configuration errors that have occurred in the field, sending the data from the unit to specialist personnel for rapid support.

STone Virtual Loop

A thermodynamic assistant at your side at all times

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Item codes and licenses

STone

	Item code	Description
Licenses		
Basic	9SLLB00Q10	STone Basic license (1 user)
	9SLLB10Q10	STone Basic license (10 users)
Pro	9SLLP00M60	STone Pro Trial license (1 user)
	9SLLP00Y10	STone Pro license (1 user)
	9SLLP10Y10	STone Pro license (10 users)
Additional modules		
Stone Simula	9SLSS00Q10	STone Add-on Simulation (up to 10 users)
STone Digital Signature	9SLDS00Q10	STone Digital Signature license
Onboarding support	9SFLP00M10	STone onboarding support
Licenses		
Course	9STSW06Q1A	STone SW tool training (4 days)
	9STSW07Q1A	STone Commissioning SW tool training (1 day)

STone Virtual Loop

Model type	Item code	Description
Residential heat pump	9SLVL01Y10	STone Virtual Loop license - residential heat pump (1 User)
Commercial chiller	9SLVL02Y10	STone Virtual Loop license - commercial chiller/heat pump (1 user)
Air conditioner	9SLVL03Y10	STone Virtual Loop license - air conditioning (1 user)
Trial version	9SLVL00M40	STone Virtual Loop license - Trial for all models - (1 user 4 months)

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