



Silver 2.3

Virtual ECU platform for rapid software development on Windows PC

Silver is a tool used by development engineers to integrate and test control software virtually on Windows PC using two alternative setups:

- *co-simulation* of control software and of hardware simulation models in order to test system-level behavior even before physical prototypes exist
- *rapid control prototyping*: controller functions running on laptop under Silver can be connected via CAN to by-pass ECUs functions running in real car or in a HIL simulation

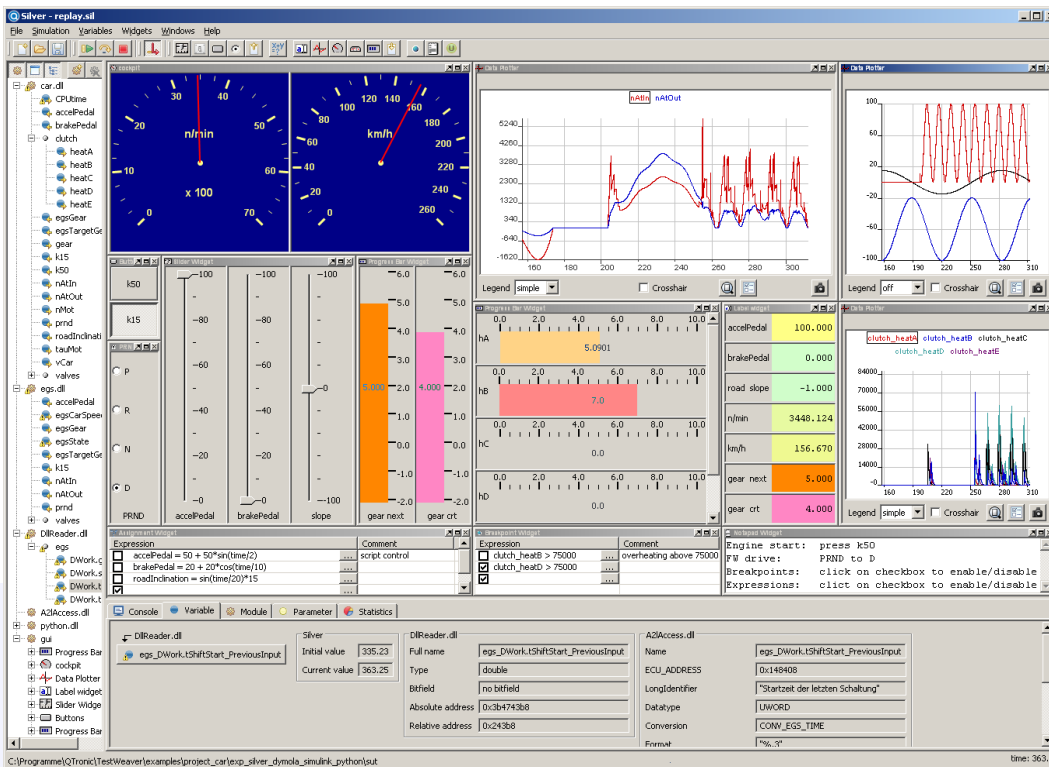
Control software and simulation models can be imported from C/C++, MATLAB/Simulink with RTW or TargetLink, ASCET, Dymola, SimulationX, SIMPACK, AMESim or Python. Silver provides built-in support for automotive standards such as ASAP2/A2L, CAN, MDF, FMI, XCP and ISO 26262.

Benefits

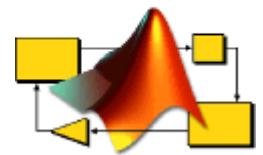
- rapid virtual integration on Windows PC
- excellent debugging and test support
- extremely fast development cycles
- executing other's contributions without their tools
- sharing results without sharing IP
- parallelize the development process

Features

- fast co-simulation of arbitrarily many modules
- easy configuration of graphical interfaces with: signal plotters, gauges, sliders, switches
- excellent debugging support: breakpoints with symbolic conditions on signals, connection to source-code debuggers for step-by-step module execution, comparison of simulations and measurements, code coverage with CTC++
- Pause / Step / Inspect / Overwrite / Continue available during simulation
- simulations driven by: graphical interface, measurement files, scripts
- reading and writing of measurements, for instance in MDF or CSV format
- Python scripting, PID controllers, filters, FFT
- test automation with TestWeaver, TPT or Python
- range monitoring for all ECU signals
- monitoring of stack and run-time requirements
- fault simulation
- worst-case analysis with TestWeaver
- ECU calibration interface (XCP)
- interface to all ECU signals with ASAP2/A2L files
- interface to CAN configured with DBC files



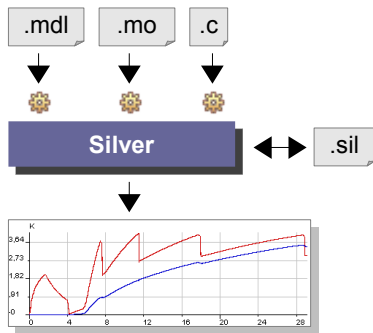
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How to virtually integrate modules with Silver



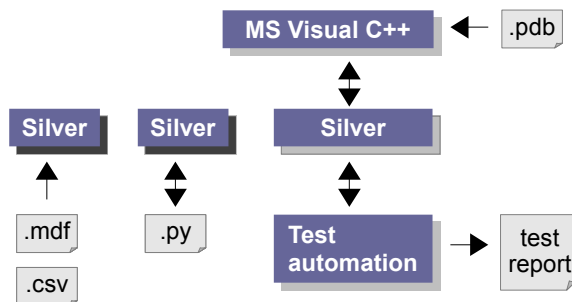
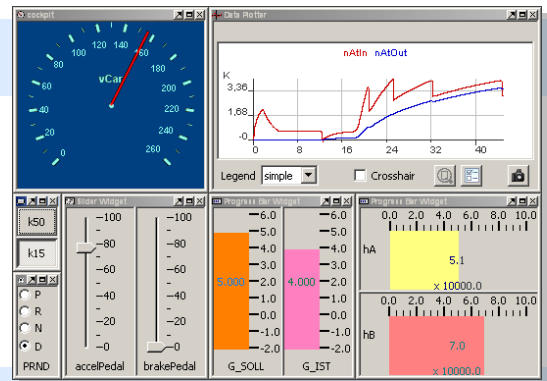
- 1 Build models using Simulink, Dymola, SimulationX, AMESim, Python, C/C++
- 2 Convert the models into Silver modules (gear icon) using the QTronic export tools. For each ECU, configure a Silver Basic SW adapter using dbc and a2l files.
- 3 Load all modules into Silver. Silver connects module outputs to module inputs automatically based on name matching. Potential problems and diagnosis information is given for undefined inputs, unused outputs, and module errors.
- 4 Add GUI elements to control simulation or display results. Store the configuration in .sil file for later re-use. Run the simulation to co-execute all the modules. Control and inspect results on-line using the GUI. For off-line analysis, measurement files can be read and written in various formats.

Silver application scenarios

Interactive test

Configure the user interface for your application and drive the system interactively. Silver provides plotters, push buttons, sliders and many more to build up a GUI using drag and drop.

Use this virtual integration to make sure that all modules of your application work together as expected when put into closed-loop with the plant model.



Test automation and debugging

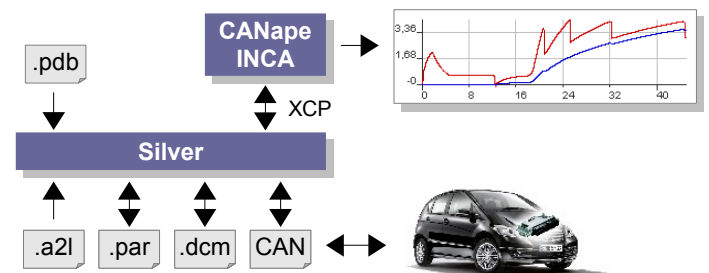
To automate testing of your application, drive simulation by Python scripts, or by mdf, dat or csv files. You can also use Silver as execution platform for test automation, for example using TestWeaver or TPT. You can also attach tools (such as CTC++) to measure the code coverage achieved by the tests.

To debug problems found during test, you can attach a C debugger to the Silver process, step through your code or set breakpoints on signal level and even on code level. Runtime exceptions, such as divisions by zero or access violations, can be easily traced back to the module and the source code that provoked it.

Measurement and calibration

Attach an a2l or pdb file to a module to measure and plot all variables for which the address in the compiled module is known. This way you can access all static variables of a running module, not only its top-level inputs and outputs.

Silver can emulate your ECU: Attach tools such as Vector CANape or ETAS INCA to Silver to measure and calibrate the running application, using the same configuration files that you use for the real ECU hardware. Silver can write ("flash") application parameters given in various formats (par, dcm, hex) into your application. Parameters can be changed on-line and saved to files.



Rapid prototyping

A laptop running Silver can be connected via CAN to a hardware-in-the-loop simulation or to a real car. Silver then by-passes the real ECU, which shortens development cycles.

Our services

- Silver setup for development projects
- Consulting for test and validation of systems
- Development of simulation models