Qualification of a Virtual Machine and OBCP Engine Based on MicroPython

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On Board Control Procedures (OBCPs) are flight procedures that can be dynamically uploaded, even after launch, and executed on board. They provide a flexible way to operate the spacecraft, to extend the On Board Software (OBSW) functionality or to modify the behaviour of on board applications. They are most of the time written in scripting language, compiled as bytecode and executed in a Virtual Machine (VM).

As main objective of this project, the MicroPython library (ported to LEON2/RTEMS in a previous activity) is formally qualified for flight as per ECSS standard. This qualification includes the production of the ECSS documentation (plans, specification, design…), the verification of the existing code and extensive testing of the Virtual Machine on target LEON2 simulator and hardware, including relevant reference tests from the standard C Python 3 test suite.

As part of this project, an OBCP Engine and PUS 18 implementation has been developed. It allows controlling and monitoring the OBCP's via TM/TC. The MicroPython VM has been enriched with dedicated interfaces giving access to the on board resources (observable parameters, TM, TC, memory, on board time…). Specific measures have been adopted to ensure fault containment, both at VM and OBCP Engine levels.