

## **CoreSight based execution monitoring for space applications**

CoreSight is a hardware technology present in many modern ARM based SoCs which enables program execution and system event tracing in a non-invasive way – without additional hardware or instrumentation of the analysed software and with negligible performance penalty. The objectives of the presented activity were to evaluate CoreSight feature availability on a selection of SoCs, develop embedded software to interface with the CoreSight hardware on the selected platform and demonstrate the capabilities and performance of the developed solution using a representative use-case based on PROBA3 payload ASW.

CoreSight feature availability was researched and reported. Embedded Trace Software Modules (ETSM) were developed for Xilinx Zynq Ultrascale+ ZCU104 board running Linux, interfacing with CoreSight via perf subsystem, supporting the required functionality and exposing it via PUS 6 and a custom PUS service over ethernet. Test and Tracing Support Modules (TTSM) were developed to interface an in-house SVF with ETSM. PROBA3 payload ASW was modified to remove its dependencies on PROBA3 HW and to run on Linux via a thin RTEMS API emulation layer. The following capabilities were successfully demonstrated: trace download for post-mortem investigation, execution time profiling and verification, as well as inter-core interference analysis.

The developed solution has the potential to facilitate performance measurements, behaviour analysis, testing and debugging of on-board software, both on-ground and in-flight. The performance measurements may be a valuable input to software verification and various analyses (e.g. schedulability and inter-core interference).