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Author: Mr. Stefano De Padova
Serco, Germany, Stefano.De.Padova@esa.int

DATA-HANDLING ANOMALY CAUSING FIRST REBOOT OF INTEGRAL CENTRAL PROCESSING UNIT AFTER 16+ YEARS

Abstract

INTEGRAL is a -ray observatory that was launched over 17 years ago and is still operating and providing valuable science data long past it's design lifetime.

The spacecraft's On-Board Data-Handling subsystem (OBDH) consists of two redundant Central Terminal Units, each containing amongst other things a MIL-STD-1750 Single Chip Microprocessor. The INTEGRAL operating system is supplied mainly by the Ada language, its kernel, and partly, regarding the scheduling of periodic processes, by APEX2. APEX2 is the INTEGRAL scheduler. It is in charge of activating the processes, which are specified in its scheduling table, w.r.t. a hardware interrupt: the RTC. The RTC is defined as a sub multiple and it is phased with the signal which defines the TM cycle. The INTEGRAL TM cycle is 8 s. and 64 RTCs are defined in that period, therefore the RTC interrupt is generated every 125 ms. and it is serviced by a routine which calls the APEX2 scheduler $(p_e xecutive). The SW cycle has the same duration of the TM cycle.$

Up to July 14th 2019 this process schedule was executed every 8 seconds without any error. After roughly 66 million cycles one of the scheduled processes $(TM_S END_P KT) did not complete within the 125 ms RTC cycle causing unexpected software error.$

This paper describes the original issue, the symptoms and impact of the overrun, the investigation performed as well as possible causes.