OCEOS: A new Real-time Operating System

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OCEOS is intended for systems where reliability and robustness are critical but resources limited, and has been developed to ECSS category B and ISO 26262 standards. Its memory requirements are small and are determined before scheduling begins. System information, including task timings, is recorded to simplify analysis and early detection of unexpected behaviour. External events are responded to rapidly, with interrupts disabled internally only for very short times and rapid context switching. Specific data outputs can be set to occur at precise times independent of task scheduling, and tasks also can be set to start at precise times. Mutexes, counting semaphores, data queues and a system log are provided. Only one system stack is required rather than a stack for each task, and potential problems such as unbounded priority inversion, chained blocking, and deadlocks are excluded by the design.

OCEOS uses pre-emptive scheduling. Each task has a fixed priority that is set when the task is created, and also has a pre-emption threshold that restricts the ability to pre-empt to tasks with higher priority than this threshold. Multiple tasks can have the same priority and are then scheduled in FIFO order, time-slicing between such tasks does not take place. Task start requests can be made by interrupt handlers or by tasks, depending on the priority of the new task pre-emption of the current task may then occur. A task can have a number of start requests that are pending. This caters for unexpected start requests, and as each start request may refer to a different unit also allows the same task be used to handle different units of the same type.

Using OCEOS divides into two phases, an initialisation phase where tasks, mutexes, etc. are created and fixed characteristics recorded, and a scheduling phase to which this fixed information is passed. Once the fixed information has been created it is possible to drop the initialisation phase code and further reduce memory usage. Tasks, mutexes, etc. can be started or used at any time after scheduling starts but can only be created in the initialisation phase before scheduling begins.

OCEOS supports up to 255 tasks each with up to 15 pending start requests, up to 63 mutexes, up to 63 counting semaphores, and up to 63 data queues. Pending queue sizes up to 255 can be specified for each counting semaphore and data queue, and up to 255 entries for each data queue.

OCEOS can be used with any SPARC based single CPU system. It was developed as the RTOS for ESA's new GR716 microcontroller, and the support of ESA for this development is gratefully acknowledged.

It is planned to develop OCEOS versions for use with ARM and other CPUs, single and multi-core.

OCE's Debug tool DMON supports applications that use OCEOS and provides real-time graphics of CPU usage by tasks and other information. Technical support for users of OCEOS is available from OCE.

For further information please contact sales@ocetechnology.com.