# PRODUCT DESCRIPTION

OCEOS is a real-time pre-emptive fixed priority operating system that can be used in applications that require European Cooperation for Space Standardization Category B or ISO 26262 standards. It has a small memory footprint (<10 kBytes), requires only one system stack rather than a stack for each task, and provides support for precisely timed data outputs independent of task scheduling. OCEOS supports applications running on SPARC & ARM based hardware. The support of the European Space Agency in developing OCEOS is acknowledged. OCEOS provides the following facilities:

- Fixed priority pre-emptive scheduling
- Based on Stack Resource Policy - unbounded priority inversion, chained blocking, and deadlocks cannot occur.
- Single stack rather than separate stack for each task
- Small code footprint (<10 kBytes for scheduling and mutex)
- Mutex, Counting Semaphore, and Data Queue support
- High precision timed actions (data output and task start)
- Supports SPARC and ARM Cortex-M single core targets
- Ideal for Cobham-Gaisler GR716 and Arm Cortex-M applications
- DMON debug tool support (execution timeline, CPU usage)
- Support & ISVV services available from OCE
- Gold standard customer support package
- Developed to ECSS Category B and ISO 26262 standards
- Developed in cooperation with European Space Agency (ESA)
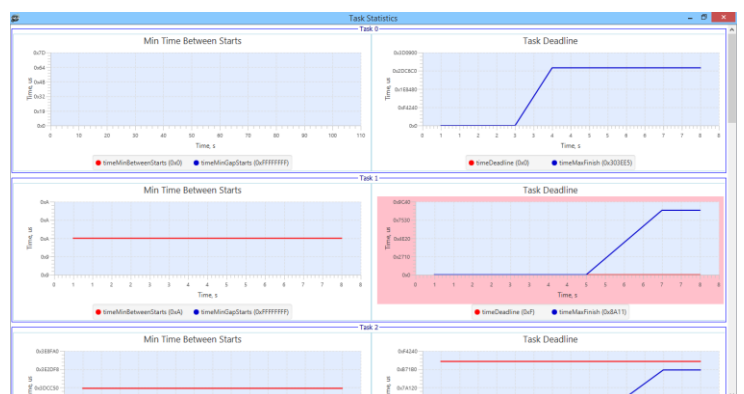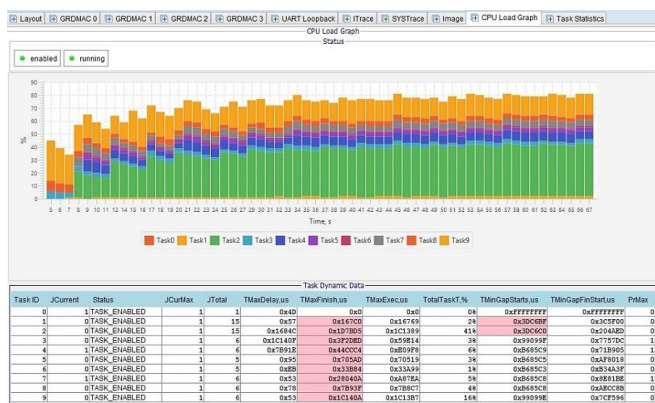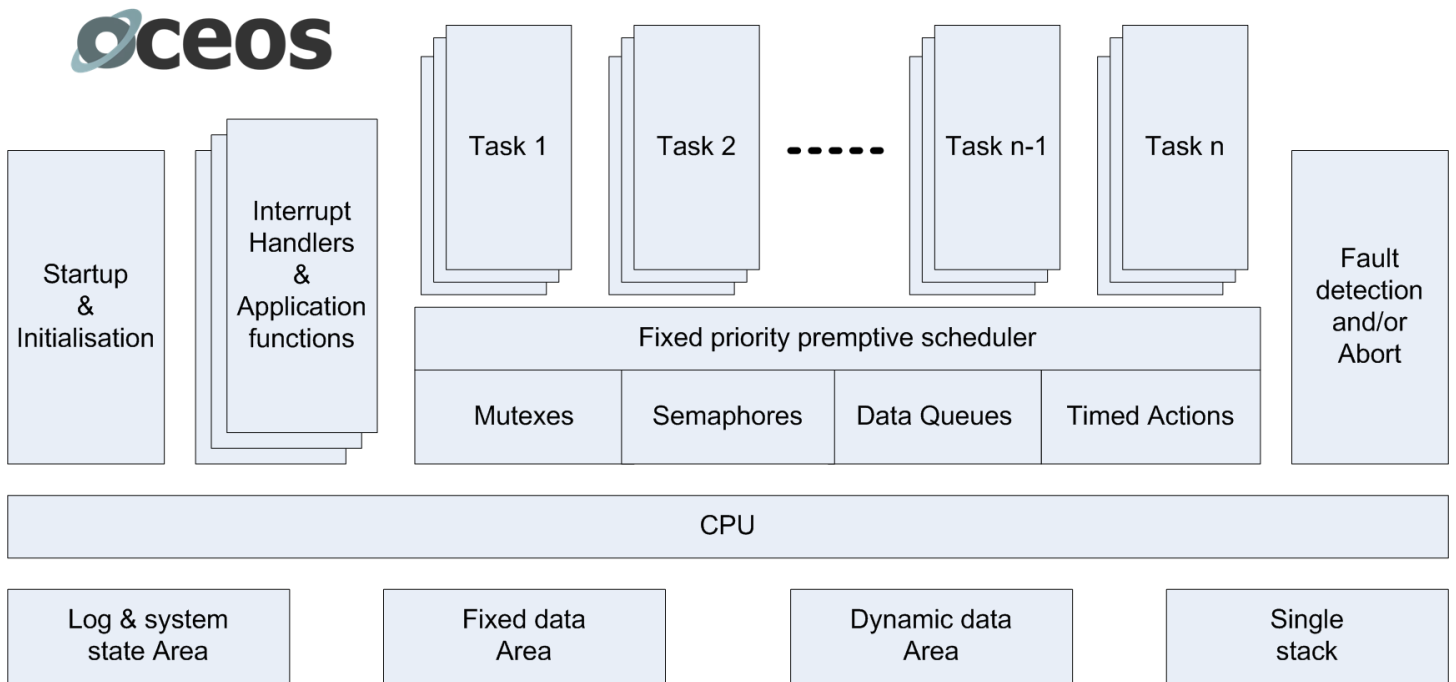
OCEOS FEATURES

OCEOS was developed for high reliability aerospace applications. Its small size and efficiency make it ideal for use in embedded systems requiring compactness and high reliability.

Real time software is often written as a set of trap/interrupt handlers and tasks managed by a RTOS. The trap/interrupt handlers start due to anomalous conditions or external happenings. They carry out the immediately necessary processing and may ask the RTOS to start a task to complete the processing. The RTOS then schedules the task for execution based on its priority.

In hard real time systems scheduling must ensure that each task completes no later than its deadline, but being early can also be a problem. OCEOS provides a timed output service that allows a data output be set for a precise time independently of scheduling. A task also can be scheduled to start at a precise time, but the actual start time may be later depending on task priority.

OCEOS supports up to 254 tasks with up to 15 current execution instances of each task, allowing one task service multiple units of the same type. Each task has a fixed priority and more than one task may have the same priority. Tasks of the same priority are FIFO scheduled, there is no time slicing between tasks in OCEOS. In OCEOS a pre-emption threshold higher than the task's priority can be set for a task so that once it starts execution it can only be pre-empted by a task with higher priority than this threshold.

Pre-emptions and any traps/interrupts that occur will delay a task's completion and potentially cause it to miss its deadline. Careful analysis is needed to ensure that task deadlines are always met. OCEOS supports this analysis and allows relatively simple determination of worst-case behaviour. Problems such as unbounded priority inversion, chained blocking, and deadlocks cannot occur in OCEOS.

OCEOS provides mutexes to protect critical shared code or data, and inter-task communication using semaphores and queues. A system state variable provides a summary of the current state of the system. Error conditions such as missed deadlines are logged and the system state variable updated. If the system state is not normal actions such as disabling a task or resetting the system may be taken.

OCEOS does not allow dynamic creation of tasks at run time. Virtual memory is not supported. Task priorities are fixed. OCEOS is based on the Stack Resource Policy extension of the Priority Ceiling Protocol [Baker 1991]. OCEOS is provided as a library and is statically linked with an application. Services not needed by an application are omitted by the linker.

Feature	Details
Task scheduling	Fixed Priority Preemptive
Scheduling policy	Stack resource policy, unbounded priority inversion and deadlocks cannot occur
Tasks	Up to 255 tasks. Max pending start requests per task 15
Mutexes	Up to 63 mutexes each with fixed priority ceiling
Counting semaphores	Up to 63 counting semaphores, each maximum permit can be set up to 4095
Data queues	Up to 63 data queues, each max entries can be set up to 255
Timed outputs	Max 255, independent of system time
Build environment	SPARC BCC, ARM DS, Keil, Segger, gcc (others on request)
Debug	OCE DMON debug tool with OCEOS extensions for analysis
Processor architecture	Single-core SPARC, ARM Cortex-M
Standards	ECSS Category B and ISO 26262 ready
Customer Support	Telephone, email, and on-site support packages

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