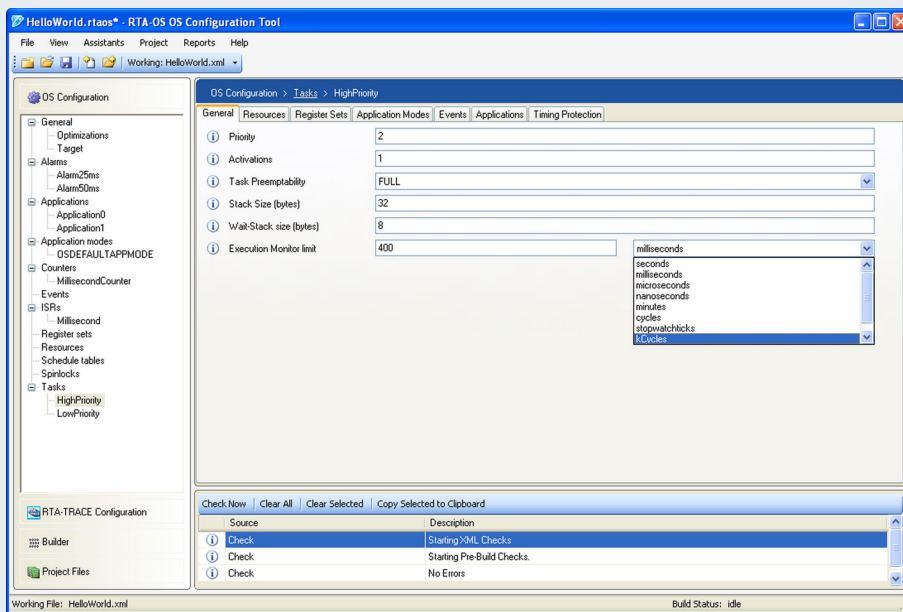


RTA-OS

Zynq Ultrascale A5X with the Green Hills Compiler



Features at a Glance

AUTOSAR R4.3 compliant
Multicore OS

Supports all scalability
classes

MISRA-C:2012 compliant

RTOS overhead:
109 bytes RAM
0 bytes ROM

Category 2 ISR latency:
943 CPU cycles

RTA-OS

RTA-OS is the new generation operating system from ETAS that conforms to the AUTOSAR OS specification and builds on the benefits of the successful RTA-OSEK product. It provides a toolsuite that includes a PC-based graphical configuration tool and adaptive OS generation capabilities to deliver flexible, fast solutions for a wide range of automotive microcontrollers.

The graphical configuration tool allows all OS objects to be configured, and creates AUTOSAR conformant XML files describing the OS configuration. In addition, it provides automatic verification against the AUTOSAR XML schema and allows users to create projects for easy management of multiple files.

RTA-OS improves on RTA-OSEK in several areas, including better runtime performance and smaller memory footprint,

support for multiple processor environments, and automatic support for up to 1024 tasks. The powerful performance analysis tools developed for RTA-OSEK have been updated for RTA-OS to allow hard real-time requirements to be met.

RTA Product Family

RTA-OS integrates seamlessly with other tools in the RTA product family, including:

- RTA-RTE – a mature, robust production quality AUTOSAR RTE Generator.
- RTA-TRACE – a software logic analyser that allows the runtime behaviour of RTA-OS to be observed.

Microcontroller Support

RTA-OS supports all variants of the Zynq Ultrascale A5X family of microcontrollers.

Compiler Toolchain

RTA-OS for the Zynq Ultrascale A5X has been developed with the Green Hills v2018.1.4 compiler.

Due to the adaptive code generation of RTA-OS, it is possible to use other versions of this compiler to build applications.

ORTI Debugger Support

RTA-OS can generate OSEK Runtime Interface information for the Lauterbach debugger.

Interrupt Model

RTA-OS supports the multiple interrupt priority levels on the Zynq Ultrascale. These can be configured to 16 or 32 interrupt levels

Memory Model

RTA-OS supports the standard 32-bit EABI memory model provided by the Green Hills compiler.

Maximum Number of OS Objects Allowed by RTA-OS

	BCC1	BCC2	ECC1	ECC2
Max. no. of tasks	Up to 1024			
Max. tasks per priority	Up to 1024			
Max. queued activations	1	$2^{32}-1$	1	$2^{32}-1$
Max. events per task	n/a	n/a	32	32
Max. alarms	$2^{32}-1$			
Max. software counters	$2^{32}-1$			
Max. hardware counters	$2^{32}-1$			
Max. nested resources	$2^{32}-1$			
Max. standard resources	$2^{32}-1$			
Max. internal resources	Not limited by RTA-OS			
Max. application modes	$2^{32}-1$			
Max. schedule tables	$2^{32}-1$			
Max. expiry points per schedule table	$2^{32}-1$			

Memory Overhead of RTA-OS

Memory Type	Overhead (bytes)
RAM	109
ROM/Flash	0

In addition to the OS overhead, each object used by an application has the following memory requirements:

Object	RAM (bytes)	ROM (bytes)
Task	0	40
Category 2 ISR	0	16
Resource	8	16
Alarm	12	2
Counter	4	32
Schedule Table	24	24
Expiry Point	0	4

Performance

The following table gives the key RTA-OS kernel performance data measured in CPU cycles. All measurements were taken on a GenericZynqUSA53 with a 1200MHz clock speed.

Task Type	Execution Time	Ref.
Pre-emption	706	A
Normal Termination	468	B
Task Switch	475	C
ChainTask	936	D
WaitEvent	1109	E
SetEvent	1339	F
Schedule	698	G
ReleaseResource	684	H
Category 2 ISR Entry Latency	943	I
Category 2 ISR Exit Latency resuming interrupted task	720	J
Category 2 ISR Exit Latency with task switch	720	K
Category 1 ISR Latency	900	L

The following figures illustrate how the RTA-OS kernel overheads are allocated during the operations given in the above table:

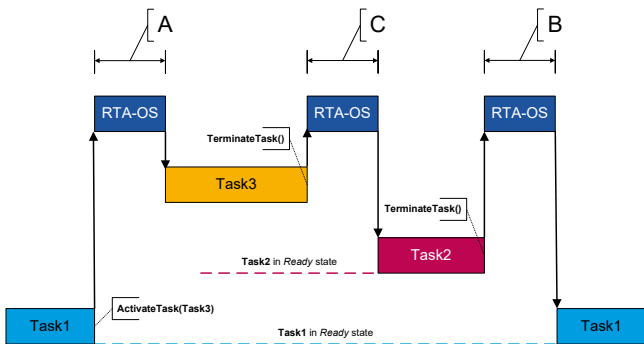


Figure 1 - Task1 is preempted by Task3, followed by a task switch and then normal termination of Task2

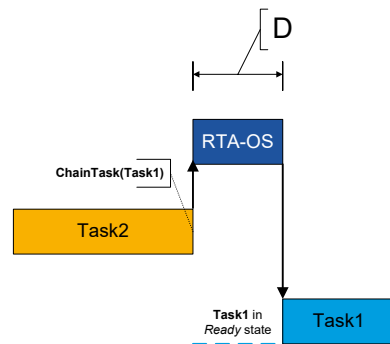


Figure 2 - Task2 chains Task1

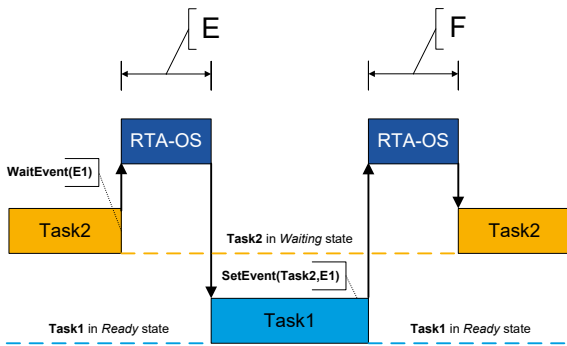


Figure 3 - Task2 waits for an event set by Task1

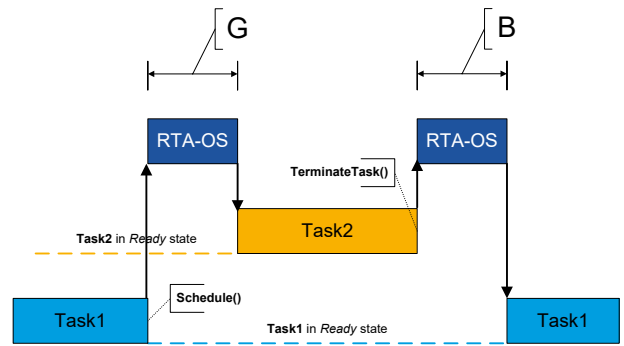


Figure 4 - Task1 allows cooperative scheduling by Task2

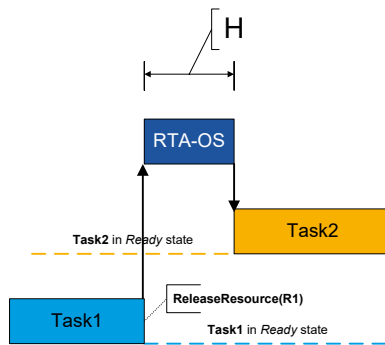


Figure 5 - Task1 releases a resource

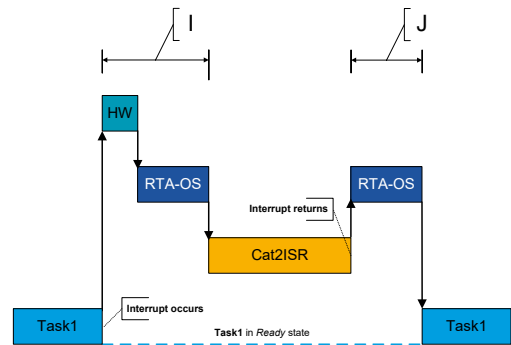


Figure 6 - Category2 ISR entry and exit latency

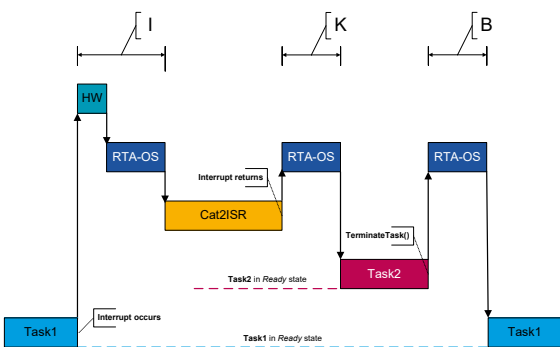


Figure 7 - Category2 ISR switches to Task2

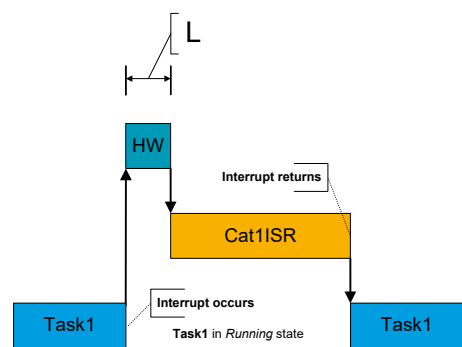


Figure 8 - Category1 ISR entry latency

Order Information

To use RTA-OS it is necessary to purchase a development license for the tools together with an add-on license for the Zynq Ultrascale A5X Green Hills port. Machine-named and floating licenses are available.

To use any operating system code generated by RTA-OS in ECU applications, a valid production license is required. Please contact your local ETAS Sales Office for details of production licenses for RTA-OS.

RTA-OS Tools Order Information

Item	Characteristics	Object
F 00K 107 119	Machine-named license for RTA-OS for Windows PC	LD_RTА-OS_VRTA_SC34_LIC-MP
F 00K 107 121	Floating license for RTA-OS for Windows PC	LD_RTА-OS_VRTA_SC34_LIC-CP
F 00K 107 136	Product CD for RTA-OS	LD_RTА-OS_VRTA_SC34_PROD

RTA-OS Zynq Ultrascale A5X Green Hills Port Order Information

Item	Characteristics	Object
F 00K 111 926	Machine-named license for RTA-OS for Zynq Ultrascale A5XES_RTА-OS_ZYNQUSA53GHS_SC34_LIC-Green Hills Scalability Classes 1 to 4	MP
F 00K 111 928	Floating license for RTA-OS for Zynq Ultrascale A5X Green Hills Scalability Classes 1 to 4	ES_RTА-OS_ZYNQUSA53GHS_SC34_LIC-CP
F 00K 111 929	Product CD for RTA-OS for Zynq Ultrascale A5X Green Hills	ES_RTА-OS_ZYNQUSA53GHS_PROD

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