



## **Application Note**

**AN1201: embOS Kernel Awareness**



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## INTRODUCTION

This Application Note provides information regarding the debug support and kernel awareness features for the Segger embOS real time operating system, available in the **Atollic® TrueSTUDIO®** product.

The kernel awareness features for Segger embOS in **Atollic TrueSTUDIO** provide the developer with a detailed insight into the internal data structures of the embOS kernel. During a debug session, the current state of the embOS kernel and the various embOS kernel objects such as tasks, mailboxes, semaphores and software timers, can easily be inspected in a set of dedicated views, in the **Atollic TrueSTUDIO** debug perspective.

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## INTENDED READERS

This document is primarily intended for software developers using the Segger embOS operating system in **Atollic TrueSTUDIO** projects.

# USAGE

This section outlines the information provided in the embOS-specific debugger views in the *Atollic TrueSTUDIO* debugger. After reading this section, you should be able to use this information in your own project.

## REQUIREMENTS

The kernel awareness features require Segger embOS version 3.80 or later.



Please note that the level of information available in the different views in *Atollic TrueSTUDIO* depends on the options used when the embOS kernel was built. This manual refers to an embOS kernel built with the debug and profiling (DP) build options.

## FINDING THE VIEWS

A number of debugger views are available in the *Atollic TrueSTUDIO Debug* perspective when debugging an application containing the embOS real-time operating system.

These views can be opened from either the **View** top level menu or the **Show View** toolbar dropdown list button.

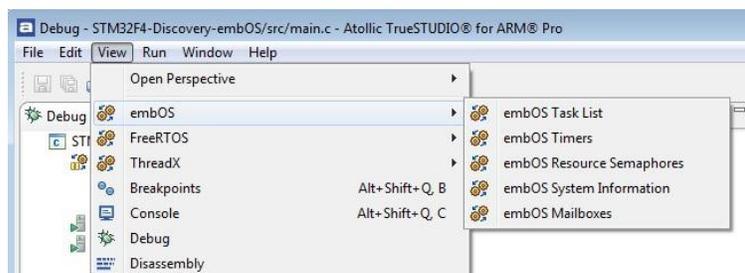


Figure 1 - View Top Level Menu

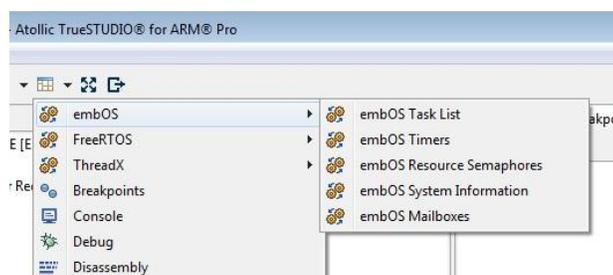
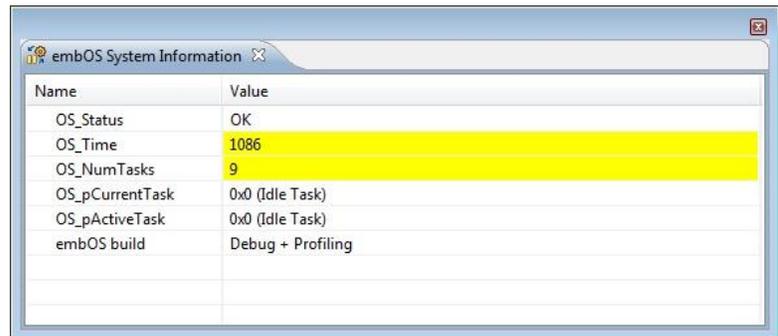


Figure 2 - Show View Toolbar Button

## SYSTEM INFORMATION

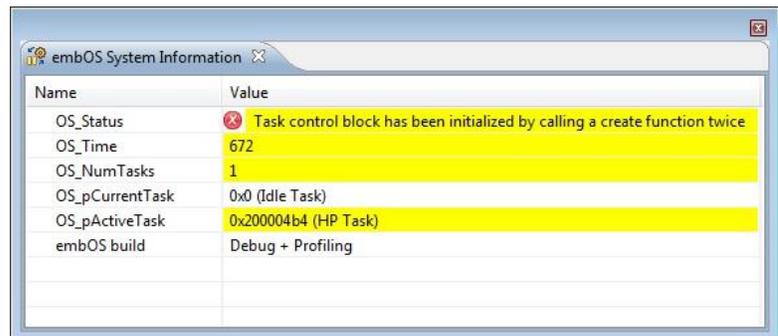
The **embOS System Information** view displays a number of system variables available in the embOS kernel, such as status, number of tasks, etc.



Name	Value
OS_Status	OK
OS_Time	1086
OS_NumTasks	9
OS_pCurrentTask	0x0 (Idle Task)
OS_pActiveTask	0x0 (Idle Task)
embOS build	Debug + Profiling

Figure 3 - embOS System Information View

This view also provides descriptive fault information messages for any fault conditions detected by the OS kernel.



Name	Value
OS_Status	Task control block has been initialized by calling a create function twice
OS_Time	672
OS_NumTasks	1
OS_pCurrentTask	0x0 (Idle Task)
OS_pActiveTask	0x200004b4 (HP Task)
embOS build	Debug + Profiling

Figure 4 - embOS System Information View (Fault Condition)

The available system variables are described in the table below:

Name	Description
<b>OS_Status</b>	The current status of embOS.
<b>OS_Time</b>	The number of system ticks since program start.
<b>OS_NumTasks</b>	The number of created tasks.
<b>OS_pCurrentTask</b>	The address (TCB) and name of the currently running task.

Name	Description
<b>OS_pActiveTask</b>	The address (TCB) and name of the next running task.
<b>embOS build</b>	The build options of the currently running embOS kernel. In the example, debugging and profiling information (DP) is available.

Table 1 – embOS System Variables

## TASK LIST

The **embOS Task List** view displays detailed information regarding all available tasks in the target system. The task list is updated automatically each time the target execution is suspended.

There is one column for each type of task parameter, and one row for each task. If the value of any parameter for a particular task has changed since the last time the debugger was suspended, the corresponding row will be highlighted in yellow.

Prio	Id	Name	Status	Timeout	Preemptions	Waitable Object	Events	Stack Info	Activations	Round Robin
⇒ 100	0x200004b4	HP Task	Ready		0		0x0	156/512 @ 0x200000b4	101	0/2
50	0x20000e6c	LP Task	Wait (Timeout)	0 (15000)	28		0x0	164/512 @ 0x200009d4	174	0/2
70	0x20001110	MP Task	Wait (Timeout)	0 (15000)	35		0x0	164/512 @ 0x20000c6c	181	0/2
50	0x200004fc	Task1	Wait (Event)(Timeout)	5000 (20000)	0		0x1	120/512 @ 0x20000ec8	1	2/2
50	0x20001220	Task2	Wait (Event)		0		0x1	100/512 @ 0x2000127c	1	2/2
50	0x20001490	Task3	Wait (Semaphore)	100 (14500)	14	0x200011f0	0x0	144/512 @ 0x20000558	51	2/2
50	0x200010c8	Task4	Wait (Timeout)	0 (15000)	0		0x0	100/512 @ 0x200007d4	60	2/2
50	0x200011a8	Task5	Wait (Mailbox)		0	0x20001204	0x0	156/512 @ 0x200002b4	1	2/2
50	0x200016d8	Task6	Wait (Mailbox)		0	0x200007b8	0x0	152/512 @ 0x200014d8	1	2/2
	Idle									

Figure 5 - embOS Task List View

Please note that due to performance reasons, stack analysis (the **Stack Info** column) is disabled by default. To enable stack analysis, use the **Stack analysis** toggle toolbar button in the **View** toolbar:



The available parameters are described in the table below:

Name	Description
<b>N/A</b>	Indicates the currently running task. The currently running task is indicated by a green arrow symbol.
<b>Prio</b>	The task priority.

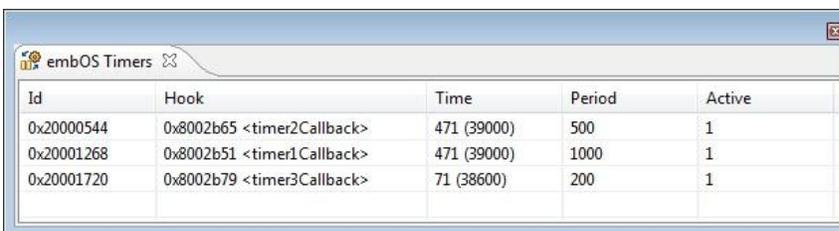
Name	Description
<b>Id</b>	The task identifier (TCB address).
<b>Name</b>	The task name.
<b>Status</b>	The current status of the task. The type of object that currently blocks a task is presented in parenthesis.
<b>Timeout</b>	The timeout value (OS_Delay) and in parenthesis the point in time when the timeout will occur.
<b>Preemptions</b>	The number of times the task has been preempted by a higher priority task.
<b>Waitable Object</b>	The address of the object the task is waiting for.
<b>Events</b>	The event mask of the task. A value of 0x0 means that the task is not waiting on any events.
<b>Stack Info</b>	The amount of used stack space, the available stack space and the stack start address. [Used/Total@Address]. Note! This feature must be enabled in the <b>View</b> toolbar.
<b>Activations</b>	The number of times the task has been activated.
<b>Round Robin</b>	The number of remaining time slices (ticks) and the time slice reload value, during round robin scheduling.

Table 2 – embOS Task Parameters

## TIMERS

The **embOS Timers** view displays detailed information regarding all available software timers in the target system. The timers view is updated automatically each time the target execution is suspended.

There is one column for each type of timer parameter, and one row for each timer. If the value of any parameter for a particular timer has changed since the last time the debugger was suspended, the corresponding row will be highlighted in yellow.



Id	Hook	Time	Period	Active
0x20000544	0x8002b65 <timer2Callback>	471 (39000)	500	1
0x20001268	0x8002b51 <timer1Callback>	471 (39000)	1000	1
0x20001720	0x8002b79 <timer3Callback>	71 (38600)	200	1

Figure 6 - embOS Timers View

The available parameters are described in the table below:

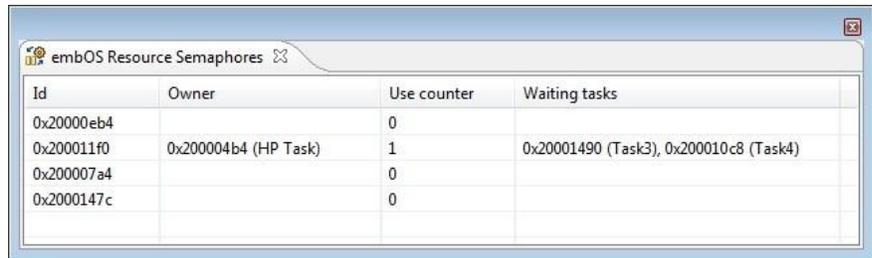
Name	Description
<b>Id</b>	The timer identifier (address).
<b>Hook</b>	The address and name of the function that is called when the timer expires.
<b>Time</b>	The current timer value (ticks) and in parenthesis the point in time when the timer expires.
<b>Period</b>	The timer time period (ticks).
<b>Active</b>	Shows whether the timer is active or not. 1 = Active 0 = Not active

Table 3 – embOS Timer Parameters

## RESOURCE SEMAPHORES

The **embOS Resource Semaphores** view displays detailed information regarding all available resource semaphores in the target system. The view is updated automatically each time the target execution is suspended.

There is one column for each type of semaphore parameter, and one row for each semaphore. If the value of any parameter for a particular semaphore has changed since the last time the debugger was suspended, the corresponding row will be highlighted in yellow.



Id	Owner	Use counter	Waiting tasks
0x20000eb4		0	
0x200011f0	0x200004b4 (HP Task)	1	0x20001490 (Task3), 0x200010c8 (Task4)
0x200007a4		0	
0x2000147c		0	

Figure 7 - embOS Resource Semaphores View

The available parameters are described in the table below:

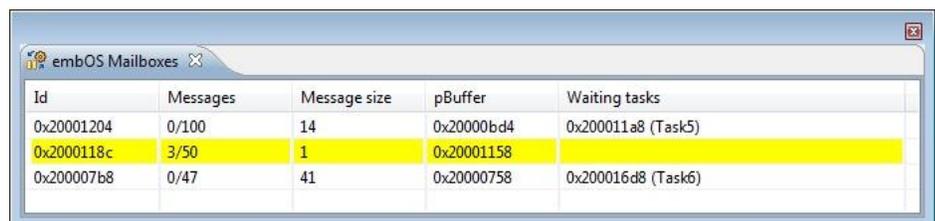
Column	Description
<b>Id</b>	The resource semaphore identifier (address).
<b>Owner</b>	The address (TCB) and name of the task currently owning the semaphore.
<b>Use counter</b>	The semaphore use counter. Keeps track of how many times the semaphore has been claimed by a task.
<b>Waiting tasks</b>	The address (TCB) and name of all tasks waiting on the semaphore.

Table 4 – embOS Resource Semaphore Parameters

## MAILBOXES

The **embOS Mailboxes** view displays detailed information regarding all available mailboxes in the target system. The view is updated automatically each time the target execution is suspended.

There is one column for each type of mailbox parameter, and one row for each mailbox. If the value of any parameter for a particular mailbox has changed since the last time the debugger was suspended, the corresponding row will be highlighted in yellow.



Id	Messages	Message size	pBuffer	Waiting tasks
0x20001204	0/100	14	0x20000bd4	0x200011a8 (Task5)
0x2000118c	3/50	1	0x20001158	
0x200007b8	0/47	41	0x20000758	0x200016d8 (Task6)

Figure 8 - embOS Mailboxes View

The available parameters are described in the table below:

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<b>Column</b>	<b>Description</b>
<b>Id</b>	The mailbox identifier (address).
<b>Messages</b>	The current number of messages and the maximum number of messages the mailbox can hold.
<b>Message size</b>	The size (in bytes) of a message item.
<b>pBuffer</b>	The address of the message buffer.
<b>Waiting tasks</b>	The address (TCB) and name of all tasks waiting on the mailbox.

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Table 5 – embOS Mailbox Parameters