



RTOS Debugger for pSOS+

680x0

683xx

ARM

PowerPC

X86

i386

- Improved support for the CMX debugger CMXBug
- Real time, non-intrusive display of CMX system resources
- CMX specific display of analyzer listing
- Statistic evaluation and graphic display of task run times
- Task related evaluation of function run times
- Statistic evaluation and graphic display of task states
- Task stack coverage
- PRACTICE functions for OS data
- CMX related pull-down menu

The TRACE32 System includes a configurable multitask debugger to provide symbolic debugging in real time operating systems. The software package contains a ready-to-run configuration for the pSOS+ Real Time Kernel from Integrated Systems.

Multitask Debugging on TRACE32 with pSOS+

Improved support for the pSOS+ Debugger pROBE+

pSOS+ provides a kernel debugger called pROBE+, which runs on the target. TRACE32 provides an interface to this debugger. I.e. you can control the debugger and view its outputs inside the TRACE32 surface. The communication is set up via the emulator's dual port memory, substituting the serial

interface routines of pROBE+. This technique provides high speed, transparent communication with the target without the use of any serial hardware or other target resources.

```

E::term T32OUT T32IN
Manual Break                                     Running: 'MEM2' -#00040000
-----
CR  =#20000000 XER =#00000000 LR  =#00032768
CTR = #00000000 MSR =#00009002
R0  =#005B1CC 000FC940 000637A8 00000000 00000002 0004BFF4 00000001 FFFFEFB
R8  =#00000000 00000000 00000000 000FC858 00000000 000637D8 00000000 00000000
R16=#00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
R24=#00000000 00000000 00000000 00000000 00000000 00000000 00000000 000F3E7C
IP  =#004B35C-0004B35C: 4E800020  bc1r      BO_ALWAYS , CR0_LT
pROBE+> qt

Name      TID    Prio  Mode  Status  Susp?  Parameters      Ticks
-----
'IDLE'   -#00010000  00  0000  Ready
'MEM1'   -#00030000  30  0000  Wkafter
'MEM2'   -#00040000  2F  0000  Running
'IO1'    -#00050000  1E  0002  Ready
'IO2'    -#00060000  1E  0002  Ready
'SRCE'   -#00070000  80  0000  Ready  YES
'SINK'   -#00080000  50  0000  Wkafter
'NUMS'   -#00090000  10  0002  Ready
'CHAR'   -#000A0000  10  0002  Ready
pROBE+>

```

Terminal window to the pSOS+ debugger pROBE+

Manual executed system calls

In pSOS+ on 68k it is possible to execute system calls, initiated with PRACTICE from the TRACE32 surface. This technique can be used, for example to

set specific signals, to suspend tasks or simulate some other special condition.

PRACTICE functions for OS data

The support includes extended PRACTICE functions for process specific data. E.g. the function "TASK.CONFIG(magic)" returns the address of the so called magic value.

Real time, non-intrusive display of pSOS+ system resources

The TRACE32 multitask debugger for pSOS+ provides display functions, closely mirroring the command set of pROBE+. The system resources configuration, tasks, objects, partitions, queues, regions and semaphores can be displayed. In addition, by using the emulators dual-port memory, the dis-

play of all these regions can be viewed non-intrusively in real time. The tables are updated permanently ("On The Fly"), without affecting the application at all. Moreover, these functions are still available, when the pROBE+ is not linked to your software.

The screenshot shows two windows from the TRACE32 debugger. The top window, titled 'E::TASK.QT', displays a list of tasks with columns for magic, name, id, prio, mode, status, susp, parameters, and ticks. The bottom window, titled 'E::TASK.QT 65588', provides a detailed view of the task with magic 00065588 and name MEM1. It shows various registers and variables, including initial pc, initial sp, asr addr, pending events, initial pri, initial mode, asr mode, and pending asr. It also indicates that there are no timers.

magic	name	id	prio	mode	status	susp	parameters	ticks
00065310	IDLE	00010000	00	0000	Ready			
00065588	MEM1	00030000	30	0000	Wkafter			00000002
000656C4	MEM2	00040000	2F	0000	Running			
00065800	I01	00050000	1E	0002	Ready			
0006593C	I02	00060000	1E	0002	Ready			
00065A78	SRCE	00070000	80	0000	Ready	YES		
00065BB4	SINK	00080000	50	0000	Wkafter			00000001
00065CF0	NUMS	00090000	10	0002	Ready			
00065E2C	CHAR	000A0000	10	0002	Ready			

Task list window and detailed window of one specific task

The screenshot shows a window titled 'E::TASK.QQ 664A4' displaying a task queue. The queue is currently empty. It shows the magic number 000664A4, name QMEM, and qid 000E0000. The queue length is 00000000 and the message queue length is 00000003. The message queue is empty.

magic	name	qid	tq len	mq len	mq limit	mgb	qtype	var
000664A4	QMEM	000E0000	00000000	00000003	none	Sys-pool	FIFO	No

Detailed view of one queue

The screenshot shows a window titled 'E::TASK.QR 0F3C7C' displaying a task region. The region is currently empty. It shows the magic number 000F3C7C, name RMEM, and rmid 000F0000. The address is 000F3C7C, length is 00000000, unit size is 00000000, and free space is 00000000. The largest task queue length is 00000000 and the do flag is NO. The queue type is FIFO.

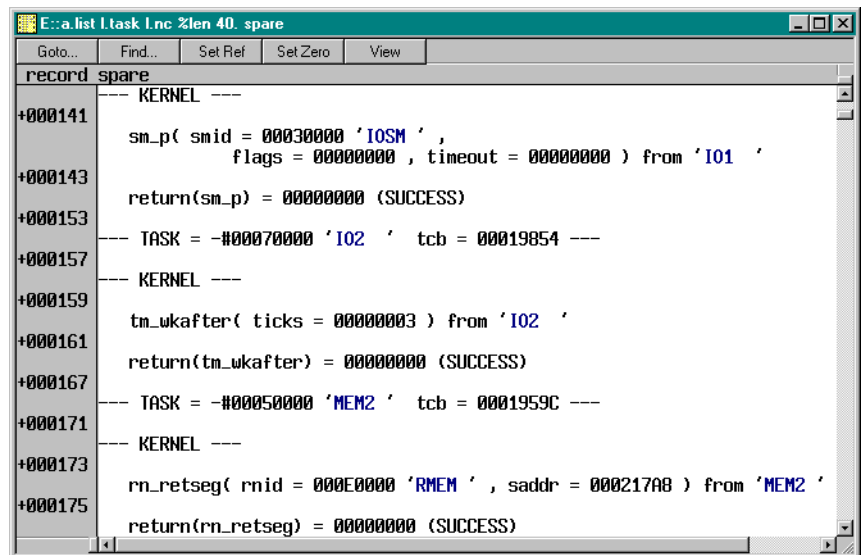
magic	name	rmid	address	length	unit size	free	largest	tq len	do
000F3C7C	RMEM	000F0000	000F3C7C	00000000	00000000	00000000	00000000	00000000	NO

Detailed view of one region

pSOS+ specific display of analyzer listing

The data recorded in the analyzer can be displayed and interpreted specific to the operating system. The task switches are displayed symbolically. In

68k systems, additionally the system calls, including their parameters, can be displayed symbolically.

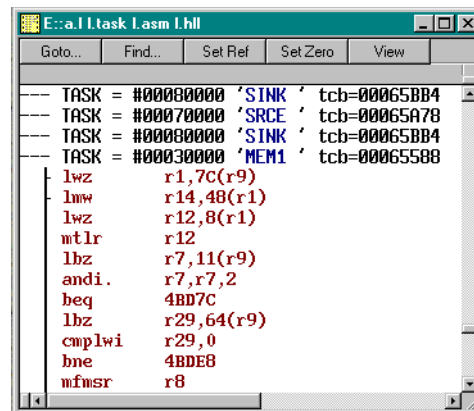


```

E::a.list l.task l.nc %len 40. spare
Goto... Find... Set Ref Set Zero View
record spare
--- KERNEL ---
+000141 sm_p( smid = 00030000 'IOSM' ,
+000143 flags = 00000000 , timeout = 00000000 ) from 'I01'
return(sm_p) = 00000000 (SUCCESS)
+000153 --- TASK = -#00070000 'I02' tcb = 00019854 ---
+000157 --- KERNEL ---
+000159 tm_wkafter( ticks = 00000003 ) from 'I02'
+000161 return(tm_wkafter) = 00000000 (SUCCESS)
+000167 --- TASK = -#00050000 'MEM2' tcb = 0001959C ---
+000171 --- KERNEL ---
+000173 rn_retseg( rmid = 000E0000 'RMEM' , saddr = 000217A8 ) from 'MEM2'
+000175 return(rn_retseg) = 00000000 (SUCCESS)

```

Analyzer listing, task switches and system calls



```

E::a.l.task l.asm l.hll
Goto... Find... Set Ref Set Zero View
--- TASK = #00080000 'SINK' tcb=00065BB4
--- TASK = #00070000 'SRCE' tcb=00065A78
--- TASK = #00080000 'SINK' tcb=00065BB4
--- TASK = #00030000 'MEM1' tcb=00065588
lwz r1,7C(r9)
lmw r14,48(r1)
lwz r12,8(r1)
mtlr r12
lbz r7,11(r9)
andi. r7,r7,2
beq 4BD7C
lbz r29,64(r9)
cmplwi r29,0
bne 4BDE8
mfmsr r8

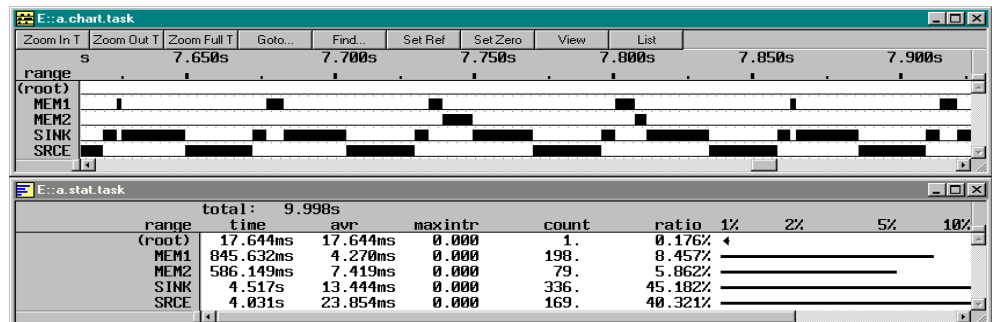
```

Analyzer listing, task selective recording, display of task switches and assembler mnemonics

Statistic evaluation and graphic display of task run times

The analyzer can calculate statistic tables of task run times and task switches. A graphical diagram shows

which task was active at a specific time, giving a clear view of the behaviour of the system.



Statistics and flow of tasks

Task related evaluation of function run times

The statistic and graphic evaluation of function calls and function run times can be done dependant to the actual running task. This is necessary, if dif-

ferent tasks call one single function at the same time, or if a task switch occurs in between the function.

record	func	address	cycle	d.l	ti.fore
+009871	SerialPollConsts+4C	P:000376C8	fetch	4E800020	20.750us
+009872	SerialDriver+0F4	P:00031D8C	fetch	4E800020	607.875us
+009873		D:00062C38	rd-long	00065BB4	19.875us
+009874		D:00062C38	rd-long	00065BB4	59.875us
TASK = #00070000 'SRCE' tcb=00065A78					
+009875		D:00062C38	wr-long	00065A78	142.875us
+009876		D:00062C38	rd-long	00065A78	303.625us
+009877	SerialDriver	P:00031C98	fetch	9421FFF8	32.000us
+009878	SerialPollConsts	P:0003767C	fetch	9421FFF8	23.375us
+009879	SerialPollConsts+4C	P:000376C8	fetch	4E800020	20.750us
+009880	SerialDriver+0F4	P:00031D8C	fetch	4E800020	277.875us
+009881	MainInHandler	P:00033A8C	fetch	9421FFF8	21.625us
+009882	DecIsr	P:00035CB4	fetch	9421FFF8	289.625us
+009883	DecIsr+60	P:00035D14	fetch	4E800020	18.250us
+009884	MainInHandler+0F4	P:00033B80	fetch	4E800020	86.375us

Analyzer listing, function call hierarchy and task switches

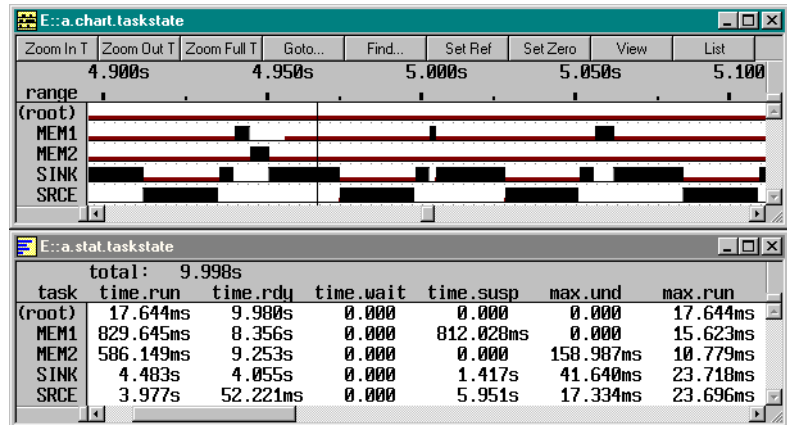
range	tree	time	min	max	avr
(root)@MEM1	(root)@MEM1	111.137ms	0.000	111.137ms	111.137ms
tn\MainInHandler@MEM1	MainInHandler@MEM1	16.235ms	329.500us	340.375us	331.336us
\ran\tick\DecIsr@MEM1	DecIsr@MEM1	14.272ms	289.625us	305.375us	291.270us
ecfg\SerialDriver@MEM1	SerialDriver@MEM1	6.638ms	76.125us	79.250us	76.301us
\SerialPollConsts@MEM1	SerialPollConsts@MEM1	2.039ms	23.375us	26.375us	23.445us
(root)@MEM2	(root)@MEM2	93.396ms	0.000	93.396ms	93.396ms
tn\MainInHandler@MEM2	MainInHandler@MEM2	15.325ms	329.500us	345.375us	333.157us
\ran\tick\DecIsr@MEM2	DecIsr@MEM2	13.491ms	289.625us	305.500us	293.282us
ecfg\SerialDriver@MEM2	SerialDriver@MEM2	3.663ms	76.125us	79.125us	76.312us
\SerialPollConsts@MEM2	SerialPollConsts@MEM2	1.125ms	23.375us	26.375us	23.437us

Statistics on function hierarchy, task related

Statistic evaluation and graphic display of task states

These tabular and graphical analyses of the status of tasks show the various states (i.e. running, ready, waiting, suspended and undefined) and times each task spent in each state. A graphical

view of the data can help to highlight prioritisation problems, critical paths etc.

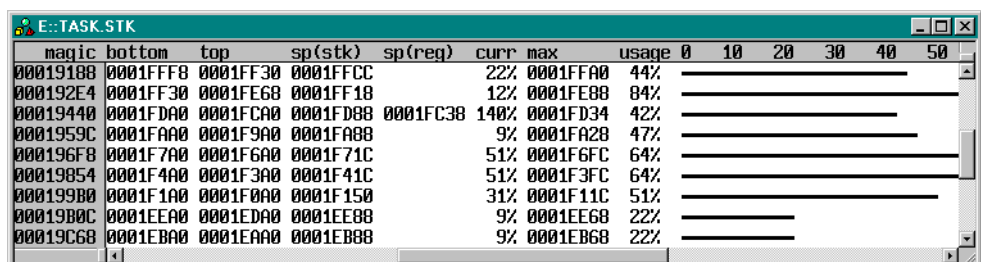


Statistics and flow of task states

Task Stack Coverage

In real time systems it is quite important to know, how much stack space each task consumes. For this purpose

a special window shows the current and the maximum usage of each separate task.

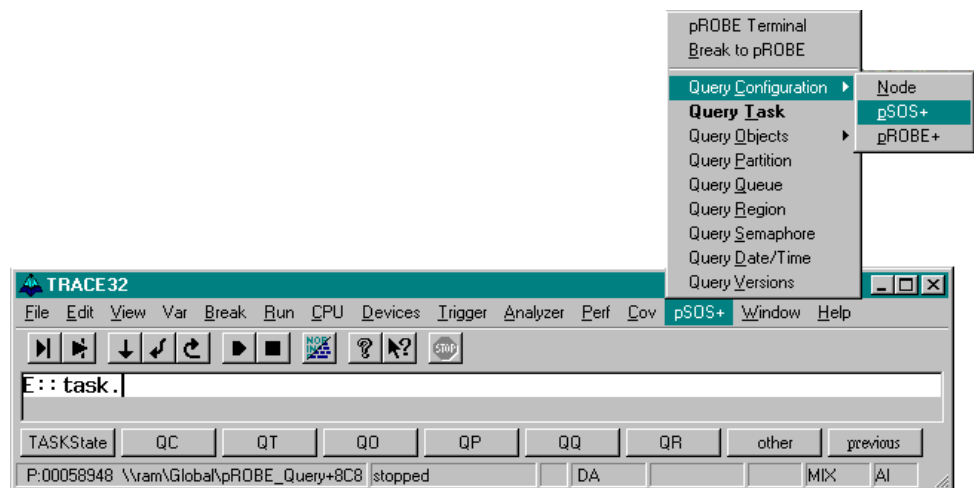


Task stack coverage window

pSOS+ related pull-down menu

Because the menu bar of the TRACE32 user interface can be fully customized, you can create a new pull down menu, including operating system specific commands. We deliver

pSOS+ support with an example for such specific menus, which provides fast access to the pSOS+ features.



TRACE32 with pSOS+ menu

Task selective debugging

On 68k processors (not CPU32), we offer you a task selective debugger. You can work on a specific task in the

foreground, while all other tasks, including the kernel, keeps on running in the background.

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