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## RTOS Debugger for OS-9

### 68K

- Hardware Independent System Terminal Emulation
- Real time, non-intrusive display of OS-9 system resources
- OS-9 specific display of analyzer listing
- Statistic evaluation and graphic display of process run times
- Process related evaluation of function run times
- Statistic evaluation and graphic display of process states
- Process stack coverage
- PRACTICE functions for OS data
- OS-9 related pull-down menu

The TRACE32 System includes a configurable multitask debugger to provide symbolic debugging in real time operating systems. Our software package contains a ready-to-run configuration for the OS-9 Real Time Kernel from Microware Systems Corporation.

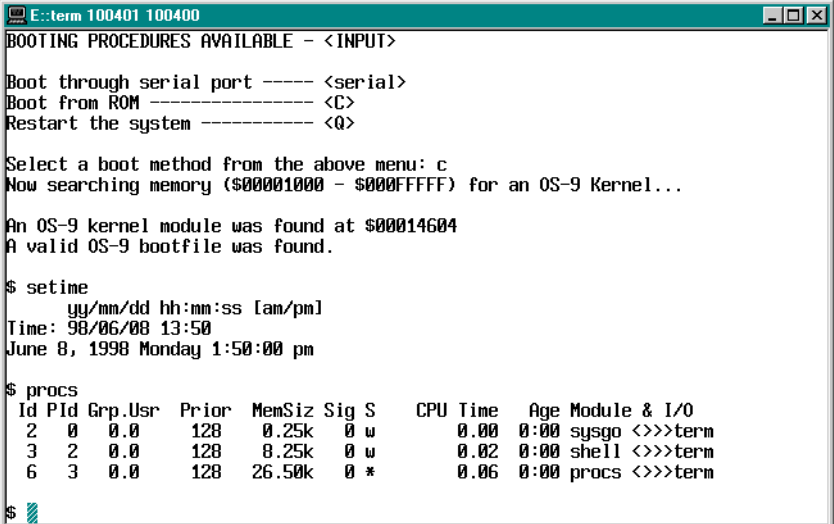
In close cooperation with Microware, we built a special multitask support for OS-9 on Motorola 68k processors. This leaflet will guide you through the additional implemented features in TRACE32, to do an effective debugging on OS-9 systems.

## Multitask Debugging on TRACE32 with OS-9

### Hardware Independent System Terminal Emulation

To control the system, OS-9 is accessed through a system terminal, which is normally connected via a serial or ethernet line. TRACE32 provides an alternate interface, without using any hardware needs. I.e. you can control the system and view its outputs inside the TRACE32 surface. The com-

munication is set up via the emulator's dual port memory, substituting the serial or ethernet lines of the terminal. This technique provides high speed, transparent communication with the target without the use of any serial hardware or other target resources.



```

E::term 100401 100400
BOOTING PROCEDURES AVAILABLE - <INPUT>
Boot through serial port ---- <serial>
Boot from ROM ----- <C>
Restart the system ----- <Q>

Select a boot method from the above menu: c
Now searching memory ($00001000 - $000FFFFF) for an OS-9 Kernel...

An OS-9 kernel module was found at $00014604
A valid OS-9 bootfile was found.

$ setime
      yy/mm/dd hh:mm:ss [am/pm]
Time: 98/06/08 13:50
June 8, 1998 Monday 1:50:00 pm

$ procs
Id Pid Grp.Usr  Prior  MemSiz Sig S   CPU Time   Age Module & I/O
 2  0  0.0    128   0.25k  0 w    0.00  0:00 sysgo <>>>term
 3  2  0.0    128   8.25k  0 w    0.02  0:00 shell <>>>term
 6  3  0.0    128  26.50k  0 *    0.06  0:00 procs <>>>term

$

```

Terminal window to the OS-9 system shell

### PRACTICE functions for OS data.

The support includes extended PRAC- TICE functions for process specific data. E.g. the function "TASK.CON-

FIG(magic)" returns the address of the so called magic value.

## Real time, non-intrusive display of OS-9 system resources

The TRACE32 multitask debugger for OS-9 provides display functions, closely mirroring the command set of the OS-9 system shell. The system resources date, processes, modules, devices, events, queues, alarms and IRQs can be displayed. In addition, by using the emulators dual-port memory,

the display 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 appropriate modules are not linked to your software.

The screenshot shows three overlapping windows from the TRACE32 debugger:

- E::TASK.MDir**: A table listing system modules with columns for address, size, owner, perm, type, revs, ed#, lnk, and name. Visible entries include cs1, del, dir, fixmod, free, load, debug, dhry, and dhry.stb.
- E::TASK.Date**: A table showing system date and time information with columns for date, time, and ticks. The date is 1998/ 6/ 8 and time is 13:55:20.
- E::TASK.Procs**: A table listing running processes with columns for magic, id, pid, grp, usr, prior, sig, s, data, module, and name. Visible entries include kernel, sysgo, shell, and dhry.

Module list, process list and date

## OS-9 specific display of analyzer listing

The data recorded in the analyzer can be displayed and interpreted specific to

the operating system. The process switches can be displayed symbolically.

The screenshot shows the **E::Analyzer.List List.Task List.Mix** window. The top part displays a list of processes with their IDs and magic numbers, and the bottom part shows assembly code instructions.

```

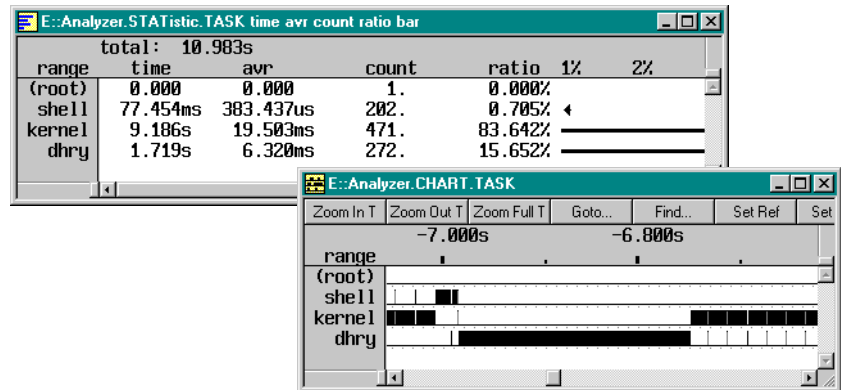
--- PROCESS id = 3., magic = 001FD250, shell
--- PROCESS id = 1., magic = 00105B00, kernel
--- PROCESS id = 3., magic = 001FD250, shell
--- PROCESS id = 1., magic = 00105B00, kernel
--- PROCESS id = 3., magic = 001FD250, shell
--- PROCESS id = 11., magic = 001FA550, dhry
pea      80
jmp      14AA8
movem.l [d0-d7,a0-a6],-(a7)
movec   vbr,a6
movea.l (a6),a6
movea.l 4C(a6),a4
clr.b   41(a7)
movea.l 42(a7),a5
move.w  (a5),d7
addq.l  #2,42(a7)
cmpi.w  #100,d7
bcc     14BD8
  
```

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

## Statistic evaluation and graphic display of process run times

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

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

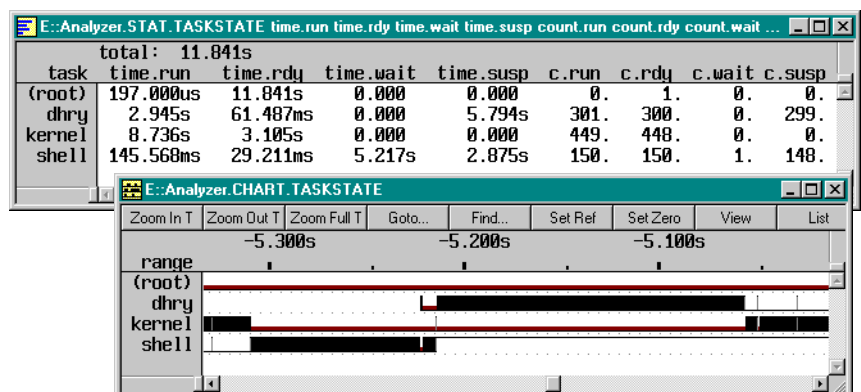


Statistics and flow of processes

## Statistic evaluation and graphic display of process states

These tabular and graphical analyses of the status of processes 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.

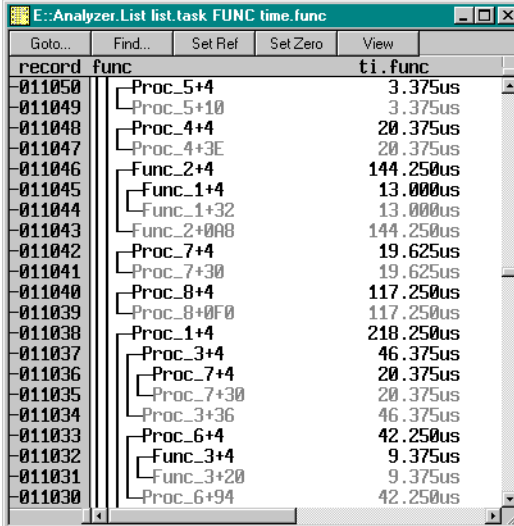


Statistics and flow of process states

## Process related evaluation of function run times

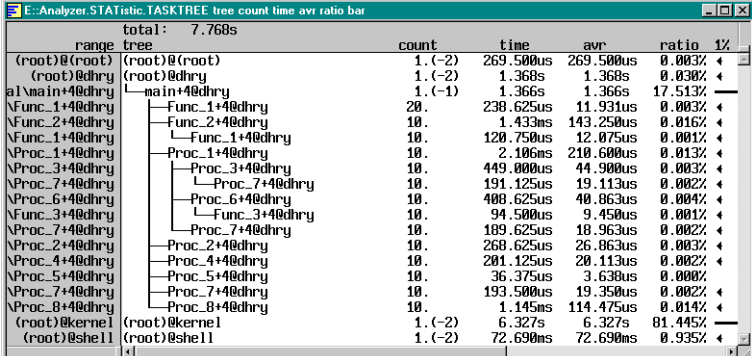
The statistic and graphic evaluation of function calls and function run times can be done dependant to the actual running process. This is necessary, if

different processes call one single function at the same time, or if a process switch occurs in between the function.



record	func	ti.func
-011050	Proc_5+4	3.375us
-011049	Proc_5+10	3.375us
-011048	Proc_4+4	20.375us
-011047	Proc_4+3E	20.375us
-011046	Func_2+4	144.250us
-011045	Func_1+4	13.000us
-011044	Func_1+32	13.000us
-011043	Func_2+0A8	144.250us
-011042	Proc_7+4	19.625us
-011041	Proc_7+30	19.625us
-011040	Proc_8+4	117.250us
-011039	Proc_8+0F0	117.250us
-011038	Proc_1+4	218.250us
-011037	Proc_3+4	46.375us
-011036	Proc_7+4	20.375us
-011035	Proc_7+30	20.375us
-011034	Proc_3+36	46.375us
-011033	Proc_6+4	42.250us
-011032	Func_3+4	9.375us
-011031	Func_3+20	9.375us
-011030	Proc_6+94	42.250us

Analyzer listing, function call hierarchy



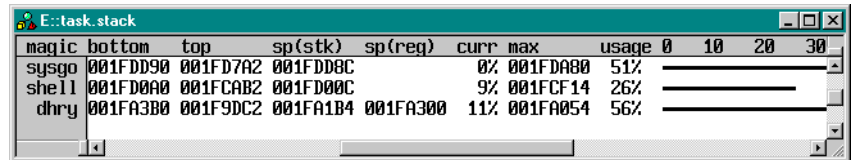
range	tree	count	time	avr	ratio	1%
total: 7.768s						
(root)@root	(root)@root	1.(-2)	269.500us	269.500us	0.003%	
(root)@dhry	(root)@dhry	1.(-2)	1.368s	1.368s	0.030%	
main+4@dhry	main+4@dhry	1.(-1)	1.366s	1.366s	17.513%	
NFunc_1+4@dhry	Func_1+4@dhry	20.	238.625us	11.931us	0.003%	
NFunc_2+4@dhry	Func_2+4@dhry	10.	1.433ms	143.250us	0.016%	
NFunc_1+4@dhry	Func_1+4@dhry	10.	120.750us	12.075us	0.001%	
NProc_3+4@dhry	Proc_3+4@dhry	10.	2.106ms	210.600us	0.013%	
NProc_7+4@dhry	Proc_7+4@dhry	10.	449.000us	44.900us	0.003%	
NProc_6+4@dhry	Proc_6+4@dhry	10.	191.125us	19.113us	0.002%	
NFunc_3+4@dhry	Func_3+4@dhry	10.	408.625us	40.863us	0.004%	
NProc_7+4@dhry	Proc_7+4@dhry	10.	94.500us	9.450us	0.001%	
NProc_2+4@dhry	Proc_2+4@dhry	10.	189.625us	18.963us	0.002%	
NProc_4+4@dhry	Proc_4+4@dhry	10.	268.625us	26.863us	0.003%	
NProc_5+4@dhry	Proc_5+4@dhry	10.	201.125us	20.113us	0.002%	
NProc_7+4@dhry	Proc_7+4@dhry	10.	36.375us	3.638us	0.000%	
NProc_8+4@dhry	Proc_8+4@dhry	10.	193.500us	19.350us	0.002%	
(root)@kernel	(root)@kernel	1.(-2)	1.145ms	114.475us	0.014%	
(root)@shell	(root)@shell	1.(-2)	6.327s	6.327s	81.445%	
(root)@shell	(root)@shell	1.(-2)	72.690ms	72.690ms	0.935%	

Statistics on function hierarchy, process related

## Process Stack Coverage

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

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



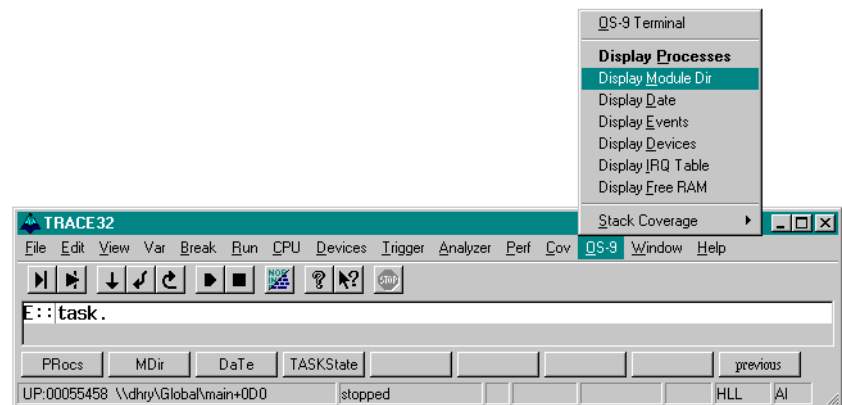
magic	bottom	top	sp(stk)	sp(reg)	curr	max	usage	0	10	20	30
sysgo	001FD090	001FD7A2	001FD08C		0%	001FD080	51%				
shell	001FD0A0	001FCAB2	001FD00C		9%	001FCF14	26%				
dhry	001FA3B0	001F9DC2	001FA1B4	001FA300	11%	001FA054	56%				

Process stack coverage window

## OS-9 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 sys-

tem specific commands. We deliver OS-9 support with an example for such specific menus, which provides fast access to the OS-9 features.



TRACE32 with OS-9 menu

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## Disclaimer

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