



Sysstat tool suite



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1 Article purpose

This article provides the basic information needed to start using the **sysstat**^[1] tool suite providing a collection of Linux tools:

- main tools: **iostat**, **mpstat** and **pidstat**
- others tools: **sar**, **sadf**

2 Introduction

The following table provides a brief description of the tool, as well as its availability depending on the software packages:



: this tool is either present (ready to use or to be activated), or can be integrated and activated on the software package.



: this tool is not present and cannot be integrated, or it is present but cannot be activated on the software package.



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™		
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package
		<p>The sysstat ^[1] tool suite contains utilities to monitor the system performance and usage activity.</p> <p>It contains various utilities, common to many commercial Unix distributions, as well as tools that can be scheduled (via a scheduler such as cron) to collect and</p>						



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™		
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package
		historize performance and activity data: <ul style="list-style-type: none">• i						



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™		
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package
		to provide statistics about this statistics collection device's accuracy and performance.						



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™		
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package
		<ul style="list-style-type: none">• n p s t a t : r e p c r t s i n c i v i c u a l c r c c n b i n e c p r c c e s s c r						



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™		
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package
		el at te cs ta ti st ic s . • p ic st at : re p c r t s s t a t i s t i c s f c						



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™		
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package
		rtLinux User tasks (: / , CF L , n e n c r y , e t c .						



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™		
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package
sysstat	Monitoring	• s a r : c c l l e c t s , r e p o r t s a n d s a v e s s y s t e m a c t i v i t y i n	✓	✓	✓	✗	✗	✗



Name	Tool		STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™		
	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package
	tools	f c r n a t i c n (C F U , n e n c r y , c i s k s , i n t e r r u p t s , n e t w o r k						



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™			
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package	
		k i n t e r f a c e s : T T Y : k e r n e l t a b l e s : e t c .) • s a c f : c i s p l							



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™		
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package
		analysis of data accuracy of collected information, user interaction, performance, statistics (CSV, ...)						



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™			
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package	
		M L , J S (N , e t c ,) . T h i s c o n n a n c c a n a l s c t e u s e c t c e x c h							



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™		
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package
		an n g e c a t a v i t h c t h e r p r c g r a n s c r i p t c o n f i g u r a p h s i l l u s						



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™		
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package
		targeting the development of applications for STM32MPU devices						



Tool			STM32MPU Embedded Software distribution			STM32MPU Embedded Software distribution for Android™		
Name	Category	Purpose	Starter Package	Developer Package	Distribution Package	Starter Package	Developer Package	Distribution Package
		... n g s V C (s c a l a b l e v e c t c r C r a p h i c s) f c r n a t .						



3 Installing the trace and debug tool on the target board

3.1 Using the STM32MPU Embedded Software distribution

The **Sysstat** tools are installed by default (/usr/bin/) and ready to be used with all STM32MPU OpenSTLinux Packages.

It is integrated in weston image distribution through meta-st package: `meta-st/meta-st-openstlinux/recipes-st/packagegroups/packagegroup-framework-tools.bb`.

```
RDEPENDS_packagegroup-framework-tools-core = "\
grep \
...
e2fsprogs \
e2fsprogs-resize2fs \
sysstat \
minicom \
...
"
```

4 Getting started

4.1 Using iostat

The **iostat** command is used for monitoring system input/output device loading by observing the time the devices are active in relation to their average transfer rates. The **iostat** command generates reports that can be used to change system configuration to better balance the input/output load between physical disks (*Source: official website^[2]*).

`/proc` filesystem must be mounted for **iostat** to work. This is the case on STM32MPU Embedded Software.

- Command line options. Please refer to manual page^[2] for details.

```
Board $> iostat --help
Usage: iostat [ options ] [ <interval> [ <count> ] ]
Options are:
[ -c ] [ -d ] [ -h ] [ -k | -m ] [ -N ] [ -s ] [ -t ] [ -V ] [ -x ] [ -y ] [ -z ]
[ -j { ID | LABEL | PATH | UUID | ... } ] [ --human ] [ -o JSON ]
[ [ -H ] -g <group_name> ] [ -p [ <device> [,...] | ALL ] ]
[ <device> [...] | ALL ]
```

- Basic command to display a single history since boot report for all CPU and devices:



```
Board $> iostat
Linux 4.14.48 (stm32mp1)          06/18/18          _armv7l_          (2 CPU)

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           0.11    0.00   0.60   0.05   0.00   99.25

Device            tps    kB_read/s    kB_wrtn/s    kB_read    kB_wrtn
mmcblk0           0.59         5.44         0.85       58539      9128
mmcblk1           0.03         0.31         0.00        3320         0
mmcblk1boot1     0.00         0.01         0.00         104         0
mmcblk1boot0     0.00         0.01         0.00         104         0
```

Note: by adding *<interval>* and *<count>* parameters, you can have a regular refresh during a given time interval:

```
Board $> iostat <interval> <count>
```

- Complex command to display statistics for block devices and all their partitions that are used by the system:

```
Board $> iostat -N -p ALL
Linux 4.14.48 (stm32mp1)          06/18/18          _armv7l_          (2 CPU)

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           0.11    0.00   0.61   0.05   0.00   99.23

Device            tps    kB_read/s    kB_wrtn/s    kB_read    kB_wrtn
ram0              0.00         0.00         0.00         0         0
ram1              0.00         0.00         0.00         0         0
ram2              0.00         0.00         0.00         0         0
ram3              0.00         0.00         0.00         0         0
ram4              0.00         0.00         0.00         0         0
ram5              0.00         0.00         0.00         0         0
ram6              0.00         0.00         0.00         0         0
ram7              0.00         0.00         0.00         0         0
ram8              0.00         0.00         0.00         0         0
ram9              0.00         0.00         0.00         0         0
ram10             0.00         0.00         0.00         0         0
ram11             0.00         0.00         0.00         0         0
ram12             0.00         0.00         0.00         0         0
ram13             0.00         0.00         0.00         0         0
ram14             0.00         0.00         0.00         0         0
ram15             0.00         0.00         0.00         0         0
loop0             0.00         0.00         0.00         0         0
loop1             0.00         0.00         0.00         0         0
loop2             0.00         0.00         0.00         0         0
loop3             0.00         0.00         0.00         0         0
loop4             0.00         0.00         0.00         0         0
loop5             0.00         0.00         0.00         0         0
loop6             0.00         0.00         0.00         0         0
loop7             0.00         0.00         0.00         0         0
mtdblock0        0.00         0.00         0.00         0         0
mtdblock1        0.00         0.00         0.00         0         0
mtdblock2        0.00         0.00         0.00         0         0
mtdblock3        0.00         0.00         0.00         0         0
mtdblock4        0.00         0.00         0.00         0         0
mtdblock5        0.00         0.00         0.00         0         0
mtdblock6        0.00         0.00         0.00         0         0
mtdblock7        0.00         0.00         0.00         0         0
mmcblk0          0.66         6.02         0.94       58539      9128
mmcblk0p1        0.00         0.04         0.00         344         0
mmcblk0p2        0.00         0.02         0.00         220         0
mmcblk0p3        0.00         0.01         0.00         72          0
```



mmcblk0p4	0.03	0.21	0.00	2065	1
mmcblk0p5	0.60	5.46	0.94	53175	9126
mmcblk0p6	0.02	0.21	0.00	2087	1
mmcblk1	0.04	0.34	0.00	3320	0
mmcblk1p1	0.00	0.01	0.00	64	0
mmcblk1p2	0.00	0.00	0.00	44	0
mmcblk1p3	0.00	0.00	0.00	44	0
mmcblk1p4	0.01	0.11	0.00	1032	0
mmcblk1p5	0.01	0.11	0.00	1032	0
mmcblk1boot1	0.00	0.01	0.00	104	0
mmcblk1boot0	0.00	0.01	0.00	104	0

4.2 Using mpstat

The **mpstat** command writes to standard output activities for each available processor, processor 0 being the first one (*Source: official website^[3]*).

- Command line options. Please refer to manual page^[3] for details.

```
Board $> mpstat --help
Usage: mpstat [ options ] [ <interval> [ <count> ] ]
Options are:
[ -A ] [ -n ] [ -u ] [ -V ] [ -I { SUM | CPU | SCPU | ALL } ]
[ -N { <node_list> | ALL } ] [ -o JSON ] [ -P { <cpu_list> | ON | ALL } ]
```

- Basic command to display three reports of global statistics for all processors at one second intervals:

```
Board $> mpstat 1 3
Linux 4.14.48 (stm32mp1)          06/18/18          _armv7l_          (2 CPU)

15:45:26   CPU   %usr  %nice  %sys %iowait  %irq  %soft  %steal  %guest  %
gnice  %idle
15:45:27   all   0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00 100.00
15:45:28   all   0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00 100.00
15:45:29   all   0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00 100.00
Average:   all   0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00 100.00
```

- Other command to display three reports of statistics for all processors at one second intervals:

```
Board $> mpstat -P ALL 1 3
Linux 4.14.48 (stm32mp1)          06/18/18          _armv7l_          (2 CPU)

15:48:32   CPU   %usr  %nice  %sys %iowait  %irq  %soft  %steal  %guest  %
gnice  %idle
15:48:33   all   0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00 100.00
15:48:33   0     0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00 100.00
15:48:33   1     0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00
0.00 100.00

15:48:33   CPU   %usr  %nice  %sys %iowait  %irq  %soft  %steal  %guest  %
gnice  %idle
15:48:34   all   0.00  0.00  0.50  0.00  0.00  0.00  0.00  0.00  0.00
```



```

0.00 99.50
15:48:34 0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 100.00
15:48:34 1 0.00 0.00 0.99 0.00 0.00 0.00 0.00 0.00 0.00
0.00 99.01

15:48:34 CPU %usr %nice %sys %iowait %irq %soft %steal %guest %
gnice %idle
15:48:35 all 0.00 0.00 0.50 0.00 0.00 0.00 0.00 0.00 0.00
0.00 99.50
15:48:35 0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 100.00
15:48:35 1 0.00 0.00 0.99 0.00 0.00 0.00 0.00 0.00 0.00
0.00 99.01

Average: CPU %usr %nice %sys %iowait %irq %soft %steal %guest %
gnice %idle
Average: all 0.00 0.00 0.33 0.00 0.00 0.00 0.00 0.00 0.00
0.00 99.67
Average: 0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
0.00 100.00
Average: 1 0.00 0.00 0.66 0.00 0.00 0.00 0.00 0.00 0.00
0.00 99.34

```

4.3 Using pidstat

The **pidstat** command is used for monitoring individual tasks currently being managed by the Linux kernel (*Source: official website^[4]*).

- Command line options. Please refer to manual page^[4] for details.

```

Board $> pidstat --help
Usage: pidstat [ options ] [ <interval> [ <count> ] ]
Options are:
[ -d ] [ -h ] [ -I ] [ -l ] [ -R ] [ -r ] [ -s ] [ -t ] [ -U [ <username> ] ]
[ -u ] [ -V ] [ -v ] [ -w ] [ -C <command> ] [ -G <process_name> ] [ --human ]
[ -p { <pid> [,...] | SELF | ALL } ] [ -T { TASK | CHILD | ALL } ]

```

- Basic command to display CPU statistic for all tasks:

```

Board $> pidstat
Linux 4.14.48 (stm32mp1)          06/18/18          _armv7l_          (2 CPU)

15:58:48  UID      PID      %usr  %system  %guest  %wait   %CPU   CPU   Command
15:58:48  0         1        0.03   0.12    0.00    0.05    0.14   0     systemd
15:58:48  0         2        0.00   0.00    0.00    0.00    0.00   1     kthreadd
15:58:48  0         7        0.00   0.01    0.00    0.01    0.01   0     ksoftirqd/0
15:58:48  0         8        0.04   0.00    0.00    0.02    0.04   1     rcu_preempt
15:58:48  0        15        0.00   0.01    0.00    0.00    0.01   1     ksoftirqd/1
15:58:48  0        18        0.00   0.00    0.00    0.00    0.00   1     kdevtmpfs
15:58:48  0        19        0.00   0.00    0.00    0.00    0.00   0     kworker/0:1
15:58:48  0        72        0.00   0.00    0.00    0.00    0.00   0     irq/82-mfx
15:58:48  0        77        0.00   0.06    0.00    0.01    0.06   1     mmcqd/0
15:58:48  0        83        0.00   0.00    0.00    0.00    0.00   0     mmcqd/1
15:58:48  0        85        0.00   0.00    0.00    0.00    0.00   0     mmcqd/lboot0
15:58:48  0        86        0.00   0.00    0.00    0.00    0.00   0     mmcqd/lboot1
15:58:48  0        91        0.00   0.63    0.00    0.00    0.63   0     kmemleak
15:58:48  0        93        0.00   0.00    0.00    0.00    0.00   0     kworker/0:3
15:58:48  0        95        0.00   0.01    0.00    0.00    0.01   1     irq/73-
5a001000

```



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15:58:48	0	98	0.00	0.00	0.00	0.00	0.00	0	kworker/0:1H
15:58:48	0	99	0.00	0.00	0.00	0.00	0.00	1	kworker/1:1H
15:58:48	0	100	0.00	0.00	0.00	0.00	0.00	0	jbd2
15:58:48	0	150	0.01	0.02	0.00	0.02	0.02	0	systemd- journal
15:58:48	0	189	0.01	0.01	0.00	0.03	0.01	1	systemd- udevd
15:58:48	0	201	0.00	0.00	0.00	0.00	0.00	0	kworker/u4:2
15:58:48	993	203	0.01	0.09	0.00	0.00	0.11	1	systemd- timesyn
15:58:48	998	273	0.09	0.04	0.00	0.02	0.14	0	avahi-daemon
15:58:48	0	276	0.00	0.00	0.00	0.00	0.00	1	systemd- logind
15:58:48	0	277	0.00	0.00	0.00	0.00	0.00	1	klogd
15:58:48	996	279	0.00	0.00	0.00	0.00	0.00	0	dbus-daemon
15:58:48	0	301	0.00	0.00	0.00	0.00	0.00	1	syslogd
15:58:48	992	312	0.00	0.00	0.00	0.00	0.00	1	systemd- network
15:58:48	0	314	0.00	0.00	0.00	0.00	0.00	0	weston- launch
15:58:48	0	319	0.01	0.01	0.00	0.00	0.01	1	weston
15:58:48	991	324	0.00	0.00	0.00	0.00	0.00	0	systemd- resolve
15:58:48	0	327	0.03	0.03	0.00	0.00	0.05	0	tcf-agent
15:58:48	0	332	0.00	0.00	0.00	0.00	0.00	1	login
15:58:48	0	333	0.00	0.00	0.00	0.00	0.00	0	agetty
15:58:48	997	334	0.00	0.00	0.00	0.00	0.00	1	named
15:58:48	0	340	0.00	0.00	0.00	0.00	0.00	0	weston- keyboard
15:58:48	0	342	0.01	0.00	0.00	0.00	0.01	0	weston- desktop-
15:58:48	0	345	0.00	0.01	0.00	0.00	0.01	1	systemd
15:58:48	0	350	0.00	0.00	0.00	0.00	0.00	0	sh
15:58:48	0	374	0.02	0.00	0.00	0.00	0.02	1	kworker/1:1
15:58:48	0	420	0.00	0.00	0.00	0.00	0.00	1	kworker/1:0
15:58:48	0	423	0.00	0.00	0.00	0.00	0.00	1	kworker/1:2
15:58:48	0	424	0.00	0.00	0.00	0.00	0.00	1	pidstat

- Basic command to display 3 reports of CPU statistics for every active task in the system at one second intervals.:

```
Board $> pidstat 1 3
Linux 4.14.48 (stm32mp1)      06/18/18      _armv7l_      (2 CPU)

15:59:56  UID      PID      %usr  %system  %guest  %wait    %CPU   CPU   Command
15:59:57  0        426     3.67   4.59    0.00    0.00    8.26   1    pidstat

15:59:57  UID      PID      %usr  %system  %guest  %wait    %CPU   CPU   Command
15:59:58  0        426     0.99   6.93    0.00    0.00    7.92   1    pidstat

15:59:58  UID      PID      %usr  %system  %guest  %wait    %CPU   CPU   Command
15:59:59  0        15      0.00   0.99    0.00    0.00    0.99   1    ksoftirqd/1
15:59:59  0        426     1.98   5.94    0.00    0.99    7.92   1    pidstat

Average:  UID      PID      %usr  %system  %guest  %wait    %CPU   CPU   Command
Average:  0        15      0.00   0.32    0.00    0.00    0.32   -    ksoftirqd/1
Average:  0        426     2.25   5.79    0.00    0.32    8.04   -    pidstat
```

- Basic command to report statistics for a specific process with all associated threads:



```
Board $> pidstat -t -p `pidof weston-launch`
Linux 4.14.48 (stm32mp1)          06/18/18          _armv7l_          (2 CPU)

16:00:59      UID      TGID      TID      %usr %system %guest  %wait  %CPU  CPU
Command
16:00:59          0        314        -      0.00  0.00   0.00   0.00   0.00   0
weston-launch
16:00:59          0          -        314      0.00  0.00   0.00   0.00   0.00   0
|__weston-launch
```

4.4 Using sar

The **sar** command collects, reports, or saves system activity information (*Source: official website^[5]*).

- Command line options. Please refer to manual page^[5] for details.

```
Board $> sar --help
Usage: sar [ options ] [ <interval> [ <count> ] ]
Options are:
[ -A ] [ -B ] [ -b ] [ -C ] [ -D ] [ -d ] [ -F [ MOUNT ] ] [ -H ] [ -h ]
[ -p ] [ -q ] [ -r [ ALL ] ] [ -S ] [ -t ] [ -u [ ALL ] ] [ -V ]
[ -v ] [ -W ] [ -w ] [ -y ] [ --human ] [ --sadc ]
[ -I { <int_list> | SUM | ALL } ] [ -P { <cpu_list> | ALL } ]
[ -m { <keyword> [,...] | ALL } ] [ -n { <keyword> [,...] | ALL } ]
[ -j { ID | LABEL | PATH | UUID | ... } ]
[ -f [ <filename> ] | -o [ <filename> ] | -[0-9]+ ]
[ -i <interval> ] [ -s [ <hh:mm[:ss]> ] ] [ -e [ <hh:mm[:ss]> ] ]
```

Main used options for activity report:

sar option	Description
-u	CPU utilization of ALL CPUs
-P	CPU utilization of individual CPU or core
-r	Statistics for memory utilization
-S	Statistics for swap space utilization
-b	Statistics for I/O and transfer rate
-F	Statistics for currently mounted filesystems
-d	Activities for individual Block Device I/O
-w	Activities for task creation and system switching
-q	Information about task run queue and load average
-n	Statistics for network activities
-B	Report paging statistics

4.4.1 Interactive mode

Two modes for using **sar**:

- Interactive mode (detailed here): **sar** is launched by the user using a command line on the console
- Non-interactive mode (detailed in *To go further chapter*): **sar** is launched by a script (`/usr/lib/sa/sa1`, which is part of sysstat tools suite) that can be managed by a scheduler daemon like `cron`^[6]

Interactive mode is used as soon as [`<interval>` [`<count>`]] parameters are present, otherwise non-interactive mode is used. In interactive mode, the command is executed immediately by taking into account the values.

As example, for getting CPU utilization of ALL CPUs, 5 times every 3s:

```
Board $> sar -u 3 5
Linux 4.14.48 (stm32mp1)          06/18/18          _armv7l_          (2 CPU)

12:30:20      CPU      %user    %nice    %system  %iowait  %steal   %idle
12:30:23      all      0.00     0.00     0.50     0.00     0.00    99.50
12:30:26      all      0.00     0.00     0.50     0.00     0.00    99.50
12:30:29      all      0.17     0.00     0.17     0.00     0.00    99.67
12:30:32      all      0.66     0.00     2.49     0.00     0.00    96.84
12:30:35      all      0.33     0.00     3.16     0.00     0.00    96.51
Average:      all      0.23     0.00     1.36     0.00     0.00    98.41
```

`-o <filename>` can be used to store information into a file in binary format, which can be later read with `sadf`.

4.5 Using `sadf`

The `sadf` command is used for displaying the contents of data files created by the `sar` command (Source: official website^[7]): `sar` in interactive mode by using `-o` option, or file created in non-interactive mode in `/var/log/sa/` directory.

- Command line options. Please refer to manual page^[7] for details.

```
Board $> sadf --help
Usage: sadf [ options ] [ <interval> [ <count> ] ] [ <datafile> | -[0-9]+ ]
Options are:
[ -C ] [ -c | -d | -g | -j | -p | -r | -x ] [ -H ] [ -h ] [ -T | -t | -U ] [ -V ]
[ -O <opts> [,...] ] [ -P { <cpu> [,...] | ALL } ]
[ -s [ <hh:mm[:ss]> ] ] [ -e [ <hh:mm[:ss]> ] ]
[ -- <sar_options> ]
```

Main used format for activity report:

sadf option	Description
-d	Print the contents of the data file in a format that can be easily ingested by a relational database system. The output consists of fields separated by a semicolon (i.e. MSExcel)
	From v11.3.1 Print the contents of the data file in SVG (Scalable Vector Graphics) format. Use the following syntax:



sadf option	Description
-g	Board \$> sadf -g <i>sar_datafile</i> [-- <sar_options>] > output.svg Take care about giving the right sar_options, i.e. when checking for memory utilization, "-- -r" have to be given in the command.
-j	Print the contents of the data file in JSON (JavaScript Object Notation) format
-t	Display timestamp in the original local time of the data file creator instead of UTC (Coordinated Universal Time)
-x	Print the contents of the data file in XML format

5 To go further

5.1 Using sar non-interactive mode

In non-interactive mode a scheduler daemon is used to plan activity record.

Recommended environment is using cron^[6] daemon and sysstat script `/usr/lib/sa/sa1` present when the tool suite is installed. Please refer to **sa1** web page^[8] for detail.

cron is not installed by default, and is part of cronie yocto package to be integrated:

- With the Distribution Package of the STM32MPU Embedded Software distribution (*st-image-weston*):

```
PC $> echo 'IMAGE_INSTALL_append += "cronie"' >> meta-st/meta-st-openstlinux/recipes-st/images/st-image-weston.bbappend
```

Then rebuild the `st-image-weston` image.

5.2 Format datas to be imported in MS-Excel

Example using sar command to get ALL CPUs usage, format datas into semicolon text, then make a graph using MS-Excel:

- Record CPUs usage data (10 iterations every 3-second interval)

```
Board $> sar -u 3 10 -o test
Linux 4.14.48 (stm32mp1)      06/18/18      _armv7l_      (2 CPU)

13:03:26      CPU      %user      %nice      %system      %iowait      %steal      %idle
13:03:29      all      4.82      0.00      3.16      0.66      0.00      91.36
13:03:32      all      3.82      0.00      3.49      0.00      0.00      92.69
13:03:35      all      18.77      0.00      7.81      5.81      0.00      67.61
13:03:38      all      11.96      0.00      4.98      0.00      0.00      83.06
13:03:41      all      36.21      0.00      8.97      0.00      0.00      54.82
13:03:44      all      1.50      0.00      1.66      0.83      0.00      96.01
```

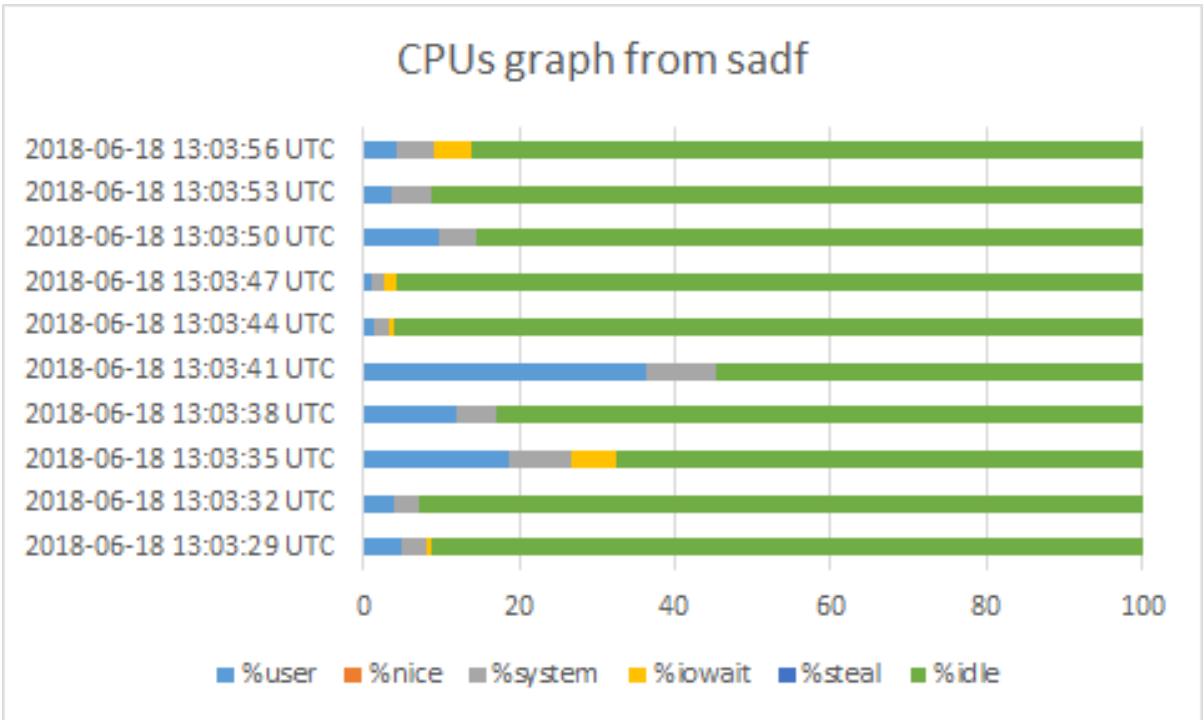



13:03:47	all	1.00	0.00	1.83	1.33	0.00	95.85
13:03:50	all	9.63	0.00	4.82	0.00	0.00	85.55
13:03:53	all	3.49	0.00	5.32	0.00	0.00	91.20
13:03:56	all	4.15	0.00	4.98	4.65	0.00	86.21
Average:	all	9.53	0.00	4.70	1.33	0.00	84.44

File *test* is also created (binary format).

- Create readable report format from *test* file, i.e. in semicolon format, which can be imported in MS Excel graph:

```
Board $> sadf -d test > test.csv
Board $> cat test.csv
# hostname;interval;timestamp;CPU;%user;%nice;%system;%iowait;%steal;%idle
stm32mp1;3;2018-06-18 13:03:29 UTC;-1;4.82;0.00;3.16;0.66;0.00;91.36
stm32mp1;3;2018-06-18 13:03:32 UTC;-1;3.82;0.00;3.49;0.00;0.00;92.69
stm32mp1;3;2018-06-18 13:03:35 UTC;-1;18.77;0.00;7.81;5.81;0.00;67.61
stm32mp1;3;2018-06-18 13:03:38 UTC;-1;11.96;0.00;4.98;0.00;0.00;83.06
stm32mp1;3;2018-06-18 13:03:41 UTC;-1;36.21;0.00;8.97;0.00;0.00;54.82
stm32mp1;3;2018-06-18 13:03:44 UTC;-1;1.50;0.00;1.66;0.83;0.00;96.01
stm32mp1;3;2018-06-18 13:03:47 UTC;-1;1.00;0.00;1.83;1.33;0.00;95.85
stm32mp1;3;2018-06-18 13:03:50 UTC;-1;9.63;0.00;4.82;0.00;0.00;85.55
stm32mp1;3;2018-06-18 13:03:53 UTC;-1;3.49;0.00;5.32;0.00;0.00;91.20
stm32mp1;3;2018-06-18 13:03:56 UTC;-1;4.15;0.00;4.98;4.65;0.00;86.21
```



6 References

- 1.01.1 <http://sebastien.godard.pagesperso-orange.fr/>
- 2.02.1 http://sebastien.godard.pagesperso-orange.fr/man_iostat.html
- 3.03.1 http://sebastien.godard.pagesperso-orange.fr/man_mpstat.html
- 4.04.1 http://sebastien.godard.pagesperso-orange.fr/man_pidstat.html



Sysstat tool suite

- 5.05.1 http://sebastien.godard.pagesperso-orange.fr/man_sar.html
- 6.06.1 <https://en.wikipedia.org/wiki/Cron>
- 7.07.1 http://sebastien.godard.pagesperso-orange.fr/man_sadf.html
- http://sebastien.godard.pagesperso-orange.fr/man_sa1.html

Document link	Document Type	Description
sysstat documentation	Standard	Official webpage by Sebastien GODARD
sysstat tutorial	User Guide	Official webpage by Sebastien GODARD
sysstat git	Sources	Sysstat github

"External links"

Central processing unit

TeleTYpewriter

universally unique identifier (https://en.wikipedia.org/wiki/Universally_unique_identifier)