



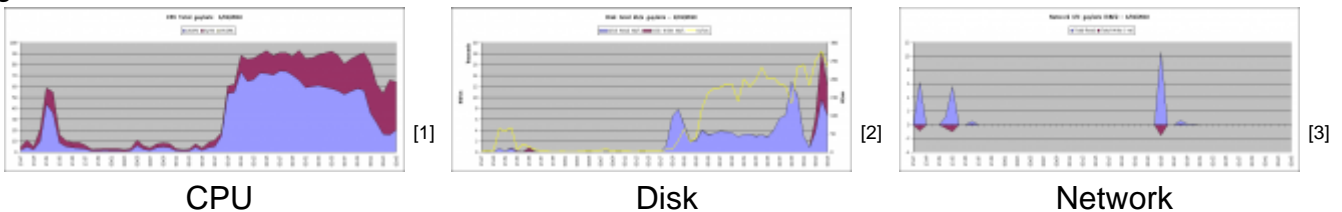
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## SARMON - SAR + NMON for Solaris

## SARMON - SAR + NMON for Solaris

guitoo - Thu, 2010-01-07 20:42



You probably know **nmon** for Linux and AIX if you come to this page... It is a very simple and nice system monitoring and reporting tool developed by IBM engineer Nigel Griffiths. Recently (July 2009) nmon Linux has been released to the OpenSource community.

NMON has for its reporting aspect many tools to represent the captured data. The main one is "nmon analyzer", to be downloaded from [http://www.ibm.com/developerworks/aix/library/au-nmon\\_analyser/](http://www.ibm.com/developerworks/aix/library/au-nmon_analyser/) [4]. This Excel macro loads a raw nmon file and generates graphs. I find Excel a perfect tool to manipulate the captured data and render as wish.

For large systems, with number of disk devices greater than 254, nmon analyzer has been edited to a XXL purpose, for Excel 2007 of higher. See [bellow](#) for more information.

For more information on this tool and its creator Nigel:

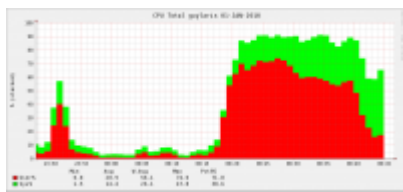
- NMON at IBM DeveloperWorks [http://www.ibm.com/developerworks/aix/library/au-analyze\\_aix/](http://www.ibm.com/developerworks/aix/library/au-analyze_aix/) [5]
- NMON Wiki <https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/Power%20Systems/p>
- NMON Analyser Wiki <https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/Power%20Systems/p>
- NMON at SourceForge <http://nmon.sourceforge.net> [6]

Working sometimes on Solaris, I could not find its equivalent for reporting purpose, especially the ability to setup the tool easily, and to get numerous OS raw measurements and graphs on Excel (as opposed to PDF or custom graphing tool).

So I decided to write such a tool, and I found the easiest way was to start from SAR tool (<http://docs.sun.com/app/docs/doc/816-5165/sar-1?a=view> [7]) and to add few hooks in order to

render system activity in NMON file format.

Sarmon also supports fully RRD output.



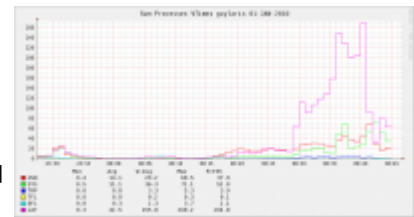
CPU

[8]



IOStat Service Time

[9]



Processes Wait Times

[10]

No warranty given or implied when using sarmon.

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## Architecture

Sarmon supports Solaris 10 and 11. Solaris 10 early versions require sarmon early release ('es' version).

Sadc, the sar daemon which captures OS activity, has been modified to output also the nmon file. If sadc generates a file called for example *sa17*, then another file called *sa17.hostname\_yymmdd\_hhmm.nmon* is generated too.

sadc output native file format is not changed.

All sarmon code has been placed into two separate files (*sarmon.c* and *sarmon.h*) with most of its methods and variables being static. Any hook method placed in *sadc.c* will have its name prefixed by *sarmon\_* to avoid any confusion. There are currently 5 hooks (*init*, *snap*, *close*, *sleep* and one to capture usage per CPU) in *sadc.c*.

Additionally *prstat* project code has been used with out any change to log statistics per process and for accounting per zone or project. At the end of *prstat.c*, some code has been

added to output statistics in nmon format.

Also iostat partial code has been used too in order to render mount points and NFS name to the raw block device name.

"Linux" OS is recognized by the analyzer via the "AAA, Linux" line inside the nmon file.

## Project Ground Rules

The project will follow the following rules for its design and implementation:

- Minimum change in original SAR project code. Only few hooks shall be added to process nmon features outside original code. One key reason is that any change of sar project can be merged in minutes
- sarmon is an extension to sar, so any command parameter, feature and output shall remain unchanged
- sadc output raw file format shall not be changed. This means any data structure required for extending sar (i.e. monitor each CPU) shall be carried within sarmon code, and shall not be placed in raw sadc files
- sarmon can provide more monitoring feature, output shall be part of nmon report
- sarmon nmon reporting shall be compatible with nmon file format (well, not formally document thought!), so that tools such as "nmon analyzer" can process the file. Currently it has been tested with version 33D, 33e, 33f and 43a
- sarmon does not need to run as root

## Source Code

Original SAR source code has been downloaded from OpenSolaris, under "Common Development and Distribution License" license. Base code version is build 130 (realigned on build 146 today). Original source code locations can be found at:

- <http://src.opensolaris.org/source/xref/onnv/onnv-gate/usr/src/cmd/sa/> [11]
- <http://src.opensolaris.org/source/xref/onnv/onnv-gate/usr/src/cmd/prstat/> [12]
- <http://src.opensolaris.org/source/xref/onnv/onnv-gate/usr/src/cmd/stat/c...> [13]

SourceForge project at <http://sourceforge.net/projects/sarmon/> [14]

As few parts are reuse of OpenSolaris, the code uses few private APIs. Over time, I will do my best to remove them over time. Namely as for v1.12: zone\_get\_id, getvmusage, di\_dim\_fini, di\_dim\_path\_dev, di\_dim\_path\_devices, di\_lookup\_node.

## Download SARMON

Source Code	Download from <a href="#">SourceForge</a> [15]
Binaries (i386 and SPARC)	
Sample Excel Output	
Sample RRD Output	
nmon analyzer XXL	

## Fields

Worksheet	Column	Description
CPU_ALL CPU <sub>nnn</sub>	User% Sys% Wait% Idle%	Average CPU time %:  <ul style="list-style-type: none"> <li>• user time</li> <li>• system time</li> <li>• wait time (= 0 on Solaris 10)</li> <li>• Idle = 100 - User% - Sys% - Wait%</li> </ul> See note on release 1.11
	CPU%	User% + Sys%
	CPUs	Number of CPUs
CPU_SUMM	User% Sys% Wait% Idle%	Breakdown of CPU Utilisation by logical processor over the collection period
MEM	memtotal	(in MB) total usable physical memory
	swaptotal	= swapfree + swapused
	memfree	(in MB) free physical memory. For Solaris file system cache (FSCache) is located inside this area. Same as 'vmstat.memory.free' value in MB
	swapfree	(in MB) Free swap space Same as 'swap -s.available' Same as 'sar -r.freeswap / 2' (/2 since unit is block size) Close to 'vmstat.memory.swap' value in MB (which does not include reserved space)
	swapused	(in MB) used swap (reserved + allocated) Same as 'swap -s.allocated'
MEMNEW	Not Used	-
MEMUSE	%rcache %wcache	Cache hit ratio Same as 'sar -b'
	lread lwrite	(/s) accesses of system buffers Same as 'sar -b'
	pread pwrite	(/s) transfers using raw (physical) device mechanism Same as 'sar -b'
	%comp	Ignore (negative value)
	bread bwrite	(/s) transfer of data between system buffers and disk or other block device Same as 'sar -b'
VM	minfaults	(pages/s) minor faults (hat and as minor faults) Same as 'vmstat.mf'

Worksheet	Column	Description
majfaults	(pages/s) major faults	
pgin pgout	(pages/s) pageins and outs	
scans	(pages/s) pages examined by pageout daemon Same as 'vmstat.sr'	
reclaims	(pages/s) pages freed by daemon or auto Same as 'vmstat.re'	
pgpgin pgpgout	(KB/s) pages paged in and out Same as 'vmstat.pi and po'	
pswpin pswpout	(KB/s) pages swapped in and out Same as 'vmstat.si and so'	
pgfree	(KB/s) pages freed by daemon or auto Same as 'vmstat.fr'	
DISKREAD IOSTATREAD CTRLREAD VxVMREAD	<i>device name</i> <i>device name</i> <i>ctrlr name</i> <i>vol name</i>	(KB/s) read from block device (disk, other [nfs, partition, iopath, tape], controller, VxVM volume) Same as 'iostat -x.kr/s'. For iostat, a disk is referred as a device. Controller stats: -C option
DISKWRITE IOSTATWRITE CTRLWRITE VxVMWRITE	<i>device name</i> <i>device name</i> <i>ctrlr name</i> <i>vol name</i>	(KB/s) written to block device (disk, other [nfs, partition, iopath, tape], controller, VxVM volume) Same as 'iostat -x.kw/s'. For iostat, a disk is referred as a device. Controller stats: -C option

Worksheet	Column	Description
DISKXFER IOSTATXFER CTRLXFER VxVMXFER	<i>device name</i> <i>device name</i> <i>ctrlr name</i> <i>vol name</i>	(ops/s) read + write (disk, other [nfs, partition, iopath, tape], controller, VxVM volume) Same as 'iostat -x.r/s+w/s'. For iostat, a disk is referred as a device. Controller stats: -C option Same as 'sar -d.r+w/s'
DISKBSIZE IOSTATBSIZE CTRLBSIZE VxVMBSIZE	<i>device name</i> <i>device name</i> <i>ctrlr name</i> <i>vol name</i>	(KB/xfer) Average data size per block device transfer (disk, other [nfs, partition, iopath, tape], controller, VxVM volume) Same as 'iostat -x.(kr/s+kw/s)/(r/s+w/s)'. For iostat, a disk is referred as a device. Controller stats: -C option
DISKBUSY IOSTATBUSY CTRLBUSY VxVMBUSY	<i>device name</i> <i>device name</i> <i>ctrlr name</i> <i>vol name</i>	(%) Percent of time the block device is busy (transactions in progress) (disk, other [nfs, partition, iopath, tape], controller, VxVM volume) Same as 'iostat -x.%b'. For iostat, a disk is referred as a device. Controller stats: -C option Same as 'sar -d.%busy'  <b>Warning:</b> for controller and VxVM volume, it is an estimation
DISKSVCTM IOSTATSVCTM CTRLSVCTM VxVMSVCTM	<i>device name</i> <i>device name</i> <i>ctrlr name</i> <i>vol name</i>	(ms) Average service time (disk, other [nfs, partition, iopath, tape], controller, VxVM volume) Same as 'sar -d.avserv' Same as 'iostat -xn.asvc_t'. For iostat, a disk is referred as a device. Controller stats: -C option
DISKWAITTM IOSTATWAITTM CTRLWAITTM VxVMWAITTM	<i>device name</i> <i>device name</i> <i>ctrlr name</i> <i>vol name</i>	(ms) Average wait time (disk, other [nfs, partition, iopath, tape], controller, VxVM volume) Same as 'sar -d.avwait' Same as 'iostat -xn.wsvc_t'. For iostat, a disk is referred as a device. Controller stats: -C option
DISK_SUM	Disk Read KB/sec	(KB/s) Total of all disk reads
	Disk Write KB/sec	(KB/s) Total of all disk writes
	IO/sec	(ops/s) Total of all disk transfers
NET	<i>if-read</i>	(KB/s) KB read on this interface
	<i>if-write</i>	(KB/s) KB written to this interface
	<i>if-total</i>	(KB/s) KB read + written for this interface
	<i>total-read</i>	(KB/s) KB read for all interfaces
	<i>total-write</i>	(KB/s) KB written for all interfaces
NETPACKET	<i>if-reads/s</i>	(packets/s) packets read on this interface
	<i>if-writes/s</i>	(packets/s) packets written to this interface
NETERROR	<i>if-ierrs</i>	(packets/s) incoming packets with error

Worksheet	Column	Description
<i>if-oerrs</i>	(packets/s) outgoing packets with error	
<i>if-collisions</i>	(col/s) collisions per second	
FILE	iget	(/s) translations of i-node numbers to pointers to the i-node structure of a file or device. Calls to iget occur when a call to to namei has failed to find a pointer in the i-node cache. This figure should therefore be as close to 0 as possible Same as 'sar -a.iget/s'
	namei	(/s) calls to the directory search routine that finds the address of a v-node given a path name Same as 'sar -a.lookupp/s'
	dirblk	(/s) number of 512-byte blocks read by the directory search routine to locate a directory entry for a specific file Same as 'sar.-a.dirblk/s'
	readch	(bytes/s) characters transferred by read system call Same as 'sar -c.rchar/s'
	writch	(bytes/s) characters transferred by write system call Same as 'sar -c.wchar/s'
	ttyrawch	(bytes/s) tty input queue characters Same as 'sar -y.rawch/s'
	ttycanch	(bytes/s) tty canonical input queue characters Same as 'sar -y.canch/s'
	ttyoutch	(bytes/s) tty output queue characters Same as 'sar -y.outch/s'
PROC		
	RunQueue	the average number of kernel threads in the run queue. This is reported as RunQueue on the nmon Kernel Internal Statistics panel. A value that exceeds 3x the number of CPUs may indicate CPU constraint Same as 'sar -q.runq-sz' Same as 'vmstat kthr.r'
	Swap-in	the average number of kernel threads waiting to be paged in Same as 'sar -q.swpq-sz' Same as 'vmstat kthr.w'
	pswitch	(/s) the number of context switches Same as 'sar -w.pswch/s'
	syscall	(/s) the total number of system calls Same as 'sar -c.scall/s'

Worksheet	Column	Description
read	(/s) the number of read system calls Same as 'sar - c.sread/s'	
write	(/s) the number of write system calls Same as 'sar - c.swrit/s'	
fork	(/s) the number of fork system calls Same as 'sar - c.fork/s'	
exec	(/s) the number of exec system calls Same as 'sar - c.exec/s'	
sem	(/s) the number of IPC semaphore primitives (creating, using and destroying) Same as 'sar - m.sema/s'	
msg	(/s) the number of IPC message primitives (sending and receiving) Same as 'sar - m.msg/s'	



Worksheet	Column	Description
%RunOcc	(%) The percentage of time that the dispatch queues are occupied Same as 'sar - q.%runocc'	
%SwpOcc	(%) The percentage of time LWPs are swapped out Same as 'sar - q.%swpocc'	
kthrR	the number of kernel threads in run queue Same as 'vmstat.kthr r'	
kthrB	the number of blocked kernel threads that are waiting for resources I/O, paging, and so forth Same as 'vmstat.kthr b'	
kthrW	the number of swapped out lightweight processes (LWPs) that are waiting for processing resources to finish Same as 'vmstat.kthr w'	
PROCSOL	USR	(%) The percentage of time all processes have spent in user mode (estimation since terminated processes are not accounted)
	SYS	(%) The percentage of time all processes have spent in system mode (estimation since terminated processes are not accounted)

Worksheet	Column	Description
TRP	(%) The percentage of time all processes have spent in processing system traps (estimation since terminated processes are not accounted)	
TFL	(%) The percentage of time all processes have spent processing text page faults (estimation since terminated processes are not accounted)	
DFL	(%) The percentage of time all processes have spent processing data page faults (estimation since terminated processes are not accounted)	

Worksheet	Column	Description
LAT	(%) The percentage of time all processes have spent waiting for CPU (estimation since terminated processes are not accounted)	
WLMPROJECTCPU WLMZONECPU WLMTASKCPU WLMUSERCPU	<i>project name</i> <i>zone name</i> <i>task id</i> <i>username</i>	CPU% for this project or zone or task or user. This value is approximative since processes that terminated during the previous laps can not be accounted Same as 'prstat -J.CPU' (or -Z or -T or -a) Shows maximum 5 entries by default. It can be adjusted via NMONWLM_MAXENTRIES environment variable (see below)
WLMPROJECTMEM WLMZONEMEM WLMTASKMEM WLMUSERMEM	<i>project name</i> <i>zone name</i> <i>task id</i> <i>username</i>	MEM% for this project or zone or task or user. Same as 'prstat -J.MEMORY' (or -Z or -T or -a) when running 64-bit sarmon version on a 64-bit kernel (or a 32-bit sarmon version on a 32-bit kernel). If not matching, it is the sum of the memory of all processes Shows maximum 5 entries by default. It can be adjusted via NMONWLM_MAXENTRIES environment variable (see below)
TOP	PID	process id. Only processes with %CPU >= .1% are listed
	%CPU	(%) average amount of CPU used by this process Same as 'prstat.CPU'
	%Usr	(%) average amount of user-mode CPU used by this process Equal to 'prstat.CPU * prstat -v.USR / (prstat -v.USR + prstat -v.SYS)'
	%Sys	(%) average amount of kernel-mode CPU used by this process Equal to 'prstat.CPU * prstat -v.SYS / (prstat -v.USR + prstat -v.SYS)'
	Threads	Number of LWPs of this process Same as 'prstat.NLWP'
	Size	(KB) total virtual memory size of this process Same as 'prstat.SIZE'

Worksheet	Column	Description
ResSize	(KB) Resident set size of the process Same as 'prstat.RSS'	
ResData	=0	
CharIO	(bytes/s) count of bytes/sec being passed via the read and write system calls	
%RAM	(%) = $100 * \text{ResSize} / \text{total physical memory}$	
Paging	(/s) sum of all page faults for this process	
Command	Name of the process Same as 'prstat.PROCESS'	
Username	The real user (login) name or real user ID Same as 'prstat.USERNAME'	
Project	Project name	
Zone	Zone name	
USR	(%) of time the process has spent in user mode Same as 'prstat -v.USR'	
SYS	(%) The percentage of time the process has spent in system mode Same as 'prstat -v.SYS'	

Worksheet	Column	Description
TRP	(%) of time the process has spent in processing system traps Same as 'prstat -v.TRP'	
TFL	(%) of time the process has spent processing text page faults Same as 'prstat -v.TFL'	
DFL	(%) of time the process has spent processing data page faults Same as 'prstat -v.DFL'	
LCK	(%) of time the process has spent waiting for user locks Same as 'prstat -v.LCK'	
SLP	(%) of time the process has spent sleeping Same as 'prstat -v.SLP'	
LAT	(%) of time the process has spent waiting for CPU Same as 'prstat -v.LAT'	
VCX	The number of voluntary context switches Same as 'prstat -v.VCX'	

Worksheet	Column	Description
ICX	The number of involuntary context switches Same as 'prstat -v.ICX'	
SCL	The number of system calls Same as 'prstat -v.SCL'	
SIG	The number of signals received Same as 'prstat -v.SIG'	
PRI	Priority of the process Same as 'prstat PRI'	
NICE	Nice of the process Same as 'prstat NICE'	
UARG	PID	process id
	PPID	parent process id
	COMM	Name of the process Same as 'prstat.PROCESS'
	THCOUNT	Number of LWPs of this process Same as 'prstat.NLWP'
	USER	The real user (login) name or real user ID Same as 'prstat.USERNAME'
	GROUP	The real group name or real group ID
	FullCommand	The process command with all its arguments
JFSFILE	<i>mount point</i>	(%) of used disk space Same as 'df.capacity'. df uses POSIX capacity rounding rules, sarmon rounds to the nearest value (.1 precision)
JFSINODE	<i>mount point</i>	(%) of used inode space Same as 'df -o i.%iused'  Removed starting v1.08

Worksheet	Column	Description
FSSTATREAD FSSTATWRITE	<i>mount point</i>	(KB/s) read or write data size to mount point Similar as 'fsstat <i>mountpoint</i> .read or write bytes' but divided by 1024 and the time interval
FSSTATXFERREAD FSSTATXFERWRITE	<i>mount point</i>	(ops/s) read or write operations to mount point Similar as 'fsstat <i>mountpoint</i> .read or write ops' but divided by the time interval
ZFSARC	reads	(ops/s) reads operation from cache = hits + misses
	hits	(ops/s) hits operation = kstat(zfs.0.arcstats).hits per second
	misses	(ops/s) misses operation = kstat(zfs.0.arcstats).misses per second
	hits%	= hits / reads * 100
	size	(MB) current size = kstat(zfs.0.arcstats).size / 1024 / 1024
	trgsize	(MB) target size = kstat(zfs.0.arcstats).c / 1024 / 1024
	maxtrgsize	(MB) maximum target size = kstat(zfs.0.arcstats).c_max / 1024 / 1024
	l2reads	(ops/s) reads operation from L2 cache = l2hits + l2misses
	l2hits	(ops/s) hits operation from L2 cache = kstat(zfs.0.arcstats).l2_hits per second
	l2misses	(ops/s) misses operation from L2 cache = kstat(zfs.0.arcstats).l2_misses per second
	l2hits%	= l2hits / l2reads * 100
	l2size	(MB) current size = kstat(zfs.0.arcstats).l2_size / 1024 / 1024
	l2actualsize	(MB) current actual size (after compression) = kstat(zfs.0.arcstats).l2_asize / 1024 / 1024
	l2readkb	(KB/s) data read from L2 cache = kstat(zfs.0.arcstats).l2_read_bytes / 1024 per second
	l2writekb	(KB/s) data written to L2 cache = kstat(zfs.0.arcstats).l2_write_bytes / 1024 per second

## Environment Variables

Since sarmon follows sadc syntax, there is no room to alter sarmon behavior from the command line. Environment variables is the mechanism chosen in replacement.

Name	Description
------	-------------

NMONDEBUG	If set, sarmon will output debug information on the console
NMONNOSAFILE	If set, sarmon does not generate the sa file, only the nmon file
NMONEXCLUDECPUN	If set, sarmon does not generate the CPU $_{nnn}$ sheets. On T series, this can reduce a lot the nmon file size
NMONEXCLUDEIOSTAT	If set, sarmon does not generate the IOSTAT* sheets. On systems with a lot of disks, this can reduce a lot the nmon file size
NMONDEVICEINCLUDE NMONDEVICEEXCLUDE	Use either one to reduce the number of devices shown in DISK* or IOSTAT* graphs. INCLUDE will only include the devices specified, while EXCLUDE will include all devices except the one specified.  Device name is the one shown in sar report. Use blank (space) as delimiter. For example:  <code>export NMONDEVICEINCLUDE="sd0 sd0,a sd0,h nfs1"</code>
NMONVXVM	If set, sarmon will generate VxVM volumes IO statistics (read below)
NMONRRDIR	If set, sarmon will generate RRD graphs (read below)
NMONWLM_MAXENTRIES	Maximum entries inside the WLM worksheets. If not defined, the default is 5
NMON_TIMESTAMP NMON_START NMON_SNAP NMON_END NMON_ONE_IN	Allows external data collectors. Please read <a href="#">nmon wiki</a> <sup>[16]</sup> for more information
NMONUARG	If set, sarmon will generate command line arguments in UARG worksheet
NMONOUTPUTFILE	If set, indicates where to write the sarmon output. A fifo file can be used. If the file exists already, it is overwritten
NMONMAXDISKSTATSPERLINE	If set, controls the maximum number of disks per line in the sheets DISK* and IOSTAT*. If set to 0, it means unlimited number of disks per line.  By default the maximum number of disks per line is 2,000 (v1.12 up) and unlimited (v1.11 and below).



## RRD Support

Sarmon since v1.02 supports RRD output (tested with v1.2.19, can be downloaded from <http://sunfreeware.com/> [17]). To enable this feature set the environment variable NMONRRDDIR to an existing directory prior to starting sarmon. For example:

```
export NMONRRDDIR=/var/adm/sa/sa12rrd
```

Sarmon will then output 5 files in a append mode. So if the files already exist, then new lines are added at the end

- genall: script which executes the 3 rrd\_ create, update and graph scripts. Execute this script to generate the graphs
- rrd\_create: to create the RRD databases
- rrd\_update: to insert new values to the databases
- rrd\_graph: to generate graphs
- index.html: load with your browser to view graphs

For a 1 day case (288 measurements), generation of all graphs shall not exceed 10 seconds.

RRD files can be processed real time with the FIFO file approach, for example

```
mkfifo /var/adm/sa/sa12rrd/rrd_update
```

## VxVM Support

Sarmon since v1.06 can output VxVM volume IO statistics by aggregating disk IO statistics. It is important to understand that statistics (IOPS, KB in and out, etc) are the aggregation of all disks composing that volume. For example assuming a RAID-1 plex, if an application writes 4KB of data, sarmon KB written reports 8KB, result of 2 writes of 4KB to 2 disks.

Sarmon obtains VxVM configuration by running automatically the following command:

```
/usr/sbin/vxprint -Ath
```

Output and device mapping is included in BBBP worksheet.

In the case a disk belongs to multiple volumes via multiple subdisks, sarmon estimates that the load of that volume is in proportion to the size of each subdisk (subdisk relevant fields are only LENGTH and DEVICE from the configuration). In such a case, the volume will be flagged as estimated (*est.*) to remind this assumption.

VxVM statistics gathering is activated when NMONVXVM environment variable is set.

## Nmon Analyzer XXL

Nmon analyzer supports a maximum of 255 disks. For larger systems, statistics for all disks won't be available. More importantly, large system total IOPs (xfers) value is not calculated correctly, SYS\_SUMM and DISK\_SUMM content is then not correct.

To check if a system requires the adjusted version of the analyzer (and the necessary Microsoft Excel 2007 up), just check any DISK\* tab on the normal Excel output. If the column IU contains data (IV being the Totals column), then it is required. For example:

**NOT FOUND: sarmon\_smallIXL2.PNG**

As of 8-jun-2013, "nmon analyser v33f XXL.xlsm" is deprecated and "nmon analyser v34a-sarmon1.xls" should be used instead. In this new version based on last nmon analyser 34a, for each DISK\* worksheet, only top usage (by WAvg.) 255 disk devices are listed in descending order. Though the total is actually calculated for all devices. This design comes from an Excel limitation I found, it is unable to graph on a worksheet having more than 256 rows and 256 columns at the same time. Any workaround is welcome.

In the new nmon analyser, the PROC worksheet contains a new graph for the kthr variables.

## How to Skip SA File Generation

Most admins would continue to rely on the OS bundled sar file generation while adding the nmon file generation, sarmon generated sa file is not necessary. There are 2 ways to skip sa file generation:

1. Run without filename and pipe the output to /dev/null. Nmon file is generated following the hostname\_yymmdd\_hhmi.nmon naming format. For example: `./sadc 60 10 > /dev/null`
2. Set the environment variable NMONNOSAFILE

## How to Test SARMON

For this, just download the binaries and put sadc inside any location. Then run the command `./sadc 5 4 tst1` which will take 20 seconds (4 snapshots, 5 seconds in between) to run. This will output 2 files, `tst1` and `tst1.hostname_yymmdd_hhmi.nmon`. You can then process the nmon file via the nmon analyzer Excel macro.

## How to Install SARMON

Once sarmon has been tested successfully, there are (at least) three ways to install SARMON, the first one now being recommended:

1. One minute setup: download `_opt_sarmon.zip`, and as root unzip inside /opt. Add the following 2 entries inside root crontab, that's it! The folder contains a README file for more information. `sa1daily` and `sa1monthly` shell scripts may need minor adjustments depending on your environment (nmon file location, file retention, VxVM used or not, etc). `sa1daily` and `sa1monthly` can be started any time (i.e. after a server reboot), the script automatically calculates the end of day or month

```
1 0 * * * /opt/sarmon/saldaily &
2 0 1 * * /opt/sarmon/salmonthly &
```

2. Place the entire bin/ directory content at any location, for example under a standard

UNIX user home directory or /usr/local/sarmon, modify sa1 script with correct path and possibly some specific sarmon environment variables. Then setup crontab for that user to run sa1 daily. Refer to /usr/cmd/sa/README or UNIX manual of sar for instructions. For example to run sarmon daily, with snapshots every 10 minutes, add the following entry to crontab of that standard UNIX user (avoid using root)

```
0 0 * * * /usr/local/sarmon/sa1 300 288 &
```

3. (not recommended) Replace /usr/lib/sa/sadc, /usr/bin/sar and timex by the ones inside the bin/ directory. Make sure you take a backup of the original executables!

## How to Compile SARMON

SARMON is currently being developed and tested with GCC. Makefile.master has been updated at few locations, search for keyword 'SARMON' to locate the changes.

1. Install gcc if not present. Binary can be downloaded from <http://sunfreeware.com/> [17] or from Solaris installation disk. Code has been tested with gcc v3.4.6 (i386) and v3.4.3 (i386, sparc), both on Solaris 10 10/09 and 1/13. According to ON documentation, one needs to build a higher version, which makes the task hard. Hence step 5 is required to support an old gcc version
2. Install ON build tools SUNWonbld-DATE.PLATFORM.tar.bz2. Binary can be downloaded from <http://hub.opensolaris.org/bin/view/downloads/on> [18]. Specifically, on SPARC I use <http://dlc.sun.com/osol/on/downloads/20090706/SUNWonbld.sparc.tar.bz2> [19] and on i386 I use <http://dlc.sun.com/osol/on/downloads/20091130/SUNWonbld.i386.tar.bz2> [20]. Simply unzip then install the package (bunzip2 SUNWonbld.xxx.tar.bz2, then tar -xvf SUNWonbld.xxx.tar, then pkgadd -d onbld)
3. Place source code, for example /a/b/sa
4. Setup environment variables as bellow (ksh syntax)

```
export PATH=/usr/bin:/usr/openwin/bin:/usr/ucb:/usr/ccs/bin
export MACH=`uname -p`
export CLOSED_IS_PRESENT=no
export CW_NO_SHADOW=Yexport SRC=/a/b/sa/src/usr
```

5. If building for SPARC (to support old gcc 3.4.3)

```
export CW_GCC_DIR=/a/b/sa/sparcgcc
```

6. Due to some incorrect inclusion (at least on Solaris 10 10/09), you may have to modify the file /usr/include/sys/scsi/adapters/scsi\_vhci.h and comment out lines that include mpapi\_impl.h and mpapi\_scsi\_vhci.h
7. To change compilation from 64 to 32 bit, change src/usr/Makefile.master (line 315 onward) from -m64 to -m32
8. Go to the correct directory

```
cd /a/b/sa/src/usr/cmd/sa
```

9. Build the code

make

## Report Issues or Request Enhancements

Just click on the "Contact" link inside the top left box. In case of issue, I am glad to track down what went wrong and get sarmon fixed ASAP.

## Up-Coming Enhancements

RRD Support:

- TOP graph
- NET: summary of all interfaces (r & w kb/s)
- System summary: CPU %busy and summary disk IO /s
- IO Summary: summary disk IO r+w kb/s and summary disk IO /s

Better handling of SIGTSTP (ctrl-Z) signal

Removal of some Solaris private APIs in the code (zone\_get\_id in prtable.c, getvmusage in prstat.c, di\_dim\_fini, di\_dim\_init in dsr.c, di\_dim\_path\_dev, di\_dim\_path\_devices, di\_lookup\_node in dsr.c)

## Version History

Version	Date	Notes
0.01	21-nov-2009	Initial release Added CPU graph: <ul style="list-style-type: none"><li>• CPU_ALL</li><li>• CPU_SUMM</li><li>• CPU_nn</li></ul>
0.02	29-nov-2009	Added memory related graphs: <ul style="list-style-type: none"><li>• MEM</li><li>• MEMNEW (empty)</li><li>• MEMUSE</li><li>• PAGE</li></ul> Fix: CPU calculation nmon filename changed More output on BBBP tab

Version	Date	Notes
0.03	11-dec-2009	<p>Added memory related graphs:</p> <ul style="list-style-type: none"> <li>• VM</li> </ul> <p>Added disk related graphs:</p> <ul style="list-style-type: none"> <li>• DISKREAD and PARTREAD</li> <li>• DISKWRITE and PARTWRITE</li> <li>• DISKXFER and PARTXFER</li> <li>• DISKBSIZE and PARTBSIZE</li> <li>• DISKBUSY and PARTBUSY</li> <li>• DISK_SUM (generated)</li> </ul> <p>Added network related graphs:</p> <ul style="list-style-type: none"> <li>• NET</li> <li>• NETPACKET</li> <li>• NETERROR</li> </ul>
0.04	20-dec-2009	<p>Added VM graphs:</p> <ul style="list-style-type: none"> <li>• FILE</li> <li>• PROC</li> <li>• TOP</li> </ul> <p>Added disk related graphs for TAPE (shows only if tape is available)</p> <p>Added SRM related graphs:</p> <ul style="list-style-type: none"> <li>• WLMZONECPU and MEM</li> <li>• WLMPROJECTCPU and MEM</li> </ul>

Version	Date	Notes
1.00	31-dec-2009	<p>Support for SPARC (gcc 3.4.3)</p> <p>List all links inside /dev/dsk, /dev/vx/dsk, /dev/md/dsk</p> <p>Align source code on ON build 130, which includes removing sag (<a href="#">bug 6905472</a> [21])</p> <p>For device name, use kstat name instead of module name</p> <p>An interface is found in the kstat when type is net, name is not mac, and has 3 properties</p> <p>Fix: Interface i/o errors output correctly</p> <p>Show mount points and nfs path</p>
1.01	07-jan-2010	<p>SAR in version 130 changes iodev time internal from kios.wlastupdate to be ks.ks_snap</p> <p>Fix: AAA,date value was incorrect</p> <p>Support nmon environment variables (debug, call external scripts, etc) : NMONDEBUG, NMON_ONE_IN</p> <p>nmon consolidator is working fine now</p> <p>Tested with nmon analyzer v. 33e</p> <p>Add project list (projects -l) to BBBP sheet</p> <p>Added to TOP stats: CharIO, Faults, Project and Zone</p> <p>Added JFS related graphs:</p> <ul style="list-style-type: none"> <li>• JFSFILE</li> <li>• JFSINODE</li> </ul>

Version	Date	Notes
1.02	08-feb-2010	<p>Added devices related graphs:</p> <ul style="list-style-type: none"> <li>• DISKSVCTM and IOSTATSVCTM</li> <li>• DISKWAITTM and IOSTATWAITTM</li> </ul> <p>Code cleanup, removed string length limitations, minor optimizations</p> <p>Fix: CPU<math>_{nn}</math> T0001 was missing</p> <p>Validated memory use with Solaris Memory Debuggers (watchmalloc.so.1 and libumem.)</p> <p>Fix: DISK / IOSTAT BSIZE and BUSY where still using old sa time range. Moved to v130 summary graph title appears correctly on Excel</p> <p>No code hard limit in CPU, IODEV, Network Interface, Projects and Zones</p> <p>Added process stats:</p> <ul style="list-style-type: none"> <li>• TOP: USR, SYS, TRP, TFL, DFL, LCK, SLP, LAT</li> <li>• PROCSOL: sum of USR, SYS, TRP, TFL, DFL, LAT</li> </ul> <p>Support of RRD. This required a full rewrite of the output mechanism</p> <p>Sleep time is exact so that there is no time drift</p>
1.03	12-may-2010	<p>Fix: negative and NaN values were improperly nullified</p> <p>Fix: MEM.memtotal showed 0 for large values</p> <p>Enhancement: mount points are also shown on DISK stats (not limited to partitions, i.e. f</p> <p>Removed limitation of 99 CPUs</p> <p>Increase MAX_VARIABLES to 255 (number of columns in Excel - 1 for date time column with a high number of disks attached</p> <p>Added task related stats and graphs:</p> <ul style="list-style-type: none"> <li>• SRM usage (CPU, MEM) per task (shows only task existing at the time sarmon sta</li> <li>• SRM usage (CPU, MEM) per user (shows only users running processes at the time</li> </ul>

Version	Date	Notes
1.04	28-jun-2010	<p>Remove completely limit of columns (MAX_VARIABLES)</p> <p>Ability to select only a subset of devices to be part of nmon report via environment variable</p> <p>Added process queue stats and graphs:</p> <ul style="list-style-type: none"> <li>• PROC: %RunOcc, %SwpOcc</li> </ul> <p>Support of early versions of Solaris 10 by disabling minor features. Addresses the following error:</p> <pre>ld.so.1: sadc: fatal: relocation error: file sadc: symbol enable_</pre>
1.05	22-nov-2010	<p>Sarmon is now built in 64 bit with debugging information</p> <p>Aligned source code on ON online version 8/11/2010</p> <p>Added controller level IO stats and graphs, similar to 'iostat -Cx'. Very useful for HBA monitoring:</p> <ul style="list-style-type: none"> <li>• DISKREAD, WRITE, XFER, BSIZE, BUSY, SVCTM, WAITTM</li> </ul> <p>Added kernel thread stats:</p> <ul style="list-style-type: none"> <li>• PROC: kthrR, kthrB, kthrW</li> </ul> <p>Reordered commands inside the BBBP sheet</p> <p>Fixes (big thanks to Frédéric Peuron):</p> <ul style="list-style-type: none"> <li>• NMON_ONE_IN and NMON_TIMESTAMP validation</li> <li>• Incorrect wait time when using NMON_SNAP</li> <li>• Negative sleep time was not correctly handled</li> <li>• Sleep is handled now with nanosleep, replacing usleep</li> <li>• Incorrect child_start initial debug statement</li> <li>• TOP.CharIO was negative for large values</li> <li>• TOP.Size and TOP.ResSize showed 0 when running a 32-bit sarmon version on a 64-bit system</li> <li>• TOP.%RAM was occasionally showing NaN</li> <li>• WLM*CPU and WLM*MEM were incorrectly calculated when used MEM% or used WLM*MEM</li> <li>• WLM*RAM is now exactly matching prstat when running 64-bit sarmon version on a 64-bit system</li> </ul>



Version	Date	Notes
1.06	14-jul-2011	<p>Support VxVM Volume IO statistics</p> <p>Ability to change the maximum number of projects, zones, tasks and users via the environment</p> <p>Added kernel threads (kthrR, kthrB, kthrW) RRD graph</p> <p>Changed in BBBP from 'psrinfo -v' to 'psrinfo -pv'</p> <p>Tested with nmon analyzer v. 33f</p> <p>Provide nmon analyzer v. 33f XXL for systems with high number of disks (&gt;254)</p> <p>Fix: DISK*, IOSTAT*, CTRL* stats are incorrect for T0001</p> <p>Fix: Early Solaris version failed on getvmusage call (referenced symbol not found)</p> <p>Fix: RRD core dumps for number of devices over 156</p>
1.07	13-sep-2011	<p>Fix: DISK*, IOSTAT*, CTRL* stats are still incorrect for T0001 in some cases</p>
1.08	13-jan-2012	<p>Rewrite of the code that handles JFSFILE to show the same directories as 'df'</p> <p>Remove 'ls /dev/*' directories in BBBP</p> <p>Change from 'prtconf' to 'prtdiag' in BBBP</p> <p>Change from 'df -h' to 'df -hZ' to show disk usage from all zones</p> <p>VxVM excludes DISABLED plex and subdisks</p> <p>RRD dsnames include a number to uniquely identify any graph variable</p> <p>Fix: IOSTAT* NFS shows mount point, not device</p>
1.09	9-nov-2012	<p>Ability to control sa file generation via the environment variable NMONNOSAFILE</p> <p>Ability to control the CPU<math>_{n}</math>n sheet generation via the environment variable NMONEXCL</p> <p>On 8-jun-2013 release of an improved nmon analyser 'nmon analyser v34a-sarmon1.xls'</p>

Version	Date	Notes
1.10	3-jul-2013	<p>Support VxVM multipathing</p> <p>RRD captures and shows only the first 254 variables (same as nmon Analyser) per graph</p> <p>Simplified deployment (_opt_sarmon.zip) for daily and monthly nmon</p> <p>Fix: change RRD graph filename extension to .png</p>
1.11	31-oct-2015	<p>Change worksheet name from CPU<i>nn</i> to CPU<i>nnn</i> (3 digits)</p> <p>CPU<i>nnn</i> shows the virtual processor number <i>nnn</i> (as listed in psrinfo) utilization. At a given time, all columns are 0. Typically <i>nnn</i> starts at 0. Some <i>nnn</i> values can be missing in the output (if they are brought back on-line, the worksheet will not show). Prior to 1.11, <i>nnn</i> starts at 1 and skips the missing number. CPU<i>nnn</i> shows the utilization of the on-line processor <i>nnn</i>-th in the processor list.</p> <p>Added 'uptime' in BBBP</p> <p>Added back 'psrinfo -v' in BBBP to show the state of each virtual processor</p> <p>Ability to control the IOSTAT* sheets generation via the environment variable NMONEXCLUDE</p> <p>Added process stats:</p> <ul style="list-style-type: none"> <li>• TOP: VCX, ICX, SCL, SIG, PRI and NICE</li> <li>• UARG: PID, PPID, COMM, THCOUNT, USER, GROUP, FullCommand</li> </ul> <p>Ability to output command line arguments in UARG worksheet via the environment variable UARG_ARGS</p> <p>Note: sarmon_v1.11.0_64bit.bin_sparc.zip is the SPARC version v 1.11. There was a typo in the filename which contained wrongly the es10 (early solaris) executable</p>

Version	Date	Notes
1.12	6-nov-2017	<p>Thank you very much to k. Chakaran Wongjumpa who did the compilation and testing on</p> <p>Added file system level IO stats and graphs, similar to 'fsstat':</p> <ul style="list-style-type: none"> <li>• FSSTATREAD, WRITE, XFERREAD, XFERWRITE</li> </ul> <p>Added ZFS ARC statistics</p> <p>Added 'zoneadm list -vc' in BBBP</p> <p>Added BBBB reference table to map logical device names (i.e. c1t0d0s0) and instance n</p> <p>Ability to define the sarmon output file or to use a fifo file via the environment variable NM</p> <p>Ability to control the number of disks inside DISK* and IOSTAT* via the environment var disks is set to 2,000 by default</p> <p>Starting this version, sarmon closes the sarmon output file at the end of the program, no</p>



**Source URL:** <http://geckotechnology.com/sarmon>

**Links:**

- [1] [http://geckotechnology.com/sites/default/files/sarmon\\_cpuall\\_0.PNG](http://geckotechnology.com/sites/default/files/sarmon_cpuall_0.PNG)
- [2] [http://geckotechnology.com/sites/default/files/sarmon\\_disksum\\_1.PNG](http://geckotechnology.com/sites/default/files/sarmon_disksum_1.PNG)
- [3] [http://geckotechnology.com/sites/default/files/sarmon\\_net\\_0.PNG](http://geckotechnology.com/sites/default/files/sarmon_net_0.PNG)
- [4] [http://www.ibm.com/developerworks/aix/library/au-nmon\\_analyser/](http://www.ibm.com/developerworks/aix/library/au-nmon_analyser/)
- [5] [http://www.ibm.com/developerworks/aix/library/au-analyze\\_aix/](http://www.ibm.com/developerworks/aix/library/au-analyze_aix/)
- [6] <http://nmon.sourceforge.net>
- [7] <http://docs.sun.com/app/docs/doc/816-5165/sar-1?a=view>
- [8] [http://geckotechnology.com/sites/default/files/samorn\\_rrd\\_CPU\\_ALL\\_total\\_0.png](http://geckotechnology.com/sites/default/files/samorn_rrd_CPU_ALL_total_0.png)
- [9] [http://geckotechnology.com/sites/default/files/samorn\\_rrd\\_IOSTATSVCTM\\_0.png](http://geckotechnology.com/sites/default/files/samorn_rrd_IOSTATSVCTM_0.png)
- [10] [http://geckotechnology.com/sites/default/files/samorn\\_rrd\\_PROCSOL\\_0.png](http://geckotechnology.com/sites/default/files/samorn_rrd_PROCSOL_0.png)
- [11] <http://src.opensolaris.org/source/xref/onnv/onnv-gate/usr/src/cmd/sa/>
- [12] <http://src.opensolaris.org/source/xref/onnv/onnv-gate/usr/src/cmd/prstat/>
- [13] <http://src.opensolaris.org/source/xref/onnv/onnv-gate/usr/src/cmd/stat/common/>
- [14] <http://sourceforge.net/projects/sarmon/>
- [15] <http://sourceforge.net/projects/sarmon/files/>
- [16] <http://www.ibm.com/developerworks/wikis/display/WikiPtype/nmon+Manual#nmonManual-nmonExternalDataCollectors>
- [17] <http://sunfreeware.com/>
- [18] <http://hub.opensolaris.org/bin/view/downloads/on>
- [19] <http://dlc.sun.com/osol/on/downloads/20090706/SUNWonbld.sparc.tar.bz2>
- [20] <http://dlc.sun.com/osol/on/downloads/20091130/SUNWonbld.i386.tar.bz2>

[21] [http://bugs.opensolaris.org/bugdatabase/view\\_bug.do?bug\\_id=6905472](http://bugs.opensolaris.org/bugdatabase/view_bug.do?bug_id=6905472)