

Hardware Storage Health

Christian Külker

2024-02-17

Contents

1	Introduction	2
2	An Investigation with lsblk	2
3	A Simple Overview with skdump	4
3.1	Installation	4
3.2	Usage	4
4	Smartmontools	6
4.1	Installation	6
4.2	A Deep Dive with smartctl	6
5	Smartctl And Skdump Differs	15
6	Hdparm	15
6.1	Installing	15
6.2	Information and Tests	15
7	UAS	17
8	Conclusion	18
9	History	18
10	Disclaimer of Warranty	19
11	Limitation of Liability	19

1 Introduction

The health of a node's storage subsystem is important. There are many ways to add storage to a node. The most common method has traditionally been a spinning disc, a hard disk drive (HDD). In the last decade, memory-based storage solutions have also been introduced: SSD or NVMe. While from a user's point of view this all seems the same, from a system administrator's point of view, managing storage subsystems requires different tools, skills and solutions.

When I had to install the first industrial-grade NVMe drive in 2017, I had to write firmware to the device before it could be used. Today, NVMe drives come with adequate firmware. But still, from a low-level protocol perspective, an NVMe is different from an SSD, even though both use memory. Some tools can handle the difference, others cannot. USB drives do not support SAT and therefore cannot be queried via SMART directly, but sometimes indirectly.

Tool	SCSI	HDD (ATA/IDE/SAT)	SDD	NVMe
skdump	no	yes	yes	no
smartctl		yes	yes	yes

Mode	Linux Device
ATA	/dev/hda
IDE	/dev/hda
STA	/dev/sda
SCSI	/dev/sda
SCSI generic	/dev/sg0
NVMe	/dev/nvme0

From the common set of tables above, it can be seen that it is not possible to deduce from the device name whether a device is supported or not.

2 An Investigation with lsblk

First you need to understand the storage subsystem topology of the node you are on. The 'lsblk' command can be used to list block devices. This command requires root privileges.

Here are three examples from three different nodes. The first node contains two disks: `sda` and `sdb`. The second hard disk is partially encrypted and uses 'LVM'.

```
lsblk
NAME                                MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda                                  8:0      0 931.5G 0 disk
├─sda1                              8:1      0   499M 0 part
├─sda2                              8:2      0   100M 0 part  /boot/efi
├─sda3                              8:3      0   128M 0 part
├─sda4                              8:4      0     1G 0 part
├─sda5                              8:5      0 869.8G 0 part
└─sda6                              8:6      0    60G 0 part
sdb                                  8:16     0 477G 0 disk
├─sdb1                              8:17     0   512M 0 part
├─sdb2                              8:18     0   244M 0 part  /boot
└─sdb3                              8:19     0 476.2G 0 part
   └─sdb3_crypt                    253:0     0 476.2G 0 crypt
      ├─s1--vg-root                253:1     0 464.2G 0 lvm   /
      └─s1--vg-swap_1              253:2     0    12G 0 lvm   [SWAP]
```

The second node used two hard drives with software RAID.

```
lsblk
NAME                                MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda                                  8:0      0 465.8G 0 disk
├─sda1                              8:1      0  1000M 0 part
│   └─md0                          9:0      0 999.4M 0 raid1 /boot
├─sda2                              8:2      0   3.8G 0 part  [SWAP]
└─sda3                              8:3      0   461G 0 part
   └─md1                          9:1      0 460.9G 0 raid1 /
sdb                                  8:16     0 465.8G 0 disk
├─sdb1                              8:17     0  1000M 0 part
│   └─md0                          9:0      0 999.4M 0 raid1 /boot
├─sdb2                              8:18     0   3.8G 0 part  [SWAP]
└─sdb3                              8:19     0   461G 0 part
   └─md1                          9:1      0 460.9G 0 raid1 /
```

The third node uses three NVMe drives in a software RAID with encrypted LVM partitions.

```
lsblk
NAME                                MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
nvme0n1                            259:0     0 476.9G 0 disk
├─nvme0n1p1                        259:1     0     1G 0 part
│   └─md0                          9:0      0  1022M 0 raid1 /boot
```

```
└─nvme0n1p2                259:2    0 475.9G  0 part
  └─md1                     9:1     0 475.8G  0 raid1
    └─luks-53152dbf-856e-4e13-b09f-... 253:0    0 475.8G  0 crypt
      ├─vg0-swap             253:1    0   32G  0 lvm   [SWAP]
      └─vg0-root             253:2    0 443.8G  0 lvm   /
nvme1n1                    259:3    0 476.9G  0 disk
├─nvme1n1p1                259:4    0    1G  0 part
│ └─md0                     9:0     0 1022M  0 raid1 /boot
└─nvme1n1p2                259:5    0 475.9G  0 part
  └─md1                     9:1     0 475.8G  0 raid1
    └─luks-53152dbf-856e-4e13-b09f-... 253:0    0 475.8G  0 crypt
      ├─vg0-swap             253:1    0   32G  0 lvm   [SWAP]
      └─vg0-root             253:2    0 443.8G  0 lvm   /
```

3 A Simple Overview with skdump

- Home: <http://0pointer.de/blog/projects/being-smart.html>
- Repository: <https://git.0pointer.net/libatasmart.git/>
- Git: <git://git.0pointer.net/libatasmart.git>

The `skdump` tool has the advantage of giving a very simple but easy to understand overview. The disadvantage is that this tool is limited to `ATA SMART` storage subsystems, so `NVMe`'s are not supported.

3.1 Installation

```
aptitude install libatasmart-bin
```

3.2 Usage

If you are not interested in the details, or want to use the output of `skdump` for cron jobs, you can just use the `--overall` switch.

Unfortunately, `skdump` does not have a man page. The help lists

```
1 Usage: skdump [PARAMETERS] DEVICE
2 Reads ATA SMART data from a device and parses it.
3
4     --overall           Show overall status
```

5	<code>--status</code>	Show SMART status
6	<code>--can-smart</code>	Show whether SMART is supported
7	<code>--power-on</code>	Print power on time in ms
8	<code>--power-cycle</code>	Print number of power cycles
9	<code>--bad</code>	Print bad sector count
10	<code>--temperature</code>	Print drive temperature in mKelvin
11	<code>--save[=FILENAME]</code>	Save raw data to file/STDOUT
12	<code>--load[=FILENAME]</code>	Read data from a file/STDIN instead of device
13	<code>-h --help</code>	Show this help

```
/usr/sbin/skdump --overall /dev/sda
BAD_SECTOR
/usr/sbin/skdump --overall /dev/sdb
GOOD

# In case you try a NVMe:
/usr/sbin/skdump --overall /dev/nvme0
Failed to open disk /dev/nvme0: No such device
/usr/sbin/skdump --can-smart /dev/nvme0
Failed to open disk /dev/nvme0: No such device

# In case you try to query a software RAID
/usr/sbin/skdump --can-smart /dev/md0
Failed to query whether SMART is available: Operation not supported

# In case you try to query a USB disk (the result depends on the USB
↳ interface)
Device: sat12:/dev/sdb
Type: 12 Byte SCSI ATA SAT Passthru
Size: 1907729 MiB
Awake: Operation not supported
ATA SMART not supported.
```

Since the last commit to `skdump` was on 2012-05-21, it is not surprising that this tool cannot support `NVMe`.

However for older devices the `--overall` parameter is very nice:

```
for i in a b c; do echo -n "DEVICE /dev/sd$i: ";skdump --overall
↳ /dev/sd$i;done
DEVICE /dev/sda: GOOD
DEVICE /dev/sdb: GOOD
DEVICE /dev/sdc: GOOD
```

4 Smartmontools

The `smartmontools` package contains two utilities (`smartctl` and `smartd`) and derived from the Linux `smartsuite` package. It supports ATA/SATA, SCSI/SAS and NVMe disks, as well as SCSI/SAS tape devices.

- [Home](#)
- [SVN](#)
- [SVN RO Mirror](#)

4.1 Installation

```
# aptitude install smartmontools
```

Among others it installs

- `/usr/sbin/smartctl`
- `/usr/sbin/smartd`

4.2 A Deep Dive with smartctl

Smartctl is part of the [Smart Monitor Tools](#) and has received several updates over the years.

Debian	#	smartmontools
Bullseye	12	7.3-1+b1
Bullseye	11	7.2-1
Buster	10	6.6-1
Stretch	9	6.5+svn4324-1

4.2.1 General Usage

In general, the `-a` command line option can be used to get a report. However, this command line option does different things on different hardware. It will print any SMART information about the hard disk, or TapeAlert information about the tape drive or changer.

- For ATA equivalent to: `-H -i -c -A -l error -l selftest -l selective`
- For SCSI equivalent to: `-H -i -A -l error -l selftest`
- For NVMe equivalent to: `-H -i -c -A -l error`

Select the drive. For example `/dev/sda`, `/dev/sdb`, `/dev/nvme0`, ...

```
smartctl -a /dev/sda > smartctl-report-dev-sda-2023-04-14.txt
```

4.2.2 Example Output

4.2.2.1 HDD

```
smartctl -i /dev/sda
smartctl 6.6 2016-05-31 r4324 [x86_64-linux-4.9.0-12-amd64] (local build)
Copyright (C) 2002-16, Bruce Allen, Christian Franke,
  ↪ www.smartmontools.org

=== START OF INFORMATION SECTION ===
Model Family:      Seagate Desktop SSHD
Device Model:      ST1000DX001-1CM162
Serial Number:     Z1DDK6Y6
LU WWN Device Id: 5 000c50 07b11bdcf
Firmware Version: CC43
User Capacity:     1,000,204,886,016 bytes [1.00 TB]
Sector Sizes:     512 bytes logical, 4096 bytes physical
Rotation Rate:    7200 rpm
Form Factor:      3.5 inches
Device is:        In smartctl database [for details use: -P show]
ATA Version is:   ACS-2, ACS-3 T13/2161-D revision 3b
SATA Version is:  SATA 3.1, 6.0 Gb/s (current: 6.0 Gb/s)
Local Time is:    Thu Jun 11 18:51:16 2020 CEST
SMART support is: Available - device has SMART capability.
SMART support is: Enabled
```

4.2.2.2 SSD

```
smartctl -i /dev/sdb
smartctl 6.6 2016-05-31 r4324 [x86_64-linux-4.9.0-12-amd64] (local build)
Copyright (C) 2002-16, Bruce Allen, Christian Franke,
  ↪ www.smartmontools.org

=== START OF INFORMATION SECTION ===
Device Model:      SAMSUNG MZ7TE512HMHP-00000
Serial Number:     AAAAAAAAAAAAAA
LU WWN Device Id: 5 002538 80001c92d
Firmware Version: EXT0100Q
User Capacity:     512,110,190,592 bytes [512 GB]
```

```
Sector Size:      512 bytes logical/physical
Rotation Rate:   Solid State Device
Device is:       Not in smartctl database [for details use: -P showall]
ATA Version is:  ACS-2, ATA8-ACS T13/1699-D revision 4c
SATA Version is: SATA 3.1, 6.0 Gb/s (current: 3.0 Gb/s)
Local Time is:   Thu Jun 11 18:51:32 2020 CEST
SMART support is: Available - device has SMART capability.
SMART support is: Enabled
```

4.2.3 Health

The `smartctl` command has a `-H` or `-health` option that prints the health status of a device.

```
smartctl -H /dev/sdb
smartctl 6.6 2016-05-31 r4324 [x86_64-linux-4.9.0-12-amd64] (local build)
Copyright (C) 2002-16, Bruce Allen, Christian Franke,
↳ www.smartmontools.org

=== START OF READ SMART DATA SECTION ===
SMART overall-health self-assessment test result: PASSED

smartctl -H /dev/sda
smartctl 6.6 2016-05-31 r4324 [x86_64-linux-4.9.0-12-amd64] (local build)
Copyright (C) 2002-16, Bruce Allen, Christian Franke,
↳ www.smartmontools.org

=== START OF READ SMART DATA SECTION ===
SMART overall-health self-assessment test result: PASSED
```

4.2.4 Test

`smartctl` tests can also be used to further investigate the health of a device. Tests are specified with the `-t` or `--test` option followed by an argument: `offline`, `short`, `long`, `conveyance`, `select,N-M`

1	<code>offline</code>	SCSI	foreground default test
2	<code>short</code>	SCSI	background short self test
3	<code>long</code>	SCSI	background long self test
4	<code>long</code>	ATA	extended self test
5	<code>conveyance</code>	ATA	
6	<code>select,N-M</code>	ATA	


```
smartctl -t long /dev/sda
smartctl 6.6 2016-05-31 r4324 [x86_64-linux-4.9.0-12-amd64] (local build)
Copyright (C) 2002-16, Bruce Allen, Christian Franke,
↳ www.smartmontools.org

=== START OF OFFLINE IMMEDIATE AND SELF-TEST SECTION ===
Sending command: "Execute SMART Extended self-test routine immediately in
off-line mode".
Drive command "Execute SMART Extended self-test routine immediately in
↳ off-line
mode" successful.
Testing has begun.
Please wait 115 minutes for test to complete.
Test will complete after Thu Jun 11 21:02:20 2020

Use smartctl -X to abort test.
smartctl -l selftest /dev/sda
```

4.2.5 USB Disk

To use tools like `smartctl` with USB drives, you need to understand that a USB drive, e.g. a SATA SSD or a spinning disc, is connected via an interface, and that adds an abstraction layer in between. It depends on that interface **if** and how well the SMART information can be read and changed. In some cases, auto-detection may not work. Also keep in mind that `smartctl` has improved over time. In one case, the Debian 9 Stretch was not able to handle SMART, while the tool did on Debian 11 Bullseye.

TLDR:

- Use modern `smartctl`
- Scan all devices: `smartctl --scan`
- Try different `-d` option:
 - `smartctl -a -d ata -T permissive /dev/sdb`
 - `smartctl -a -d scsi -T permissive /dev/sdb`
 - `smartctl -a -d sat /dev/sdb`
- Use `--smart=on`

First scan the device to understand what type of device or interface we have:

Debian 9 Stretch (The device to be used, is the missing `/dev/sdb`)

```
smartctl --scan
/dev/sda -d scsi # /dev/sda, SCSI device
```

Debian 11 Bullseye (Also device `/dev/sdb`):

```
smartctl --scan
/dev/sda -d scsi # /dev/sda, SCSI device
/dev/sdb -d sat # /dev/sdb [SAT], ATA device
```

When we use ATA the device shows some information, but not all and it shows at least one error:

```
smartctl -a -d ata --smart=on /dev/sdb
smartctl 7.2 2020-12-30 r5155 [x86_64-linux-5.10.0-21-amd64] (local build)
Copyright (C) 2002-20, Bruce Allen, Christian Franke,
↳ www.smartmontools.org

Read Device Identity failed: Invalid argument

A mandatory SMART command failed: exiting. To continue, add one or more
'-T permissive' options.
```

Adding `-T permissive` gives more information, but this is still not good.

```
smartctl -a -d ata --smart=on -T permissive /dev/sdb
smartctl 7.2 2020-12-30 r5155 [x86_64-linux-5.10.0-21-amd64] (local build)
Copyright (C) 2002-20, Bruce Allen, Christian Franke,
↳ www.smartmontools.org

Read Device Identity failed: Invalid argument

=== START OF INFORMATION SECTION ===
Device Model:          [No Information Found]
Serial Number:         [No Information Found]
Firmware Version:     [No Information Found]
Device is:             Not in smartctl database [for details use: -P showall]
ATA Version is:       [No Information Found]
Local Time is:        Sun Apr 23 14:06:37 2023 CEST
SMART support is:     Ambiguous - ATA IDENTIFY DEVICE words 82-83 don't show if
                      SMART supported.
SMART support is:     Ambiguous - ATA IDENTIFY DEVICE words 85-87 don't show if
                      SMART is enabled.
A mandatory SMART command failed: exiting. To continue, add one or more
```

```
'-T permissive' options
```

Since the first guess using the '-scan' option is sub-optimal, we try SAT. This works on Debian 11 Bullseye, but not on Debian 9 Stretch.

```
smartctl -a -d sat --smart=on /dev/sdb
smartctl 7.2 2020-12-30 r5155 [x86_64-linux-5.10.0-21-amd64] (local build)
Copyright (C) 2002-20, Bruce Allen, Christian Franke,
↳ www.smartmontools.org

=== START OF INFORMATION SECTION ===
Model Family:      Seagate Mobile HDD
Device Model:      ST2000LM007-1R8174
Serial Number:     ABCDEFGH
LU WWN Device Id: 5 000000 0000000000
Firmware Version: SBK2
User Capacity:     2,000,398,934,016 bytes [2.00 TB]
Sector Sizes:     512 bytes logical, 4096 bytes physical
Rotation Rate:    5400 rpm
Form Factor:      2.5 inches
Device is:        In smartctl database [for details use: -P show]
ATA Version is:   ACS-3 T13/2161-D revision 3b
SATA Version is:  SATA 3.1, 6.0 Gb/s (current: 3.0 Gb/s)
Local Time is:   Sun Apr 23 14:08:24 2023 CEST
SMART support is: Available - device has SMART capability.
SMART support is: Enabled

=== START OF ENABLE/DISABLE COMMANDS SECTION ===
SMART Enabled.

=== START OF READ SMART DATA SECTION ===
SMART overall-health self-assessment test result: PASSED

General SMART Values:
Offline data collection status: (0x00) Offline data collection activity
                               was never started.
                               Auto Offline Data Collection: Disabled.
Self-test execution status:    (   0) The previous self-test routine
↳ completed
                               without error or no self-test has ever
                               been run.

Total time to complete Offline
data collection:                (   0) seconds.
```

```

Offline data collection
capabilities:          (0x71) SMART execute Offline immediate.
                    No Auto Offline data collection support.
                    Suspend Offline collection upon new
                    command.
                    No Offline surface scan supported.
                    Self-test supported.
                    Conveyance Self-test supported.
                    Selective Self-test supported.
SMART capabilities:  (0x0003) Saves SMART data before entering
                    power-saving mode.
                    Supports SMART auto save timer.
Error logging capability: (0x01) Error logging supported.
                    General Purpose Logging supported.

Short self-test routine
recommended polling time: ( 1) minutes.
Extended self-test routine
recommended polling time: ( 332) minutes.
Conveyance self-test routine
recommended polling time: ( 2) minutes.
SCT capabilities:    (0x3035) SCT Status supported.
                    SCT Feature Control supported.
                    SCT Data Table supported.

SMART Attributes Data Structure revision number: 10
Vendor Specific SMART Attributes with Thresholds:
ID# ATTRIBUTE_NAME          FLAG     VAL WOR THR TYPE       UPDATE WHEN
  1 Raw_Read_Error_Rate      0x000f  081 064 006 Pre-fail Always - 125167745
  3 Spin_Up_Time              0x0003  097 097 000 Pre-fail Always - 0
  4 Start_Stop_Count          0x0032  100 100 020 Old_age Always - 37
  5 Reallocated_Sector_Ct     0x0033  100 100 036 Pre-fail Always - 0
  7 Seek_Error_Rate           0x000f  068 060 045 Pre-fail Always - 5940389
  9 Power_On_Hours            0x0032  100 100 000 Old_age Always - 385 (121
    ↪ 42 0)
 10 Spin_Retry_Count          0x0013  100 100 097 Pre-fail Always - 0
 12 Power_Cycle_Count         0x0032  100 100 020 Old_age Always - 36
184 End-to-End_Error          0x0032  100 100 099 Old_age Always - 0
187 Reported_Uncorrect        0x0032  100 100 000 Old_age Always - 0
188 Command_Timeout           0x0032  100 100 000 Old_age Always - 0
189 High_Fly_Writes           0x003a  100 100 000 Old_age Always - 0
190 Airflow_Temperature_Cel   0x0022  071 045 040 Old_age Always - 29
    ↪ (Min/Max 27/29)

```

```
191 G-Sense_Error_Rate      0x0032 100 100 000 Old_age Always - 0
192 Power-Off_Retract_Count 0x0032 100 100 000 Old_age Always - 4
193 Load_Cycle_Count        0x0032 100 100 000 Old_age Always - 1195
194 Temperature_Celsius     0x0022 029 055 000 Old_age Always - 29 (0 18
↪ 0 0 0)
197 Current_Pending_Sector  0x0012 100 100 000 Old_age Always - 0
198 Offline_Uncorrectable   0x0010 100 100 000 Old_age Offline - 0
199 UDMA_CRC_Error_Count    0x003e 200 200 000 Old_age Always - 0
240 Head_Flying_Hours       0x0000 100 253 000 Old_age Offline - 41 (80
↪ 206 0)
241 Total_LBAs_Written      0x0000 100 253 000 Old_age Offline -
↪ 2284679980
242 Total_LBAs_Read         0x0000 100 253 000 Old_age Offline - 37878002
254 Free_Fall_Sensor        0x0032 100 100 000 Old_age Always - 0

SMART Error Log Version: 1
No Errors Logged

SMART Self-test log structure revision number 1
No self-tests have been logged. [To run self-tests, use: smartctl -t]

SMART Selective self-test log data structure revision number 1
SPAN  MIN_LBA  MAX_LBA  CURRENT_TEST_STATUS
  1         0         0  Not_testing
  2         0         0  Not_testing
  3         0         0  Not_testing
  4         0         0  Not_testing
  5         0         0  Not_testing

Selective self-test flags (0x0):
  After scanning selected spans, do NOT read-scan remainder of disk.
  If Selective self-test is pending on power-up, resume after 0 minute delay.
```

4.2.5.1 Trouble Shooting

The following has not been tested, but may be worth exploring.

<https://askubuntu.com/questions/637450/cannot-perform-smart-data-and-self-test-on-external-hard-drive>

1. Plug in device
2. `lsusb`, note id and vendor (Bus 002 Device 057: ID 0bc2:2323 Seagate RSS LLC Expansion+)

3. Unplug device
4. `modprobe -r uas`
5. `modprobe -r usb-storage`
6. `modprobe usb-storage quirks=VendorId:ProductId:u` Example:
`modprobe usb-storage quirks=0bc2:2323:u`
Alternatively: Example: `modprobe usb-storage quirks=0bc2:2323:`
7. Plug in device
8. See above link to make permanent

4.2.6 Understanding

The `smartctl` report obtained with the `-a` switch is divided into sections. The names of the sections are not always the same.

```
1 smartctl 6.5+svn4324-1 sda
2 START OF INFORMATION SECTION
3 START OF READ SMART DATA SECTION
4
5 smartctl 6.6-1 sda
6 START OF INFORMATION SECTION
7 START OF READ SMART DATA SECTION
8
9 smartctl 7.2-1 nvme
10 START OF INFORMATION SECTION
11 START OF SMART DATA SECTION
12
13 smartctl 7.3-1+b1 sda
14 START OF INFORMATION SECTION
15 START OF READ SMART DATA SECTION
```

The tool `smartctl` gives a summary after the keyword `result:`. If you are strictly only interested at the result a `grep` including the colon works.

```
smartctl -a /dev/sda |grep 'result:'
SMART overall-health self-assessment test result: PASSED
```

However warnings often includes the word 'result', therefore `grep` without colons is advised:

```
smartctl -a /dev/sda |grep 'result'  
SMART overall-health self-assessment test result: PASSED  
Warning: This result is based on an Attribute check.
```

5 Smartctl And Skdump Differs

If you compare the result of `smartctl` with `skdump`, it is obvious that the booth tools have different opinions about the health of the disk. I have noticed that when `skdump` gives a `BAD SECTOR` result, it is still `PASSED` by `smartctl`. The error count is not a clear indicator. I have seen discs with a low error count `>0` reported as `GOOD` and `PASSED`, while a higher error count is likely to be reported as `BAD SECTOR`.

So it seems difficult to decide when a drive is **bad**. However, a drive that has 0 errors can be considered **good**.

6 Hdparm

`hdparm` is not a classic tool for determining the health of a specific storage subsystem device. However, it can be used to heuristically understand the performance and therefore indirectly the health of a device. It is advisable to query a device after purchase and decide on a speed margin for the future, and see in subsequent queries if the device is performing as expected.

6.1 Installing

```
aptitude install hdparm
```

6.2 Information and Tests

```
hdparm -v /dev/sdb  
  
/dev/sdb:  
multcount      = 0 (off)  
readonly       = 0 (off)  
readahead     = 256 (on)  
geometry      = 243201/255/63, sectors = 3907029167, start = 0
```

```
hdparm -t /dev/sdb
```

```
/dev/sdb:
```

```
Timing buffered disk reads: 102 MB in 3.01 seconds = 33.93 MB/sec
```

```
hdparm -T /dev/sdb
```

```
/dev/sdb:
```

```
Timing cached reads: 6416 MB in 2.00 seconds = 3211.52 MB/sec
```

```
hdparm -I /dev/sdb
```

```
/dev/sdb:
```

```
ATA device, with non-removable media
```

```
Standards:
```

```
    Likely used: 1
```

```
Configuration:
```

Logical	max	current
cylinders	0	0
heads	0	0
sectors/track	0	0

```
--
```

Logical/Physical Sector size:	512 bytes
device size with M = 1024*1024:	0 MBytes
device size with M = 1000*1000:	0 MBytes
cache/buffer size	= unknown

```
Capabilities:
```

```
    IORDY not likely
```

```
    Cannot perform double-word IO
```

```
    R/W multiple sector transfer: not supported
```

```
    DMA: not supported
```

```
    PIO: pio0
```

```
smartctl -a /dev/sdb -d scsi --smart=on
```

```
smartctl 7.2 2020-12-30 r5155 [x86_64-linux-5.10.0-21-amd64] (local build)
```

```
Copyright (C) 2002-20, Bruce Allen, Christian Franke,
```

```
↳ www.smartmontools.org
```

```
=== START OF INFORMATION SECTION ===
```

```
Vendor: Seagate
```

```
Product: Expansion+
```



```
Revision:          9300
Compliance:       SPC-4
User Capacity:    2,000,398,933,504 bytes [2.00 TB]
Logical block size: 512 bytes
Physical block size: 4096 bytes
Logical Unit id:  0x5000000000000001
Serial number:    NA8L4Z89
Device type:      disk
Local Time is:    Sun Apr 23 13:35:40 2023 CEST
SMART support is: Available - device has SMART capability.
SMART support is: Disabled
Temperature Warning: Disabled or Not Supported

=== START OF ENABLE/DISABLE COMMANDS SECTION ===
Informational Exceptions (SMART) disabled
Temperature warning disabled

=== START OF READ SMART DATA SECTION ===
SMART Health Status: OK
Current Drive Temperature:    0 C
Drive Trip Temperature:       0 C

Error Counter logging not supported

Device does not support Self Test logging
```

7 UAS

The `uas` (USB Attached SCSI) kernel module in Linux is responsible for handling USB 3.0 storage devices that support the UAS protocol. This protocol is an alternative to the older USB Mass Storage Bulk-Only Transport (BOT) standard and is designed to improve the performance of USB storage devices.

Understand if UAS ins active:

```
lsmod|grep uas
uas                32768  0
usb_storage        81920  1 uas
usbcore            331776  14 xhci_hcd,ehci_pci,snd_usb_audio,usbhid,\
                    snd_usbmidi_lib,usb_lp,apple_mfi_fastcharge,\
                    usb_storage,uvcvideo,ehci_hcd,ath3k,btusb,\
                    xhci_pci,uas
```

```
scsi_mod          270336  6  sd_mod,usb_storage,uas,libata,sg,sr_mod
```

Check the driver:

```
lsusb -t|egrep -e 'usb-|uas'  
    |__ Port 3: Dev 52, If 0, Class=Mass Storage, Driver=usb-storage,  
    |__ 480M
```

This device do not use `uas`, it uses `storage` so BOT. It should display `uas` if UAS is used.

```
lsusb -t|egrep -e 'usb-|uas'  
    |__ Port 2: Dev 5, If 0, Class=Mass Storage, Driver=uas, 5000M
```

To test BOT mode you can remove the UAS kernel module.

```
modprobe -r uas  
modprobe -r usb-storage
```

- Use `smartctl` tests, `hdparm` tests or `dd` to stress the USB device
- Use `dmesg | grep -i usb` to check for any USB related errors.

8 Conclusion

While `skdump` is easier to use and understand, the number of supported devices is very limited and the software has not been updated since 2012, so unless the system is old, it is recommended to use `smartctl` instead.

For many USB devices it is difficult to impossible to test the health of the device. However, it may be useful to use UAS mode for the USB drive if possible. If this is not possible, check for a quirk or switch to OBT USB mode.

While `hdparm` and similar tools do not directly check the health, they can be used to evaluate a drive:

- performance
- power mode
- bad sectors

9 History

Version	Date	Notes
0.1.3	2024-02-17	Skdump –overall
0.1.2	2024-02-16	Reorder sections, + UAS section
0.1.1	2023-03-14	More on USB disks
0.1.0	2020-06-11	Initial release

10 Disclaimer of Warranty

THERE IS NO WARRANTY FOR THIS INFORMATION, DOCUMENTS AND PROGRAMS, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE INFORMATION, DOCUMENT OR THE PROGRAM "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE INFORMATION, DOCUMENTS AND PROGRAMS IS WITH YOU. SHOULD THE INFORMATION, DOCUMENTS OR PROGRAMS PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

11 Limitation of Liability

IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MODIFIES AND/OR CONVEYS THE INFORMATION, DOCUMENTS OR PROGRAMS AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE INFORMATION, DOCUMENTS OR PROGRAMS (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE INFORMATION, DOCUMENTS OR PROGRAMS TO OPERATE WITH ANY OTHER PROGRAMS), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.