Costruisci la tua cassetta degli attrezzi open source

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CHI È PCOFFICINA

Associazione Culturale, nata nel 2011.
Sostiene l'accesso a mezzi di comunicazione moderna per tutti, attraverso:

- sportello aperto alla cittadinanza per risolvere insieme problemi col PC
- rigenerazione di Computer ricevuti da privati, aziende ed enti pubblici
- donazione di materiale per singoli, scuole ed associazioni in stato di necessità

Contrasta l'obsolescenza programmata dei dispositivi elettronici, in particolare PC

Diffonde la cultura della riparazione e l'uso del Software Libero: Linux e non solo

Vienici a trovare al nostro stand!

DI COSA PARLEREMO OGGI?

Vi illustreremo gli **strumenti diagnostici** essenziali che non possono mancare nella vostra “cassetta degli attrezzi” informatica.

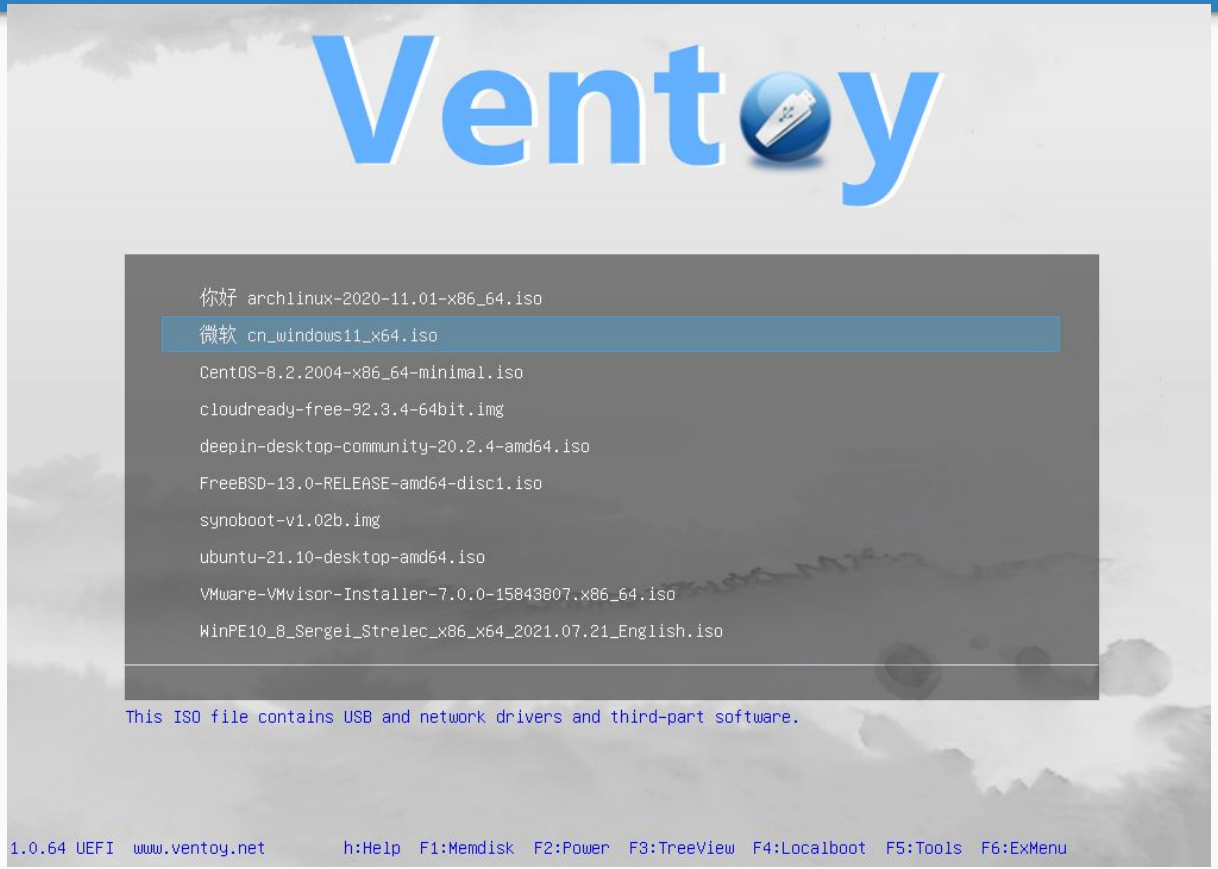
In particolare, vi faremo vedere una collezione di software **open source** regolarmente **utilizzati da PCOfficina** per diagnosticare e inventariare i PC donati, un passaggio essenziale per la futura riparazione e rigenerazione.

Agenda

1. Il contenitore
2. Testare la RAM
3. Il sistema operativo di recupero
4. Conoscere l’hardware
5. Conoscere il disco
6. Controllare il disco
7. Conclusione

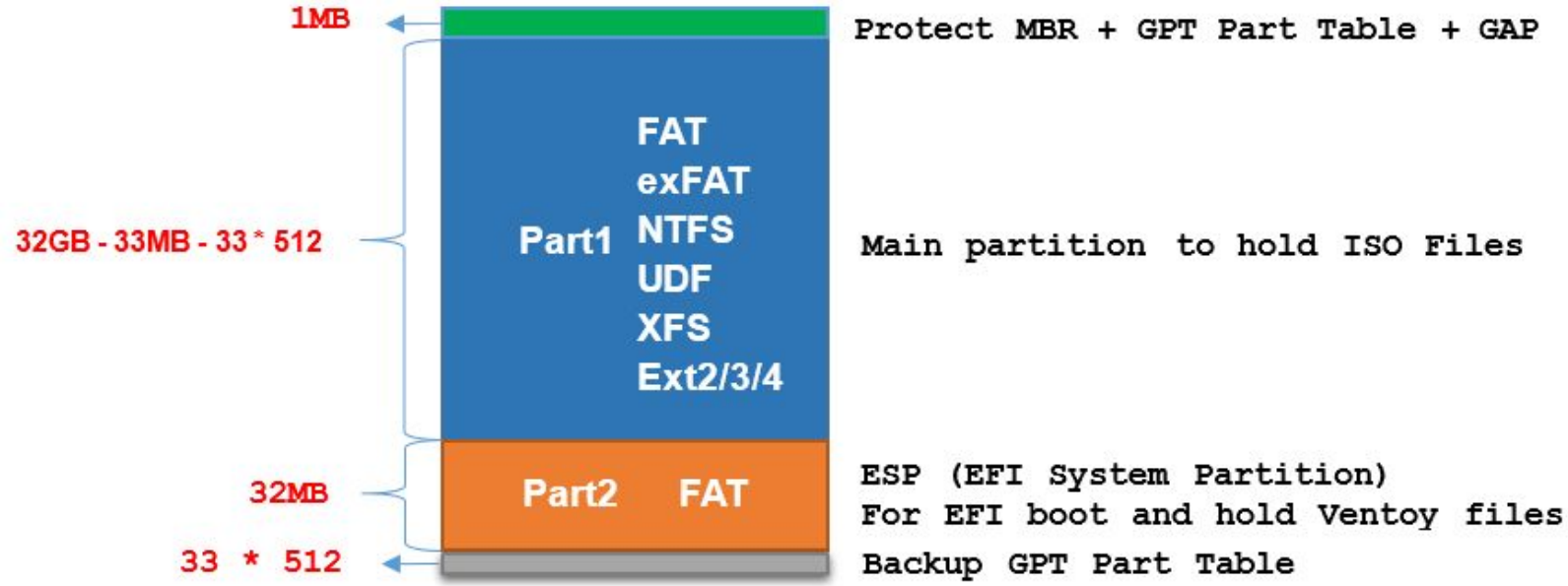
1. Il contenitore

LA NOSTRA CASSETTA: VENTOY



https://ventoy.net/

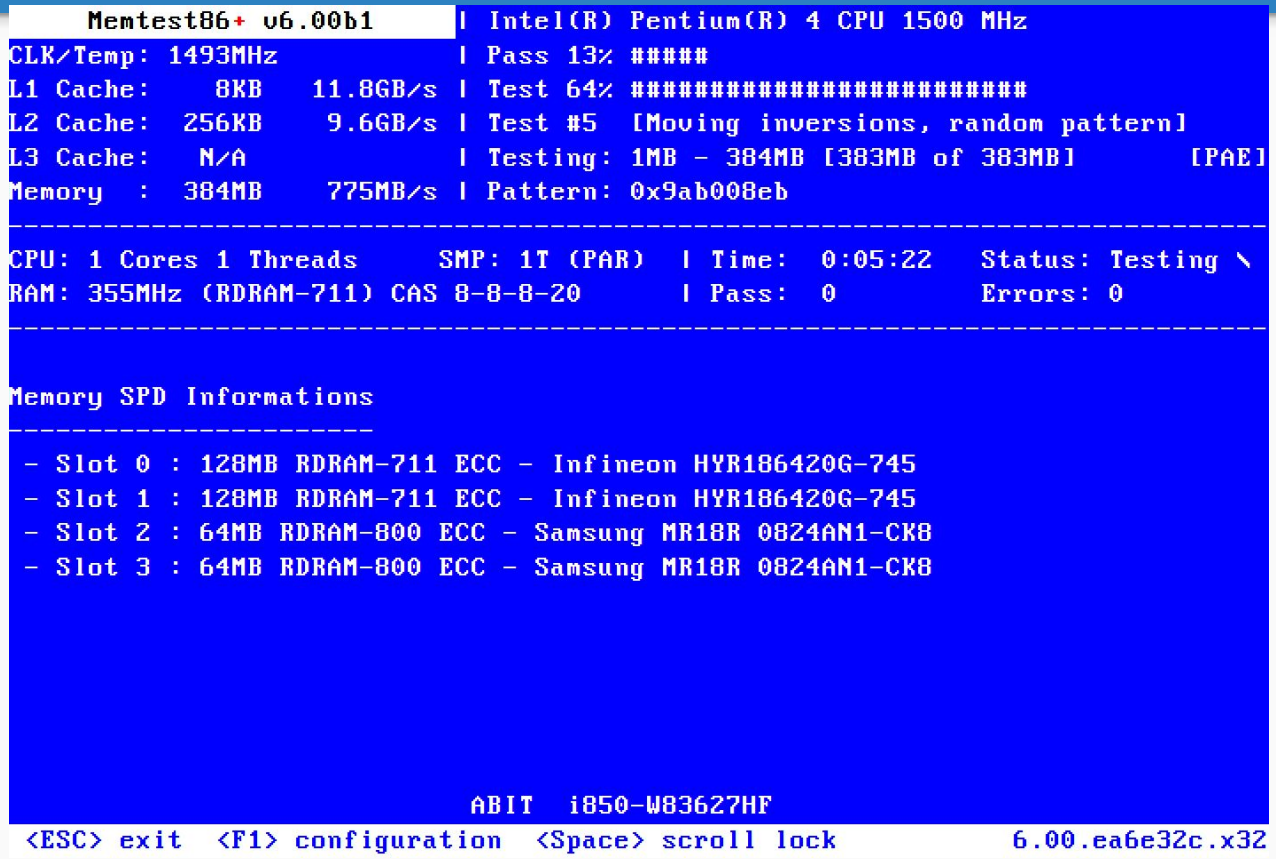
COME FUNZIONA VENTOY



Ventoy USB Disk Layout In GPT Style

2. Testare la RAM

TASTARE IL TERRENO: MEMTEST86+



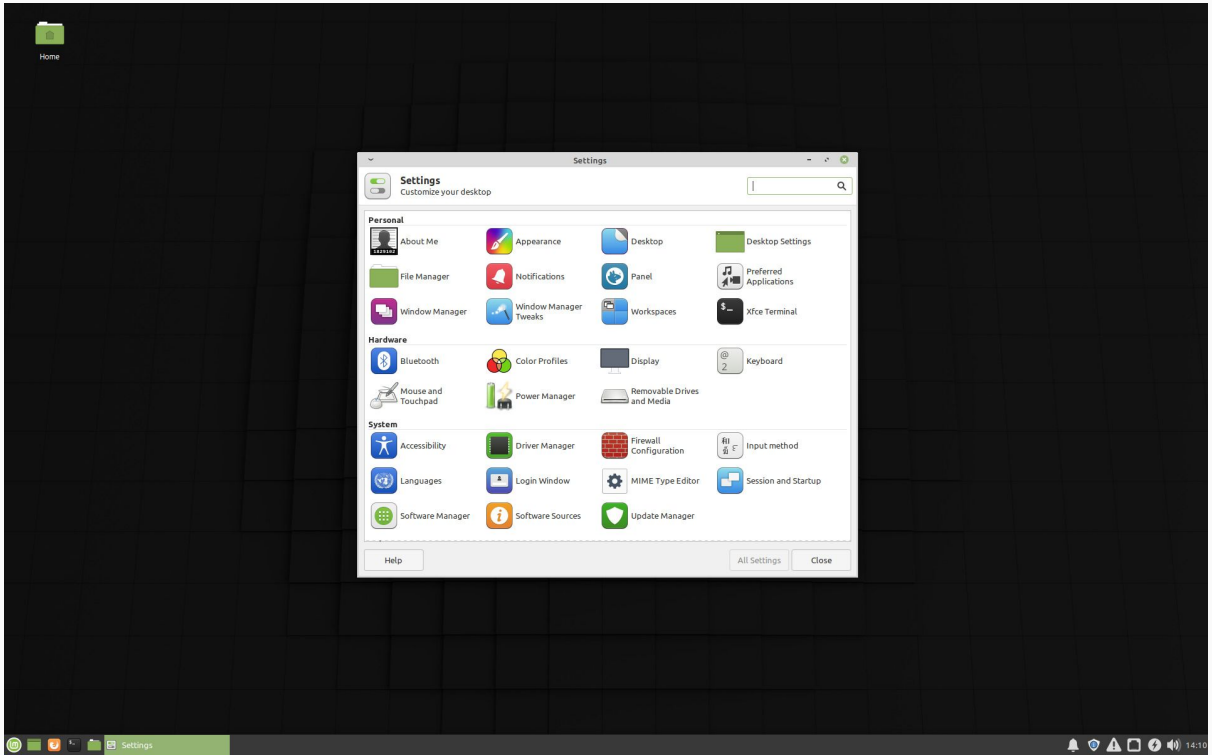
https://www.memtest.org/

I TEST DI MEMTEST86+

- Test 0: Address test, walking ones, no cache
- Test 1: Address test, own address in window
- Test 2: Address test, own address + window
- Test 3: Moving inversions, ones & zeros
- Test 4: Moving inversions, 8 bit pattern
- Test 5: Moving inversions, random pattern
- Test 6: Moving inversions, 32/64 bit
- Test 7: Block move, 64 moves
- Test 8: Random number sequence
- Test 9: Modulo 20, random pattern
- Test 10: Bit fade test, 2 patterns

3. Il sistema operativo

LIVE ISO PER LA MANUTENZIONE: LINUX MINT



4. Conoscere l’hardware

Conoscere l’hardware: dmidecode

- dmidecode: mostra la tabella SMBIOS in formato leggibile
- Supporto per x86-64 e ARM
- https://www.nongnu.org/dmidecode/

```
[emanuele@thinkpadt470 ~]$ sudo dmidecode
[sudo] password for emanuele:
# dmidecode 3.4
Getting SMBIOS data from sysfs.
SMBIOS 3.0.0 present.
Table at 0xCA6B9000.

Handle 0x0000, DMI type 222, 14 bytes
OEM-specific Type
        Header and Data:
                DE 0E 00 00 01 99 00 03 10 01 20 02 30 03
        Strings:
                Memory Init Complete
                End of DXE Phase
                BIOS Boot Complete

Handle 0x0001, DMI type 14, 8 bytes
Group Associations
        Name: Intel(R) Silicon View Technology
        Items: 1
                0x0000 (OEM-specific)

Handle 0x0002, DMI type 134, 13 bytes
OEM-specific Type
        Header and Data:
                86 0D 02 00 21 10 17 20 00 00 00 00 00

Handle 0x0003, DMI type 16, 23 bytes
Physical Memory Array
        Location: System Board Or Motherboard
        Use: System Memory
        Error Correction Type: None
        Maximum Capacity: 32 GB
        Error Information Handle: Not Provided
        Number Of Devices: 2

Handle 0x0004, DMI type 17, 40 bytes
Memory Device
        Array Handle: 0x0003
        Error Information Handle: Not Provided
        Total Width: 64 bits
```

Tabella SMBIOS

- SMBIOS: System Management BIOS
- Definisce strutture dati e metodi di accesso che l’OS può usare per leggere le informazioni sull’hardware
- Inizializzata dal BIOS all’avvio
- Attenzione: il BIOS può mentire!
- Obiettivo: eliminare la necessità di accedere direttamente all’hardware
  - Usato anche da Linux

dmidecode in azione (1)

```
[emanuele@thinkpadt470 ~]$ sudo dmidecode
[sudo] password for emanuele:
# dmidecode 3.4
Getting SMBIOS data from sysfs.
SMBIOS 3.0.0 present.
Table at 0xCA6B9000.

Handle 0x0000, DMI type 222, 14 bytes
OEM-specific Type
        Header and Data:
                DE 0E 00 00 01 99 00 03 10 01 20
        Strings:
                Memory Init Complete
                End of DXE Phase
                BIOS Boot Complete

Handle 0x0001, DMI type 14, 8 bytes
Group Associations
        Name: Intel(R) Silicon View Technology
        Items: 1
                0x0000 (OEM-specific)

Handle 0x0002, DMI type 134, 13 bytes
OEM-specific Type
        Header and Data:
                86 0D 02 00 21 10 17 20 00 00 00

Handle 0x0003, DMI type 16, 23 bytes
Physical Memory Array
        Location: System Board Or Motherboard
        Use: System Memory
        Error Correction Type: None
        Maximum Capacity: 32 GB
        Error Information Handle: Not Provided
        Number Of Devices: 2
```

```
Handle 0x0004, DMI type 17, 40 bytes
Memory Device
        Ar      e: 0x0
        Er      mation                  Provided
        To              64 bits
        Data            bits
        Size: 4 GB
        Form Factor: SODIMM
        Set: None
        Locator: ChannelA-DIMM0
        Bank Locator: BANK 0
        Type: DDR4
        Type Detail: Synchronous Unbuffe
        Speed: 2133 MT/s
        Manufacturer: 859B
        Serial Number: E7CEB5CD
        Asset Tag: None
        Part Number: CT4G4SFS824A.M8FF
        Rank: 1
        Configured Memory Speed: 2133 MT
        Minimum Voltage: Unknown
        Maximum Voltage: Unknown
        Configured Voltage: 1.2 V

Handle 0x0005, DMI type 17, 40 bytes
Memory Device
        Array Handle: 0x0003
        Error Information Handle: Not Pr
        Total Width: 64 bits
        Data Width: 64 bits
        Size: 4 GB
        Form Factor: SODIMM
        Set: None
```

```
Handle 0x0004, DMI type 17, 40 bytes
Memory Device
        Array Handle: 0x0003
        Error Information Handle: Not Provided
        Total Width: 64 bits
        Data Width: 64 bits
        Size: 4 GB
        Form Factor: SODIMM
        Set: None
        Locator: ChannelA-DIMM0
        Bank Locator: BANK 0
        Type: DDR4
        Type Detail: Synchronous Unbuffered (Unregistered)
        Speed: 2133 MT/s
        Manufacturer: 859B
        Serial Number: E7CEB5CD
        Asset Tag: None
        Part Number: CT4G4SFS824A.M8FF
        Rank: 1
        Configured Memory Speed: 2133 MT/s
        Minimum Voltage: Unknown
        Maximum Voltage: Unknown
        Configured Voltage: 1.2 V
```

dmidecode in azione (2)

```
[emanuele@thinkpadt470 ~]$ sudo dmidecode -t processor
[sudo] password for emanuele:
# dmidecode 3.4
Getting SMBIOS data from sysfs.
SMBIOS 3.0.0 present.

Handle 0x000A, DMI type 4, 48 bytes
Processor Information
        Socket Designation: U3E1
        Type: Central Processor
        Family: Core i5
        Manufacturer: Intel(R) Corporation
        ID: E9 06 08 00 FF FB EB BF
        Signature: Type 0, Family 6, Model
        Flags:
                FPU (Floating-point unit on
                VME (Virtual mode extension
                DE (Debugging extension)
                PSE (Page size extension)
                TSC (Time stamp counter)
                MSR (Model specific registe
                PAE (Physical address exten
                MCE (Machine check exceptio
                CX8 (CMPXCHG8 instruction s
                APIC (On-chip APIC hardware
                SEP (Fast system call)
                MTRR (Memory type range reg
                PGE (Page global enable)
                MCA (Machine check architec
                CMOV (Conditional move inst
                PAT (Page attribute table)
                PSE-36 (36-bit page size ex
                CLFSH (CLFLUSH instruction
                FXSR (FXSAVE and FXSTOR instructions supported)
                SSE (Streaming SIMD extensions)
                SSE2 (Streaming SIMD extensions 2)
                SS (Self-snoop)
                HTT (Multi-threading)
                TM (Thermal monitor supported)
                PBE (Pending break enabled)
        Version: Intel(R) Core(TM) i5-7200U CPU @ 2.50GHz
        Voltage: 0.9 V
        External Clock: 100 MHz
        Max Speed: 2700 MHz
        Current Speed: 2500 MHz
        Status: Populated, Enabled
        Upgrade: Other
        L1 Cache Handle: 0x0007
        L2 Cache Handle: 0x0008
        L3 Cache Handle: 0x0009
        Serial Number: None
        Asset Tag: None
        Part Number: None
        Core Count: 2
        Core Enabled: 2
        Thread Count: 4
        Characteristics:
                64-bit capable
                Multi-Core
                Hardware Thread
                Execute Protection
                Enhanced Virtualization
                Power/Performance Control
```

Keyword	Types
bios	0, 13
system	1, 12, 15, 23, 32
baseboard	2, 10, 41
chassis	3
processor	4
memory	5, 6, 16, 17
cache	7
connector	8
slot	9

5. Conoscere il disco

Conoscere il disco: Smartmontools

- Smartmontools: insieme di programmi (**smartctl**…) per controllare e monitorare dischi tramite S.M.A.R.T

- **S.M.A.R.T**: Self-Monitoring, Analysis, and Reporting Technology

smartctl in azione (1)

```
[emanuele@thinkpadt470 ~]$ sudo smartctl --all /dev/sda
smartctl 7.3 2022-02-28 r5338 [x86_64-linux-6.0.7-301.fc37.x86_64] (local build)
Copyright (C) 2002-22, Bruce Allen, Christian Franke, www.smartmontools.org

=== START OF INFORMATION SECTION ===
Device Model:     INTEL SSDSC2KF180H6L
Serial Number:    CVLT707400A6180BGN
LU WWN Device Id: 5 5cd2e4 14d33e603
Firmware Version: LSFL37P
User Capacity:    180,045,766,656 bytes [180 GB]
Sector Size:      512 bytes logical/physical
Rotation Rate:    Solid State Device
Form Factor:      2.5 inches
TRIM Command:     Available, deterministic
Device is:        Not in smartctl database 7.3/5319
ATA Version is:   ACS-3 (minor revision not indicated)
SATA Version is:  SATA 3.2, 6.0 Gb/s (current: 6.0 Gb/s)
Local Time is:    Sat Oct 26 09:36:26 2024 CEST
SMART support is: Available - device has SMART capability.
SMART support is: 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
```

smartctl in azione (2)

```
SMART Attributes Data Structure revision number: 1
Vendor Specific SMART Attributes with Thresholds:
ID# ATTRIBUTE_NAME          FLAG     VALUE WORST THRESH TYPE      UPDATED  WHEN_FAILED RAW_VALUE
  5 Reallocated_Sector_Ct   0x0032   100   100   000    Old_age   Always       -       0
  9 Power_On_Hours          0x0032   100   100   000    Old_age   Always       -       1140
 12 Power_Cycle_Count       0x0032   100   100   000    Old_age   Always       -       5905
170 Unknown_Attribute       0x0033   100   100   010    Pre-fail  Always       -       0
171 Unknown_Attribute       0x0032   100   100   010    Old_age   Always       -       0
172 Unknown_Attribute       0x0032   100   100   010    Old_age   Always       -       0
173 Unknown_Attribute       0x0032   100   100   000    Old_age   Always       -       36
174 Unknown_Attribute       0x0032   100   100   000    Old_age   Always       -       70
183 Runtime_Bad_Block       0x0032   100   100   000    Old_age   Always       -       0
184 End-to-End_Error        0x0033   100   100   097    Pre-fail  Always       -       0
187 Reported_Uncorrect      0x0032   100   100   000    Old_age   Always       -       0
190 Airflow_Temperature_Cel 0x0032   020   040   000    Old_age   Always       -       20 (Min/Max 8/40)
192 Power-Off_Retract_Count 0x0032   100   100   000    Old_age   Always       -       70
194 Temperature_Celsius     0x0032   020   040   000    Old_age   Always       -       20 (Min/Max 8/40)
199 UDMA_CRC_Error_Count    0x0032   100   100   000    Old_age   Always       -       0
225 Unknown_SSD_Attribute   0x0032   100   100   000    Old_age   Always       -       4525
226 Unknown_SSD_Attribute   0x0032   100   100   000    Old_age   Always       -       0
227 Unknown_SSD_Attribute   0x0032   100   100   000    Old_age   Always       -       0
228 Power-off_Retract_Count 0x0032   100   100   000    Old_age   Always       -       0
232 Available_Reservd_Space 0x0033   100   100   010    Pre-fail  Always       -       0
233 Media_Wearout_Indicator 0x0033   094   094   001    Pre-fail  Always       -       0
236 Unknown_Attribute       0x0033   094   094   001    Pre-fail  Always       -       0
241 Total_LBAs_Written      0x0032   100   100   000    Old_age   Always       -       4525
242 Total_LBAs_Read         0x0032   100   100   000    Old_age   Always       -       8136
249 Unknown_Attribute       0x0032   100   100   000    Old_age   Always       -       3907
```

smartctl in azione (3)

ID	Attribute name	Ideal	!	Description
01 0x01	**Read Error Rate**	Low ▼	⚠	(Vendor specific raw value.) Stores data related to the rate of hardware read errors that occurred when reading data from a disk surface. The raw value has different structure for different vendors and is often not meaningful as a decimal number. For some drives, this number may increase during normal operation without necessarily signifying errors.[31][32][33]
02 0x02	**Throughput Performance**	▲ High		Overall (general) throughput performance of a hard disk drive. If the value of this attribute is decreasing there is a high probability that there is a problem with the disk.
03 0x03	**Spin-Up Time**	Low ▼		Average time of spindle spin up (from zero RPM to fully operational [milliseconds]).
04 0x04	**Start/Stop Count**			A tally of spindle start/stop cycles. The spindle turns on, and hence the count is increased, both when the hard disk is turned on after having before been turned entirely off (disconnected from power source) and when the hard disk returns from having previously been put to sleep mode.[34]
05 0x05	**Reallocated Sectors Count**	Low ▼	⚠ [35][36][37]	Count of reallocated sectors. The raw value represents a count of the bad sectors that have been found and remapped.[38] Thus, the higher the attribute value, the more sectors the drive has had to reallocate. This value is primarily used as a metric of the life expectancy of the drive; a drive which has had any reallocations at all is significantly more likely to fail in the immediate months.[35][39] If Raw value of 0x05 attribute is higher than its Threshold value, that will reported as "drive warning".[40]

https://en.wikipedia.org/wiki/Self-Monitoring,_Analysis_and_Reporting_Technology

smartctl in azione (4)

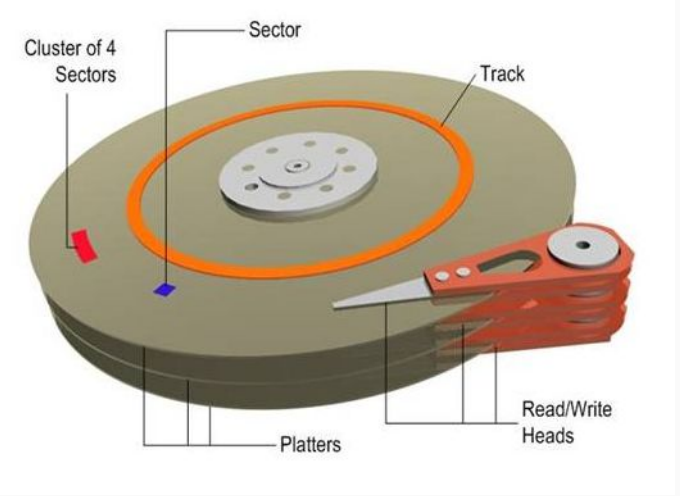
```
SMART Attributes Data Structure revision number: 16
Vendor Specific SMART Attributes with Thresholds:
ID# ATTRIBUTE_NAME          FLAG     VALUE WORST THRESH TYPE      UPDATED  WHEN_FAILED RAW_VALUE
  1 Raw_Read_Error_Rate     0x002f   098   097   051    Pre-fail  Always       -       13993
  2 Throughput_Performance  0x0026   252   252   000    Old_age   Always       -       0
  3 Spin_Up_Time            0x0023   088   088   025    Pre-fail  Always       -       3726
  4 Start_Stop_Count        0x0032   100   100   000    Old_age   Always       -       780
  5 Reallocated_Sector_Ct   0x0033   252   252   010    Pre-fail  Always       -       0
  7 Seek_Error_Rate         0x002e   252   252   051    Old_age   Always       -       0
  8 Seek_Time_Performance   0x0024   252   252   015    Old_age   Offline      -       0
  9 Power_On_Hours          0x0032   100   100   000    Old_age   Always       -       4
 10 Spin_Retry_Count        0x0032   252   252   051    Old_age   Always       -       0
 11 Calibration_Retry_Count 0x0032   100   100   000    Old_age   Always       -       553
 12 Power_Cycle_Count       0x0032   100   100   000    Old_age   Always       -       323
191 G-Sense_Error_Rate      0x0022   100   100   000    Old_age   Always       -       13
192 Power-Off_Retract_Count 0x0022   252   252   000    Old_age   Always       -       0
194 Temperature_Celsius     0x0002   059   058   000    Old_age   Always       -       41 (Min/Max 25/42)
195 Hardware_ECC_Recovered  0x003a   100   100   000    Old_age   Always       -       0
196 Reallocated_Event_Count 0x0032   252   252   000    Old_age   Always       -       0
197 Current_Pending_Sector  0x0032   099   099   000    Old_age   Always       -       125
198 Offline_Uncorrectable   0x0030   252   252   000    Old_age   Offline      -       0
199 UDMA_CRC_Error_Count    0x0036   100   100   000    Old_age   Always       -       1
200 Multi_Zone_Error_Rate   0x002a   100   100   000    Old_age   Always       -       11
223 Load_Retry_Count        0x0032   100   100   000    Old_age   Always       -       553
225 Load_Cycle_Count        0x0032   097   097   000    Old_age   Always       -       35267

SMART Error Log Version: 1
```

5. Controllare il disco

Controllare il disco: badblocks

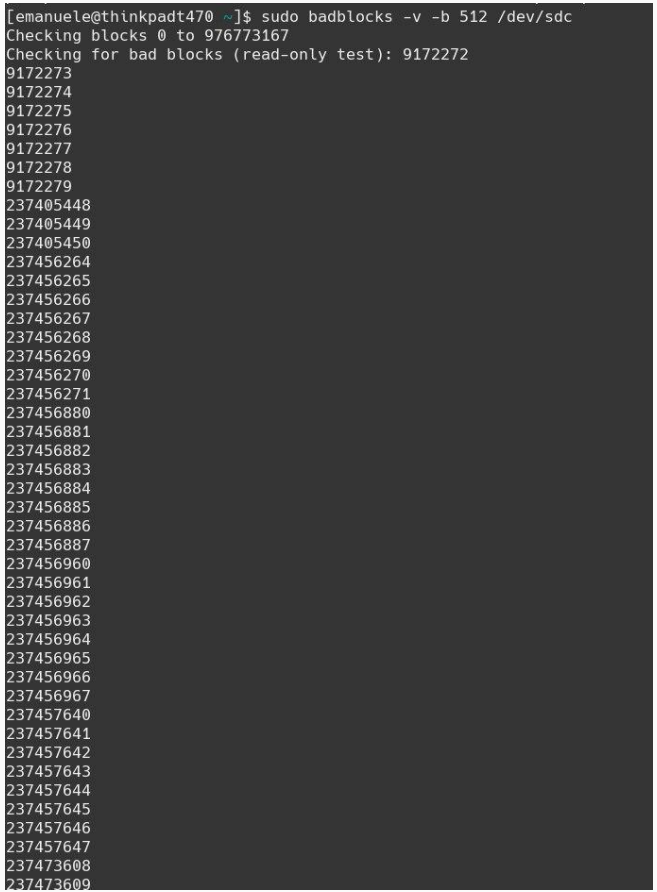
- Badblocks: controlla un disco alla ricerca di settori danneggiati
  - I settori danneggiati possono essere esclusi
- Uso principale: controllare lo stato effettivo del disco
  - Con le limitazioni (SSD, struttura disco…)
- Badblocks è nato per i floppy disk!



Modalità di testing

1. **Test sola lettura**
    - Non invasivo e veloce ma limitato (SMART self-test)
2. **Test in scrittura distruttivo**
    - Adatto su dischi senza dati importanti (o nuovi)
3. **Test in scrittura non distruttivo**
    - Effettua un backup settore per settore

badblocks in azione




```
# badblocks -wsv /dev/device

Checking for bad blocks in read-write mode
From block 0 to 488386583
Testing with pattern 0xaa: done
Reading and comparing: done
Testing with pattern 0x55: done
Reading and comparing: done
Testing with pattern 0xff: 22.93% done, 4:09:55 elapsed. (0/0/0 errors)
[...]
Testing with pattern 0x00: done
Reading and comparing: done
Pass completed, 0 bad blocks found. (0/0/0 errors)
```

6. Conclusione

Conclusione

- La cassetta degli attrezzi open source:

  1. Ventoy
  2. Memtest86+
  3. Linux Mint
  4. dmidecode
  5. smartmontools
  6. badblocks

- Il tutto senza aprire il computer 😄

Domande?

GRAZIE!

Restiamo in contatto:

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