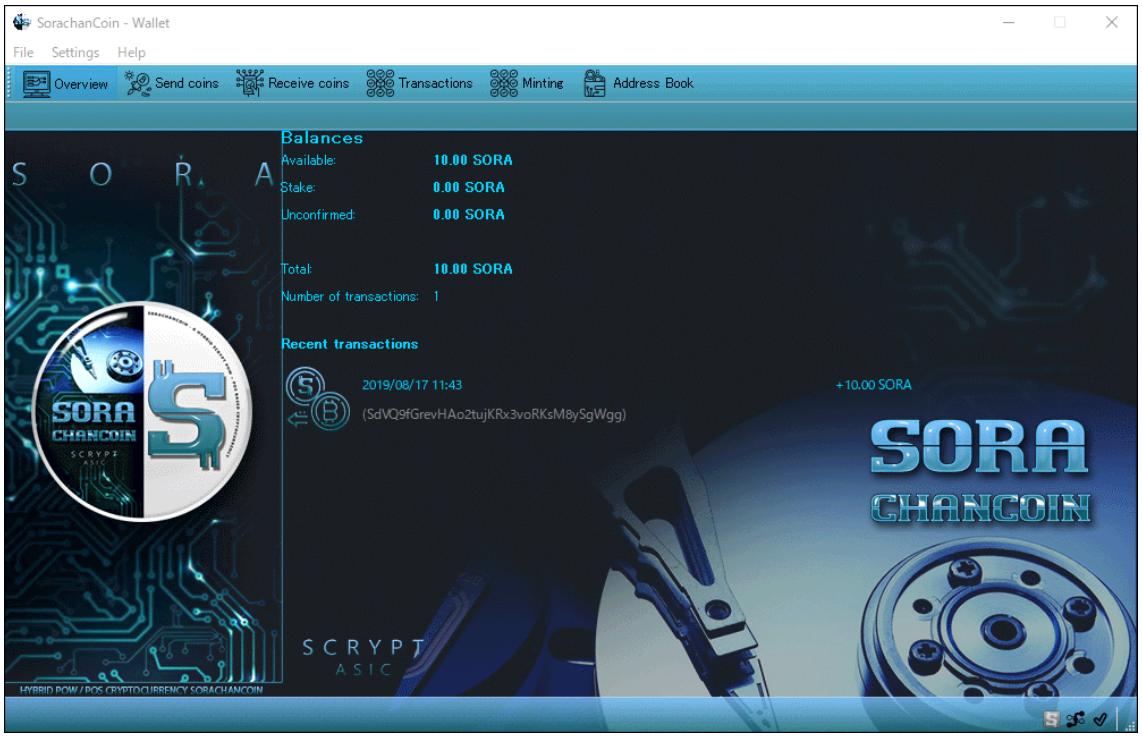
Autonomous Drives(HDD/SSD) operation Blockchain

SorachanCoin



INDEX

1, Introduction

A drive capacity and speed are great,
but there is one annoying problem.
It's complicated to manage.
Do you really feel that managing data is troublesome?

Wouldn't it be useful to have a system which the non-centralized system by autonomous blockchain automatically manages drive failure prediction, safe data recovery control and calculation cost settlement?

The goal is to achieve this.

2, About S.M.A.R.T.

I think that you know a drives(HDD/SSD) has a drive failure prediction detection function called the "S.M.A.R.T.".

However, because of ambiguity of define, they are difficult to say that mission of "DATA PROTECT" is fulfilled,
and there are many cases which prediction is failure and DATA ARE LOST.

What do you think about this?
I understand best way that data proteced by backup.
But it is difficult to ptotecrt data for working even a hardworking person that backup every day.

Why not?
If you do not read to a drives for a long time(If you only use a drives for backup,
its will only write), the range that can not be read is expanded!

This will result in the loss of backed up data!
Therefore data of important are lost.

3, About mirror (RAID-1)

In HDD and SSD, there are some sectors that cannot be read.
These are called "bit corruption" and are still defined.

Note: It does not matter whether the drive is used or not.

In other words, long-term storage data, etc., that are left behind and rarely accessed are sacrificed.
Such a phenomenon is similar to how food slowly rots, so the name "bit rot" is thought to have resulted.

Is it normal if you can see the file list after accessing the drive?
Access starts with metadata (tree structure) recorded in BPB and drive.

When the target hierarchy is reached, the data list (record) of that part is read and the queue is completed.
In other words, once you get there, access is complete, so there is no further reading.

This means that even if the first access is successful, the success is "only a few sectors".
In addition, the frequency of accessing frequently used files will increase on a daily basis, but storage data will be reversed.
This property makes it necessary to inspect the drive.

In the data recovery function, this part is called "metadata" and data reconstruction is performed from there.

For RAID, bit corruption is the "threat" itself.
This is because RAID requires "all sector integrity" for live drives to rebuild.

If bit corruption occurs from any place in the meantime, this will cause the rebuild to fail.

Running something without a backup without knowing if it can be rebuilt will eventually result in data loss.

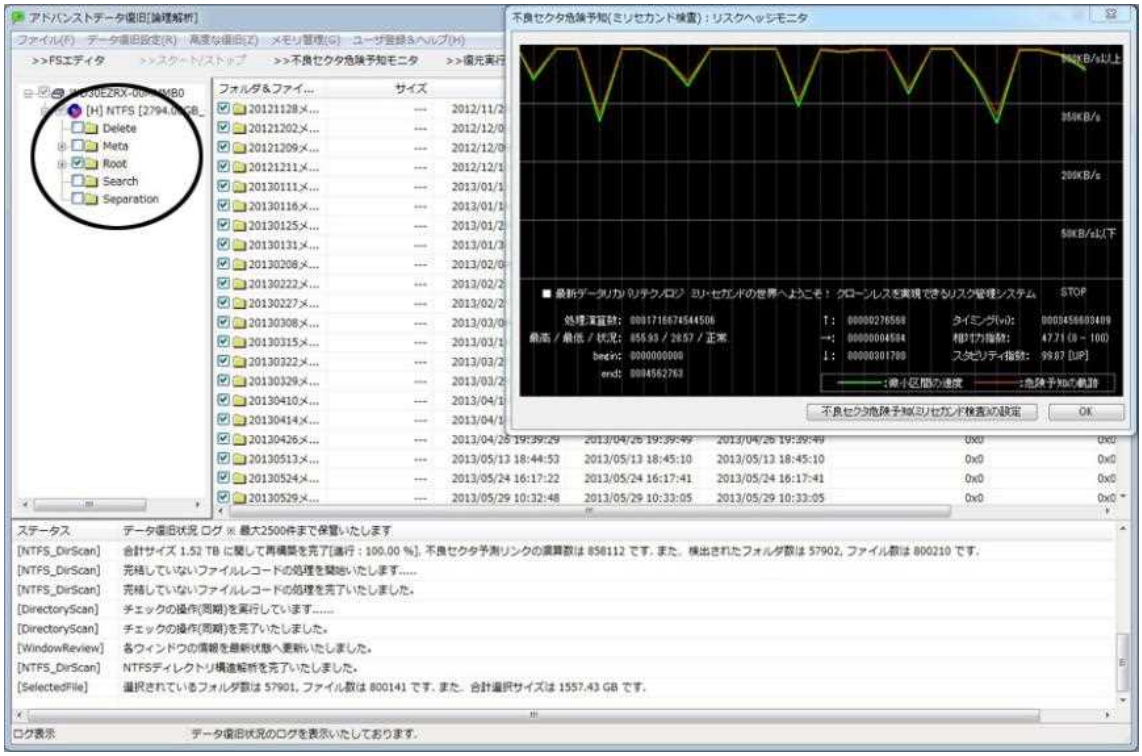
Note: For bit corruption, please make sure you always back up instead of being careful. Deterioration is inevitable even if you are careful.

Due to the nature of accessing over a network, the transfer speed will inevitably decrease.

This makes them vulnerable to "bit corruption" if the drive changes are less noticeable and the percentage of data that is not used much is high.

For bit corruption, please make sure you always back up instead of being careful.
There is no time to notice the deterioration itself.

Such naturally occurring bad sectors are categorized as "bit corruption" and added to the consensus analysis element.
There is no problem in recognizing the scary "bad sector" where important data that has been stored collapses without sound.


アドバンストデータ復旧[論理解析]
ファイル(F)　データ復旧設定(R)　高度な復旧(Z)　メモリ管理(G)　ユーザ登録&ヘルプ(H)
>>FSエディタ
>>スタート/ストップ
>>不良セクタ危険予知モニタ
>>復元実行
[H] NTFS
Delete
Meta
Root
Search
Separation
フォルダ&ファイ...
サイズ
ステータス
データ復旧状況 ログ ※ 最大2500件まで保管いたします
[NTFS_DirScan] 合計サイズ 1.52 TB に関して再構築を完了[進行：100.00 %]. 不良セクタ予測リンクの演算数は 858112 です. また、検出されたフォルダ数は 57902, ファイル数は 800210 です.
[NTFS_DirScan] 完結していないファイルレコードの処理を開始いたします.....
[NTFS_DirScan] 完結していないファイルレコードの処理を完了いたしました.
[DirectoryScan] チェックの操作(周期)を実行しています.....
[DirectoryScan] チェックの操作(周期)を完了いたしました.
[WindowReview] 各ウィンドウの情報を最新状態へ更新いたしました.
[NTFS_DirScan] NTFSディレクトリ構造解析を完了いたしました.
[SelectedFile] 選択されているフォルダ数は 57901, ファイル数は 800141 です. また、合計選択サイズは 1557.43 GB です.
ログ表示
データ復旧状況のログを表示いたしております.
不良セクタ危険予知(ミリセカンド検査)：リスクヘッジモニタ
■ 最新データリカバリテクノロジ ミリ・セカンドの世界へようこそ！ クローンレスを実現できるリスク管理システム
STOP
処理実績数:
最高 / 最低 / 状況:
begin:
end:
タイミング(v0):
相対力指数:
スタビリティ指数:
不良セクタ危険予知(ミリセカンド検査)の設定
OK

4, About drive badsector inspection

The minimum recording unit of a drive is called a sector, and the minimum recording unit of a file system is called a cluster.

Here, since the cluster size is generally 4096 bytes, the next generation to match this Sectors are also coming out.
However, this is not a drastic improvement in performance, but only for securing capacity.

In the operation of the drive, it is not necessarily accessed in units of the smallest sector.
Since it is possible to access by overlapping sectors,
there is no effect on the speed even if the conventional method is to make multiple sectors into one cluster.

A sector that can no longer be read is called a bad sector.

Also, the cluster includes sectors, so it is also called a bad cluster.
And in the drive inspection or data recovery, the handling of this sector determines the drive's fate.
This is because the cause of the inability to read out is complicated and branches,
and the "important rule ... complete the queue" provided in the drive and OS works like a side effect and determines the state.

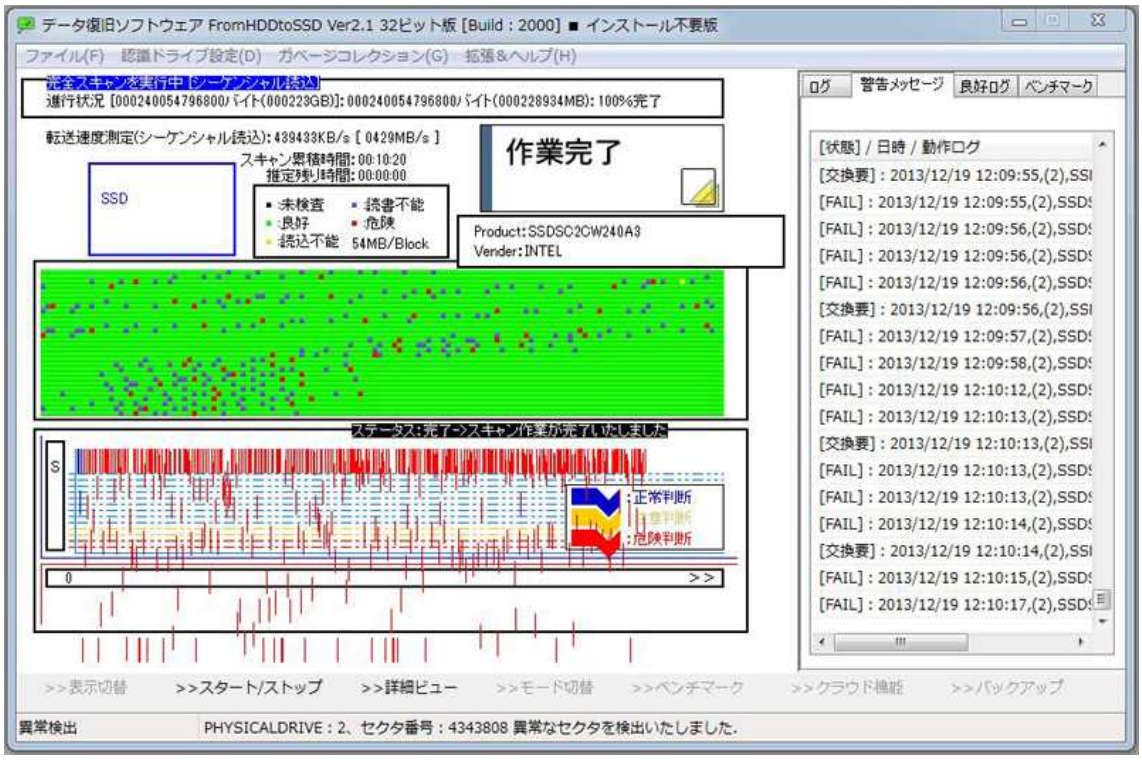
The minimum unit of 1 sector is defined as 1 times. For example, 256 sectors is defined as 256 times.
If the operating environment of the drive is good and there is no problem, you will enjoy the maximum processing speed at 256 times.
However, here it is surrounded by an iron wall that says “important rules ... complete the queue”.
The rule that this read / write queue must be completed is also built into the driver and is absolute.

And no drive promises permanent good. Someday it will break.

A bad sector appears at the moment when it is no longer possible to prevent a failure,
such as "alternative sector" or "waiting for bad sector".

Note: Due to the error correction mechanism to prevent bad sectors, there is a certain amount of error even if it is new.

It is not enough to interpret bad sectors as simply unreadable sectors, and these complex factors are intertwined.
If a bad sector occurs, it is necessary to grasp its properties and consider the next action.


データ復旧ソフトウェア FromHDDtoSSD Ver2.1 32ビット版 [Build : 2000] ■ インストール不要版
ファイル(F) 認識ドライブ設定(D) ガベージコレクション(G) 拡張&ヘルプ(H)
完全スキャンを実行中 [シーケンシャル読込]
進行状況 [000240054796800バイト(000223GB)]: 000240054796800バイト(000228934MB): 100%完了
転送速度測定(シーケンシャル読込): 439433KB/s [0429MB/s]
スキャン累積時間: 00:10:20
推定残り時間: 00:00:00
作業完了
SSD
未検査
良好
読込不能
読書不能
危険
54MB/Block
Product: SSDSC2CW240A3
Vender: INTEL
ステータス: 完了 ->スキャン作業が完了いたしました.
:正常判断
:危険判断
ログ
警告メッセージ
良好ログ
ベンチマーク
[状態] / 日時 / 動作ログ
[交換要] : 2013/12/19 12:09:55,(2),SSI
[FAIL] : 2013/12/19 12:09:55,(2),SSDS
[FAIL] : 2013/12/19 12:09:56,(2),SSDS
[FAIL] : 2013/12/19 12:09:56,(2),SSDS
[FAIL] : 2013/12/19 12:09:56,(2),SSDS
[交換要] : 2013/12/19 12:09:56,(2),SSI
[FAIL] : 2013/12/19 12:09:57,(2),SSDS
[FAIL] : 2013/12/19 12:09:58,(2),SSDS
[FAIL] : 2013/12/19 12:10:12,(2),SSDS
[FAIL] : 2013/12/19 12:10:13,(2),SSDS
[交換要] : 2013/12/19 12:10:13,(2),SSI
[FAIL] : 2013/12/19 12:10:13,(2),SSDS
[FAIL] : 2013/12/19 12:10:13,(2),SSDS
[FAIL] : 2013/12/19 12:10:14,(2),SSDS
[交換要] : 2013/12/19 12:10:14,(2),SSI
[FAIL] : 2013/12/19 12:10:15,(2),SSDS
[FAIL] : 2013/12/19 12:10:17,(2),SSDS
>>表示切替
>>スタート/ストップ
>>詳細ビュー
>>モード切替
>>ベンチマーク
>>クラウド機能
>>バックアップ
異常検出
PHYSICALDRIVE : 2、セクタ番号 : 4343808 異常なセクタを検出いたしました.

5, About drive benchmark

A HDD and SSD have different read / write bases.
Therefore, it is naturally necessary to incorporate the optimal medium into the computer according to the application.

For HDD that are restricted by physical operation,
it is sufficient with addition averaging.

However, we were able to conclude that SSD, whose operation is largely determined by firmware, are severe in terms of addition averaging.

For example, While earning numerical benchmark with a small quantity (size), most of the processing carried over in the parts that do not affect much (benchmark switching parts, parts that can be deceived by continuous writing, etc.) is performed.

This alone can greatly change where a time-consuming process is brought.

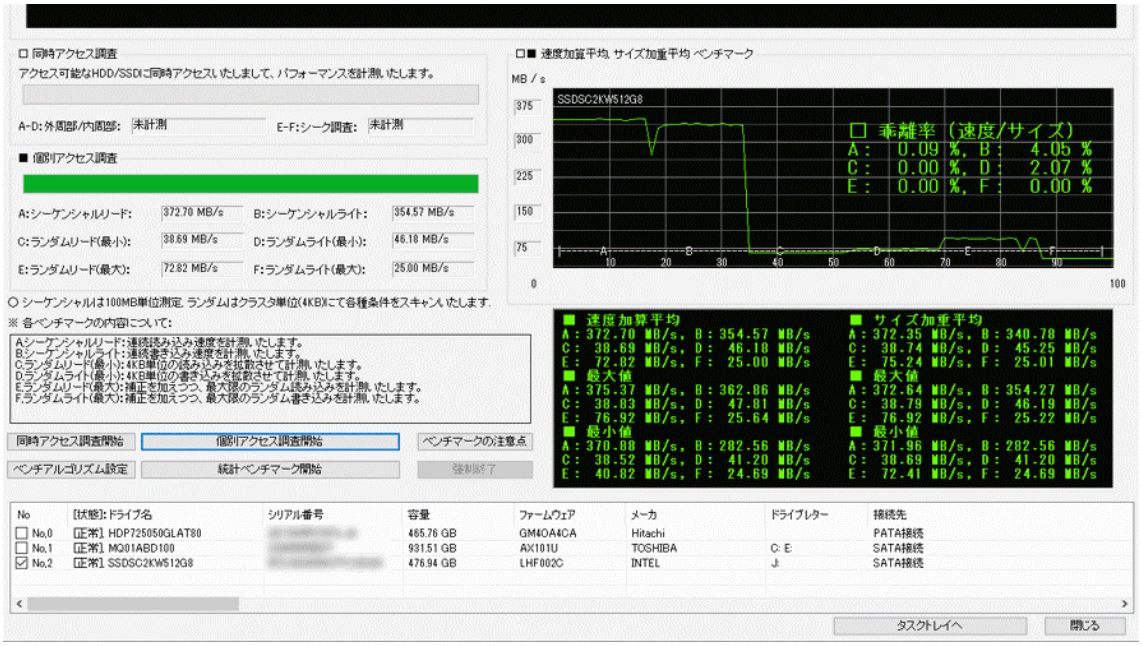
If data is a little larger in size arrives continuously (or a scene in which a large number of files of small size are rushed together),
symptoms such as waiting abnormally appear.

In addition, the file system driver can be adversely affected (records with unusual shapes can be created), causing logical damage that requires repair on the check disk.

Note: If a file system error that you are in occurs during SSD operation, it is necessary to give priority to backup and take action (e.g. checkdisk) without leaving it unattended.

The value obtained by dividing the speed addition average by the size-weighted average,

A SSD with excessively large separation on the writing side (e.g. frequent occurrences of 20-30%) can be expected to have such a high risk of breakage.

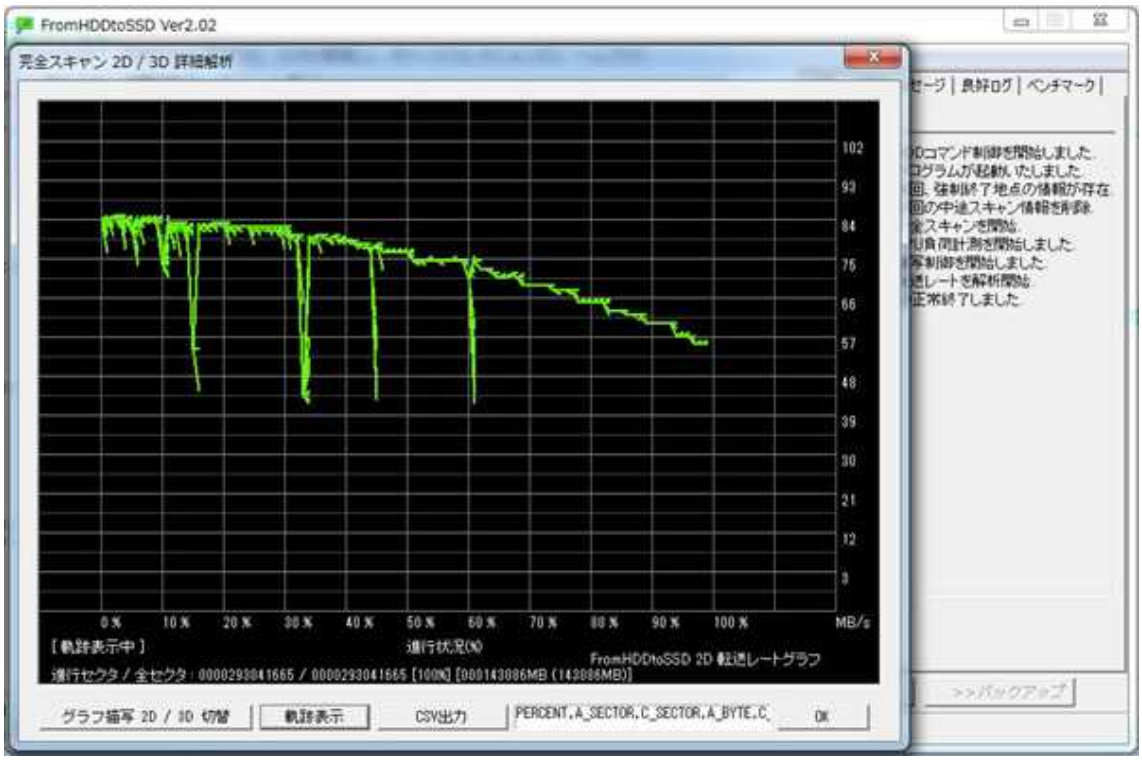


6, About drive duplication

Bad sector.

This determines the drive status and manages the failure.
This chapter explain that when duplicating a drive of broken.

First, It is indication of graph that the transfer rate of a Western Digital HDD that has been used for about 32,000 hours.



The point of interest is the line width (amplitude).
On average, it is not so much.

Even with a simple scan, there are so many differences that the characteristics of failure can vary greatly.

Bad sector classification
(SorachanCoin DriveInfo Wallet JSON-RPC):

A1: Unreadable sector
A2: Unwritable sector
A3: Unsuccessful read sector,
sometimes it becomes unreadable sector
A4: Diffusion unreadable sector,
sector that becomes the main cause of non-readable sector spreading after spreading
A5: Rewritable unwritable sector,
sometimes it becomes unwritable sector
A6: Diffusion-writable sector,
sector that becomes the main cause of non-writable sector spreading in various directions after spreading

B1: Unreadable / writable sector
(conditions A1 and A2)
B2: Recurrence impossible read / write sector
(conditions A3 and A5)
B3: Diffusion unreadable / sectorable sector
(conditions A4 and A6)
B4: Sudden unsuccessful spread read sector
(conditions A3 or A4)
B5: Sudden diffusion-writable sector
(conditions A5 or A6)
B6: Sudden diffusion read / write impossible sector
(conditions B4 or B5)

Here are the details of general bad sectors.

description of A1:
Error modify is not effective and data cannot be returned.
Instead, it returns an error status.
Alternative is assigned when this sector is "written" and temporarily restored.

Since sectors that cannot be read grow without being noticed,
there is a danger in mechanisms such as "Automatic Drive Backup" and "Mirroring with 2 units over" that make it uncertain whether they can be read.
Data erosion occurs when this sector spreads.

description of A2:
If an error occurs, writing stops.
At this time, if reading is also unstable, it will be shifted to a state that is completely broken.

Note: If a drive gets out of order while writing data,
it should be considered dangerous. BACK UP YOUR DATA IMMEDIATELY!

description of B1:
This happens due to scratches on the platter or abnormal magnetic materials before the alternative sector bottoms out.
Unlike writing impossible, there is nothing you can read. This is due to the detection of read errors.

Note: In the case of SSD, it is said that it is safe because it changes to read-only after broken,
but it is extremely dangerous to operate without backup in anticipation of this. This is because it often becomes unrecognizable.

description of A3:
This applies to sectors that reoccur "unreadable".

"S.M.A.R.T." is behaving normally, but it is often broken, and they can trigger a risk of loss.

The first unreadable sector is difficult to find because it has a range of itself or small, and can often be restored by a writing operation that occurs without your knowledge.

However, at the moment when they recur and spread, the extent of damage greatly expands.

After all, at the moment when it spreads largely, you realize that you can't read it for the first time, and it is not easy to return the data.

Daily backup is important.

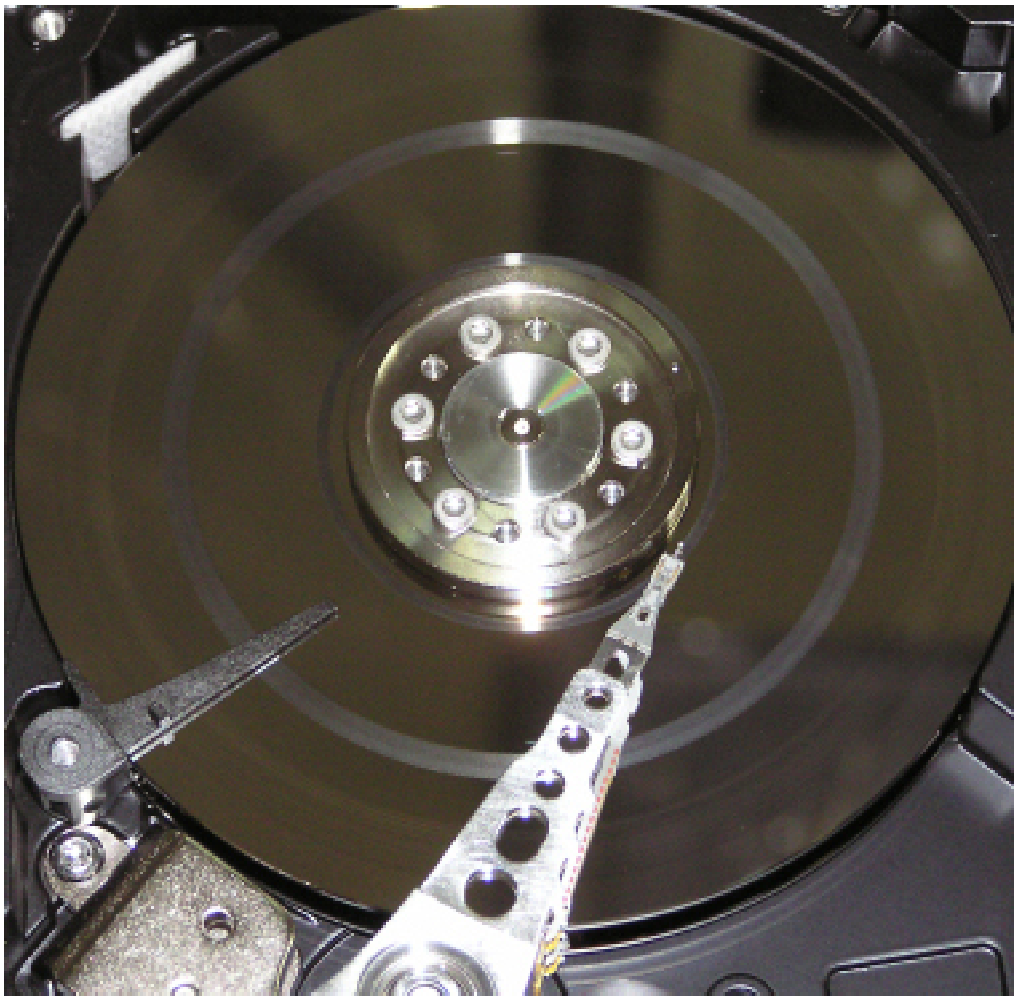
description of A4:
Repeated unreadable sectors spread and become a sector that breaks drive functionality.

If these occur, data salvage is not possible without a physical remedial action (e.g. clean room).

Although it is considered that abnormal noise due to head crashes is common in HDD failures, such failures are also frequent.

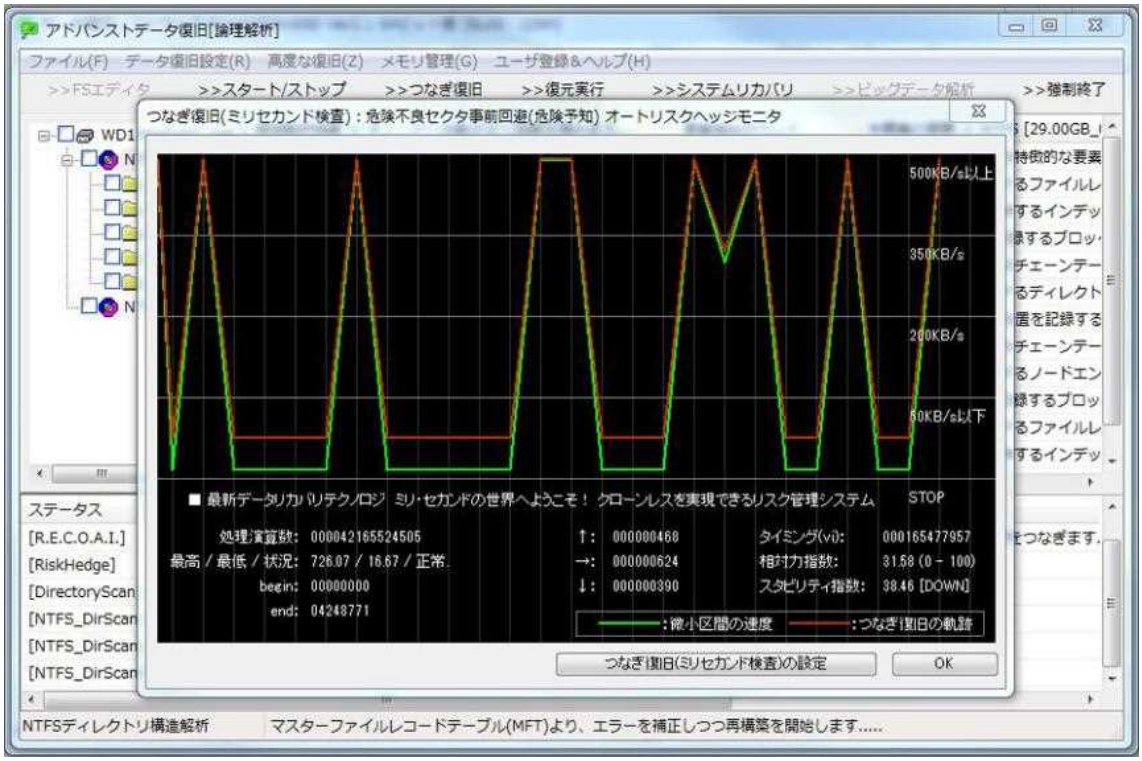
For SSD, this symptom makes it difficult to extract data.
It may not spread again but spread from the first reading failure. (Probability is low)

It is a troublesome point, and it can operate normally until just before spreading. Certainly,
there are only a few unreadable sectors before spreading, so you can't notice it.



In this way, bad sectors can be in a considerable state depending on conditions.
And we know that it will be mirrored completely by duplicating after grasping this in advance as much as possible.

One particular point to pay attention to is the deterioration of the condition. Please see the graph below.



This graph shows how the drive, which was fine just before, suddenly deteriorated and became uncontrollable.

The top is normal and the bottom is uncontrollable.

With this deterioration, the data that should be returned will no longer return.

As a result, this chapter explained that when duplicating a drive, the problem is that the duplicated drive may be broken.
However, we cannot go ahead with the inspection.

It would be nice if there was something like non-destructive inspection, but "S.M.A.R.T.", which was supposed to be responsible for it, is not decent, so it can not be expected.

A system that can autonomously determine and predict such bad sectors will be important.

7, About drive data recovery

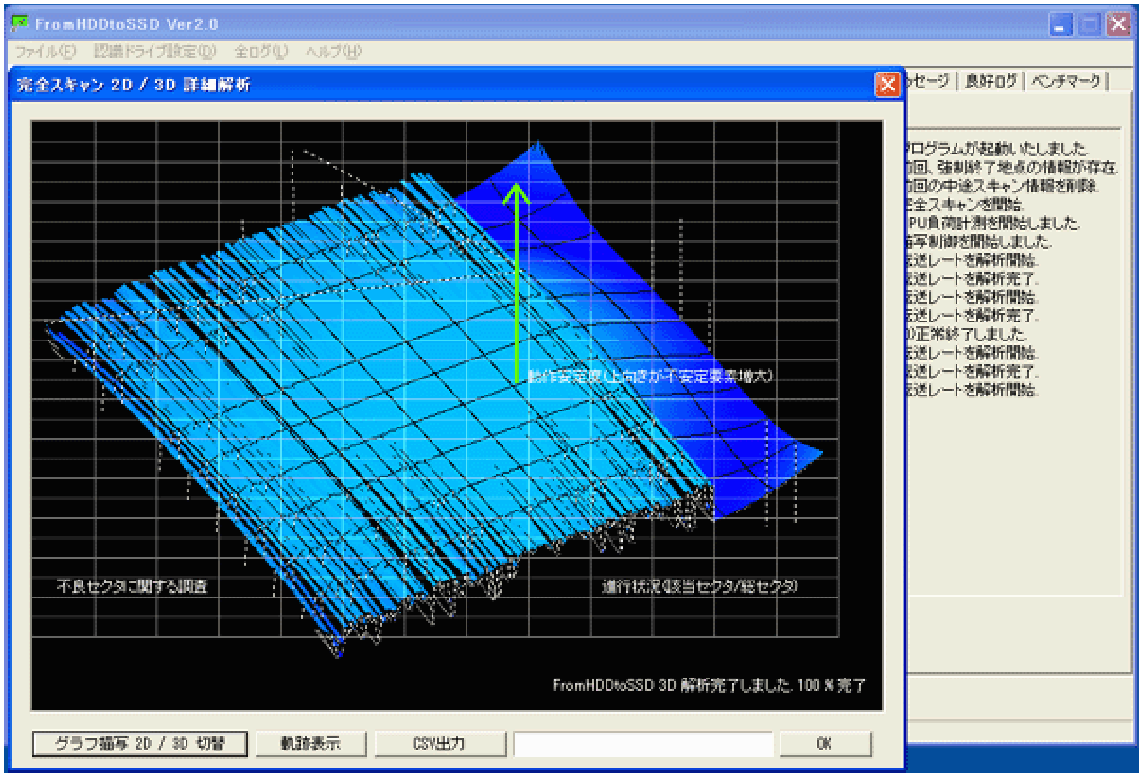
With the contents up to the previous chapter, you can understand that the drive status is always unknown.
Actually, "S.M.A.R.T." should play this role, but there is no way.

Since problems such as bit corruption are intricately involved, there are a wide variety of drive failures.
And the condition of the drive is getting worse, so if you don't take any doing, you will soon run out of life.

In addition to minimizing the amount of scanning and properly processing bad sectors, the technology that retrieves the data you want first corresponds to "appropriate risk management".
And if you increase the possibility of hitting the target data,
the smaller the amount of data, the easier it will be for data recovery.
That's why no matter how much you adjust the scan side properly, if the data is not what you want, that work is wasted.

If you can try again and again, it doesn't matter. However, if such waste is accumulated while the remaining operation time is limited, the amount of data that can be recovered will decrease at a stretch.

Since the purpose is data recovery, we needed a separate method to find the data we wanted as much as possible.
... What is “appropriate risk management”?



Example Single-sided platter:
As the drive capacity increases, the density of the platter increases, which makes it more complicated to break.
In addition, the cause of a crash also increases in a drive that has a large capacity with many platters.

Furthermore, it is a drive with a capacity such as a so-called “platter single-sided head”.

Since one or more heads are removed and the drive is adjusted in capacity (there are many halfway capacities),
we see many cases that are disadvantageous due to obstacles such as platter distortion.

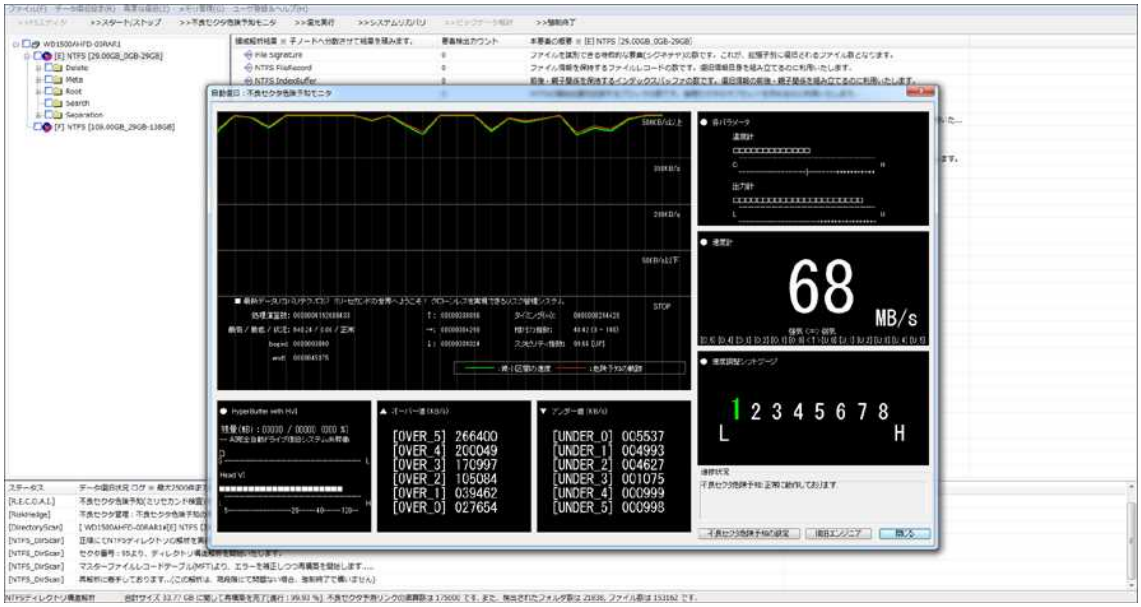
In this example, if you can control autonomously according to this, the data recovery rate will increase and it will be fun!!

Of course, stand-alone (manual work) can support.
However, doing this manually is painful.
The capacity is too large, you require operatiorn of recovery the broken drive for over a week.

Whether you are eating or sleeping, snuggle up to a broken drive!

And in the mass-produced drive, failure points are biased.
If we analyze this information accurately, we have confirmed that the best system that can be smoothly advanced without stopping on the way.

The following released several years ago as a beta version in Japan.



However, this was even the biggest problem.

Since the number of drives sold is huge, the data for analysis put pressure on the server.

The process of organizing the data by data mining analysis and leaving the optimal data was not in time for the amount of data to be added, and as a result, unprocessed data have been accumulated one after another.

The system was good, but to solve this problem, there was no solution other than adding servers.

8, About drive blockchain consensus

So, I came up with a way to allow blockchain consensus to perform work equivalent to data mining and confirmation work.
If this works autonomously, the biggest server problem is solved.

We plan to have PoS be responsible for data mining and PoW for confirmation work.

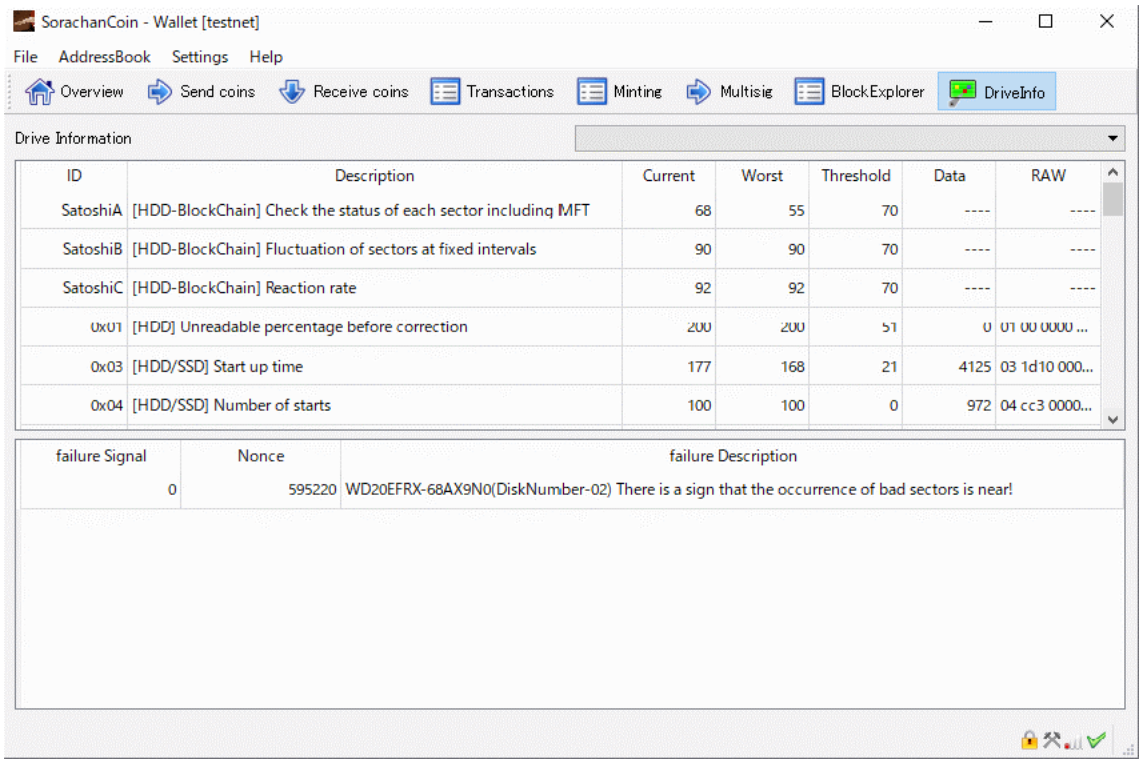
The reason for this is to emphasize the dispersibility of the analysis.

PoW is likely to occupy a lot of mining pools, so the number of block approval locations is limited.

For this reason, we thought that the analysis result confirmation work was appropriate.

PoS performs data mining in addition to blockchain processing.
In addition to PoS rewards, we are considering a mechanism for granting other rewards for data mining cooperation.

As a result, the analyzed data is left in the blockchain and can be used from any node.


SorachanCoin - Wallet [testnet]
File
AddressBook
Settings
Help
Overview
Send coins
Receive coins
Transactions
Minting
Multisig
BlockExplorer
DriveInfo
Drive Information
ID
Description
Current
Worst
Threshold
Data
RAW
SatoshiA
[HDD-BlockChain] Check the status of each sector including MFT
68
55
70

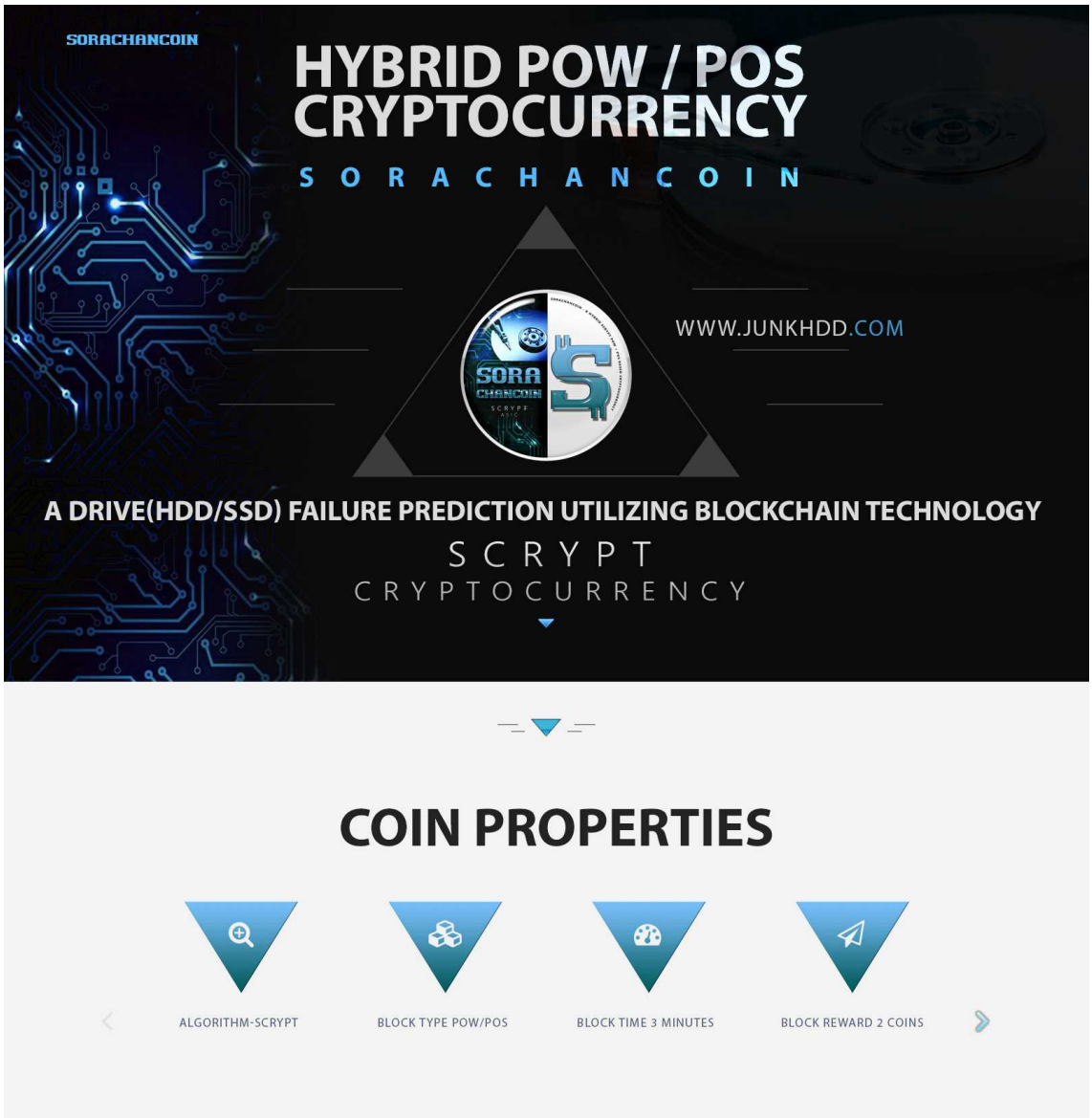
SatoshiB
[HDD-BlockChain] Fluctuation of sectors at fixed intervals
90
90
70

SatoshiC
[HDD-BlockChain] Reaction rate
92
92
70

0x01
[HDD] Unreadable percentage before correction
200
200
51
0
01 00 0000 ...
0x03
[HDD/SSD] Start up time
177
168
21
4125
03 1d10 000...
0x04
[HDD/SSD] Number of starts
100
100
0
972
04 cc3 0000...
failure Signal
Nonce
failure Description
0
595220
WD20EFRX-68AX9N0(DiskNumber-02) There is a sign that the occurrence of bad sectors is near!

9, Integration with payment system -- SorachanCoin

We will use the records(transactions) of coin movements on the blockchain.
It is the same as the general cryptocurrency method.
For example, the goal is a system that automatically completes the settlement after diagnosing the work related to the drive desired by the user.



10, About us

The SorachanCoin Developers
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Official Twitter:
https://twitter.com/SoraMeetino/

Github:
https://github.com/FromHDDtoSSD/SorachanCoin-qt

Community Discord:
https://discord.gg/ThMeemM