Hard Drive Stats for Q1 2018

By Andy Klein | May 1st, 2018

As of March 31, 2018 we had 100,110 spinning hard drives. Of that number, there were 1,922 boot drives and 98,188 data drives. This review looks at the quarterly and lifetime statistics for the data drive models in operation in our data centers. We'll also take a look

data presented and we look forward to you doing the same in the comments.

Background

Since April 2013, Backblaze has recorded and saved daily hard drive statistics from the drives in our data centers. Each entry consists of the date, manufacturer, model, serial number, status (operational or failed), and all of the SMART attributes reported by that drive. Currently there are about 97 million entries totaling 26 GB of data. You can download this data from our website if you want to do your own research, but for starters here's what we found.

Hard Drive Reliability Statistics for Q1 2018

At the end of Q1 2018 Backblaze was monitoring 98,188 hard drives used to store data. For our evaluation below we remove from consideration those drives which were used for testing purposes and those drive models for which we did not have at least 45 drives. This leaves us with 98,046 hard drives. The table below covers just Q1 2018.

MFG	Model	Drive Size	Drive Count	Drive Days	Drive Failures	Annualized Failure Rate
Seagate	ST12000NM0007	12 TB	16,800	1,296,465	32	0.90%
Seagate	ST10000NM0086	10 TB	1,220	109,738	0	0.00%
HGST	HUH728080ALE600	8 TB	1,045	94,024	3	1.16%
Seagate	ST8000DM002	8 TB	9,891	888,774	21	0.86%
Seagate	ST8000NM0055	8 TB	14,390	1,293,557	28	0.79%
Seagate	ST6000DX000	6 TB	1,881	169,017	1	0.22%
WDC	WD60EFRX	6 TB	437	39,201	0	0.00%
Toshiba	MD04ABA500V	5 TB	45	4,050	0	0.00%
HGST	HDS5C4040ALE630	4 TB	108	123,504	0	0.00%
HGST	HMS5C4040ALE640	4 TB	5,578	505,045	8	0.58%
HGST	HMS5C4040BLE640	4 TB	15,339	1,363,173	16	0.43%
Toshiba	MD04ABA400V	4 TB	146	13,090	0	0.00%
Seagate	ST4000DM000	4 TB	30,941	2,822,282	178	2.30%
WDC	WD40EFRX	4 TB	45	4,050	0	0.00%
WDC	WD30EFRX	3 TB	180	16,200	1	2.25%
		Totals	**98,046**	**8,742,170**	**288**	**1.20%**

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Notes and Observations

If a drive model has a failure rate of 0%, it only means there were no drive failures of that model during Q1 2018.

The overall *Annualized Failure Rate* (AFR) for Q1 is just 1.2%, well below the Q4 2017 AFR of 1.65%. Remember that quarterly failure rates can be volatile, especially for models that have a small number of drives and/or a small number of *Drive Days*.

There were 142 drives (98,188 minus 98,046) that were not included in the list above because we did not have at least 45 of a given drive model. We use 45 drives of the same model as the minimum number when we report quarterly, yearly, and lifetime drive statistics.

Q1 Stats chart. What gives? We only had 20 of the Toshiba 8 TB drives in operation in Q1, so they were excluded from the chart. Why do we have only 20 drives? When we test out a new drive model we start with the "tome test" and it takes 20 drives to fill one tome. A tome is the same drive model in the same logical position in each of the 20 Storage Pods that make up a Backblaze Vault. There are 60 tomes in each vault.

In this test, we created a Backblaze Vault of 8 TB drives, with 59 of the tomes being Seagate 8 TB drives and 1 tome being the Toshiba drives. Then we monitored the performance of the vault and its member tomes to see if, in this case, the Toshiba drives performed as expected.

Q1 2018 Hard Drive Failure Rate - Toshiba 8TB

Reporting period 1/1/2018 - 3/31/2018 inclusive

MFG	Model	Drive Size	Drive Count	Drive Days	Drive Failures	Annualized Failure Rate
Toshiba	HDWF180	8TB	20	400	0	0.00%

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So far the Toshiba drive is performing fine, but they have been in place for only 20 days. Next up is the "pod test" where we fill a Storage Pod with Toshiba drives and integrate it into a Backblaze Vault comprised of like-sized drives. We hope to have a better look at the Toshiba 8 TB drives in our Q2 report — stay tuned.

Lifetime Hard Drive Reliability Statistics

While the quarterly chart presented earlier gets a lot of interest, the real test of any drive model is over time. Below is the lifetime failure rate chart for all the hard drive models which have 45 or more drives in operation as of March 31st, 2018. For each model, we compute their reliability starting from when they were first installed.

MFG	Model	Size	Count	Days	Failures	Failure Rate	Low	High
Seagate	ST12000NM0007	12TB	16,800	1,609,449	48	1.09%	0.80%	1.40%
Seagate	ST10000NM0086	10TB	1,220	234,415	3	0.47%	0.10%	1.40%
HGST	HUH728080ALE600	8TB	1,045	182,626	6	1.20%	0.40%	2.60%
Seagate	ST8000DM002	8TB	9,891	5,495,178	157	1.04%	0.90%	1.20%
Seagate	ST8000NM0055	8TB	14,390	3,969,942	117	1.08%	0.90%	1.30%
Seagate	ST6000DX000	6TB	1,881	2,056,024	58	1.03%	0.80%	1.30%
WDC	WD60EFRX	6TB	437	540,039	62	4.19%	3.20%	5.40%
Toshiba	MD04ABA500V	5TB	45	50,355	2	1.45%	0.20%	5.20%
HGST	HDS5C4040ALE630	4TB	108	4,483,084	94	0.77%	0.50%	1.10%
HGST	HMS5C4040ALE640	4TB	5,578	9,318,849	134	0.52%	0.40%	0.60%
HGST	HMS5C4040BLE640	4TB	15,339	10,801,260	151	0.51%	0.40%	0.60%
Toshiba	MD04ABA400V	4TB	146	154,909	4	0.94%	0.30%	2.40%
Seagate	ST4000DM000	4TB	30,941	38,078,697	3,029	2.90%	2.80%	3.00%
WDC	WD40EFRX	4TB	45	67,312	4	2.17%	0.60%	5.60%
WDC	WD30EFRX	3TB	180	124,096	22	6.47%	4.10%	9.80%
		Totals	**98,046**	**77,166,235**	**3,891**	**1.84%**		

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Notes and Observations

The failure rates of all of the larger drives (8-, 10- and 12 TB) are very good, 1.2% AFR (Annualized Failure Rate) or less. Many of these drives were deployed in the last year, so there is some volatility in the data, but you can use the *Confidence Interval* to get a sense of the failure percentage range.

The overall failure rate of 1.84% is the lowest we have ever achieved, besting the previous low of 2.00% from the end of 2017.

Our regular readers and drive stats wonks may have noticed a sizable jump in the number of HGST 8 TB drives (model: HUH728080ALE600), from 45 last quarter to 1,045 this quarter. As the 10 TB and 12 TB drives become more available, the price per terabyte of the 8 TB drives has gone down. This presented an opportunity to purchase the HGST drives at a price in line with our budget.

Seagate drives arrived in Q3 2017. We'll take a first look into whether or not Helium makes a difference in drive failure rates in an upcoming blog post. [Post is now published: The Helium Factor and Hard Drive Failure Rates. — Editor]

New SMART Attributes

If you have previously worked with the hard drive stats data or plan to, you'll notice that we added 10 more columns of data starting in 2018. There are 5 new SMART attributes we are tracking each with a raw and normalized value:

- 177 – Wear Range Delta
- 179 – Used Reserved Block Count Total
- 181- Program Fail Count Total or Non-4K Aligned Access Count
- 182 – Erase Fail Count
- 235 – Good Block Count AND System(Free) Block Count

The 5 values are all related to SSD drives.

Yes, SSD drives, but before you jump to any conclusions, we used 10 Samsung 850 EVO SSDs as boot drives for a period of time in Q1. This was an experiment to see if we could reduce boot up time for the Storage Pods. In our case, the improved boot up speed wasn't worth the SSD cost, but it did add 10 new columns to the hard drive stats data.

Speaking of hard drive stats data, the complete data set used to create the information used in this review is available on our Hard Drive Test Data page. You can download and use this data for free for your own purpose, all we ask are three things: 1) you cite Backblaze as the source if you use the data, 2) you accept that you are solely responsible for how you use the data, and 3) you do not sell this data to anyone. It is free.

Good luck and let us know if you find anything interesting.

[Ed: 5/1/2018 – Updated Lifetime chart to fix error in confidence interval for HGST 4TB drive, model: HDS5C4040ALE630]

Bio **Latest Posts**

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Andy has 20+ years experience in technology marketing. He has shared his expertise in computer security and data backup at the Federal Trade Commission, Rootstech, RSA and over 100 other events. His current passion is to get everyone to back up their data before it's too late.

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I agree. When Crashplan threw me overboard, there was only one possible choice, and it wasn't the one they recommended. I hope every Crashplan user comes here.

3 ^ | v • Reply • Share ›

Intelligent Toasters ➚ Phillip Remaker • 7 days ago

Ditto, I was rescued from CrashPlan by BackBlaze and I'm continually impressed by the visionary team leading BB. Well done!

^ | v • Reply • Share ›

ironicbadger • 18 days ago

Fantastic stuff as usual. Thank you for publishing these stats every Q.

11 ^ | v • Reply • Share ›

Richard Fisher • 18 days ago

Thanks for sharing this. You data and reviews is much better than I can find on amazon.

Do you see any changes in failure rates of time - for example, year 1, year 2, year 3, ..

How long do you keep a drive before retiring it? Any what do you do with old drives? Data security is an issue and they would need to be fully wiped (several times) before giving them away, but I hope that they don't end in a landfill.

7 ^ | v • Reply • Share ›

Andy Klein Mod ➚ Richard Fisher • 16 days ago

You mean you can't buy our data on Amazon ;-)

The failure rates do change over time. In general, the failure rates follow the bathtub curve, but there's some indications this may be changing, especially at the front end of the curve.

We don't have a set time to retire drives, but the desire to improve storage density is probably the biggest driver these days - replacing 4 TB drives with 12 TB drives for example.

3 ^ | v • Reply • Share ›

Phillip Remaker ➚ Andy Klein • 10 days ago

"you can't buy our data on Amazon". Oooh, Burn! Yeah, Amazon reviews are increasingly less useful, especially for anything that you need to watch for some time to know if it is any good. Love the drive stats!

1 ^ | v • Reply • Share ›

DataMeister1 ➚ Richard Fisher • 18 days ago

I wouldn't be surprised if they go through a shredder.

2 ^ | v • Reply • Share ›

That first chart is kind of weird however. It's like saying "People in their nineties tend to die at a higher rate than teenagers." Even when annualized, I'm not sure that information makes sense because natural truncation of the data range makes the samples non-random. The second chart is much more informative. (Hey -- and I'm just a writer of sci-fi novels. What do I know?) The whole newsletter is damn interesting. Great job.

3 ^ | v • Reply • Share ›

QPsychedelic • 18 days ago

Excellent always looking forward for the Quarter reports. And just in time as I'm about to buy 8TB drives, guess Seagate gives me a bit of confidence vs previous years.

1 ^ | v • Reply • Share ›

Omen Wild • 18 days ago

One request, could you make the charts HTML active charts so we can click on headers and re-sort? It would help when trying to pick out a drive with the lowest failure rate when I'm flexible on the size.

Thanks

1 ^ | v • Reply • Share ›

Andy Klein Mod ➚ Omen Wild • 18 days ago

Omen, We do provide the data from the tables/charts in a ZIP file. The link is near the bottom of the post or here: https://f001.backblazeb2.co...

1 ^ | v • Reply • Share ›

Omen Wild ➚ Andy Klein • 18 days ago

Which is totally awesome of you(!) and I've downloaded it before and poked around with it, but rather than have to redo your analysis I thought it would be handy to just be able to click on the table headers. No biggie, it was just a thought.

Thanks for putting the stats out there, I read them every time you release a new batch and have based a few drive purchases off the data.

^ | v • Reply • Share ›

DarkerGreen • 6 days ago

Great info, stay awesome Backblaze!

^ | v • Reply • Share ›

Chris Moore • 8 days ago

What do you do with the drives that you are decommissioning when you migrate to larger drives?

^ | v • Reply • Share ›

Hank Barta • 16 days ago

Thanks again for providing this information. I find it very useful.

I'm curious about any testing that Backblaze performs on drives in service. There are SMART commands that perform long and short tests and some filesystems (ZFS) support a scrub operation that reads all of the data on the drives to detect read errors. Does Backblaze execute any of these tests or do they just monitor SMART stats to detect problems? (To be honest, I don't think that testing has revealed any problems in any of my drives. It has only served to confirm that a drive that was demonstrating issues like pending sectors or read/write errors really was going bad.)

Reply • Share ›

Andy Klein Mod ➚ Hank Barta • 16 days ago

Testing a given drive when you have 100,000 of them is not optimal, especially since we have the data encoded so that any given drive failure is a non-event from a data perspective. What is more important is checking the integrity of the individual files, which we do for every file on a regular basis.

1 Reply • Share ›

Hank Barta ➚ Andy Klein • 16 days ago

Thanks for the answer. That is similar to a ZFS scrub operation. After all, the integrity of the data is what really matters.

Reply • Share ›

JohnAtl • 17 days ago

Is mean time to failure data available?
I have an aging external drive that is making me nervous.

Reply • Share ›

Andy Klein Mod ➚ JohnAtl • 16 days ago

Most of the drive manufacturers publish MTBF specs for their drives. We don't calculate that number.

Reply • Share ›

Phillip Remaker ➚ Andy Klein • 10 days ago

But hey, you can download the 26GB of data and calculate it yourself!

Are there any interesting public third-party analyses of Backblaze data?

1 Reply • Share ›

gilahacker ➚ Andy Klein • 9 days ago

It might be interesting to compare the manufacturer's claimed MTBF to the actual

DataMeister1 • 16 days ago

That HGST 8TB doesn't look so good compared to the competition, which is a complete flip vs previous sizes. I wonder if this means WD's way of doing things finally rubbed off on them. Or I guess it could be a basic revision 1 design flaw from the switch to helium filled drives?

Reply • Share ›

Andy Klein Mod ➚ DataMeister1 • 16 days ago

Give the HGST 8TB drives some time. Most of them are very new.

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Lynn McGuire • 18 days ago

Do you buy your drives directly from the manufacturer or a third party ? I have been getting HGST 8 TB helium drives by buying the WD 8 TB external from Amazon for $170 and stripping the case to get bare drive:
https://www.amazon.com/Book...

Reply • Share ›

This comment is awaiting moderation. Show comment.

Lynn McGuire ➚ Trips • 16 days ago

The WD HGST WD80EZAZ drive is definitely 5400 rpm.

Reply • Share ›

This comment is awaiting moderation. Show comment.

Lynn McGuire ➚ Trips • 16 days ago

I just want a cheap and reliable 8 TB bare drive.

Reply • Share ›

Hank Barta ➚ Trips • 16 days ago

I have a Seagate 8TB "Expansion" (USB) drive. SMART data indicates a model number very similar to a Barracuda which is a 7200 RPM drive whereas the Expansion SMART data indicates a 5300 RPM class drive. I suspect that the rotational speed is variable under S/W control and that the firmware in the external drives keeps them running slower to reduce power usage and drive temperature.

Reply • Share ›

timmmay ➚ Hank Barta • 16 days ago

The problem these days is you can't shuck modern USB drives. WD often solders the USB port and controller to the drive PCB, and Seagate cripples the firmware of their drives to reject AHCI command set, meaning you can't

Backblaze to survive the drive price surge of 2011. A great deal of drives they put into service from 2011-2012 are shucked drives. I noticed in 2012-2013 drives began to become unshuckable.

Reply • Share ›

Lynn McGuire ➚ timmmay • 15 days ago

I just shucked a WD 8 TB external drive that I bought a month ago at Amazon. The USB daughter board is screwed to the drive PCB. Easy to get off. The drive is an HGST white label WD80EZAZ SATA with 256 MB cache.
https://www.amazon.com/Book...

One must remember to reformat the drive to NTFS before removing the USB daughter board because the drive is shipped ExFAT. Or else one has to reconnect the USB daughter board to reformat it since Windows 7 x64 won't boot with an ExFAT SATA drive.

And yes, I did destroy the external case whilst removing the bare drive from it.

Reply • Share ›

timmmay ➚ Lynn McGuire • 14 days ago

Good to know! The 2.5” WD external USB drives I’ve come across over the years have all had USB on the PCB, not a bridge. Good the 3.5” drives are not the same way.

Had a friend try to shuck a Seagate Expansion 3.5” USB as recently as last year and the drive wouldn’t initialize with any controller other than the SATA USB bridge it was attached too inside the case (which as you mentioned, naturally has to be destroyed to get the drive out.)

Reply • Share ›

Chris Moore ➚ timmmay • 8 days ago

I shuck Seagate drives frequently. Never had a problem using them. I know other people that have done it too. I have never heard anything of what you are saying, except for the 2.5" WD drives having integrated USB interfaces.

Reply • Share ›

timmmay ➚ Chris Moore • 7 days ago

Just because you and “other people” haven’t run into problems doesn’t mean they don’t exist. There are entire model lines such as Seagate Expansion with ST4000DM004 drives that have verified nerfed firmwares. A quick google search would verify this has been a common issue with

Further research shows many WD drives still contain soldered USB ports to the drive PCB so there is no bridge:

https://forums.anandtech.co...

Granted these are 2.5” drives.

Reddit has rolling threads going back as far as 2012 when people discovered 3.5” drives started becoming unshuckable, cooncidentally after Backblaze admittedly bought up entire stores of external retail drives due to shortages during the 2011 tsunami floods wiped out hard drive

see more

Reply • Share ›

Lewno Mark ➚ Lynn McGuire • 18 days ago

What's the model of the drive's you're getting out of these?

Reply • Share ›

Lynn McGuire ➚ Lewno Mark • 17 days ago

I just popped another USB on my PC. The disk is Model : WDC WD80EZAZ-11TDBA0.

Reply • Share ›

Lynn McGuire ➚ Lewno Mark • 18 days ago

So far, it has been the WD WD80EZZX which is an HGST 8 TB helium drive with a white label. But some people have been getting WD red drives also.
https://tinkertry.com/liber...

Reply • Share ›

Stephan Stengel ➚ Lynn McGuire • 17 days ago

large discussion of WD easystore's 8tb from best buy here:
https://www.reddit.com/r/Da...

Reply • Share ›

Lewno Mark ➚ Lynn McGuire • 17 days ago

Thankee.

Looking for the hgst 8tb NAs drives sadly. Got a couple bays in my synology 8 bay that need filling.

Reply • Share ›

Andy Klein Mod • 18 days ago

Joel Cornett • 18 days ago

can someone explain to me what the confidence interval means?

Reply • Share ›

Squozen ➚ Joel Cornett • 18 days ago

The range of values that the true value is believed to be within. A wide interval between the two suggests that the number of drives is low or that they haven't been installed for long enough.

1 Reply • Share ›

Joel Cornett ➚ Squozen • 18 days ago

Awesome, thanks!

Reply • Share ›

Doug Elam • 18 days ago

My Seagate failed with NO support
How and where can I get my pics off from it?
10 years of my grand kids life gone
Seagate said that they can't help

Reply • Share ›

Lux Pro ➚ Doug Elam • 18 days ago

Drivesavers in Novato, CA can probably save it. Don't try spinning it up any further, just give them a call and send it over. There's no cost if they can't recover it.

It is expensive but if the pics are truly valuable I expect it would be worth it. Next time use Backblaze ;)

2 Reply • Share ›

timmmay ➚ Lux Pro • 16 days ago

I sent a client to them. It was $700 and all the data was retrieved. The client mailed them the crashed drive, a functional 1TB USB drive and drive savers mailed the drives back 3 days later with the data recovered to the USB drive. Not expensive, not cheap, but no lost data.

Of course that's 10+ years of Backblaze subscription down the drain they could have otherwise paid for :P

Reply • Share ›

leexgx ➚ Doug Elam • 16 days ago

Guess I am a little disappointed with crashplan removing the family plan as my samsung 850 evo decided to die on me after they removed it so little salty about that (I did not

unsure if I am going to be able to get any data off it the bios is detecting as smart fail condetion of has failed like the sandisk ssd did where it got stuck in a Infinite CRC failed retry read state

I had to use hirens boot cd with the unstoppable copier program on a customers ssd which is actually stoppable and everytime it hit a file it could not read because the drive was not returning a CRC read fail I had to press the pause button skip the file it was stuck on and then press resume and I kept having to do that until it got to the end (hoping I can do the same on my ssd) but if crash plan had not removed there family plan I would not been as bothered (data is not critical but I would have preferred if this Drive had not failed even though I don't even use this old computer for much now)

is there an issue with Samsung 850 Evo if you leave them on for more than 30 days they fail, also there was an issue with malwarebytes where it was consuming all memory and virtual memory causing lots of writes some people claimed that Malwarebytes had destroyed their disks because of the constant writing

Reply • Share ›

Mathew Gregson ➚ Doug Elam • 18 days ago

Google "hdd recovery services". Be aware that data recovery services are not cheap; though neither, I imagine, is the loss of your family pics. Backups, backups, backups :(

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M. Najamudin Ridha — hi, backblaze planning opening data center on singapure? ;-)

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