

15 March 2023

DIY NAS

NAS Build

TrueNAS

DIY NAS: 2023 Edition

A suprisingly affordable DIY NAS featuring TrueNAS SCALE, an Intel Celeron N5105 CPU, 32GB of DDR4 RAM, 2x 250GB NVMe SSDs, and room for 7 hard drives (5x 3.5-inch and 2x 2.5 inch).



Brian Moses
@brianmoses



I've been building—and oftentimes giving away—DIY NAS builds for over a decade now. I started doing this because I was frustrated when I was planning [my very first DIY NAS](#). I had something in mind, but when I looked to others for some inspiration,

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that build on my blog, and the surprising popularity of that first blog has inspired a whole series of yearly DIY NAS build blogs.

I like to think that my key criteria for building a DIY NAS build has been pretty consistent over the years; that criteria is:

- Small form factor
- Room for six or more 3.5" hard disk drives
- Passively-cooled CPU for quieter operation
- Power efficient

My desire for a diminutive, quiet, and power-efficient DIY NAS was born from a lack of space in my office from ten years ago. My office has grown considerably since then, but I still value these features and strive to meet them with each of my DIY NAS builds.

Motherboard and CPU

The minute I learned about the [Topton N5105 NAS Motherboard](#), I knew that it was going to be in the *DIY NAS: 2023 Edition*. In fact, I was so excited about it that I ordered it the very next day after learning about it. When I couldn't find any US-based vendors, I was inspired to buy some from the manufacturer and to open [a store on eBay](#) and see if I could sell some myself!

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- Integrated [Jasper Lake Intel Celeron N5105](#) CPU
- 2x M.2 NVMe (PCIe 3.0 x1) 2280
- 6x SATA 3.0 ports
- 4x Intel i226-V 2.5Gbps network interfaces
- 2x SO-DIMM DDR4 (2400/2666/2933MHz) slots (64GB max)
- Mini-ITX form factor



Nearly every one of my ideal criteria for a DIY NAS is checked off by this incredibly interesting motherboard. It supports up to 8 drives (2x M.2 and 6x SATA), it fits a small form factor, and its CPU sips power. The only criteria that it does not meet is that the CPU requires a fan. The icing on the cake on the [Topton N5105 NAS Motherboard](#) is that it includes four 2.5Gbps network interfaces. For what you're getting, I believe that the [Topton N5105 NAS Motherboard](#) is a fantastic value to use in a DIY NAS build.

- [Patshead.com: I Am Excited About the Topton N5105 Mini-ITX NAS Motherboard!](#)

Case

One of my bigger gripes every year is that there are just not very many NAS-specific cases being designed each year. I strive to pick a new NAS-centric case each year, but each year the landscape of NAS cases is pretty static. In March of 2022, I [caught a glimpse of the JONSBO N1 on the Linus Tech Tips YouTube channel](#). The release of the [JONSBO N1 \(specs\)](#) solved a big problem for me in 2023.



The [JONSBO N1](#) has room for a MiniITX motherboard, requires a SFX power supply, has room for up to five 3.5" HDDs, and room for an additional 2.5" HDD. Personally, I'd like to see room for at least one more 3.5" HDD but I'm not deducting points for that. My criteria of six 3.5" HDDs was established back when you were lucky to get a 2TB HDD at \$200. In 2023, we're regularly seeing [hard drives five times as big \(or bigger\) under \\$200](#). I believe it might be time to rethink this particular criteria. Unless you're a serious data hoarder, five drives in 2023 can be more than plenty!

RAM

The [Topton N5105 NAS motherboard](#) has two laptop-style DDR4 SO-DIMM slots, so I opted to max it out with a [Crucial 32GB kit of DDR4 2933Mhz RAM \(specs\)](#). One of my only disappointments with the [Topton N5105 NAS motherboard](#) is that its capacity for RAM tops out at 32GB. Had I realized that the [Topton N5105 NAS motherboard](#) actually supported up to 64GB of RAM, I would've gladly bought twice the RAM for twice the price.



For the ECC zealots out there, I agree ECC RAM is a better choice—but that doesn't mean it is a requirement. I tackled this quite a few years ago when I shared [why I chose Non-ECC RAM for my own DIY NAS back in 2012](#). In the years since, I've built up and replaced all of that hardware a couple different times, and I happen to be using ECC RAM today.

However, I stand by [what I wrote back in 2014](#). For the *DIY NAS: 2023 Edition*, the motherboard, CPU, and RAM added up to just over \$350. I'm reasonably confident that an equivalent motherboard, CPU, and ECC RAM would wind up being twice as expensive. Even *if* you wanted to spend that extra money, I think there's more value in spending it differently than there is in spending it on ECC RAM.

- [Backing up my FreeNAS to Backblaze B2](#)

Storage

For the past few years, I've divided the storage devices into two categories: storage for the boot drive and the devices for the storage of your data.

In [last year's DIY NAS build](#), that line got a bit blurry as I partitioned the SSDs and used a slice of them for the boot device and then used the leftover space as storage for my VMs and containers. While I'm happy with how this has worked out, I'm not necessarily certain if I'd encourage others to do the same. It's not a supported solution and requires going in and modifying the installation script prior to installing TrueNAS.

Boot Drives

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[NAS motherboard](#) supports up to 6 SATA devices and two M.2 devices.

Because I like having redundancy on the boot drive, I opted to pick up a pair of [250GB PNY CS1030 NVMe SSDs \(specs\)](#). 250 GB of capacity is definitely overkill for the capacity, but at around \$20, the price was in the right ballpark.

If maximizing data density were my goal, I probably would've picked a single SATA SSD like the [240GB Crucial BX500](#). That would create the possibility of using the motherboard's two M.2 slots for a pair of NVMe SSDs for some additional storage capacity to the NAS.



Storage Drives

For the sake of writing this blog, I pulled out five of my retired 4TB HDDs and loaded them into the *DIY NAS: 2023 Edition*. These are just excess drives that have been either upgraded or removed because their SMART test results have been suspicious.

It has been a while since I actually bought storage for one of DIY NAS builds. Most of the money spent on a NAS will be spent on hard drives, and the amount of capacity you'll need depends on how much data you're hoarding and how quickly you're adding to it.

If I were building this for my own use, I think I'd be pretty interested in mirrored pairs of higher-capacity drives. I'd leave the fifth drive bay empty and use a spare hard drive to sneakernet large chunks of data between machines. For my needs, hard drive capacity has steadily outpaced how quickly I'm accumulating data. I no longer need half a dozen drives to hold all of my data like I did when I got started.



When I'm shopping for hard disk drives, I usually get pretty excited when I see a drive with a price-per-terabyte below \$15. I very frequently see [12-16TB shuckable external hard drives](#) hit this price. This [Toshiba MG08ACA16TE 16TB 7200RPM SATA Enterprise HDD](#) is on the verge of being tempting at \$~260 (\$16.25 per TB).

We are constantly sharing deals on hard disk drives in [the #deals channel of the Butter, What?! Discord server](#). If you're looking for a good deal or wanting to share a

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| Manufacturer | Model | Qty. | Specs | Capacity | Condition | Price | Value |
|-----------------|---------------------------------|------|-----------------------|----------|-------------|----------|------------|
| HGST / WD | HUH721010ALE601 | 1 | specs | 10 TB | Refurbished | \$79.35 | \$7.93/TB |
| Western Digital | WD4000FYYZ | 1 | specs | 4 TB | Refurbished | \$42.00 | \$10.50/TB |
| Seagate | ST1600NM001G | 2 | specs | 16 TB | New | \$450.00 | \$14.07/TB |
| Seagate | ST8000DM008 | 1 | specs | 8 TB | New | \$119.00 | \$14.99/TB |

SATA Cables

Motherboard manufacturers have been cutting costs by skimping on things like SATA cables for years. But with the [Topton N5105 NAS motherboard](#), they've taken it to a new level!

The motherboard didn't come with any SATA cables whatsoever. In this scenario, this is actually preferable because the amount of room in the [JONSBO N1](#) case requires that you use [right-angle SATA cables](#).



Power Supply

It is very common for small form factor cases to require a small form factor (SFX) power supply too. Being somebody who's a big enthusiast for small form factor DIY NAS builds, I understand and accept this reality—but I kind of wish that weren't the case. I'd gladly trade a bit of case volume for a wider choice of compatible power supplies.

The [JONSBO N1](#) is no different than many of the other Mini-ITX cases I've used in the past. A SFX power supply is required. As a result, I picked the [SilverStone Technology 450W SFX \(ST45SF-V3-USA\)](#) power supply ([specs](#)).

In picking out the power supply, I did some back-of-the-napkin math and attributed about 10–20W to the Celeron N5105 CPU, 5–10W for the each of NVMe SSDs, and up to 25W for each of the five 3.5" HDDs. I probably would have been fine with a 300W power supply, but I opted for the 450W power supply to be safe.



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My biggest concern in building the *DIY NAS: 2023 Edition* was that I'd discover that Linux support of the hardware found on the [Topton N5105 NAS motherboard](#) would be lacking.

The [Topton N5105 NAS](#)

[motherboard](#) was enough of a value that I gambled the hardware would be

supported by TrueNAS SCALE, and thankfully, the gamble

paid off. But had it gone a

different direction, I would've gladly switched to another NAS appliance like UNRAID, OpenMediaVault, or building a NAS from the ground up using a recent flavor of Linux.



TrueNAS
SCALE

It'd be overly melodramatic to say that I breathed a big sigh of relief after I installed TrueNAS SCALE without any issues and had the NAS up and running, but I was definitely relieved.

Tell us more about [TrueNAS SCALE](#), Brian!

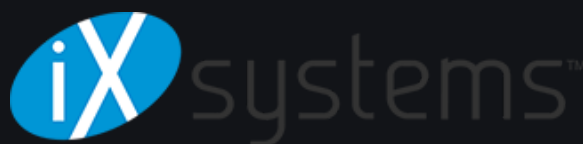
In my opinion TrueNAS SCALE is a fantastic solution, regardless of whether you buy the hardware in the *DIY NAS: 2023 Edition*. To see

if your hardware is likely to work well with

TrueNAS SCALE, check out the [TrueNAS](#)

[SCALE hardware compatibility guide](#). You can

also check out the [TrueNAS Community Forums](#) and/or [TrueNAS Discord](#) for tips and examples of DIY builds and more on [containerized apps](#) (Nextcloud, Plex, Syncthing, and more!) with TrueNAS SCALE.



Final Parts List

| Component | Part Name | Qty | Cost |
|-------------|---|---------------------------|----------|
| Motherboard | Topton N5105 NAS Motherboard | specs 1 | \$224.99 |
| CPU | Intel Celeron N5105 | specs N/A | N/A |
| Memory | Crucial 32GB DDR4 3200MHz CL22 (2x16GB Kit) | specs 1 | \$56.99 |
| Case | JONSBO N1 | specs 1 | \$140.00 |

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| | | | | |
|------------|--|-----------------------|---|------------------------|
| Boot Drive | PNY CS1030 250GB M.2 NVMe | specs | 2 | \$24.05 |
| SATA Cable | Rosewill 3-Pack SATA III Right Angle Cable | N/A | 2 | \$6.99 |
| | | | | TOTAL: \$573.60 |

Hardware Assembly, BIOS Configuration, and Burn-In

Hardware Assembly

Most years, I include a time-lapse video of the assembly, but I wound up needing surgery to repair a partially torn rotator cuff. It was rather difficult to assemble the DIY NAS: 2023 Edition by itself—there was no way I was going to be able to set up my overhead camera rig!

That being said, assembling the DIY NAS: 2023 Edition was fairly straightforward. Building small form factor computers isn't easy, but this year's DIY NAS was easy enough that I managed to do it without aggravating my bad shoulder!



BIOS Configuration

The only changes that I wound up needing to make in the BIOS were changes to the boot order. That’s a really simple change that’s *usually* straightforward. But the BIOS provided on the [Topton N5015 NAS motherboard](#) proved to be a bit more challenging than most other BIOS versions. It wound up taking a little bit of spelunking through the BIOS menus to find the boot order. It wasn’t difficult, but it wasn’t as easy as it should be.

Burn-In

The night before my shoulder surgery, I finished assembling *the DIY NAS: 2023 Edition*, booted it up for the first time, kicked off Memtest86+, and then promptly forgot all about it as I recovered from my surgery.

Nearly 76 hours later, it’d completed a total of [42](#) successful passes!



Normally, I’m inclined to do some CPU stress testing. But seeing as how the answer to *“the Ultimate Question of Life, the Universe, and Everything”* matched the number of successful Memtest86+ passes, I decided that the three days’ worth of running Memtest86+ was sufficient burn-in all by itself.

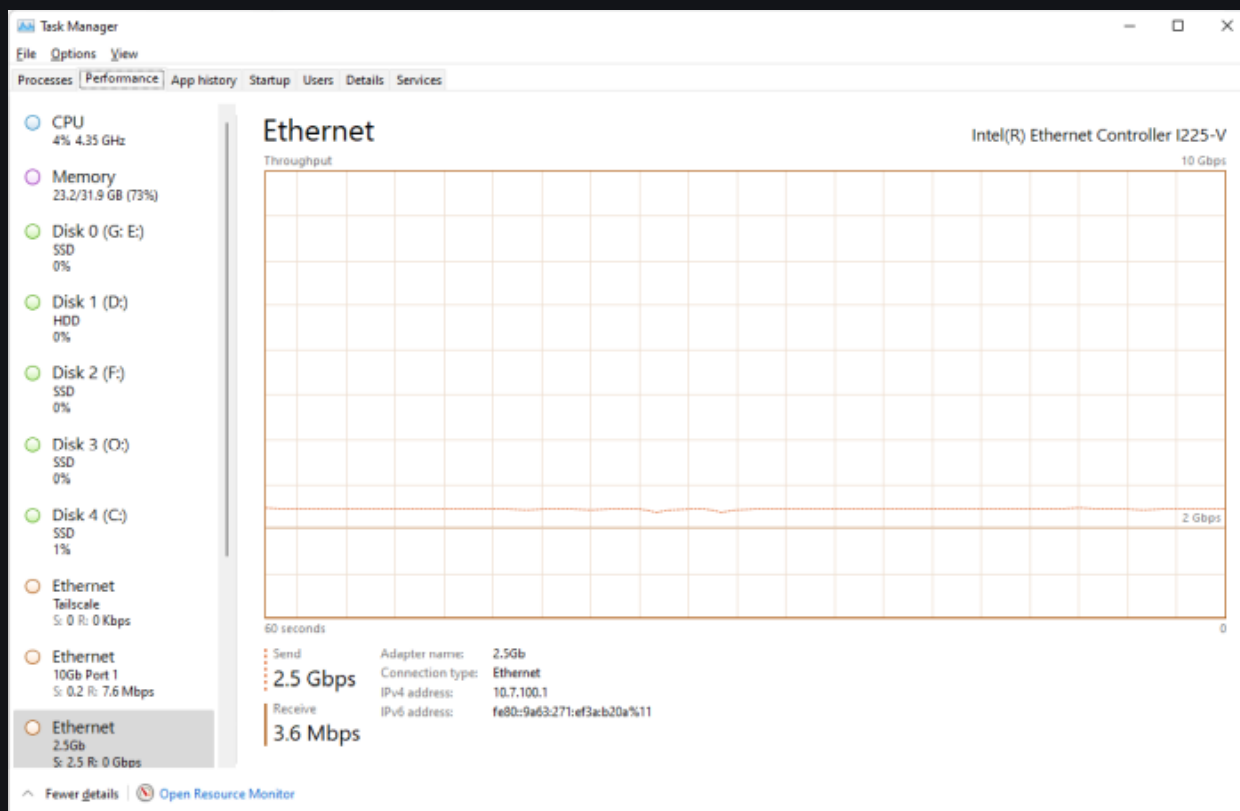
As I’m writing this blog, the uptime on the DIY NAS: 2023 Edition is over 60 days and would’ve been longer had I not been keeping it up to date with updates to TrueNAS

Benchmarks

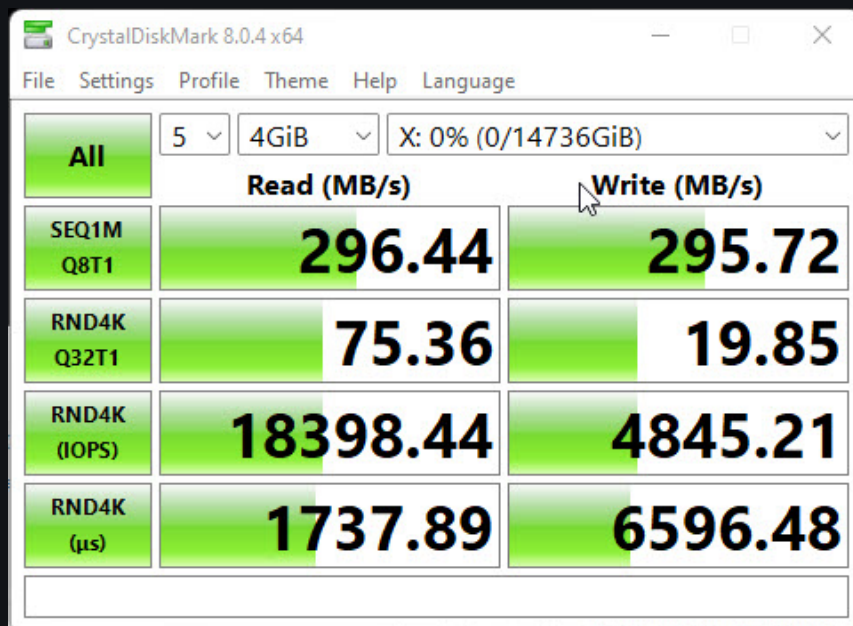
Each year, I like to do a few different benchmarks to validate that the DIY NAS is performing up to my expectations. I'm not particularly interested in tweaking for the absolute best performance; these benchmarks are more a matter of validating that what I built is sound.

Throughput

The first thing that I benchmark is network performance. The first and most likely bottleneck for a DIY NAS is going to be the network. TrueNAS SCALE includes the `iperf3` binaries, so I grabbed the Windows binaries for my desktop PC and directly connected the *DIY NAS: 2023 Edition* to the unused 2.5gbps interface on my desktop computer. After setting up static IP addresses on each end, I ran iperf3 both as a server and as a client on this year's DIY NAS. Unsurprisingly, iperf3 was able to fully saturate the 2.5gbps connection between my desktop PC and the NAS.



After that, I skip right to benchmarking throughput to a drive mapped to a Samba share hosted by the *DIY NAS: 2023 Edition* using [CrystalDiskMark](#). I was pleased to



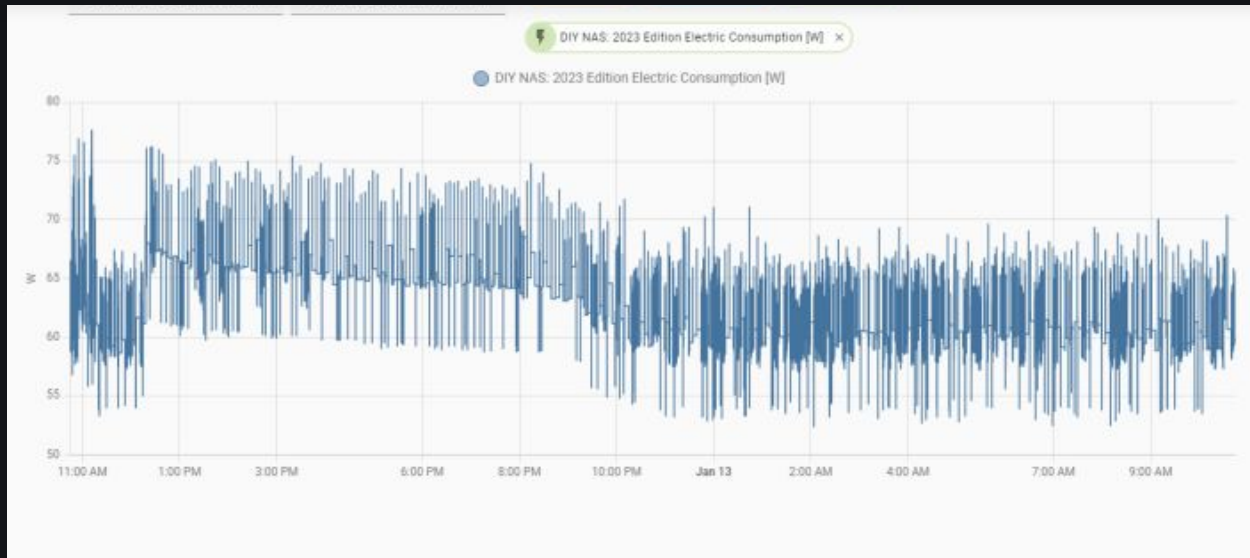
The screenshot shows the CrystalDiskMark 8.0.4 x64 application window. The interface includes a menu bar (File, Settings, Profile, Theme, Help, Language) and a toolbar with a profile dropdown set to 'All', a test size dropdown set to '4GiB', and a progress indicator 'X: 0% (0/14736GiB)'. The main display area is a table of performance metrics for a drive, with columns for 'Read (MB/s)' and 'Write (MB/s)'. The metrics are as follows:

| | Read (MB/s) | Write (MB/s) |
|--------------|-------------|--------------|
| SEQ1M Q8T1 | 296.44 | 295.72 |
| RND4K Q32T1 | 75.36 | 19.85 |
| RND4K (IOPS) | 18398.44 | 4845.21 |
| RND4K (μs) | 1737.89 | 6596.48 |

Power Consumption

In the past two years, I [dove headfirst into home automation](#). One of the things that I've done in the past year is put smart outlets at each of my computers for monitoring their power consumption and track them using [Home Assistant's Energy Management](#). I made sure to reserve a smart outlet for my DIY NAS builds too.

For fun one day, I worked through a series of tasks and noted the peak wattage during each of those tasks. In addition, I captured the average wattage of the NAS being idle for an hour. Here's a graph of the wattage over the 24-hour period from the beginning of these tasks.



I went through some of the metrics captured in Home Assistant and the peak wattage recorded during each of those tests. I also grabbed the peak and average wattage when the NAS is idle. Lastly, I grabbed some data for a 36-hour period of time—including these tasks—and captured the maximum wattage, average wattage, and total consumption over those 3 days.

| Task | Duration | Max Wattage | Avg. Wattage | Total Consumption |
|----------------------|----------------|---------------|----------------|-------------------|
| Idle | 60 min. | 68.8 w | 59.87 w | --- |
| Boot | ~2 min. | 73.0 w | --- | --- |
| FIO Benchmark | ~13 min. | 73.0 w | --- | --- |
| SMB Benchmark | ~4 min. | 77.6 w | --- | --- |
| ZFS Scrub | ~1 min. | 71.2 w | --- | --- |
| S.M.A.R.T. Long Test | N/A | 76.2 w | --- | --- |
| Total | 36 hrs. | 77.6 w | 60.49 w | 3.4 kWh |

Notes:

- The ZFS scrub was comically fast because the pool was empty. I don't believe that what I've captured here is a quality measurement; please take it with a grain of salt!

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3.4kWh of consumption in 36 hours conflict. An average of 60.49W over 36 hours should be ~2.2kWh **or** 3.4kWh over 36 hours should be an average of ~94.4W. I'm sure this is a result of error(s) on my part, but I don't have the ability to go back to identify which error(s) were made and correct them.

Lastly, I wanted to share just how much less power the *DIY NAS: 2023 Edition* is using compared to my own desktop computer (Animal), [my own TrueNAS SCALE machine](#) and my homelab machine (Deskmeat). So I charted out the power consumption of the 24 hours following the beginning of these tasks.



What Does Brian think of the *DIY NAS: 2023 Edition*?

Weaknesses

It does not matter. Regardless of how much effort I put into parts or how carefully I work to assemble the DIY NAS, there's always something that I believe can be improved with every DIY NAS that I build. The *DIY NAS: 2023 Edition* is no exception.

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adding a GPU, a 10GbE NIC, or a HBA for additional SATA ports. Pretty much the only viable upgrade option would be to upgrade from 32GB of RAM to 64GB of RAM.

2. ***The JONSBO N1 front panel's USB and audio ports aren't connected***, as there are no audio or USB 3 headers on the [Topton N5105 NAS motherboard](#).
3. ***It is a tiny bit noisy***. The *DIY NAS: 2023 Edition* has sat right next to [my current DIY NAS](#) for over a month now, and with 2 fewer drives and ***way less utilization***, it's still the noisier of the two machines. However, it never approached the threshold where I thought it was noisy enough that I wanted to do something about it. Regardless, this felt like something I should mention.

Of these complaints, the first one is the most worrisome. Upgrades aren't actually impossible, but if you're wanting more CPU, or PCI-e slots for other components, then you'll need to shop for a new motherboard. The other two weaknesses seem a bit nitpicky.

Strengths

1. ***The CPU compares well to past DIY NAS Builds***. I [compared the Celeron N5105 against the CPUs to the other CPUs](#) that I've personally used here at home. I was shocked and impressed with how well the Celeron N5105 CPU measures up to the others and what a fantastic value it is today.
2. ***Saturates the 2.5 gigabit network***. This wasn't *that* surprising. I expected that it should saturate the 2.5 gigabit network. But given that 2.5Gbit interfaces are becoming more common and the price-per-port on switches has dropped to around \$20, it was very encouraging.
3. ***The DIY NAS: 2023 Edition is inexpensive and carries a lot of value***. At under \$630 the entire build is less expensive than last year's motherboard alone. A sub-\$1,000 DIY NAS build is entirely possible ***with*** [a pair of 10 TB NAS HDDs](#).

The cost of the four prior DIY NAS builds without any storage was \$1565 in 2022, \$1728 in 2020, \$1379 in 2019, and \$1890 in 2017. At \$630, the cost of the *DIY NAS: 2023 Edition* is between 33% and 46% of the cost of those systems!

Each year, I strive to put together something with a quality price-to-performance ratio, and I think the *DIY NAS: 2023 Edition* really hits that mark. I think it could easily be argued that this year's build is one of the best in terms of its value.

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It should go without saying that I'm impressed by the *DIY NAS: 2023 Edition*, but what do you all think? If you're interested in building your own DIY NAS, does the *DIY NAS: 2023 Edition* seem like something you would want to build? Has the *DIY NAS: 2023 Edition* sparked your curiosity and inspired you to build a unique DIY NAS of your own? Let me know in the comments or come tell us about it in [the #diynas-and-homelab channel in The Butter, What?! Discord server](#).

Giveaway

As I have more than 10 times in the past, I'm giving away the *DIY NAS: 2023 Edition* and a \$100 giftcard for some TrueNAS schwag! The team at iXsystems deserves a shoutout for sponsoring the giveaway and spicing it up! In prior years, this was a luck-of-the-draw raffle, but I'm changing things up this year.

For this year's giveaway, I'm tasking entrants with answering this question:

If you won the *DIY NAS: 2023 Edition*, what would you do with it? What sort of problems would it solve for you?

Share your answer somewhere publicly accessible on the Internet: in a blog, a Tweet, post it to Mastodon, talk about it on TikTok, vlog about it on YouTube, live stream it on Twitch, etc. Then submit your entry by [filling out the *DIY NAS: 2023 Edition* giveaway form](#).

As the giveaway runs its course, I'll be consuming each entry, promoting everyone's entries on social media, and eventually picking a winner. The winning entry will find a way to set itself apart from the others. The creativity and quality of the entry will be critical! Please keep that in mind when choosing the platform and crafting your entry.

As an example, it's hard to imagine that a Tweet that says "To store files!" could be more compelling than a YouTube video from a dog rescue group that needs more capacity for videos that they create to help abandoned dogs find their forever homes.

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your entry. We'd love to host your entry on [The Butter, What?! blog!](#)

Rules

1. **Only one entry per individual**
2. **Each entry must:**
 1. Include a link to this blog.
 2. Be publicly accessible on the Internet.
3. **Anybody can win, but** shipping will only be covered in continental United States. Winners outside of the continental US will be responsible for the cost of shipping and customs.
4. The winner will be chosen **90 days after the publish date** on this blog.
5. The winner has **3 business days** to respond after being chosen.



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Add a comment

M ↓ MARKDOWN

ADD COMMENT

Upvotes Newest Oldest



Сергей Ковалевич
1 point · 6 months ago



I have pretty similar build - the same case and motherboard. I also replaced front panel by my custom 3d-printed panel with ssd1306 display.

B Brian Moses **MODERATOR**
0 points · 6 months ago



That's fantastic, Сергей! Thank you for sharing it with the rest of us!

M Mike
2 points · 8 months ago



I just found this case and love it. I would like to move on from qnap and build my own.

B Brian Moses **MODERATOR**
0 points · 8 months ago



It's a pretty awesome case. If my experience is any indicator, I think you'll like it!

M Mike
0 points · 7 months ago



I misread the entry requirements. I had to edit the entry to give you my media post url.

By the way, if I want to have some GPU for encoding, do you think the Coral M.2 would work? I've order one (Nov eta)

B Brian Moses **MODERATOR**
0 points · 7 months ago



If I want to have some GPU for encoding, do you think the Coral M.2 would work? I've order one (Nov eta)

Off the top of my head and after one or two Google searches, I'm not very confident. But I have very little understanding of the coral.ai product and its use cases.

It's worth pointing out that the N5105 CPU's GPU does include Intel's Quick Sync. While I was writing the blog, I used all of my available compute power (including the DIY NAS: 2023 Edition) to re-encode my media library to H.265 using Unmanic.

J Jan
2 points · 8 months ago



Great blog post, as always! Following your series since the beginning, and appreciate the insights I got over the years. I actually built my new NAS last month using this mainboard, but with the N6005 CPU and in an older LianLi PC-Q25 case.

The board does support 64 GB of RAM in total, only the limit per SO-DIMM is 32 GB. I successfully installed a G.Skill RipJaws 64GB (2x 32GB) Kit (<https://www.gskill.com/product/2/197/1540866339/F4-3200C22D-64GRS>) and it's running perfectly with TrueNAS Scale and a couple of Apps.

B Brian Moses **MODERATOR**
1 point · 8 months ago



I actually built my new NAS last month using this mainboard, but with the N6005 CPU and in an older LianLi PC-Q25 case.

The LianLi PC-Q25 is one of my all-time favorite NAS cases! I'm always excited to see that others continue to use it.

The board does support 64 GB of RAM in total, only the limit per SO-DIMM is 32 GB. I successfully installed a [G.Skill RipJaws 64GB \(2x 32GB\) Kit](#) and it's running perfectly

Nice! Thanks for sharing!

I bought a topton with the N6005 at the end of 2022 with lots of discounts and such from ali express direct from topton, I'm using it in a Node 304 with unRAID and some spare hard drives and am thoroughly enjoying it but also barely using it to it's full potential lol.

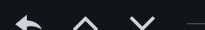
B **Brian Moses** **MODERATOR**
1 point · 8 months ago



The Topton N5105 that I bought also came from AliExpress direct from Topton. Being impatient waiting for it to get shipped to the US and frustrated at all the added unseen expenses is part of why I bought 25 more in the hopes of saving other folks that same frustration!

I'm glad to hear you're enjoying the N6005 and feel like there's untapped potential out there for you. What kind(s) of things do you think you might use it for?

E **Eric Joseph**
1 point · 8 months ago



Awesomeness! I may eventually move my Plex Server and nextcloud vm over. Funny story, I had just read an article/review of the motherboard from a friend of yours and then your article popped up in my google discover feed!

B **Brian Moses** **MODERATOR**
1 point · 8 months ago

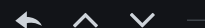


Pat's a good dude! We've both been excited about this motherboard since it showed up on my radar.

How have I not linked to that blog, yet?! It looks like it's time to publish an update!

[I Am Excited About the Topton N5105 Mini-ITX NAS Motherboard!](#)

A **Andrej Friesen**
2 points · 8 months ago



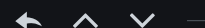
When I saw the motherboard I immediately thought: how cool would the Johnsbo N1 be with that board. And then you have gone for this as well. Nice!

Love the build!

You mentioned some noise "issues". Could you elaborate where the noise is from? Is it the CPU fan, the fan of that small SFX power supply or maybe just the HDDs?

Sorry to hear about your shoulder. Had a similar surgery 2 years ago and I am still working on it. Wish you a speedy recovery!

B **Brian Moses** **MODERATOR**
1 point · 8 months ago



Thanks for both the compliment and the well wishes! It was interesting and surprising when the doctor said it'd take 6 months to heal and that it'd probably be 2 years until it felt "normal" again.

When I saw the motherboard I immediately thought: how cool would the Johnsbo N1 be with that board.

The pairing of the JONSBO N1 and the Topton N5105 NAS Motherboard are quite nice--both from a perspective of features and because they were both products that were only available from AliExpress and/or Banggood for the longest time.

You mentioned some noise "issues". Could you elaborate where the noise is from? Is it the CPU fan, the fan of that small SFX power supply or maybe just the HDDs?



A.C.

1 point · 4 months ago



Brian - thanks for the great work, and great writeup. It looks like my old FreeNAS mini has finally given up its motherboard, but the remainder of the components look to be OK. I have two questions: [1] Do you see any reason to not just get this motherboard, memory and power supply, but use the old case? [2] I note this motherboard does not have a separate IPMI port. Is it possible to dedicate one of the NICs/ports to management, so it can be isolated from the rest?



Brian Moses

MODERATOR

0 points · 4 months ago



Sorry to hear about your FreeNAS Mini's motherboard, A.C.! I keep hoping that TrueNAS will let me borrow a Mini so that I can write blogs about them, but that wish hasn't come true yet!

Firstly, I've never touched one of the Minis before, so please take everything I'm about to say with a grain of salt--it's mostly guesswork on my part! I *believe* that the FreeNAS Mini case is a typical MiniITX case. If my belief is correct, I believe you'd be able to put nearly any MiniITX motherboard and memory into the new case. If the PSU in your Mini is still functional, you probably wouldn't need to replace it.

Secondly, the answer really depends on how you're defining "management." IPMI is more than just spare a network interface. There's actual electronics on the motherboard itself that contains the firmware that all the IPMI features are powered by. There is no IPMI hardware on the Topton N5105 NAS Motherboard at all. But if what you're meaning by "management" is to somehow segregate the remote management of TrueNAS (either via the web UI or SSH), it is certainly possible to re-configure each to only listen on the IP address of a particular network interface.



A.C.

1 point · 4 months ago



Brian - thanks for the great write-up! It looks like my old FreeNas Mini's motherboard has finally reached its end of life, so I am considering options. A couple of questions come to mind: What are the considerations for/against reusing the old case, which works fine and has hot swap drive carriages? Obviously I would get the new motherboard, memory and [likely] power supply. Or, am I better off just getting all new parts with zero hours on them, and which have been demonstrated to work together?



Brian Moses

MODERATOR

0 points · 4 months ago



Assuming that the old case would will work with whatever new components you wind up buying, re-using the old case saves you money and preserves features of the case that you've grown accustomed to.

Buying a new case costs more money, lets you pick a case based on the features you're wanting, and probably gets you covered by some sort of warranty.

I can't really tell you which option you'll be better off with--that's ultimately your decision to make . If I were in your shoes, I'd keep the case unless there was something that I disliked about it.



Joe

1 point · 7 months ago



Newbi question: The N5105 specification shows a MAXIMUM RAM of 16GB (<https://www.intel.com/content/www/us/en/products/sku/212328/intel-celeron-processor-n5105-4m-cache-up-to-2-90-ghz/specifications.html>). The CW-N5105-NAS motherboard claims to provide 2x32GB = 64GB (4 times the N5105 MAXIMUM RAM). How does a CPU which is limited to 16GB address 64GB?

briancmoses.com

That's not a newbie question at all! I'm not sure I know the answer to this question, I definitely don't know the answer right off the top of my head.

I rarely question a product's specifications page, but it makes me wonder if this might be an error. I tried to cross-reference other products from Intel and found that the [Intel NUC w/ a N5105 CPU NUC11ATKC4](#) lists support for more RAM than the 16GB maximum noted on the CPU's specifications page.

My firsthand experience demonstrates that 32GB is definitely addressable. If the CPU couldn't address that RAM, there's no way I would've been able to complete 42 passes of Memtest86 without any errors. In that same vein, ZFS is currently using 16GB alone of the RAM as cache and another 8GB for its services. If the N5105 CPU couldn't address RAM beyond 16GB, I'd expect there'd be all sorts of stability issues using the machine.



Matt Davis

1 point · 7 months ago



Hi there, awesome write up and build. I know you mentioned the front usb ports don't connect... what are your thoughts on using only ONE of the NVME drives and using the other m.2 connector for something like this to hook up the case:

<https://www.amazon.com/dp/B09TB68S1G/>



Brian Moses

MODERATOR

0 points · 7 months ago



Thanks, Matt! I'm glad you like it and appreciate the feedback!

Something like what you're suggesting might work, but I wouldn't recommend it. You have to weigh what you're gaining (front panel USB) against what you're giving up (potential storage).

The truth of the matter is that for a NAS, you really probably aren't plugging that many USB devices in. A keyboard, mouse, and USB device temporarily when you're setting it up and maybe a USB hard drive (backups, or copying files over via sneakernet)

That M.2 slot can be used for more high speed storage (NVMe SSD) or it could even be used for more SATA ports via something like the [SilverStone Technology ECS07 5-Port SATA Gen3 6Gbps Non-RAID M.2 PCIe Storage Expansion Card](#) (Note: You'd need a different case to enjoy these extra SATA ports).

Being able to add more storage to your NAS is going to way more valuable in the long run than being able to use the front panel USB ports.

If this were my NAS, I'd completely disassemble the case's front panel and eliminate the front panel's orphaned USB and audio cables inside the case



Zygfryd Homonto

1 point · 14 days ago



I have finally finished my NAS, the elements are very similar: 1- Topton N6005 board 2- 2x32GB Crucial RAM 3- 2x512GB SSD for OS 4- 4x WD Plus 6TB in 2 pools, each is 1+1 so in total 12TB space 5- Jonsbo N3 (I thought about N2, finally decided on N3) 6- 2x 80mm Noctua fans in mobo space 7- 2x 92mm Noctua fans in HDD space (old one in trash bin) 8- 1x 60mm Noctua fan for CPU (old one in trash bin) 9- TrueNAS Scale

For fans I created script and I control them automatically (or manually) from Home Assistant Power consumption:

idle: 48W (4 fans at 30%)

scrub: 53W Temperatures:

with Fans in manual mode, 30% PWM: HDD around 31-33C, NVMe: 24-25W

CPU is set in BIOS to keep around 40C Noctua fans at 30% are practically quiet - the original fans were not PWM so no way to control them - they were too loud and it was... too cold ;-)

brianmoses.com

I am quite happy with this build. Still space for 4 more HDD. The CPU is very little utilised, even during heavy operations.



Brian Moses MODERATOR
0 points · 14 days ago



It sounds like you've built a really nice DIY NAS, Zygfyrd. You've done a good job!

I especially like how you've incorporated Home Automation into managing the fans in your DIY NAS.



Carlos Pérez
0 points · 2 months ago



Hi, first of all, thank you for this excellent post. I ended up going with this mobo for my first NAS and I'm very happy with it. I'm checking your videos and I would like to know how you did you did the setup for Unmanic so this mobo can use the Quick Sync. I did allocate 1 gpu into the settings for Unmanic from TrueCharts but it's failing when trying to convert.

Thanks again for this very helpful post.



Brian Moses MODERATOR
0 points · 2 months ago



Hi, first of all, thank you for this excellent post

You're very welcome, I'm glad you liked it!

I would like to know how you did you did the setup for Unmanic so this mobo can use the Quick Sync.

I would've liked to have used Quick Sync when re-encoding my media library, but as you've mentioned that wasn't an option.

As I understand it, the kernel included with the current TrueNAS SCALE release does not fully support the N5105's iGPU.

The next major version of TrueNAS SCALE (Cobia) should increment the kernel to 6.1, which will hopefully resolve this. TrueNAS SCALE Cobia recently had its first beta release and according to its schedule should be released in late October.



Carlos Pérez Gutiérrez
0 points · 58 days ago



Thanks! I checked more about it and I was able to turn on igpu for this setup, I got it work on handbrake but not unmanic, but at least I can transcode with QSV in Jellyfin. Still, I'll be waiting for Cobia.

Btw, since this is my first NAS, I'm wondering if you have a guide on picking up an UPS, I would like to see how this setup can have an UPS for gracefully turning off when there are power problems. Also, does this board has power on lan?

Thank you!



Brian Moses MODERATOR
1 point · 58 days ago



I got it work on handbrake

Nice work!

I'm wondering if you have a guide on picking up an UPS

Services should be all you need to get it configured to suit your needs.

Also, does this board has power on lan?

I don't know, sorry. I would expect that you'd see an option to enable or disable Wake on Lan in the BIOS. That'd be a good place to start and find the answer to your question.

D Donald Louie
0 points · 7 months ago



have you considered anything like the zimaboard type computers? its like a raspberry pi, but with a pcie

B Brian Moses **MODERATOR**
0 points · 7 months ago



The Zimaboard looks to be way more than a RaspberryPi. Although, I'm not sure I'd seriously consider it for one of my DIY NAS builds. By the time you buy the Zimaboard and a PCI-e SATA card you're in the same price ballpark of the Topton N51055 NAS Motherboard. In my opinion, I think the Topton N5105 NAS motherboard is a much better value; more/upgradable RAM, a more powerful CPU, more onboard storage, and much more network capability.

But I could see why someone might be excited about building a NAS around the Zimaboard! I'd be interested to see what kind of cases folks use--it seems like an ideal project to 3D-design and print your own case for.

B Bart Ellast
0 points · 6 months ago



Very interesting build; But i still find the idle power consumption a bit high for a 10W tdp cpu build? Are the drives not spinning down in truenas?

Can you explain what i am missing or interpreting wrong here ?

B Brian Moses **MODERATOR**
0 points · 6 months ago

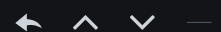


The CPU is just one of many components which are consuming power. The 5x 7200 RPM HDDs are probably consuming the most amount of power. But you also have to account for the power consumption of all the other components, too. The NVMe SSDs, the RAM, the four 2.5Gbps NICs, and all the other assorted components on the motherboard all draw power, too. It adds up!

The idle power consumption might seem high to you, but not to me. Comparing the idle power consumption to my own NAS (60W TDP CPU, 7 HDDs, 2x SATA SSDs) the difference essentially boils down to the 50W difference between the CPUs' TDP and a handful of watts (<10) for my the components in my NAS which aren't found in this build.

With regards to the HDDs spinning down, I'd never want that to happen or recommend it for others. Spending the money on a little bit of extra electricity is well worth saving the wear caused by spinning down and spinning up the HDDs.

J Jonathan Durand
0 points · 6 months ago



Wonderful post and exactly what i was looking for. I have a question before buying the motherboard. I have two Samsung 870 evo plus m2 1To (overkill for ssd cache i know but was under 50 each ;)) to use as cache for my nas project. I'm wondering if this kind of motherboard (and the PCI inside for the m2 slots) has the potential to use these two m2 ? Will i see some good speed improvement if I put them as cache ? I have 4x4To of HDD, 32go de ram (for dockers and VMs). I will use unraid also. Thank you very much for your reply ! I'm totally a newbie in DIY nas :)

I've never used UNRAID. I can't really comment about how its caching works, what sort of performance boost you should expect to see from using a cache, or if you'll even notice! I'm probably not the best person to answer questions about UNRAID's performance, sorry!

The motherboard's two M.2 2280 slots and PCI-e 3.0 X1. The specifications for the Samsung 870 Plus NVMe SSD say that its PCI-e 3.0 X4. While the SSDs will certainly work with the motherboard but they'll both be bottlenecked to the slots' slower PCIe 3.0 X1 speeds (1GB/sec).

**Jonathan Durand**

0 points · 6 months ago



Thank you Brian for your reply Another question, do you think it's possible to put an 6x SSD 2.5 storage pool instead of HDD ? Because the price of the SSD getting lower and lower, and the cost of electricity getting higher, it can be a super solution with this motherboard. I'm just wondering if the Jmicron 585 PCI GEN3 to sata (installed on this board) will offer good performance with 6 SSD on it ? If yes it would be so nice ! Where i live the 2 To SSD are under 90 euros. A 6x2To SSD + 2x1To M2 SSD will be so low power consuming and quiet !

**Brian Moses** MODERATOR

0 points · 6 months ago



I suppose you *could* buy five 3.5" to 2.5" HDD adapters but only assuming they put the SATA power and data connectors in correct spot and then put those into each of the JONSBO N1's five drive bays and then mount a sixth 2.5" drive in the internal 2.5" bay. But I wouldn't recommend it, that's a bunch of extra money to spend contorting the case into something it is not. I'd recommend shopping for a different case.

I haven't personally tried what you're asking, so it's a bit difficult to answer your question about performance. But I'd definitely expect that six SATA SSDs would outperform the six HDDs. My five HDDs' performance was enough to saturate the 2.5gbit network connection on sequential writes and reads. You'd definitely see more IOPS and better performance on random writes/reads with SATA SSDs, but you'd quickly run into your network being the bottleneck. All sorts of quality SATA SSDs regularly benchmark at over 400-600MB/sec on a single drive, that's way more than 2.5Gbps (3.2Gbps to 4.8Gbps). For any kind of network attached storage tasks, most of that performance benefit would be wasted. But for more homelab-related tasks, that performance benefit is likely to be appreciated.

I'd be more concerned about storage capacity and the expense of that capacity. A 2TB SATA SSD is definitely inexpensive, but its cost-per-terabyte (45 euros per terabyte) is higher than a HDD. A quick search (and Google translate) on Amazon.de shows that 2TB NAS-grade HDDs are 80-85 euros (40-43 euros per terabyte). And smaller HDDs have a much higher price-per-TB than larger capacity drives. For example a 16TB NAS grade HDD is 240 euros (15 euro per TB).

Personally, I'd rather have a pair of 16TB HDDs, 3 empty drive bays, a noisier office, and a *tiny* bit more expensive electricity bill than six 2TB SSDs, 0 empty drive bays, a quieter office, and a *tiny* bit cheaper electricity bill. But that's very much a personal preference!

**vinicius martins**

0 points · 6 months ago



Hey, I'm starting the Nas world and I saw topton has the 2bay version with athlon 300u processor. Would you say is worth it?

**Brian Moses** MODERATOR

0 points · 6 months ago



brianmoses.com

That being said, the product sure looks pretty interesting. Personally, I'd prefer more drive bays--two could be very limiting. But if it works for you, I'd encourage you to try it out!

O **October 2023 Calendar**
0 points · 29 days ago



My desire for a diminutive, quiet, and power-efficient DIY NAS was born from a lack of space in my office from ten years ago. My office has grown considerably since then, but I still value these features and strive to meet them with each of my DIY NAS builds.

A **Antonio**
0 points · 5 months ago



Hello, you say that you use the two M.2 ports for redundant boot but in the BIOS there is no raid option. How do you do a redundant boot with the two M.2 drives? Thank you.

B **Brian Moses** **MODERATOR**
0 points · 5 months ago

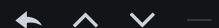


The redundancy in the boot pool (and in storage, too!) is managed by the filesystem, ZFS.

When installing TrueNAS, you will be prompted to pick which devices to use when creating the boot pool. When you select more than one device, it will create a mirror across all the devices selected for the boot pool. This is covered in the TrueNAS SCALE documentation, see: [TrueNAS Installer Console Setup Instructions](#)

As a rule of thumb, you don't want to combine the use of hardware RAID solutions and the ZFS file system.

L **L.J. Miller**
0 points · 5 months ago



Great post, as always! Re: Topton N5105 NAS Motherboard Are you planning on restocking your eBay store?

B **Brian Moses** **MODERATOR**
0 points · 5 months ago



Thanks, L.J.! I'm glad you liked this year's DIY NAS build!

I absolutely plan on restocking the store. Overseas shipping is always a bit unpredictable, but I hope that I'll have replenished the inventory in a week or so.

H **Haris Solakidis**
-1 points · 7 months ago



Have a look at storaxa on kickstarter, they offer this board with a case, psu, ram, boot ssd, wifi, and as a bonus 4xnvme extra (total 6). Also similar boards with cpu upgrades, both intel and AMD.

B **Brian Moses** **MODERATOR**
1 point · 7 months ago



The Storaxa is a potentially neat project. Neat enough that I decided to participate in its crowd-funding.

They might have used this motherboard in their Kickstarter materials, but I'd speculate that was for a prototype and to boost the feasibility of the crowdfunding. I'd be shocked--and potentially disappointed--to hear if this exact motherboard wound up in anybody's Storaxa if the project is successful enough to deliver to its backers.

The Topton N5105 NAS Motherboard lacks available PCIe lanes to support an additional 4x NVMe drives. If they wind up using this motherboard, I worry about the potential bottlenecks and fragility of trying to squeeze these 4 extra

which meet the different pledge options that Storaxa has outlined. These motherboards might be coming from the same manufacturer--but they might not, I'm not sure that they've shared that in any of their updates.

**Haris Solakidis**

0 points · 7 months ago



It's true the base board is severely limited in bandwidth, something the upgrades rectify, but then again not everyone needs to max out their ssds and for a small 1Gb home network it would seem sufficient and great value.

**Brian Moses** MODERATOR

1 point · 7 months ago



If the Topton N5105 NAS motherboard is a great value with two fully-functional NVMe slots (PCI-e 3.0), then it'll be an even better deal with an additional 4 NVMe slots even if they're bottlenecked somehow!

But I don't think we'll see the Topton N5105 NAS motherboard in the Storaxa--I think it'll be something similar but unique designed specifically for the Storaxa. I guess we'll have to wait and see what they deliver!

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