

Rethinking, downsizing, and revisiting the idea of a home server

Lately I've found myself spending way too much time and effort on my home server while not solving any of the issues I uncovered. It was time to take a step back.

Over a decade ago I had a rented KVM. It had 128MB memory, negligible disk space, but it was enough to run some website and mailing. Eventually I bought a second hand 1U HP node, which was nice, but also near impossible to upgrade (SCSI disks, pricey, ancient ECC memory, etc). In 2012 I heard about Hetzner^[^1] and had a rented server from them ever since, until a few months ago.

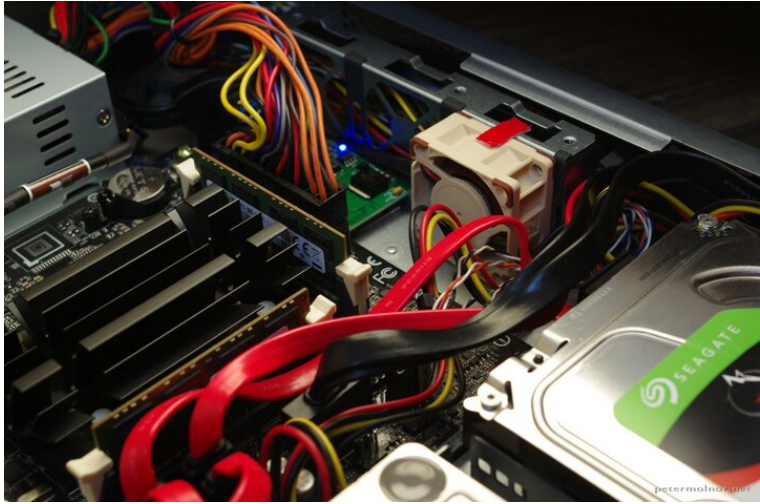
When we moved houses we had to switch ISPs. My beloved previous ISP, Zen^[^2], due to the lack of fibre in the local exchange, could only offer 16/1Mbps ADSL, which is not enough for these days. The only speedy alternative with static IP was the dreaded Virgin Media Business. Unaware of all the mess it will bring into my life - their participation in the IWF block list, the fact that their "static" IP is a GRE tunnel^[^3], the frequent outages caused by T3 timeouts^[^4] triggering a router reboot that lasts 20 minutes, etc - I foolishly moved my services to my home server^[^5].

With this move, apart from the reliability issues, I eliminated an important factor I had: off-site backups. I thought I can simply replace this with an external hard drive and monthly offline archiving, but other issues started to pile up. The home server lived under a cabinet, which is nice, but far from being physically secure. We were burgled once and got very lucky - barely anything was taken - it made me be aware of such events. That offline single copy is also in my house, albeit in a fire safe, and it certainly didn't contain up to date copies of the website data. Because we now have hard floor, and that the area is eerily quiet during the night, I heard the machine way too well at late hours.

Another trouble was FreeNAS. The goal of running FreeNAS was have a GUI that less technical people could use as well, but the moment I started using jails, custom devfs rulesets, etc., the FreeNAS interface became rather complicated immediately.

Then there were the failed ideas with the server's physical existence.

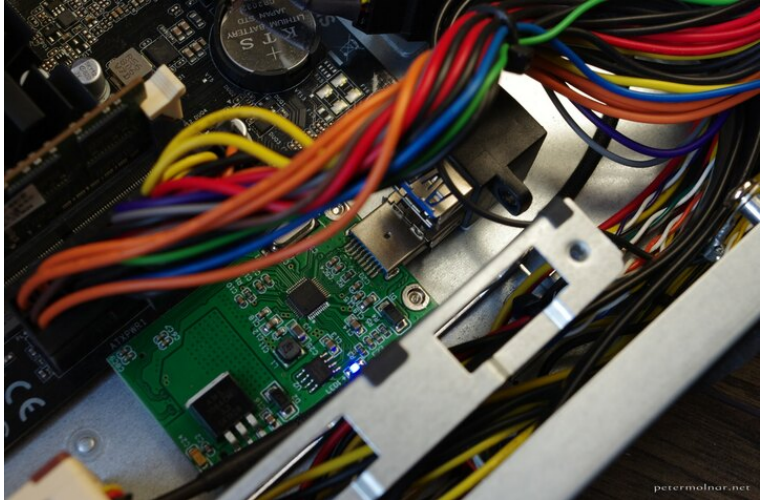
1. I tried to make a "custom case" by putting all components in a drawer. It failed, because I failed to realize how much space cabling would need
2. I was at the second "silent" fan - I have to tip my hat towards Noctua, their fans are actually pretty nice - but I still couldn't fit in properly in the case, which was meant to house some 10k rpm jet engines



A silent fan in the iw-rf100s chassis, held in place by double sided tape

PENTAX K-5 II s, 35.0 mm, f/8.0, 1/60 sec, ISO 400 | smc PENTAX-DA 35mm F2.4 AL | CC-BY-NC-ND-4.0

3. I was constantly thinking of needing more drives to have RAID on everything



The front USB3.1 ports converted into internal ones with an mSATA to USB converter and a 64GB mSATA SSD to RAID it with the 64GB SATA SSD

PENTAX K-5 II s, 35.0 mm, f/8.0, 1/60 sec, ISO 400 | smc PENTAX-DA 35mm F2.4 AL | CC-BY-NC-ND-4.0

4. I bought car deadening mats^[6] to silence the machine, and while it worked a bit, it didn't nearly work well enough. *3.5" drives are NOISY, I forgot how noisy they are, because 20 years ago my computers at home were not running 24/7.*
5. I ended up putting a \$5 DigitalOcean droplet as caching nginx proxy in front of the setup to prevent downtimes of the websites

6. I spent days trying to find a better PC case



The 1U server case needs an ultra low profile IO shield, which didn't come with a motherboard, given it's consumer grade - the one on the picture is cardboard with aluminium tape

PENTAX K-5 II s, 35.0 mm, f/8.0, 1/60 sec, ISO 400 | smc PENTAX-DA 35mm F2.4 AL | CC-BY-NC-ND-4.0

... and the list goes on, so at this point I decided to take a step back.

The question I should have started with: what do I need?

Instead of thinking about "simplifying" by moving to a single machine, "saving money" by canceling the rented server I should answer the needs.

I need:

- a reliable 24/7 server for web, email, xmpp, etc.,
- backup server for this server's data
- local backups for our laptops
- off-site backups
- archives
- a media renderer
- something that can host Domoticz

So let's go one by one.

A reliable 24/7 server and off-site backups: back to Hetzner

Hetzner is a wonderful provider, and though their hardware fleet is a bit aging now, it's still going strong. For roughly €30 a month, one can get a machine of with an Intel Xeon E3-1245, 2x Enterprise level 3.0 TB SATA HDD, 4x 4GB ECC RAM. That is more, than enough to run the services, plus the off-site backups.

I decided to stick to FreeBSD, mainly because of the smooth ZFS experience, and because it certainly feels ile oldschoool sysadmining.

Backup server, local backups, Domoticz: home server revisited

I had some hardware lying around, namely a lot of 2.5" drives: an 1TB HGST Travelstar, a 2TB Samsung Spinpoint, an 1TB Toshiba SSHD. These used to be the drives in my previous home server, when it manifested as a ThinkPad T400 laptop, but when the 2TB Spinpoint started to throw ZFS errors, I panicked, and moved to 3.5" drives. Ever since then I ran amplitudes of tests on that drive and never found any issue, so when this day came, it was time to add it back.

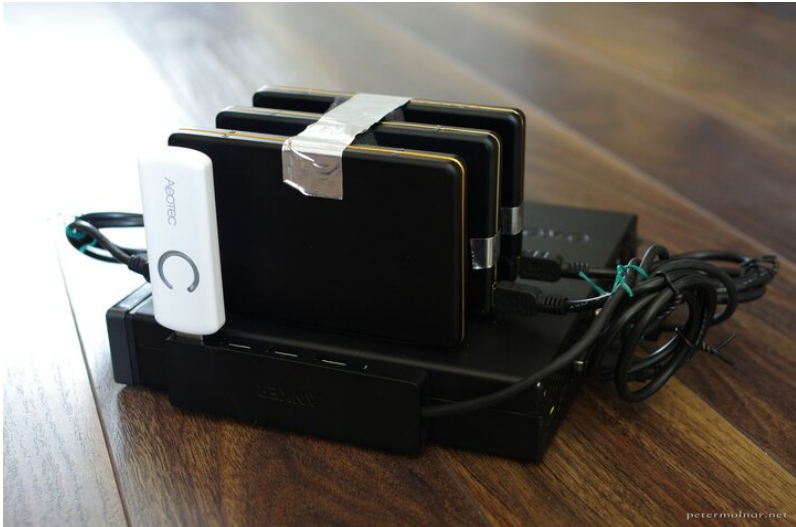
One of the pain points of trying to find a case was trying to find a board with enough SATA sockets and a case to accommodate it. Truth is, if you get angry enough you realize that if you don't overdo it, USB is actually enough(ish). I also happened to find the Thinkcentre Tiny line of Lenovo, mainly the Thinkcentre M600[7]: these are low power, passively cooled, made to be thin client machines, but just enough to also be home servers. It has 2 USB2, 4 USB3, 2 DisplayPort, 1 Gbit ethernet, an m.2 slot (also a SATA slot, but it's unusable because of the heatsink), and it goes nicely with all the ThinkPads at home. I managed to source one on eBay for ~£60.



Lenovo ThinkCentre M600 with external hard drives, front view

PENTAX K-5 II s, 35.0 mm, f/4.0, 1/60 sec, ISO 800 | smc PENTAX-DA 35mm F2.4 AL | CC-BY-NC-ND-4.0

As for the disks, I had 3 USB2 enclosures, which was possible to glue with a strong, double sided tape on the top of the case, e voilà, my ugly little duckling home server, that fits inside a drawer, near silent, and is working remarkably well.



Lenovo ThinkCentre M600 with external hard drives, side view

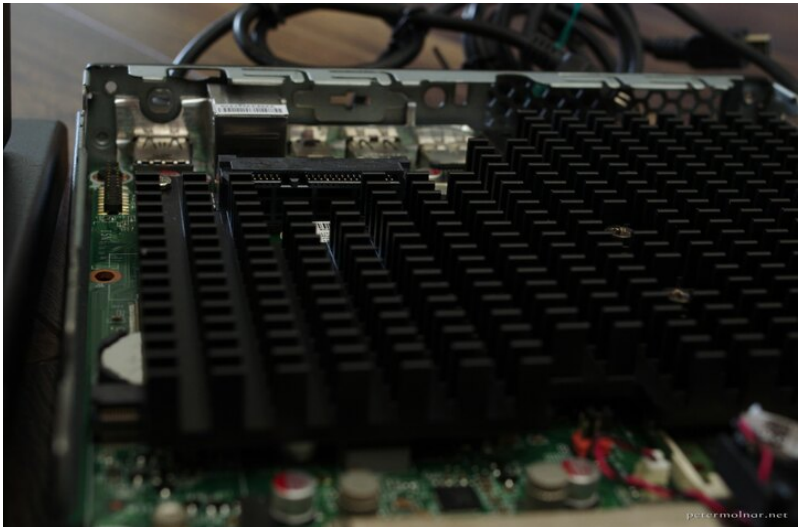
PENTAX K-5 II s, 35.0 mm, f/4.0, 1/60 sec, ISO 800 | smc PENTAX-DA 35mm F2.4 AL | CC-BY-NC-ND-4.0

Is it fast? No. But it does the job. *And it's certainly faster than the WordPress I once ran on a HTC Desire mobile phone. Yeah, don't do that.*



Lenovo ThinkCentre M600 with external hard drives, opened

PENTAX K-5 II s, 35.0 mm, f/8.0, 1/20 sec, ISO 800 | smc PENTAX-DA 35mm F2.4 AL | CC-BY-NC-ND-4.0



Lenovo ThinkCentre M600 - the ones with passive heatsink can't fit a 2.5" drive, there's simply no space

PENTAX K-5 II s, 35.0 mm, f/8.0, 1/20 sec, ISO 800 | smc PENTAX-DA 35mm F2.4 AL | CC-BY-NC-ND-4.0

Note: during the external enclosure ventures I made an interesting discovery. The peak power use of any of my SSDs, both SATA and mSATA, is 1.5A on 5V, whereas the

HDDs have peak 900mA (even though the sticker says 700mA on the HGST, 850mA on the Samsung, and 1A on the Toshiba). This is a rather serious problem when you take the USB3 port capacity into account, which is 900mA - making it unadvised to run external SSDs off them. The M600 has a "charging" USB3 port, which I'd assume is giving more power off, so I'm running the Toshiba off that, but I've given up on the idea of running SSDs over USB < 3.1.

Archives

Whenever there's a discussion about archiving, one of the important points is that the formats - physical media, file format, etc - should be something that is as future proof and/or as widely used as possible.

Due to the size of the things I'd want to archive - photos over a TB - I gave up on Blu-Ray. External hard drives, even if they are sub-par on performance^[19], are OK for write occasionally, maybe read in the future, so I got a 4TB Seagate USB3 hard drive. But what about the filesystem?

When I tried to copy from FreeBSD I realized having a common file system is, surprisingly, nearly unsolved. Ext3/4 is a no go on FreeBSD, ZFS is obscure for desktop and nonexistent on Windows; problems are similar with XFS, UFS, etc. I don't trust FAT and 4TB may even be over it's limits. Which left me with NTFS.

Due to the existence of `ntfs-3g` nearly anything - Windows, Mac, Linux, BSD, etc - can read and write NTFS, even if compression is on. (*Note: don't turn `ntfs-3g` compression on. It's a serious resource hog.*) Plus, unlike FAT, NTFS is POSIX compliant.

```
sudo apt install ntfs-3g
```

bash

My drive was `sdd`, once I made a single partition, mounting it is:

```
sudo mkfs.ntfs -s "$(lsblk -d -o name,PHY-SEC | grep sdd  
| awk '{print $2}')" -f /dev/sdd1  
sudo mount -o auto,users,permissions /dev/sdd1 /mnt/
```

bash

And it's all good.

Media renderer

I covered this already in my previous entry under 'Raspberry Pi 3 as featherweight headless media renderer'^[^10].

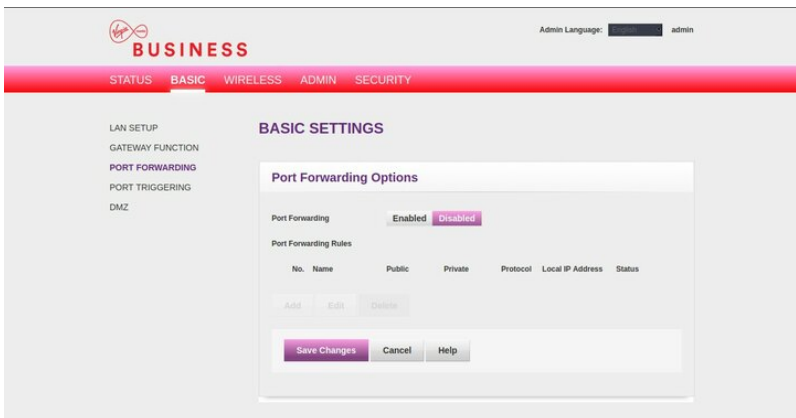
• 1: addressing the router outages

Virgin Media had a nasty series of outages; 6 of them on every first quarter of the hour. Yep, it does sound like a cronjob. The annoying bit wasn't really the internet not being available but that whenever the router reboots, I lose my home network. So I started to look into way that I could reduce my reliance on the router to an absolute bare minimum and maybe even had a 4G connection as a fallback.

I still have my previous router from a relatively unknown manufacturer, AVM, a FRITZ!Box 3490^[^11]. AVM is an oldschool German manufacturer, meaning the have DOCUMENTATION on everything. Plus reliable and rock solid products.

It turns out that while the 3490 is a VDSL modem/router it can be easily put into Ethernet mode^[^12] or even 4G over USB mode^[^13]. Unfortunately with Ethernet mode it is not possible to use the fallback to 4G in case of an outage option; it's either ethernet or 4G. It still gives me an option to connect a mobile phone with tethering in case Virgin has a really bad outage without needing to reconfigure a single device in my household.

In order to actually use the FRITZ!Box, I did the following in the Hitron router:



turn off port forwarding

Admin Language: en admin

BUSINESS

STATUS BASIC WIRELESS ADMIN SECURITY

LAN SETUP
GATEWAY FUNCTION
PORT FORWARDING
PORT TRIGGERING
DMZ

BASIC SETTINGS

LAN Settings

IP Address

Subnet Mask

DHCP Status **Enabled** Disabled DHCP Reservation

Lease Time

DHCP Start IP

DHCP End IP

Save Changes Cancel Help

Connected Devices

Host Name	IP Address	MAC Address	Type	Interface	Status
Unknown	192.168.1.253	7C:FF:4D:F4:7B:89	Self-assigned	Ethernet	Inactive

Turn off DHCP

Admin Language: en admin

BUSINESS

STATUS BASIC WIRELESS ADMIN SECURITY

BASIC SETTINGS
WPS & SECURITY
GUEST NETWORK
ACCESS CONTROL
ADVANCED
ATF

WIRELESS

2.4G 5G

Basic Settings

Wireless Mode **2.4G**

Channel Bandwidth **20MHz**

Wireless Channel **11**

SSID Settings

2.4G Primary SSID

Network Name (SSID)

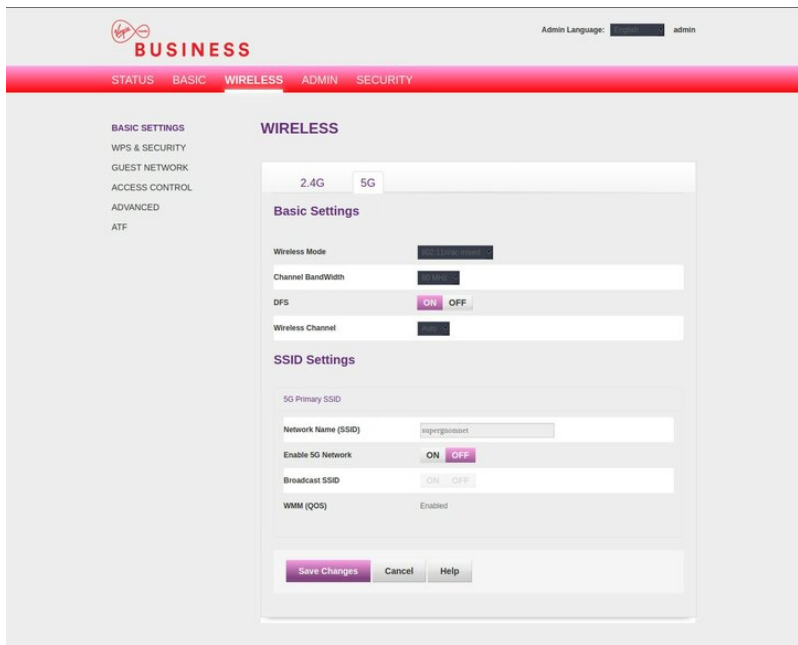
Enable 2.4G Network **ON** OFF

Broadcast SSID **ON** OFF

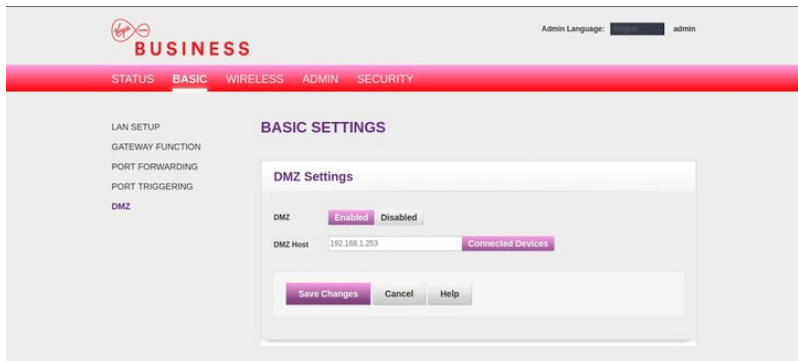
WMM (QoS) Enabled

Save Changes Cancel Help

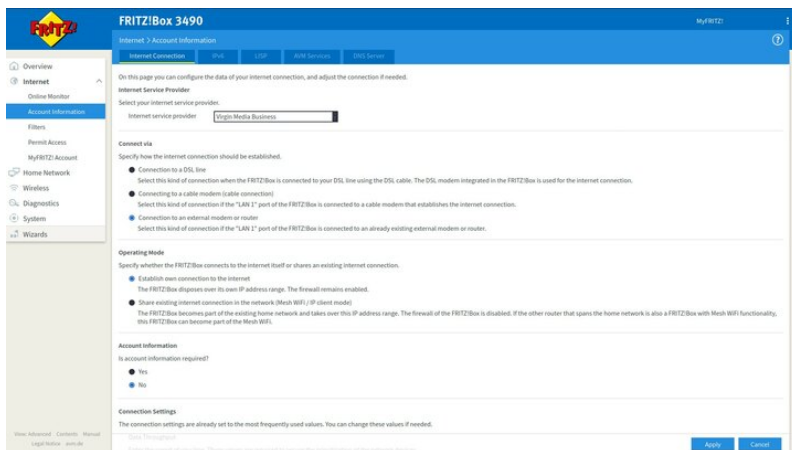
Turn off 2.4GHz Wi-Fi



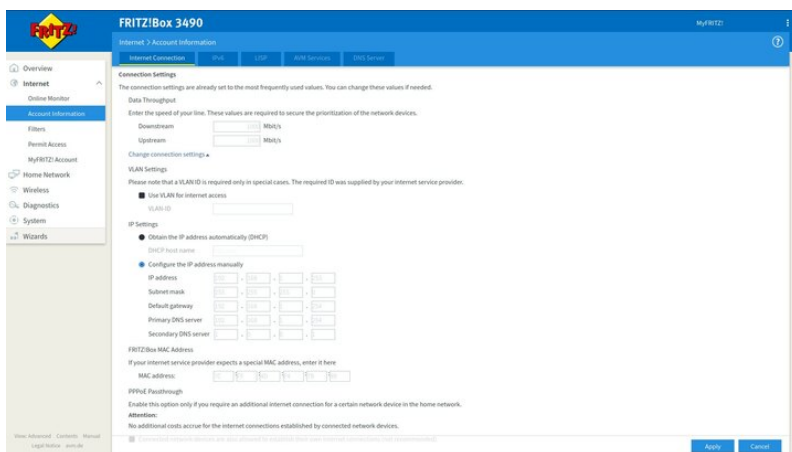
Turn off 5GHz Wi-Fi



Point the DMZ option at the FRITZ!Box



Set the FRITZ!Box to internet over LAN 1 mode



and set it to a static IP to eliminate potential issues with DHCP

And with that, I have a NAT behind a NAT (yay?), 2 devices, but at least a reliable and nice solution if Virgin fails us again.

Links

1. <https://hetzner.de>
2. <https://zen.co.uk>
3. <https://www.ispreview.co.uk/index.php/2017/11/uk-virgin-media-business-static-ip-users-suffer-unstable-broadband.html>
4. <https://www.thinkbroadband.com/broadband/monitoring/quality/share/33a204abf691e1ed2e9dc2bac326be6f0f7298b1>
5. <https://petermolnar.net/home-server-2019/index.html>

6. <https://www.amazon.co.uk/gp/product/B01KZ5X7KO>
7. <https://www.lenovo.com/us/en/desktops-and-all-in-ones/thinkcentre/m-series-thin-clients/M600-Thin-/p/11TC1MTM60010KH>
8. https://documents.westerndigital.com/content/dam/doc-library/en_us/assets/public/western-digital/product/hgst/travelstar-5k-series/product-manual-travelstar-5k1000.pdf
9. <https://community.wd.com/t/invalid-command-operation-code-write-same/242463>
10. <https://petermolnar.net/lightweight-headless-media-player-raspberry-pi/index.html>
11. <https://en.avm.de/service/fritzbox/fritzbox-3490/overview/>
12. https://en.avm.de/service/fritzbox/fritzbox-3490/knowledge-base/publication/show/106_Setting-up-the-FRITZ-Box-for-use-with-another-router/
13. https://en.avm.de/service/fritzbox/fritzbox-3490/knowledge-base/publication/show/1205_Configuring-FRITZ-Box-for-internet-access-via-an-Android-smartphone-USB-tethering/

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