

RACK

# DIY | Sound Proof Server Rack

[UPDATED 2022-02-01] My home lab gear seems to be multiplying at a constant speed, and my dusty desk has run out of space a long time ago. It has also been noticed that these things can get noisy ..



Jukka

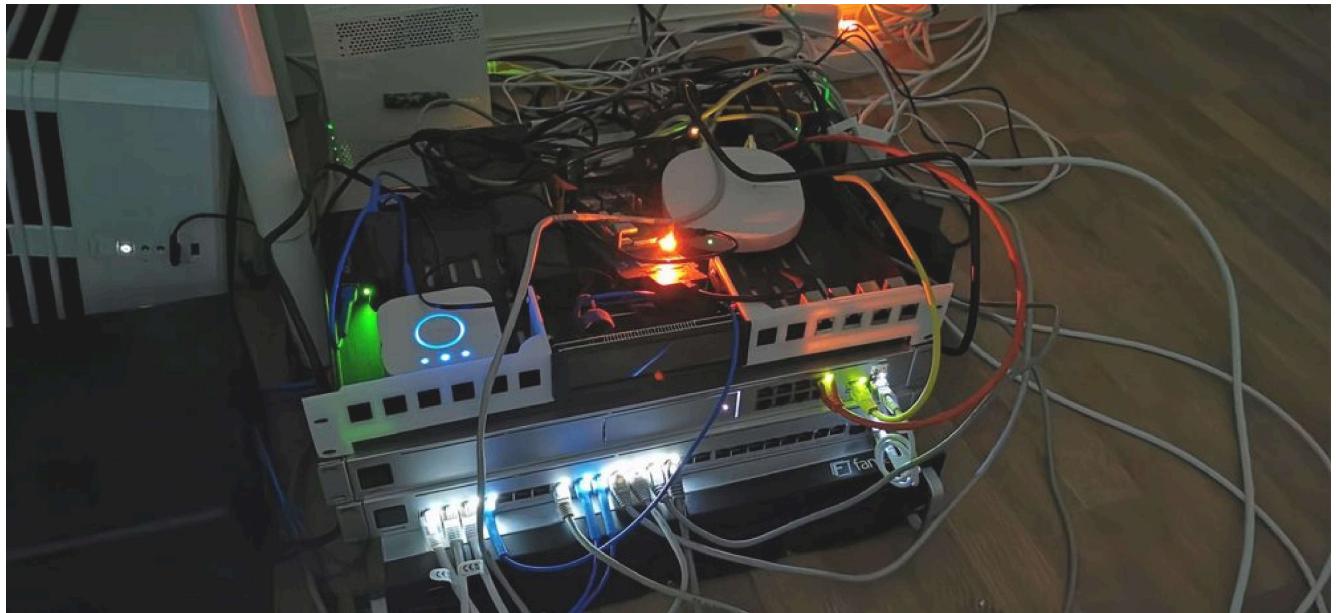
Jan 22, 2022 • 14 min read



Like all my DIY projects .. this is a work in progress, until abandoned or replaced by something else.

My home lab gear has been laying around, on desks, on the floor, inside drawers ... generating heat, noise, and collecting a lot of dust. And I mean, a lot of dust, it is a weekly job to clean the equipment. So I started thinking about buying a rack cabinet, preferably one that would

reduce noise and help to protect against dust. Currently, I don't have a separate room, where I could keep this equipment, and also my working space is just one side of the room, so preferably the rack should also blend in.



I started searching online for commercially available cabinets, but I rather quickly realized that these kinds of closed racks or cabinets cost way more than I am willing to spend on it.

I turned my searches towards DIY-built racks. I found a couple of examples that were aesthetically quite pleasing, but the exact builds were too big, tall, or too deep for the room where it will be in. Furthermore, I measured that the max device depth that I currently had was 550mm, short-sighted thinking I know, but really anything deeper and it would start blocking my access to my work desk.

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## "The Design"



All the parts are listed at the end of this page

I had previously done some hacks with Ikea furniture, so I thought that why not see if there is something that I could just easily hack to my needs. What I ended up buying was two 60 x 37 x 80 cm Ikea Metod wall cabinet frames, Ikea doors and hinges to match the cabinets and some 39 x 66 x 2550 cm drywall studs.

While searching for suitable cabinets, most were not quite deep enough. But then I had the realization that two 60 x 37 x 80 Ikea Metod wall cabinets combined would be almost a perfect depth. The internal width I could just adjust with an internal frame, which would then also join the 2 Ikea cabinets, while searching for the wood I also realized that the Dry Wall studs as such would also be a perfect fit.

## The Build



## The Cabinet Frames

It was exactly as Ikea promised, "*Ikea Metod - Kitchens customizable according to your dreams*" .. indeed that, and with these slight modifications, this kitchen cabinet can be fitted with short depth rack servers (max 550 mm deep). Even my wife got a little excited when I announced that I am buying some new kitchen cabinets. Although in the end, it turns out this kitchen cabinet is not allowed in the kitchen.



I started by assembling the Ikea cabinets, this is where I just followed the Ikea guides.



## The Internal Frame

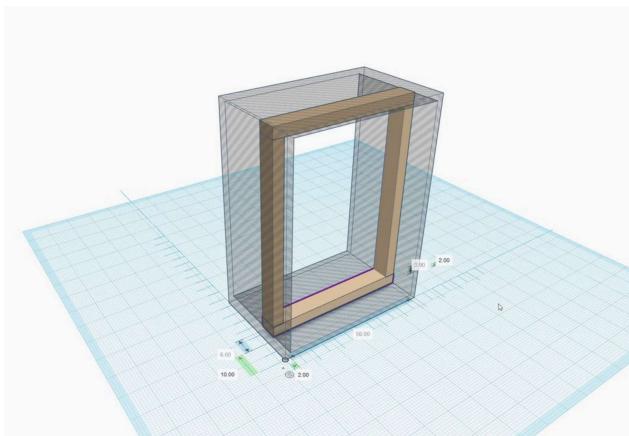
With the 39 x 66 mm wood studs, the cabinet internal width was almost perfect, and the shelf clearance is quite spot-on for a 19" rack (later I found out that it can be a bit tight fit for some devices). The internal frame made out of these studs would be sturdy enough to keep the cabinets together and also support the actual weight of the rack equipment. Plus, between the studs, I would still have plenty of space to add soundproofing materials.



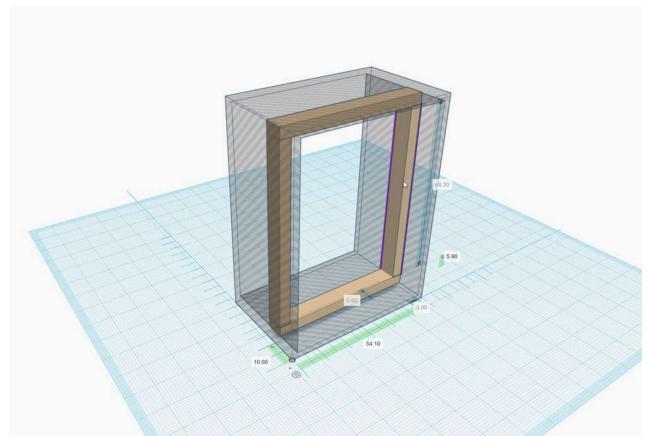
I measured the wood studs for the Ikea front and back frames, so that they really fit inside the Ikea Cabinets.

Cut them to size, drilled holes for the assembly screws and finally assembled the front and back frames.

*Making sure the whole time that they will fit inside the cabinets, but not attaching the frames to the cabinets yet.*



I measured the width to be 56 cm



The height of 68.2 cm

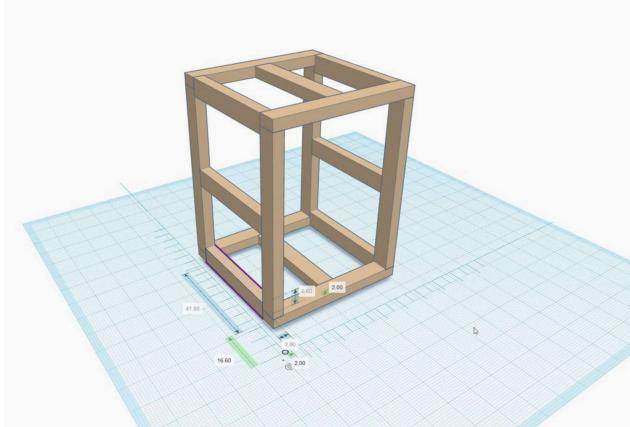
*At this point I wanted to also test that my gear actually will fit in. and I attached the rack rails to the internal front frame. I noticed that Unifi Dream Machine Pro was a bit snug fit, although it did go in, but scratched slightly the right side of the rack ears. Otherwise everything fitted in without any problems.*



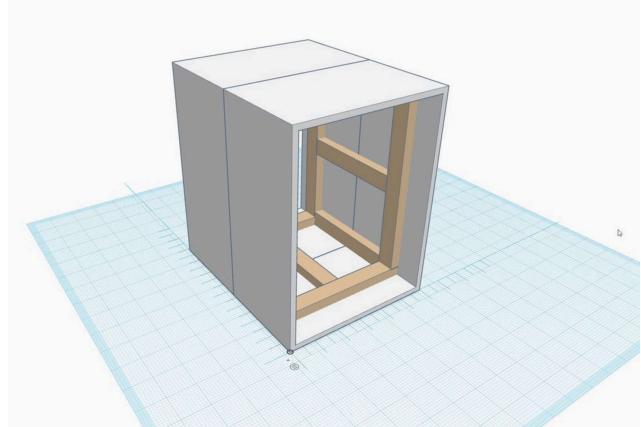
I measured the wood studs needed to hold the front and back frames together so that the depth of the frame matched my max depth of 550 mm. Cut the pieces, and drill assembly screw holes.

I wanted to make sure the frame would fit inside the cabinets, so I

slid the front and back frames inside the cabinets and assembled the whole frame, but I did not attach them to the cabinets yet.



I measured the middle pieces to be around 41.8 cm



Slide the frames inside the cabinets and assemble the frame.



Next, I measured a 10 cm gap between the front frame and the cabinet front edge (the 10 cm is to provide room for patch cables). In the back there will be a bit less room, but still enough for my needs.

I attached the internal frame to the cabinets using 4 x 50 mm screws.

## Rack Rails

For the rack rails I measured I could fit in 15U rails, but could not find 15U rails from anywhere (*at least not in stock*), so I ended up buying four 10U and four 5U rails.



After the Internal frame was attached to the cabinets. I mounted the rack rails to the front and back of the internal frame.

## Cabinet Wheels

I also needed to be able to move this cabinet around, and for that, I first bought some really cheap cabinets wheels .. and the first wheel broke apart within the first week, and the rest of them within a month after that. The wheels were still holding ok, but the rubber part of the wheel just peeled off, exposing this quite thin-looking plastic core. I've now replaced these wheels with a different 2-wheel model, which each should be able to hold 75 kg.



I installed the wheels right to the same spot where I measured that the wood studs would be inside the cabinet, and I made sure the screws were long enough to go through the cabinet floor for best possible hold.



Broken cheap wheel



New wheels attached

## Cooling, Air Flow, and Dust Proofing

Since this is a closed cabinet, and some relatively hot stuff will be inside, heat build-up inside the cabinet was a real concern for me. I wanted to make sure that there is proper airflow, but without bringing up the sound levels too much, or allowing dust to build up inside either.

Most of the DIY cabinets, I found pictures of, had air vents on top of the cabinets, which make a lot of sense since the hot air rises up. My problem with that placement is that I want to keep my 3D printer on top of this cabinet, and with that comes the risk that something will fall through the vents and damage the exhaust fans.

## Back Door

On the back door, I decided to place 2 active fans, to push out hot air. To keep the noise down, I choose to use 200 mm Noctua NF-A20 PWM fans, which are relatively silent (*actually amazingly silent in my opinion*), and still push out a good amount of air. For the fans, I also 3D printed exhaust fan guards.



All 3D print models used in this project can be found at the end of this page.



200 mm Noctua NF-A20 PWM fan



3D printed fan guard

The back door fans are controlled by Thermaltake Commander FT Touchscreen Fan Controller. This controller can control up to 5 fans, so I could add 3 more fans if needed. The controller has a thermal sensor, with automatic and manual fan speed modes. You can control each fan separately if required.

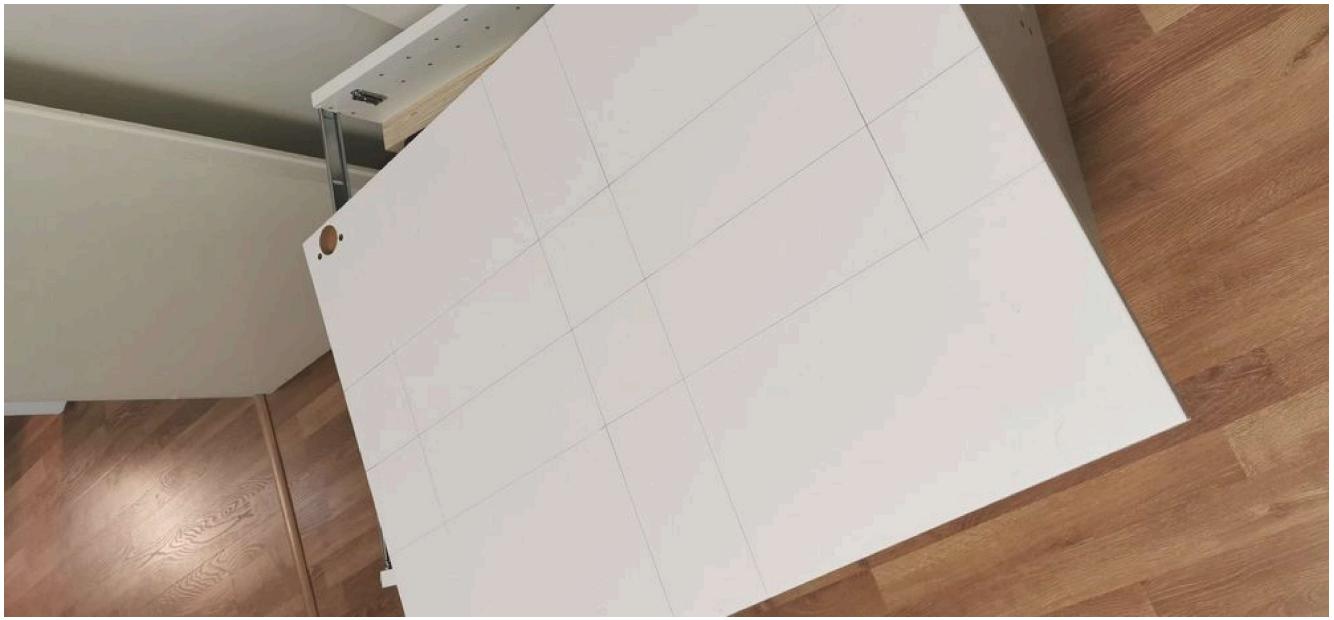


Thermaltake Commander FT

## Front Door

For the front door, I opted not to use any active fans, to keep the noise levels down, but I wanted to keep that option available if later on, it would look like fans would be needed to control the internal temperatures.

Instead of fans, I added a relatively large air intake, which would be covered with a dust mesh. I created an opening of 172 mm wide and 600 mm high, this way I could, later on, add up to three 200 mm fans to blow cooler ambient air in.



For the air intake opening I 3D printed a multi-piece frame, to hide the "ugly", not so straight saw line and also, on the other hand, to keep the dust mesh in place. And I also decided I wanted to try to add something inside the air intake opening to block sound a bit.



Using a drill bit hole saw I drilled the corners of the opening, and then used a saw to cut through the middle parts.

I first carefully drilled holes for the outside 3D printed frame parts and attached them to their places. Then I cut a piece from the mesh roll and measured the correct place for the internal 3D printed frame and drilled holes for the screws.

I placed the dust mesh under the internal frame and screwed the frame pieces carefully into their place. Then I just cut off the excess of the mesh.



Inside of the front door, the frame and dust mesh attached.



Dust mesh from the inside



Front Door - 3D printed frame with the dust mesh



Inside the door, I added cardboard with echo canceling foam, and If needed I can just slide the cardboard out.

## Sound Proofing

I am not an expert on this matter, but I did a small "google" study on the subject and came to the conclusion that I'd want to add two different materials in layers, 1st layer to reduce or suppress resonating sounds and 2nd layer to further reduce sound reflections.



Under the "pyramid" foam there is 1 cm thick mat to reduce resonating.



First I installed a 1 cm thick sound absorbing mat on all the walls of the cabinet, in between the wood studs.

Then used carpet tape on top of the mat to add one more layer of pyramid foam mat. I secured the foam in place with small screws.

On the floor, I didn't apply any foam mat. I am planning to place my UPS and Synology NAS there.



Adding the 1 cm thick mat to all sides



Adding the 1 cm thick mat to all sides



Carpet tape on top of the first layer



"Pyramid" foam attached with the carpet tape



In this view, you can also see that I added a LED stripe to the front of the rack

## Dust Proofing

Since there was a small gap between the doors and the cabinet, I added these small wood rims inside the cabinet and installed self-adhesive window rubber seal strips along the wooden rims to fully seal the doors from sound and dust.

For final touches, I adjusted the door hinges and added 2 small latches to both doors, to pressure them tightly against the seal.



The wood rims and the window rubber seal



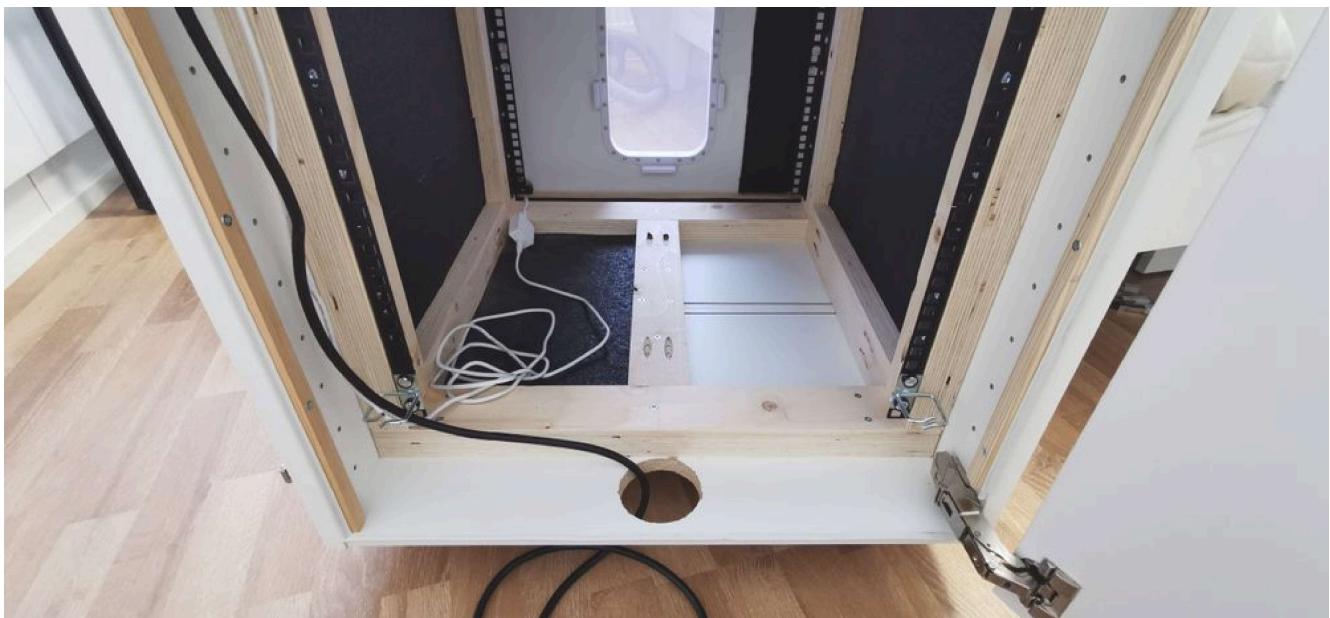
Added latches to the bottom and top of both doors

## Cabling

For the cables to go in and out of the cabinet, I drilled a 6 cm diameter hole to the bottom back edge of the cabinet .. without thinking about it too much.

Then I realized that I need to figure out how to dustproof that hole, and also prevent air from coming in all together from that hole, as I rather want to keep the airflow going from the front to back.

To keep the cables in order inside the rack, I added 8 cable hooks to the back rails



Hole for the cables and cable hooks on the rails (2 installed)

## 3D Prints

While you can definately complete this build without any printed parts, or instead buy some ready made parts, I wanted to use 3D prints, for the fun of it and for the unique look. I used TinkerCad to design the 3D printed components, and the desings are public so you can save some time if you want to use them in your projects, links to the designs are below. I used standard PLA material, and my Creality Ender 5 Pro for Printing.

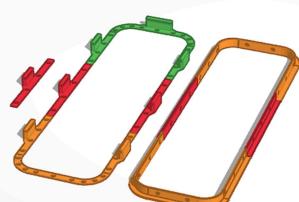


Make sure you measure the door cut holes based on your final prints!

3D design Server Rack Air Intake Frame | Tinkercad

3D design Server Rack Air Intake Frame created by  
jukka.evaluoto with Tinkercad

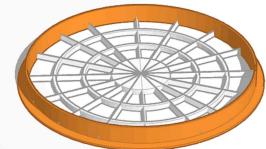
 Tinkercad



The internal frame can hold a 3mm board with sound absorbing mat to cover the intake opening and will hold a dust mesh in place. The external frame will cover the saw marks.

### 3D design Fan Guard | Tinkercad

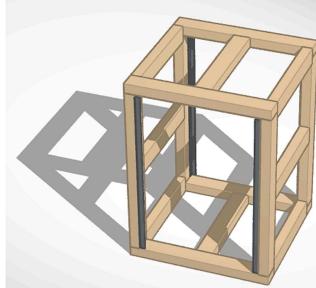
3D design Fan Guard created by jukka.evaluoto with Tinkercad



Server rack back door fan guard for a 200mm fan

### 3D design Rack Cabinet Model v2 | Tinkercad

3D design Rack Cabinet Model v2 created by jukka.evaluoto with Tinkercad



Model of the Ikea Cabinets and the rack frame (I used this for rough measurements)

## List of parts

In no way am affiliated or sponsored with any of the companies or products linked below. These are the exact products I used in my build, depending on where you live you may or may not find exactly the same products.

METOD Seinäkaapin runko, valkoinen, 60x37x80 cm - IKEA

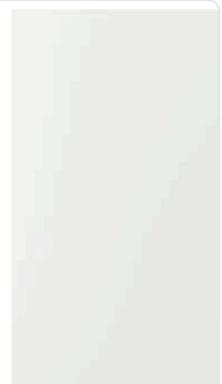
METOD Seinäkaapin runko, valkoinen, 60x37x80 cm....



Ikea Metod Wall Cabinet Frame - Total 60€

VEDDINGE Ovi, valkoinen, 60x80 cm - IKEA

VEDDINGE Ovi, valkoinen, 60x80 cm. VEDDINGE-ovi...



Ikea Veddinge Door (for the Metod Wall Cabinet Frame) - Total 58€

UTRUSTA Keittiösarana + sis.rak. vaimennin, 153



LVL Väliseinätolppa 39 x 66 x 2550 mm



° - IKEA

UTRUSTA Keittiösarana + sis.rak. vaimennin, 153 °.

 IKEA • IKEA



Utrusta 153° Opening Hinge - Total 38€

Kaksoispyörä 50 mm |  
Clas Ohlson

Kaksinkertaiset  
kuulakehälaakerit ja...

 Clas Ohlson



Two Wheel Casters (Max 75kg per wheel) - Total  
12€

Adam Hall Heavy Duty  
Black 19" Rack Strip, 5U |  
Gear4music

Adam Hall Heavy Duty  
Black 19" Rack Strip, 5U |...

 www.gear4music.fi



Heavy Duty 5U Rack Rail - Total 22€

STP rouhepuristeinen  
äänieriste PU-pinnalla 1  
cm | Motonet Oy

• Paksuus 1 cm•  
Tilavuuspaino 110 kg/m3...

 Motonet Oy • Moto...



Soveltuu käytettäväksi  
väliseinätolppana. T-laatu...

 bauhaus.fi • Kirjaudu



39x66x2550 mm Wood Studs - Total 35€

Adam Hall Heavy Duty  
Black 19" Rack Strip, 10U  
| Gear4music

Adam Hall Heavy Duty  
Black 19" Rack Strip, 10U ...

 www.gear4music.fi



Heavy Duty 10U Rack Rail - Total 27€

3.53€ 31% OFF|30 \*  
100cm Computer Mesh  
Case Fan Cooler Pvc  
Dust Filter Case  
Dustproof Cover Chassis  
Dust Net Magnetic  
Strip|Device Cleaners| -  
AliExpress

Smarter Shopping, Better  
Living! Aliexpress.com

 aliexpress.com



Dust Mesh

Puuruuvi Essve Essdrive

4 x 50 mm UK SS-20

Ruuvi on valmistettu  
karkaistusta teräksestä ja...

 bauhaus.fi • Kirjaudu



Sound absorbing mat

4 x 50mm Wood Screws to attach the wood frame in to the Ikea Metod cabinets (box of 200 pcs)

Puuruuvi Essve Essdrive

Cut 4,0 x 30 mm UK

FZB-200

TX20:lla ja uppokannalla varustettu puuruuvi. Sopii...



 bauhaus.fi • Kirjaudu

4 x 30 mm Wood Screws to attach the rack rails to the wood frame (box of 200 pcs)

Thermaltake

Commander FT |

Edullinen

Osta edullisesti

Thermaltake Commander...



 PROSHOP • Thermal...

5 Channel Fan Controller

Noctua NF-A20 PWM chromax.black.swap

Osta Noctua NF-A20 PWM chromax.black.swap...

 Multitronic



200mm Fan

Salpa RST 55 mm |

Motonet Oy

Materiaali: ruostumaton teräs A2/AISI304

 Motonet Oy • Moto...



Latch for the doors

NAVILOCK Power supply

240 V > 4 pin Molex 12

V / 2 A (41410)

NAVILOCK Power supply

240 V > 4 pin Molex 12 V...

 NAVILOCK • NAVILO...



4pin Power Supply for the Thermaltake Fan Controller

Höylälista Maler SH

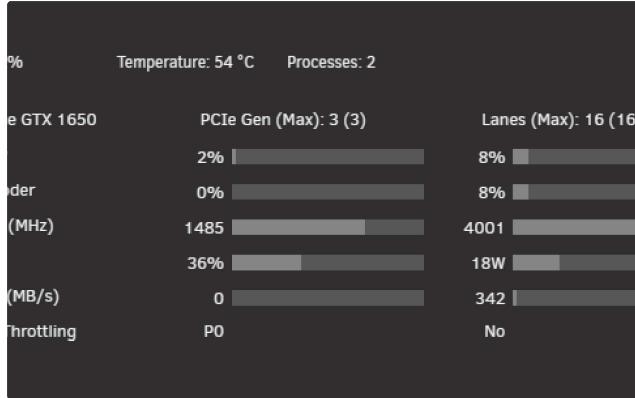
Mänty Puuvalmis 15 x 15

x 2400 mm

Ympärihöylätty, lähes oksaton puuvalmis lista...

 bauhaus.fi • Kirjaudu





## Proxmox | GPU Passthrough to unRAID VM

Running unRAID as a VM in Proxmox and passthrough the GPU to unRAID to be used for Docker containers (Plex, Frigate, etc.).



Jukka

Feb 4, 2023 • 2 min read

## UnRAID | Google Coral Mini PCI-E EdgeTPUs

Installed Google Coral Mini PCI-E EdgeTPUs with PCI-E adapters into UnRAID



Jukka

Jul 9, 2022 • 2 min read

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