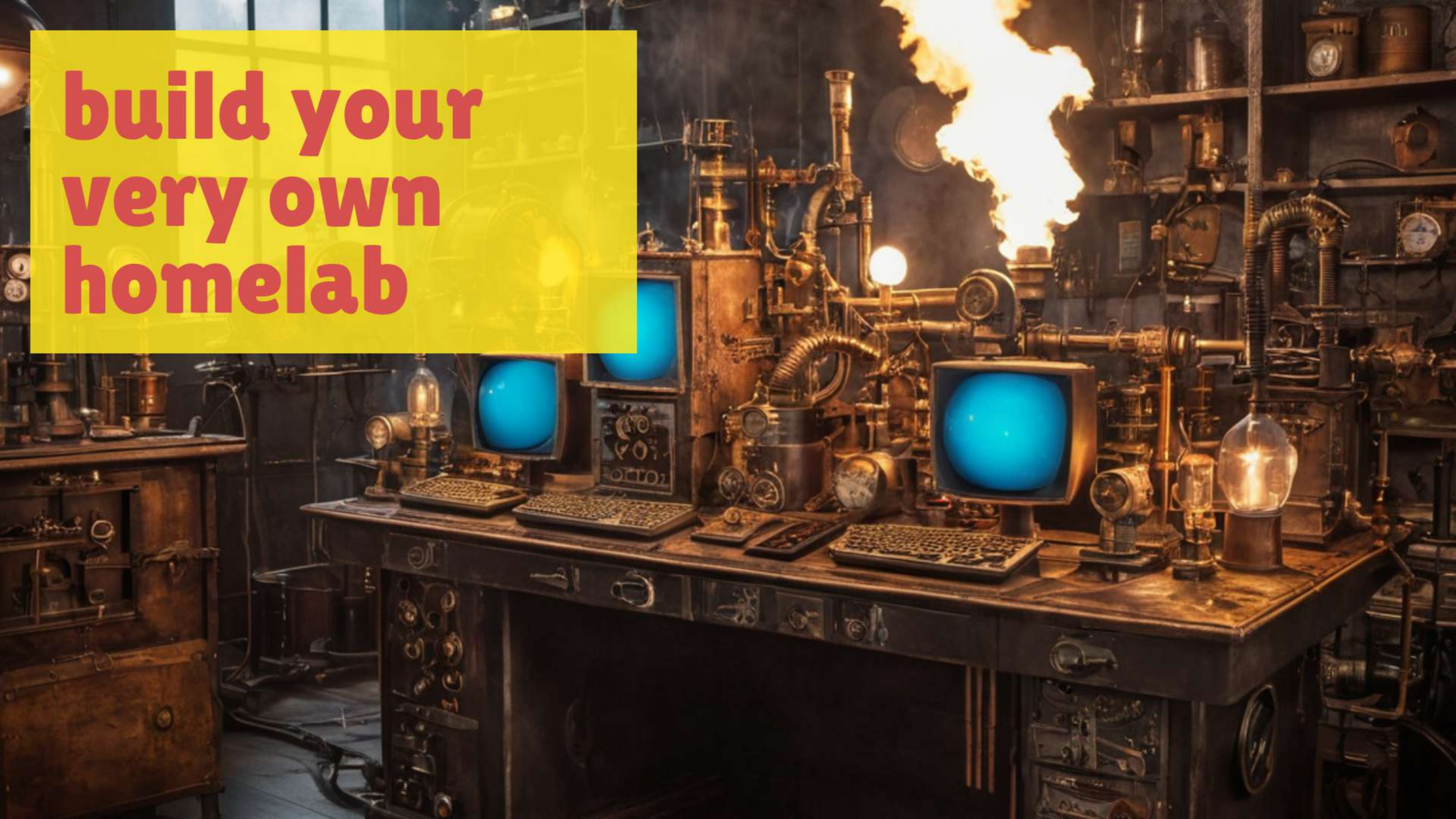
build your very own homelab



who am i?

javi
moreno

postgraduate course co-director

UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH

principal cloud consultant

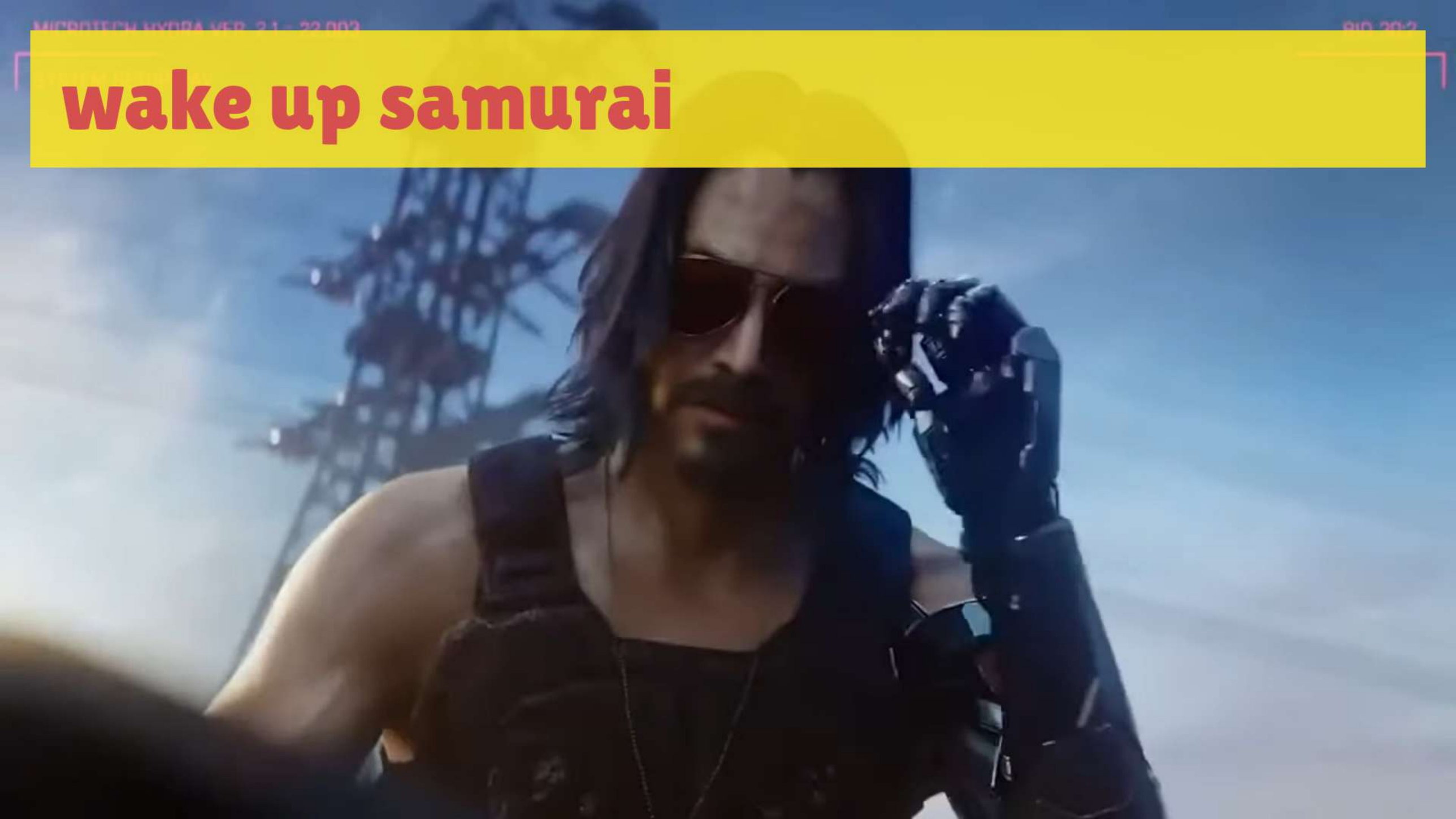
NTT DATA

12 years of techno-optimism

elon musk

the world in 12 years?

wake up samurai



homelab

what?

why?

how?

where

the basic stack

windows 10

docker

wsl

automatic start

```
// Just press `Win+R`, type `shell:startup`,
// and drop it there with the name `wsl-init.vbe`.

Set ws = CreateObject("Wscript.Shell")
ws.run "wsl -d Ubuntu", vbhide
```

docker under wsl under windows

26:51
15903
146

KANE BROWN
KANE BRO

regular services

photos with immich

immich

Search your photos

Administration

P

Photos

Explore

Map

Sharing

LIBRARY

Favorites

Albums

Utilities

Archive

Trash

Albums

All | Owned | Shared

Search albums

Create album

Most recent photo

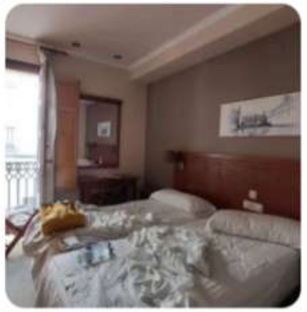
Group by year

List

2022 (5 Albums)

Vallfogona
Dic 2022
115 items

Fiesta de colores
Ago 2022
20 items



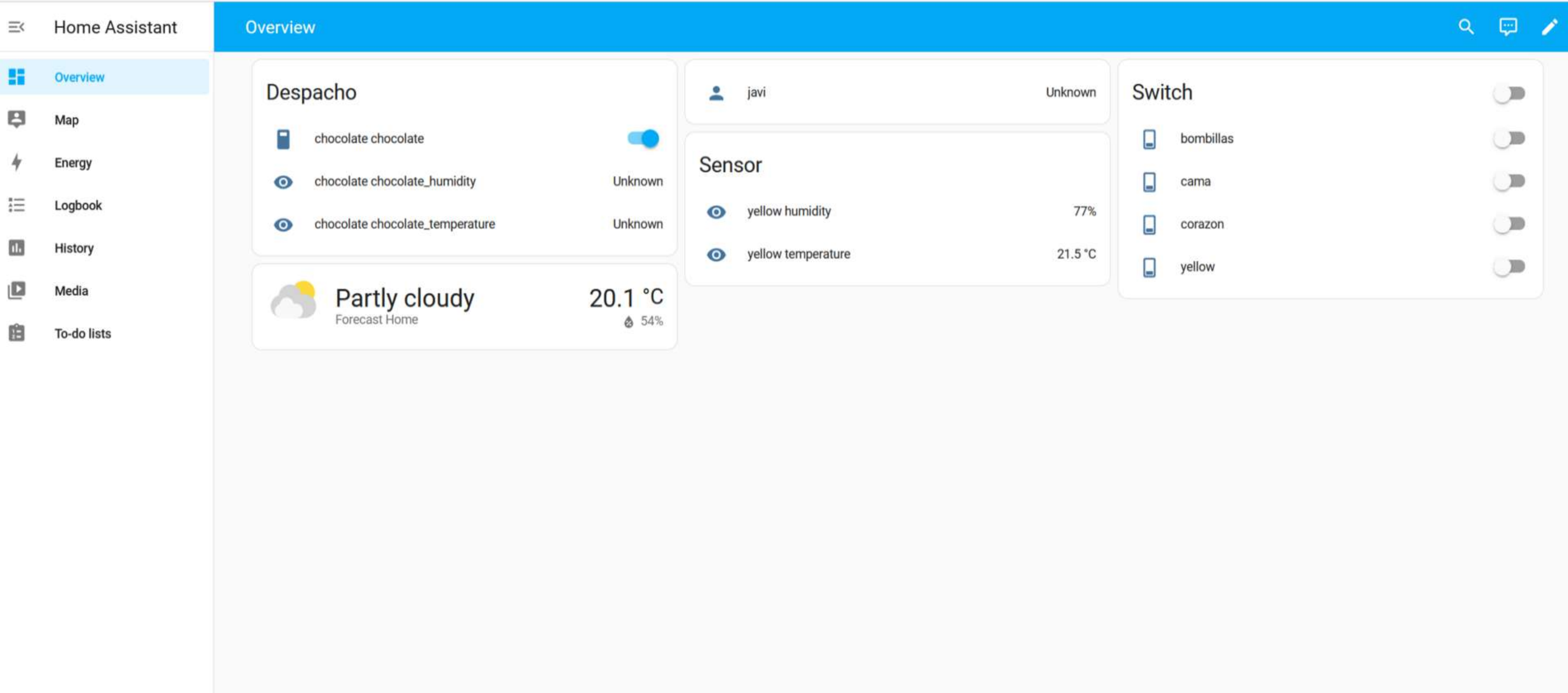
Sin título
Oct 2021 - Jul 2022
502 items

Santiago 2022
Jul 2022
467 items

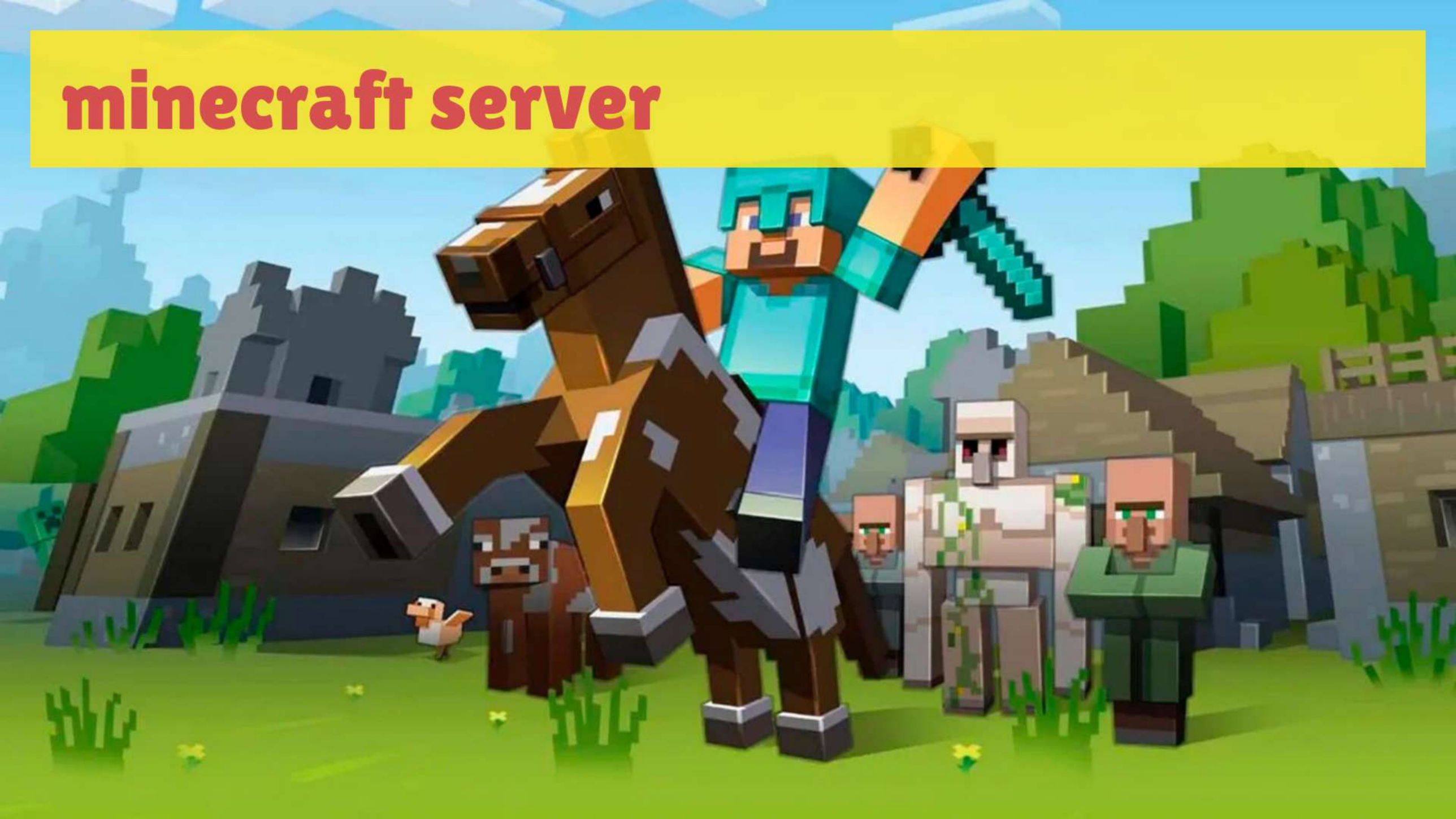
Colonias Espluga de Francolí
May 2022
7 items

2020 (5 Albums)

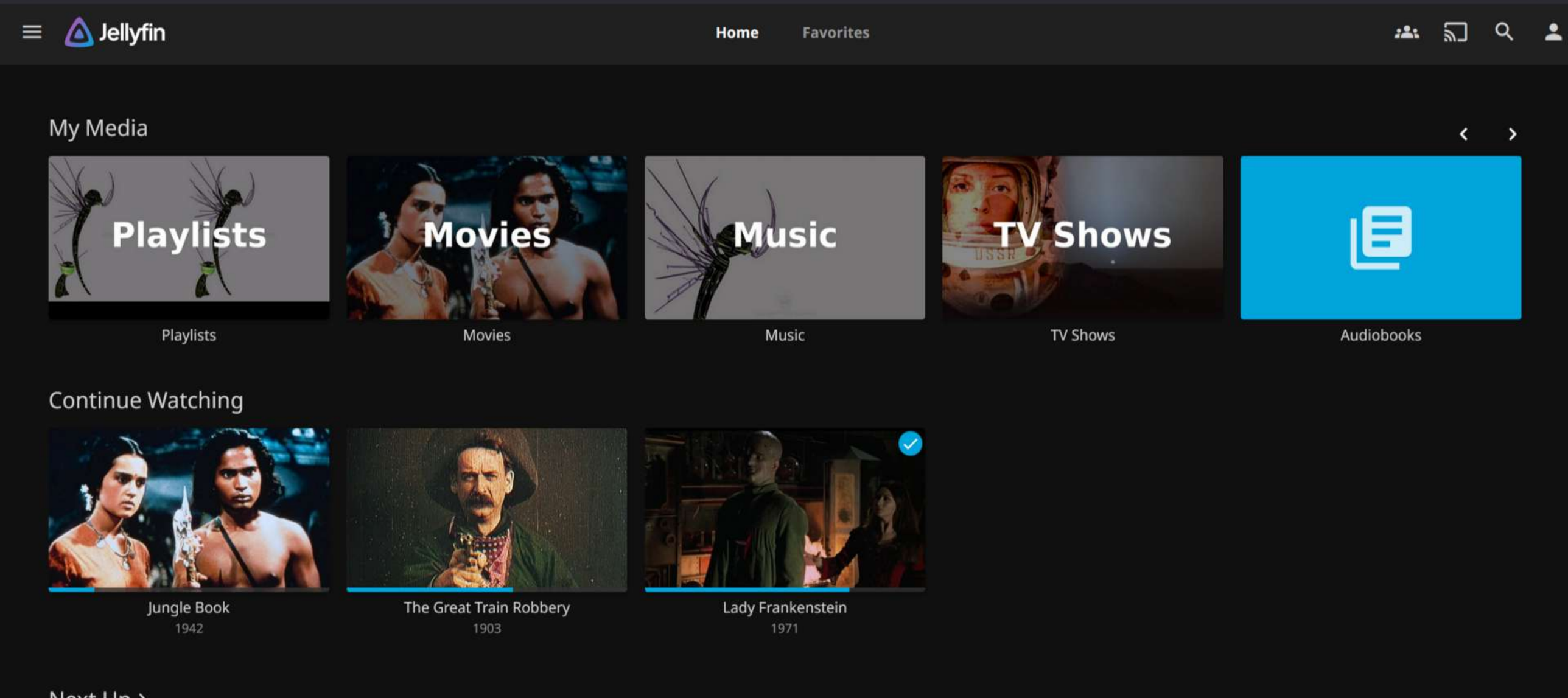
iot with home assistant



minecraft server



media management with jellyfin

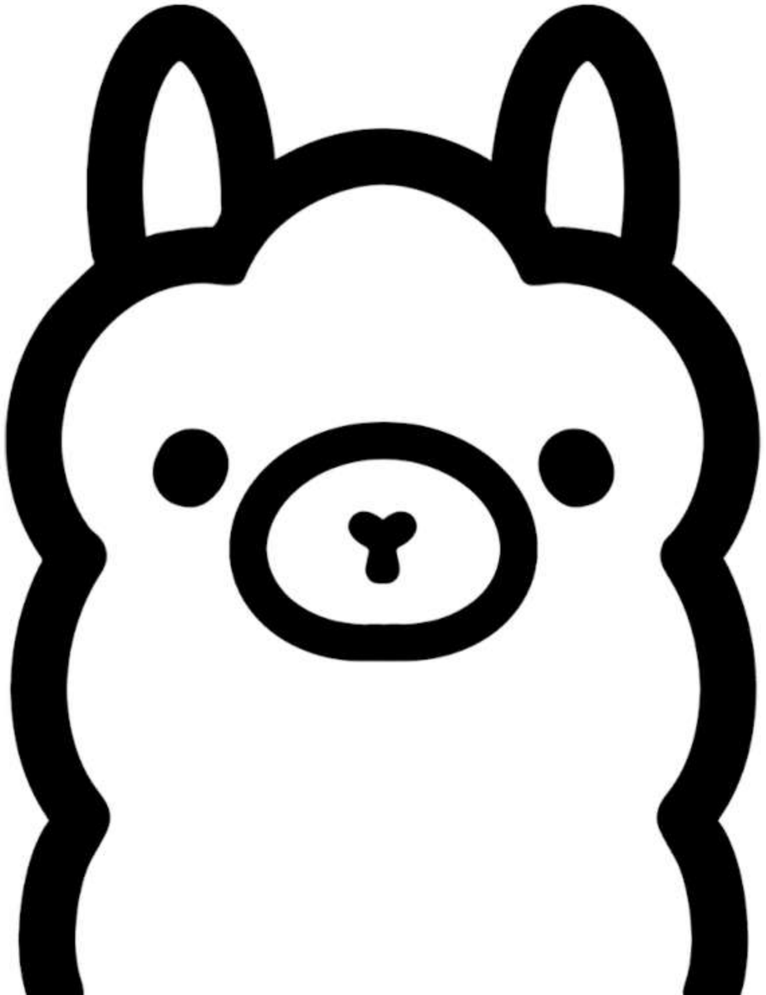


demo! docker for running services

advanced services

image generation with foocus

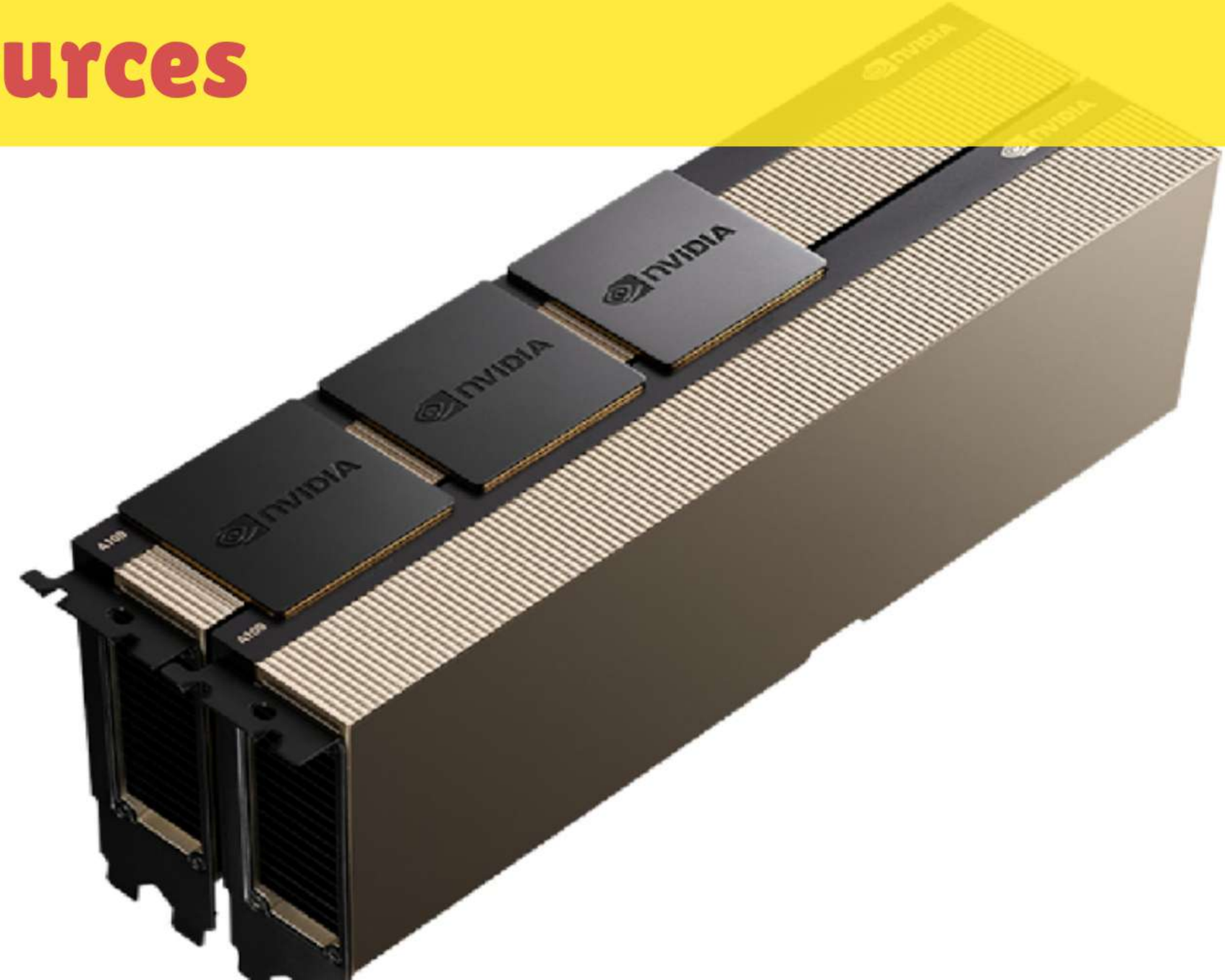
llm with ollama



challenges

remote access

resources

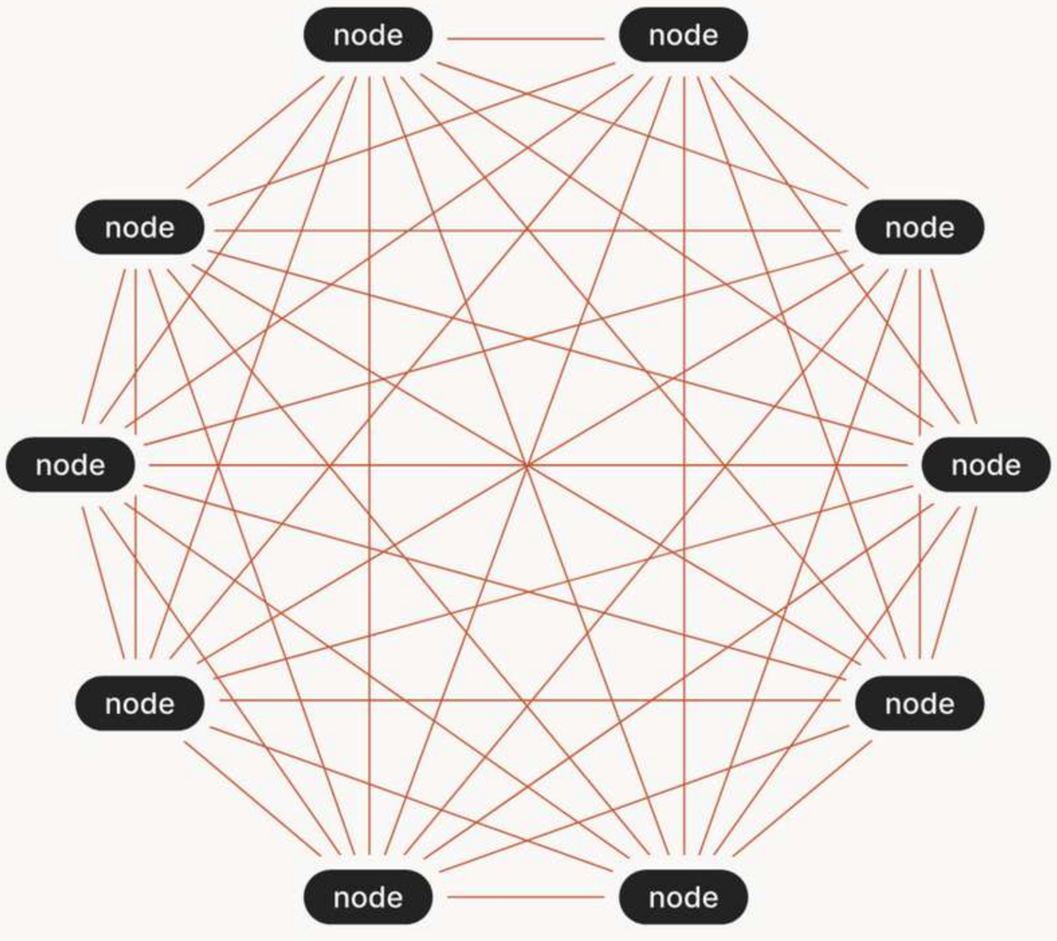


connectivity complexity

introducing tailscale

company history

product technology



Overlay network (tailnet)

UDP peer-to-peer VPN

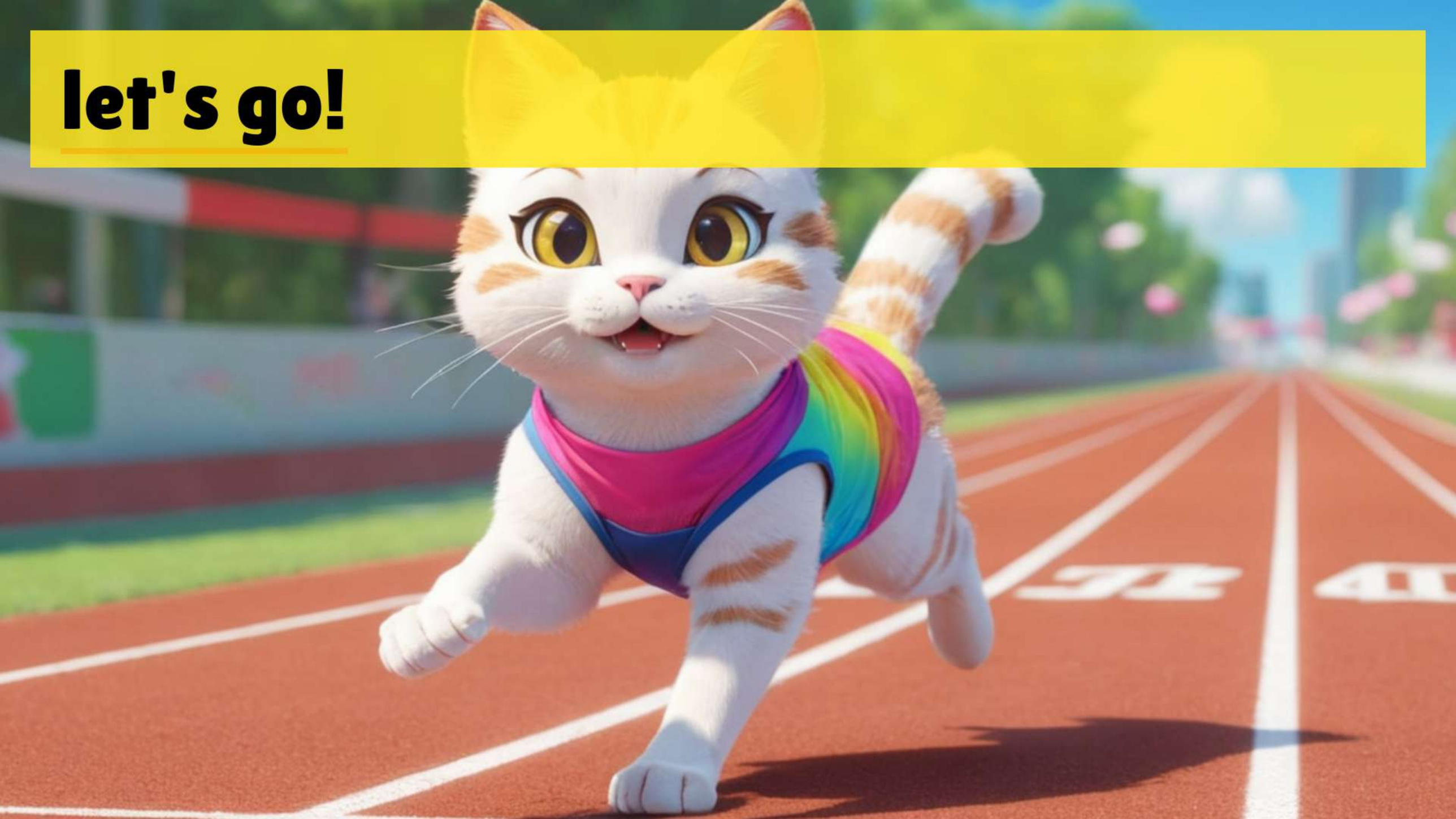
Wireguard-based

Open source client

Free for 3 users / 100 devices

Alternative control plane available

let's go!



Tailscale · Best VPN Service for S
Navegación privada
https://tailscale.com
70%
Just-in-time Network Access: Demo and Q&A Sign up now

tailscale

Product Solutions Enterprise Customers Docs Blog Pricing

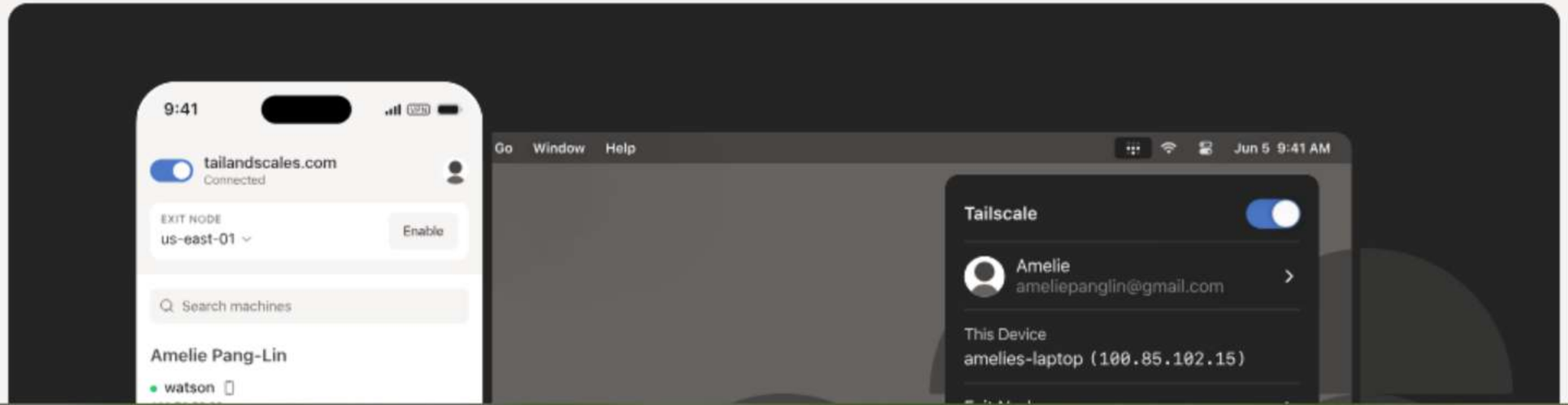
Download Log in Get started - it's free!

Secure, remote access to databases

Tailscale makes creating software-defined networks easy: securely connecting users, services, and devices.

Start connecting devices →

Contact Sales



Tailscale

Navegación privada

https://login.tailscale.com/start

tailscale

Sign up with your identity provider

You'll use this provider to log in to your network (more)

By clicking the buttons below, you acknowledge that you have read, understood, and agree to Tailscale's Terms of Service and Privacy Policy.

Sign up with Google

Sign up with Microsoft

Sign up with GitHub

Sign up with Apple

Sign up with OIDC

Inicia sesión: Cuentas de Google

Navegación privada

https://accounts.google.com/signin/oauth/id?authuser=0&part=AJi8hANiE3JjMyQ0kWcfCMgV_B

Iniciar sesión con Google

Iniciar sesión en tailscale.com

homelab@aprender.cloud

Si continúas, Google compartirá tu nombre, tu dirección de correo electrónico, tu preferencia de idioma y tu imagen de perfil con tailscale.com. Consulta la Política de Privacidad y los Términos del Servicio de tailscale.com.

Puedes gestionar Iniciar sesión con Google en tu cuenta de Google.

Cancelar

Continuar

Español (España)

Ayuda Privacidad Términos

Tailscale

Navegación privada

https://login.tailscale.com/admin/welcome

aprender.cloud Trial 14 days left

Download Support Docs H

Welcome to Tailscale!

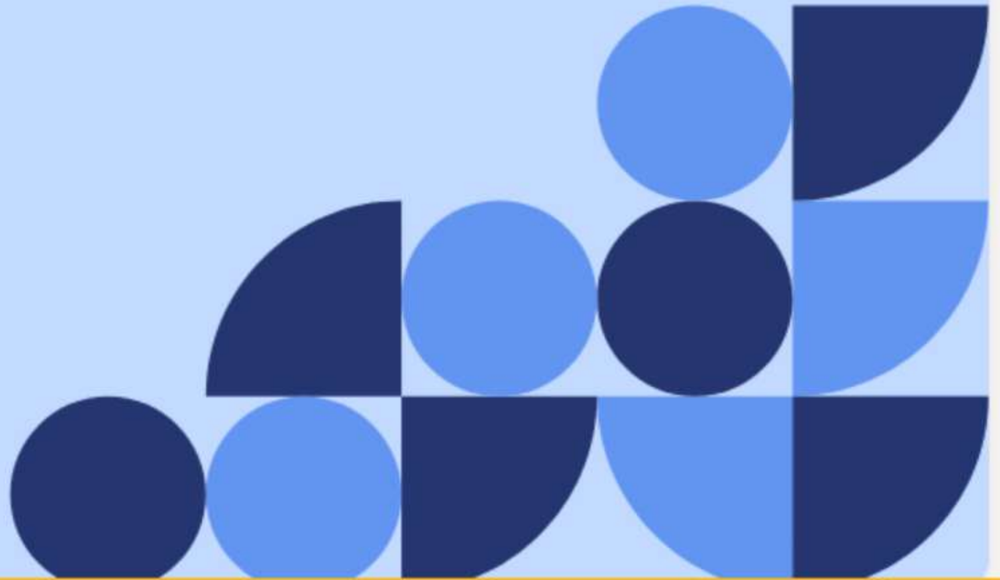
How will you primarily be using this network?

Select one

Business use

Personal use

Next



Tailscale

Navegación privada

https://login.tailscale.com/admin/welcome

aprender.cloud Trial 14 days left

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Welcome to Tailscale!

How will you primarily be using this network?

Select one

- Business use
- Personal use

Next

TAILSCALE FOR PERSONAL USE

- Connect anything from a DigitalOcean droplet to a Raspberry Pi, a home security camera, or even a Steam Deck
- Remotely access your home network from anywhere, on-the-go
- Share your private network with friends and family

Tailscale | Instances | EC2 | eu-central-1 | Navegación privada

https://login.tailscale.com/admin/welcome

Let's add your first device.

Install Tailscale and sign in as **homelab@aprender.cloud**. Once you sign in on a device, it will be automatically added to your Tailscale network.

- Linux
- Windows
- macOS
- iPhone & iPad
- Android
- Synology

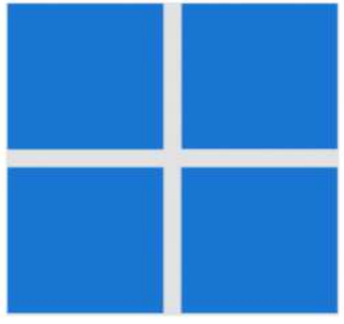
Use our install script, or read our installation guide.

```
$ curl -fsSL https://tailscale.com/install.sh
```

Waiting for your first device

Already familiar with Tailscale? Skip this introduction →

client install



demo! adding nodes to the tailnet

MAGIC

Tailscale | Instances | EC2 | eu-central-1 | Systems Manager | eu-central-1 | Navegación privada

https://eu-central-1.console.aws.amazon.com/systems-manager/session-manager/i-083aab27e370d4f29?r

Session ID: ciberado-a4jpr6tus2tz9fhaeuxhi4ggqe

Instance ID: i-083aab27e370d4f29

Terminate

```
Preparing to unpack .../tailscale_1.80.3_amd64.deb ...
Unpacking tailscale (1.80.3) ...
Selecting previously unselected package tailscale-archive-keyring.
Preparing to unpack .../tailscale-archive-keyring_1.35.181_all.deb ...
Unpacking tailscale-archive-keyring (1.35.181) ...
Setting up tailscale-archive-keyring (1.35.181) ...
Setting up tailscale (1.80.3) ...
Created symlink /etc/systemd/system/multi-user.target.wants/tailscaled.service → /usr/lib/systemd/system/tailscaled.service.
Scanning processes...
Scanning linux images...

Running kernel seems to be up-to-date.

No services need to be restarted.

No containers need to be restarted.

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
+ [ false = true ]
+ set +x
Installation complete! Log in to start using Tailscale by running:

sudo tailscale up
ubuntu@ip-172-31-12-164:~$ sudo tailscale up

To authenticate, visit:

        https://login.tailscale.com/a/d80503013691
```

Tailscale | Instances | EC2 | eu-central-1 | Systems Manager | eu-centr | Tailscale | Navegación privada

https://login.tailscale.com/login?next_url=%2Fa%2Fd80503013691&refresh=true

tailscale

Log in to connect a device to your tailnet.

homelab@aprender.cloud

Sign in

OR

Sign in with Google

Sign in with Microsoft

Sign in with GitHub

Sign in with Apple

Sign in with a passkey

Tailscale | Instances | EC2 | eu-central-1 | Systems Manager | eu-centr | Tailscale | Navegación privada

https://login.tailscale.com/a/d80503013691?refreshed=true

tailscale

homelab@aprender.cloud H

Connect device

You are about to connect the device **ip-172-31-12-164** to the **aprender.cloud** tailnet.

Connect

▼ Device details

Public key	nodekey:07b1dd6f81c795526175c33429f8e…
Hostname	ip-172-31-12-164
Operating system	linux (6.8.0-1021-aws)
Tailscale version	1.80.3-tb107adf2b-g9497b39a5

Tailscale | Instances | EC2 | eu-central-1 | Systems Manager | eu-centra | Tailscale | Navegación privada

https://login.tailscale.com/admin/welcome

aprender.cloud Trial 14 days left

Download Support Docs H

Next, add a second device.

Your device (**ip-172-31-12-164**) was added to your network!

Tailscale connects multiple devices together, so you'll need it installed on more than one device. Open the link below on a second device and download Tailscale there too.

Linux | Windows | macOS

iPhone & iPad | Android | Synology

Download Tailscale from our website, send yourself an email with a download link, or read our installation guide.

ip-172-31-12-164 100.124.237.9

Waiting for your second device

Tailscale | Instances | EC2 | eu-central-1 | Systems Manager | eu-centr | Machines - Tailscale | Navegación privada

https://login.tailscale.com/admin/machines

aprender.cloud Trial 14 days left

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Machines Apps Services Users Access controls Logs DNS Settings Get started

Machines

Manage the devices connected to your tailnet. Learn more ↗

Add device

Search by name, owner, tag, version...

Filters

1 machine

MACHINE	ADDRESSES	VERSION	LAST SEEN
ip-172-31-12-164 homelab@aprender.cloud	100.124.237.9	1.80.3 Linux 6.8.0-1021-aws	Connected

Add devices to your network

Tailscale works best when it's installed on multiple devices. Explore what you can do with Tailscale in these environments.

tailnet configuration

Tailscale | Instances | EC2 | eu-central-1 | Systems Manager | eu-centra | DNS - Tailscale | Navegación privada

https://login.tailscale.com/admin/dns

aprender.cloud Trial 14 days left

Download Support Docs H

Machines Apps Services Users Access controls Logs DNS Settings Get started

DNS

Manage DNS and nameservers of your network. Learn more ↗

Tailnet name

This unique name is used when registering DNS entries, sharing your device to other tailnets, and issuing TLS certificates. Learn more ↗

tail9338cf.ts.net

Rename tailnet...

Apps Beta

Control device and user access to your third-party applications, without requiring any end user

Tailscale | Instances | EC2 | eu-central-1 | Systems Manager | eu-centra | DNS - Tailscale | Navegación privada

https://login.tailscale.com/admin/dns

aprender.cloud Trial 14 days left

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Machines Apps Ser ngs Get started

DNS

Manage DNS and nameservers of you

Tailnet name

This unique name is used when registering DNS entries, sharing your device to other tailnets, and issuing TLS certificates. Learn more ↗

tail9338cf.ts.net

Rename tailnet...

Apps Beta

Control device and user access to your third-party applications, without requiring any end user

Rename tail9338cf.ts.net

Renaming your tailnet may break existing links to devices in your tailnet.
Learn more ↗

I understand, let me rename the tailnet

Tailscale | Instances | EC2 | eu-central-1 | Systems Manager | eu-centr | DNS - Tailscale | Navegación privada

https://login.tailscale.com/admin/dns

aprender.cloud Trial 14 days left

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Machines Apps Ser ngs Get started

DNS

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issuing TLS certificates. Learn more

tail9338cf.ts.net

Rename tailnet...

Apps Beta

Control device and user access to your third-party applications, without requiring any end user

Rename tail9338cf.ts.net

Select a generated name or re-roll to get a fresh set. If you use your tailnet name in HTTPS certificates, it will be bound to your account and you will no longer be able to select a new fun name. Learn more

- end-hops.ts.net
- end-python.ts.net
- laperm-carob.ts.net
- zonkey-denebola.ts.net

Re-roll options

Cancel Rename tailnet

Tailscale | Instances | EC2 | eu-central-1 | Systems Manager | eu-centra | DNS - Tailscale | Navegación privada

https://login.tailscale.com/admin/dns

aprender.cloud Trial 14 days left

Download Support Docs H

Machines Apps Ser ngs Get started

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tail9338cf.ts.net

Rename tailnet...

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Rename tail9338cf.ts.net

Select a generated name or re-roll to get a fresh set. If you use your tailnet name in HTTPS certificates, it will be bound to your account and you will no longer be able to select a new fun name. Learn more

- cetacean-lake.ts.net
- hartley-banjo.ts.net
- kinkajou-chimaera.ts.net
- siren-piano.ts.net

Re-roll options

Cancel Rename tailnet

Tailscale | Instances | EC2 | eu-central-1 | Systems Manager | eu-centr | DNS - Tailscale | Navegación privada

https://login.tailscale.com/admin/dns

aprender.cloud Trial 14 days left

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Machines Apps Services Users Access controls Logs DNS Settings Get started

DNS

Manage DNS and nameservers of your network. Learn more ↗

Tailnet name

This unique name is used when registering DNS entries, sharing your device to other tailnets, and issuing TLS certificates. Learn more ↗

cetacean-lake.ts.net

Rename tailnet...

Tailnet name updated

Apps Beta

Control device and user access to your third-party applications, without requiring any end user

cetacean-lake.ts.net

Add search domain...

MagicDNS

Automatically register domain names for devices in your tailnet. This lets you to use a machine's name instead of its IP address. Learn more ↗

Disable MagicDNS...

HTTPS Certificates

Allow users to provision HTTPS certificates for their devices. Learn more ↗

Enable HTTPS...

Tailscale | Instances | EC2 | eu-central-1 | Systems Manager | eu-centr | DNS - Tailscale | Navegación privada

https://login.tailscale.com/admin/dns

cetacean-lake.ts.net

Add search domain...

MagicDNS

Automatically register domain names
instead of its IP address. Learn more

Disable MagicDNS...

HTTPS Certificates

Allow users to provision HTTPS certificates for their devices. Learn more ↗

Enable HTTPS...

Enable HTTPS

The name of any machine for which you obtain a HTTPS certificate will be published in a public ledger from which it cannot be removed.
Learn more ↗

The machine name includes your tailnet name, which is used to obfuscate your organization's name (example: `machine-name.cetacean-lake.ts.net`).

Cancel | Enable

Tailscale | Instances | EC2 | eu-central-1 | Systems Manager | eu-centra | DNS - Tailscale | Navegación privada

https://login.tailscale.com/admin/dns

cetacean-lake.ts.net

Add search domain...

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Disable MagicDNS...

HTTPS Certificates

Allow users to provision HTTPS certificates for their devices. Learn more ↗

Disable HTTPS...

HTTPS enabled ×

demo! extending to the cloud

external connectivity

automatic tls (https://)

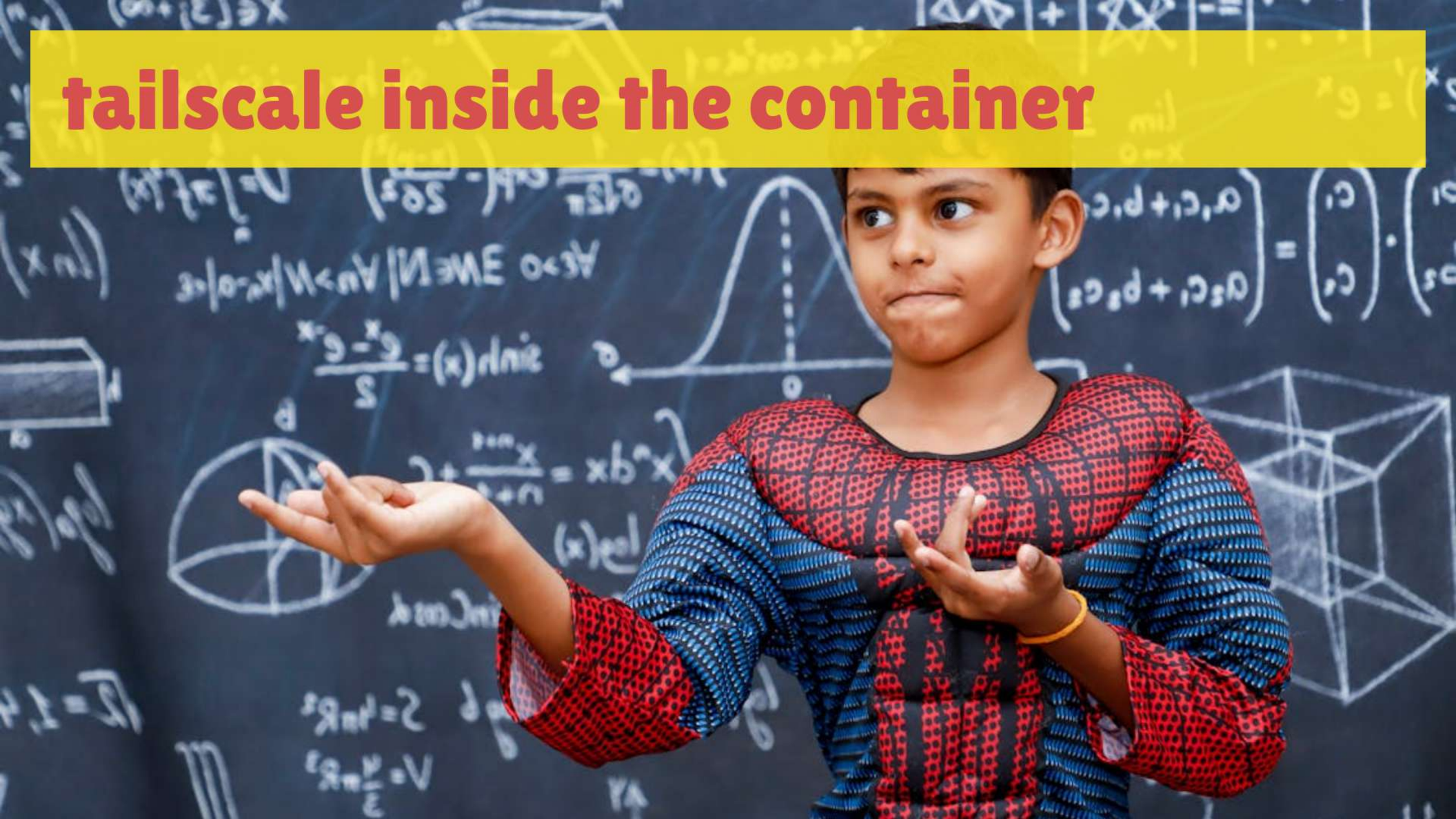
public access

exit nodes

containerization

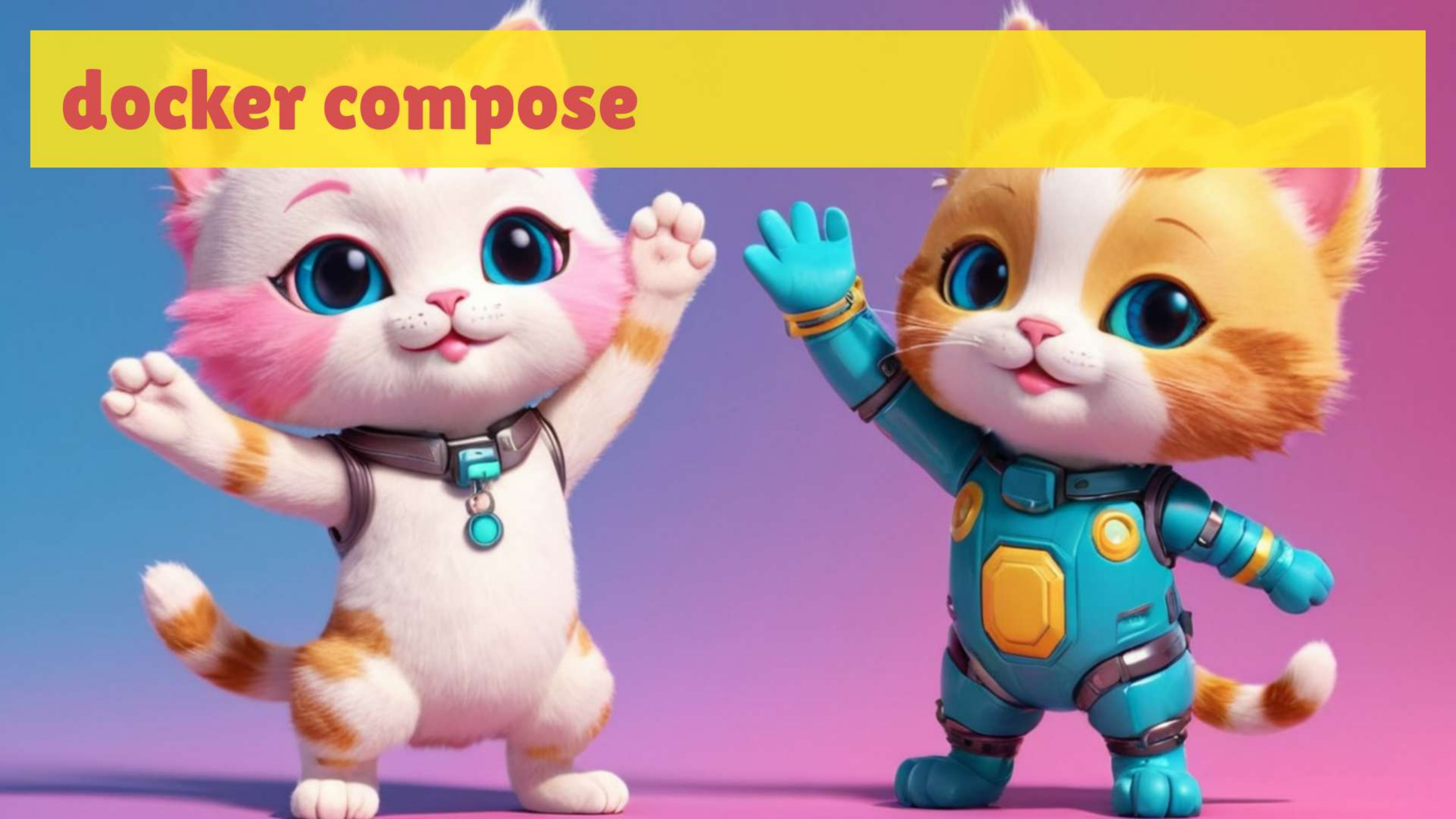
previously on...

tailscale inside the container



demo! containers as nodes

docker compose



Access Controls - Tailscale

Navegación privada

https://login.tailscale.com/admin/acls/file

aprender.cloud Trial 14 days left

Download Support Docs H

Machines Apps Services Users Access controls Logs DNS Settings Get started

Access Controls

Define a policy for which devices and users are allowed to connect in your network. Learn more ↗

Edit file | Preview changes | Preview rules

```
// Example/default ACLs for unrestricted connections.
{
    // Declare static groups of users. Use autogroups for all users or users with a specific ro
    // "groups": {
    //     "group:example": ["alice@example.com", "bob@example.com"],
    // },

    // Define the tags which can be applied to devices and by which users.
    // "tagOwners": {
    //     "tag:example": ["autogroup:admin"],
    // },

    // Define access control lists for users, groups, autogroups, tags,
    // Tailscale IP addresses, and subnet ranges.
    "acls": [
```

Docs

Learn how to configure your tailnet policy file.

Syntax reference
Tags reference
SSH reference
Funnel reference
Tests reference
Examples

Tailscale SSH

Access Controls - Tailscale

Navegación privada

https://login.tailscale.com/admin/acls/file

```
{
    // Declare static groups of users. Use autogroups for all users or users with a specific ro
    // "groups": {
    //      "group:example": ["alice@example.com", "bob@example.com"],
    // },

    "tagOwners": {
        "tag:container": ["homelab@aprender.cloud"]
    },

    // Define access control lists for users, groups, autogroups, tags,
    // Tailscale IP addresses, and subnet ranges.
    "acls": [
        // Allow all connections.
        // Comment this section out if you want to define specific restrictions.
        {"action": "accept", "src": ["*"], "dst": ["*:*"]},

        // Allow users in "group:example" to access "tag:example", but only from
        // devices that are running macOS and have enabled Tailscale client auto-updating.
        // {"action": "accept", "src": ["group:example"], "dst": ["tag:example:*"], "srcPosture"
    ],

    // Define postures that will be applied to all rules without any specific
    // srcPosture definition.
    // "defaultSrcPosture": [
    //      "posture:anyMac",
    // ],

```

Learn how to configure your tailnet policy file.

Syntax reference
Tags reference
SSH reference
Funnel reference
Tests reference
Examples

>_ Tailscale SSH

SSH into servers using Tailscale & ACLs for authentication and authorization.

Disable Tailscale SSH...

Funnel Beta

Manage which nodes are allowed to accept internet traffic.

Error: line 14, column 2: invalid character '"' after object value (expecting ',' or '}')

Access Controls - Tailscale

Navegación privada

https://login.tailscale.com/admin/acls/file

```
8     "tagOwners": {
9         "tag:container": ["homelab@aprender.cloud"],
10    },
11
12    // Define access control lists for users, groups, autogroups, tags,
13    // Tailscale IP addresses, and subnet ranges.
14    "acls": [
15        // Allow all connections.
16        // Comment this section out if you want to define specific restrictions.
17        {"action": "accept", "src": ["*"], "dst": ["*:*"]},
18
19        // Allow users in "group:example" to access "tag:example", but only from
20        // devices that are running macOS and have enabled Tailscale client auto-updating.
21        // {"action": "accept", "src": ["group:example"], "dst": ["tag:example:*"], "srcPosture"
22    ],
23
24    // Define postures that will be applied to all rules without any specific
25    // srcPosture definition.
26    // "defaultSrcPosture": [
27    //     "posture:anyMac",
28    // ],
29
```

Save

Discard changes

Tags reference

SSH reference

Funnel reference

Tests reference

Examples

Tailscale SSH

SSH into servers using Tailscale & ACLs for authentication and authorization.

Disable Tailscale SSH...

Funnel Beta

Manage which nodes are allowed to accept internet traffic.

Access Controls - Tailscale

Navegación privada

https://login.tailscale.com/admin/acls/file

```
8       "tagOwners": {
9           "tag:container": ["homelab@aprender.cloud"],
10      },
11
12      // Define access control lists for users, groups, autogroups, tags,
13      // Tailscale IP addresses, and subnet ranges.
14      "acls": [
15          // Allow all connections.
16          // Comment this section out if you want to define specific restrictions.
17          {"action": "accept", "src": ["*"], "dst": ["*:*"]},
18
19          // Allow users in "group:example" to access "tag:example", but only from
20          // devices that are running macOS and have enabled Tailscale client auto-updating.
21          // {"action": "accept", "src": ["group:example"], "dst": ["tag:example:*"], "srcPosture"
22      ],
23
24      // Define postures that will be applied to all rules without any specific
25      // srcPosture definition.
26      // "defaultSrcPosture": [
27      //     "posture:anyMac",
28      // ],
29
```

Tags reference
SSH reference
Funnel reference
Tests reference
Examples

Tailscale SSH

SSH into servers using Tailscale & ACLs for authentication and authorization.

Disable Tailscale SSH...

Funnel Beta

Manage which nodes are allowed to accept internet traffic.

Save

Discard changes

Saved tailnet policy file

General - Tailscale

Navegación privada

https://login.tailscale.com/admin/settings/general

aprender.cloud Trial 14 days left

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Machines Apps Services Users Access controls Logs DNS Settings Get started

Tailnet Settings

- General
- User management
- Device management
- OAuth clients
- Webhooks
- Contact preferences
- Billing

Personal Settings

- Keys

General

Manage your tailnet account settings.

Organization

This is your organization's name. It cannot be changed.

aprender.cloud

Regional Routing

Route traffic to the closest available subnet router or app connector region. Available on the Premium plan and above. Learn more ↗

Keys - Tailscale

Navegación privada

https://login.tailscale.com/admin/settings/keys

Tailnet Settings

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Keys

Keys

View and manage your Auth keys and API access tokens.

Your private device keys are not included here: they are always private, stay on your device, and are never shared with Tailscale. Learn more ↗

Auth keys

Authenticate devices without an interactive login. Learn more ↗

Generate auth key...

You don't have any auth keys yet

API access tokens

Access tokens give access to the Tailscale API.

Generate access token...

You don't have any access tokens yet

Keys - Tailscale

Navegación privada

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Expiration

Number of days until this auth key expires. This will not affect the node key expiry of any machine authenticated with this auth key.

90 – + days

Must be between 1 and 90 days.

DEVICE SETTINGS

These settings will apply to any devices authenticated using this key.

Ephemeral

Devices authenticated by this key will be automatically removed after going offline. Learn more ↗

Tags

Devices authenticated by this key will be automatically tagged. This will also disable node key expiry for the device. Learn more ↗

No tags assigned.

tag:container

Add tags

Manage tags in Access Controls →

ivate, stay on your device, and are

Generate auth key...

yet

Generate access token...

s yet

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tag:container ×

Add tags

Manage tags in Access Controls →

Cancel

Generate key

ivate, stay on your device, and are

Generate auth key...

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Keys - Tailscale

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Keys

View and manage your Auth keys and API access tokens.

te, stay on your device, and are never

Generate auth key...

	TYPE	
	Single-use, Ephemeral	Revoke...

Generated new key

Be sure to copy your new key below. It won't be shown in full again.

```
tskey-auth-ktDd6atBBB21CNTRL-
pQ7pyHFJvNSV9kQt53WZNSDLxnnwgA9WJ
```

This key will expire on Jun 13, 2025. If you'll then want to continue using an auth key, you'll need to generate a new one.

Done

API access tokens

Access tokens give access to the Tailscale API.

Generate access token...

You don't have any access tokens yet

administration

audited ssh

Access Controls - Tailscale

https://login.tailscale.com/admin/acls/file

Edit file | Preview changes | Preview rules

```
45      //  ],
46      //      // Require devices running macOS and a stable
47      //      // Tailscale version.
48      //  "posture:anyMac": [
49      //      "node:os == 'macos'",
50      //      "node:tsReleaseTrack == 'stable'",
51      //  ],
52      // },
53
54      // Define users and devices that can use Tailscale SSH.
55      "ssh": [
56          {
57              "action": "accept",
58              "src":    ["homelab@aprender.cloud"],
59              "dst":    ["tag:container"],
60              "users":  ["ubuntu", "ec2-user", "javi", "root"],
61          },
62      ],
63
64      // Test access rules every time they're saved.
65      // "tests": [
66      //      {
67      //          "src": "alice@example.com",
68      //          "accept": ["tag:example"],
69      //          "deny": ["100.101.102.103:443"],
70      //      },
71      // ],
72  }
```

Docs

Learn how to configure your tailnet policy file.

- Syntax reference
- Tags reference
- SSH reference
- Funnel reference
- Tests reference
- Examples

Tailscale SSH

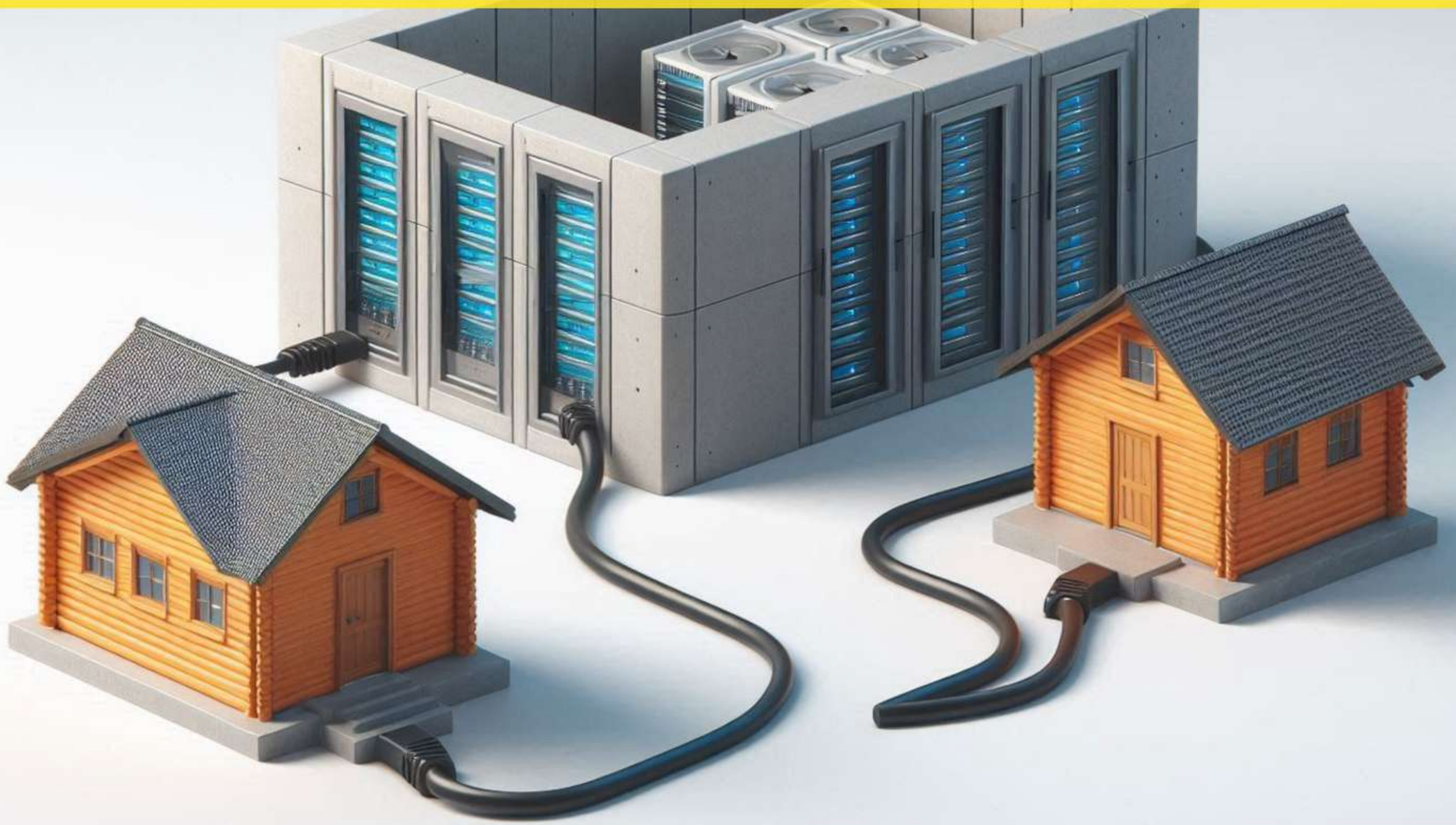
SSH into servers using Tailscale & ACLs for authentication and authorization.

Disable Tailscale SSH...

Funnel Beta

Manage which nodes are allowed to

subnet propagation



gotchas

windows & wsl

wsl network propagation

docker compose restart

recommendations

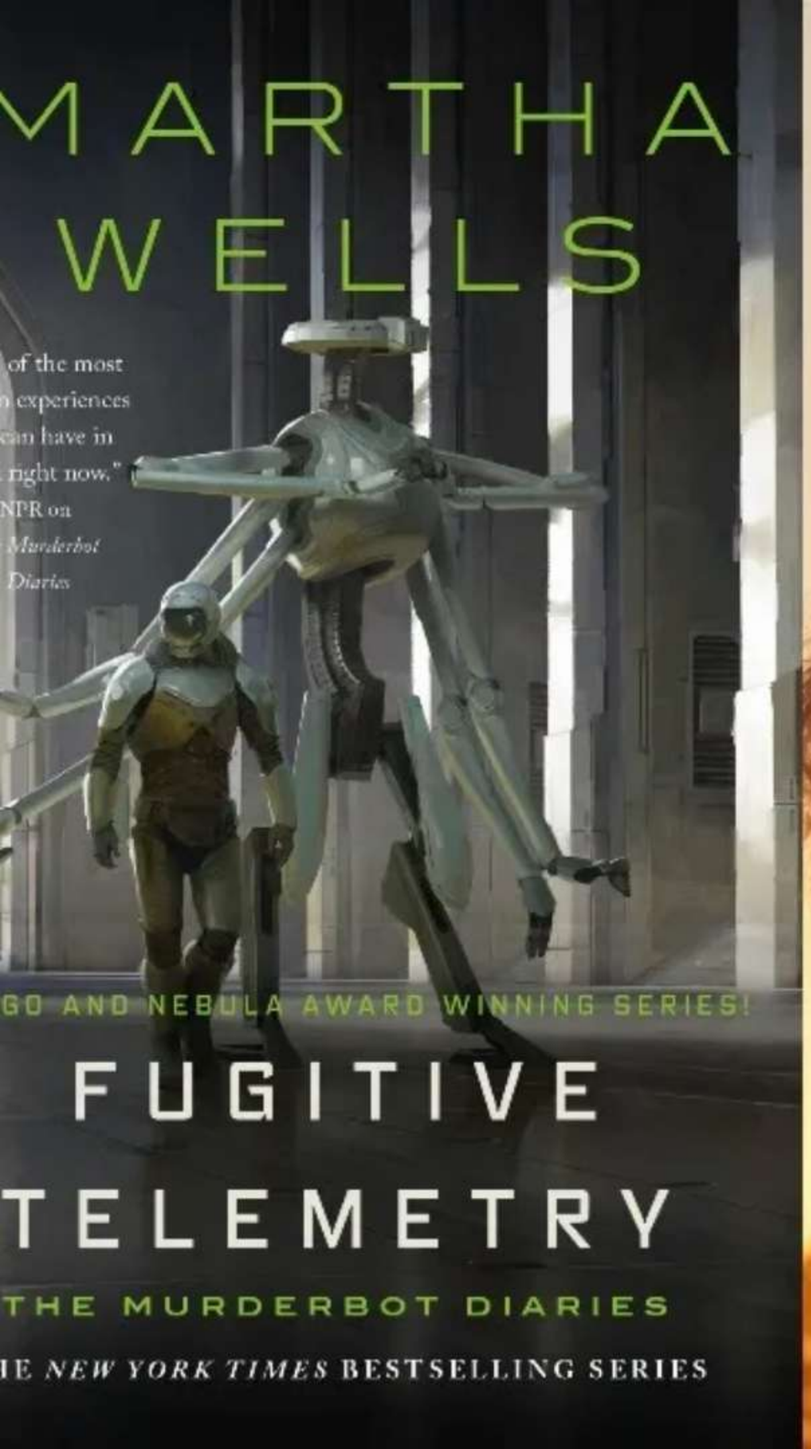
cory doctorow

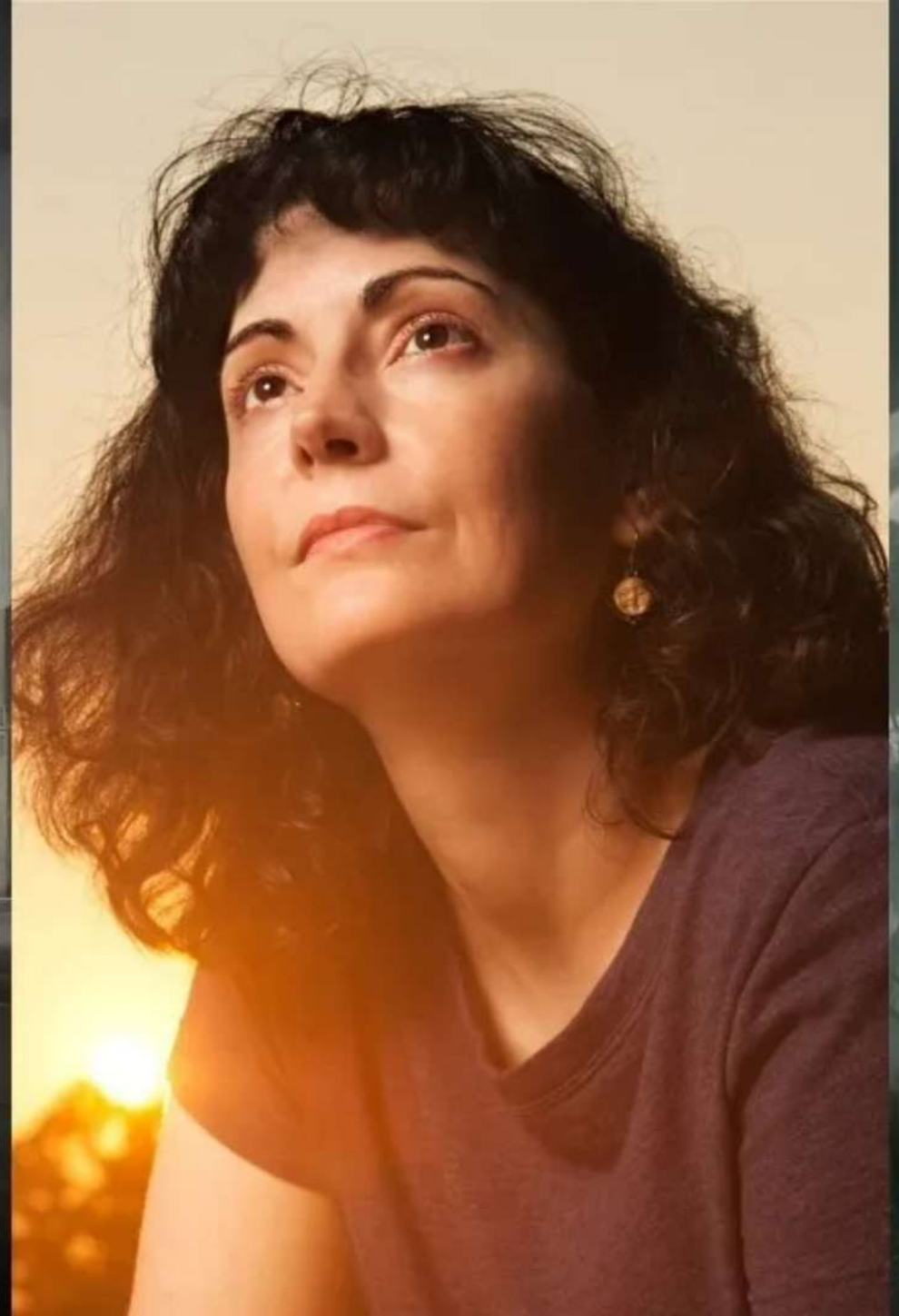
"A wonderful novel: everything we've come to expect from Cory Doctorow and more." —**William Gibson**

NEW YORK TIMES **BESTSELLING AUTHOR OF** ***LITTLE BROTHER***

walkaway

CYBERPUNK
2077

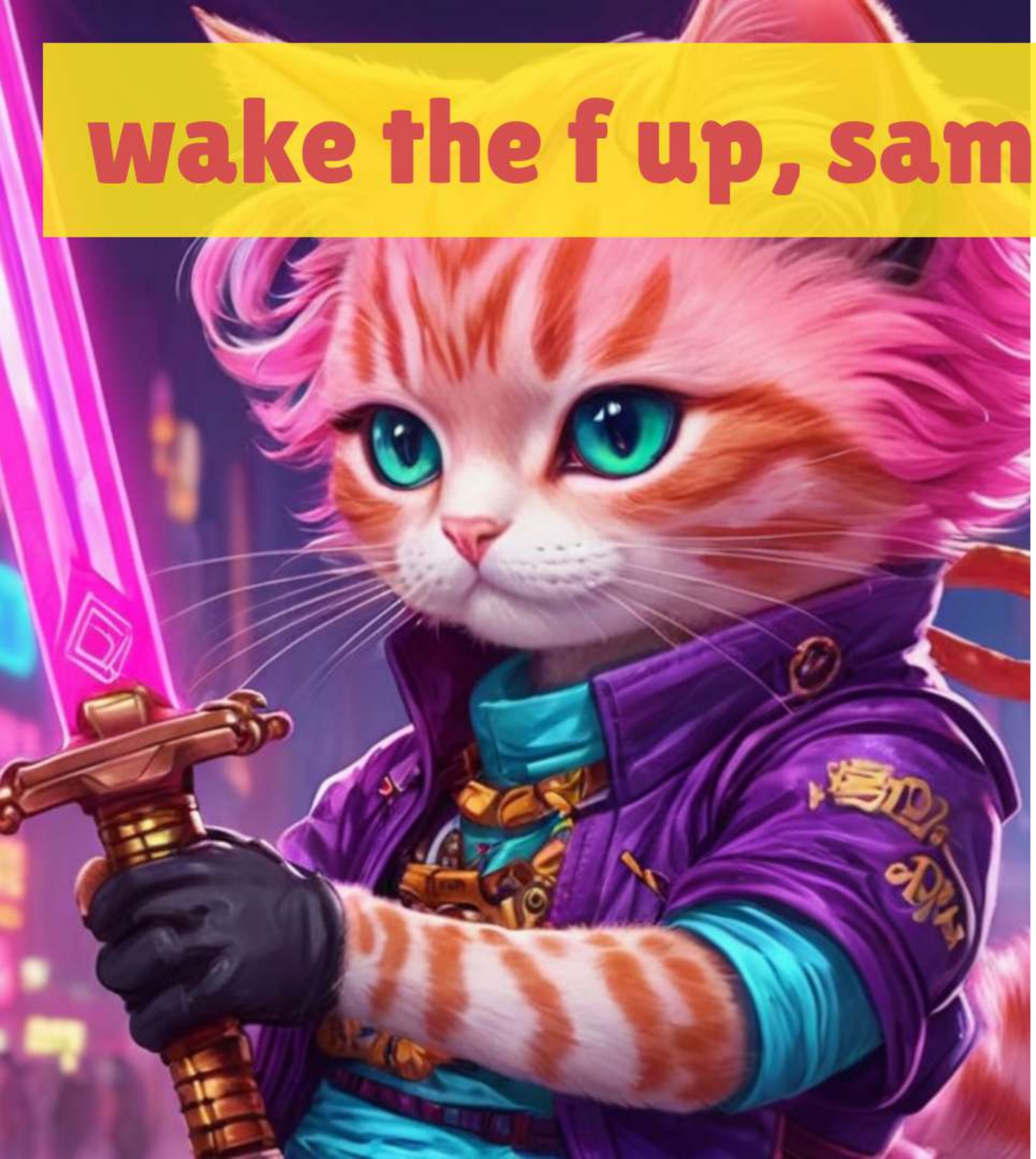

MARTHA
WELLS
of the most
experiences
can have in
right now."
NPR on
Murderbot
Diaries
GO AND NEBULA AWARD WINNING SERIES!
FUGITIVE
TELEMETRY
THE MURDERBOT DIARIES
IE NEW YORK TIMES BESTSELLING SERIES



MARTHA
WELLS
"I love Murderbot!"
ANN LECKIE
HUGO AND NEBULA AWARD WINNER!
ALL SYSTEMS
RED
THE MURDERBOT DIARIES
THE NEW YORK TIMES BESTSELLING SERIE

BIOSHOCK
THE COLLECTION

wake the f up, samurai



Perhaps it would be nice to progress towards a world where we, as citizens, also own part of **our infrastructure**.

tinyurl.com/tlscl