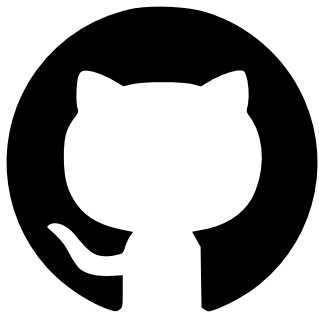




Self-hosting

Hashdump Security Club

Cloud-based services



Why use cloud-based services



Advantages

- Infrastructure is managed for you
- Greater exposure (w/ public-facing platforms like GitHub)
- Better reliability (backups, automatic failover)

Overall: less effort/overhead

Disadvantages

- Must trust provider not to make mistakes / lose your data
- Provider will use your data for their own purposes
- Data may be shared with third parties
- May need to pay subscription fees

Overall: less privacy/control

Alternatives to the cloud

- **Self-hosting:** running services on your own hardware, often to replace cloud-based applications
- *Disadvantages:* more effort to set up and maintain own servers
- *Advantages:* more control over your own data, greater flexibility, lower latency
- Hardware requirements are low: if you have an old desktop or laptop lying around, it can become a server
- Many free and open-source programs are available


```
... object to mirror  
mirror_mod.mirror_object
```

```
operation == "MIRROR_X":  
    mirror_mod.use_x = True  
    mirror_mod.use_y = False  
    mirror_mod.use_z = False  
operation == "MIRROR_Y":  
    mirror_mod.use_x = False  
    mirror_mod.use_y = True  
    mirror_mod.use_z = False  
operation == "MIRROR_Z":  
    mirror_mod.use_x = False  
    mirror_mod.use_y = False  
    mirror_mod.use_z = True
```

```
...selection at the end -add  
mirror_ob.select= 1  
mirror_ob.select=1  
context.scene.objects.act  
("Selected" + str(mirror_ob.name))  
mirror_ob.select = 0  
bpy.context.selected_objects  
data.objects[one.name].select  
print("please select exactly one mirror")
```

```
-- OPERATOR CLASSES --
```

```
types.Operator):  
    X mirror to the selected  
    object.mirror_mirror_x"  
    mirror X"
```

Use cases

Looking at software we've used in practice

Nextcloud

Alternative to
Google/Microsoft suites

File/photo storage

Calendar

Contacts

Notes

Tasks

Office suite

Mobile app integration

The screenshot displays the Nextcloud web interface. On the left is a sidebar with navigation options: 'All files' (selected), 'Personal files', 'Recent', 'Favorites', 'Shares', 'Tags', 'All folders', 'Deleted files', '276.6 MB used', and 'Files settings'. The main area shows a file list for the 'Hashdump' folder. The list includes columns for file type, name, size, and modification date. Files listed include 'tor-presentation', 'assembly-presentation.pdf.old', 'assembly-slides.pdf', 'assembly3.odp', 'assembly4.odp', 'description.odt', 'Hashdump-tor-notes.pdf', 'HashdumpSep22.pdf', 'tor.odt', and 'tor-presentation.odp'.

Type	Modified	People	Name	Size	Modified
			tor-presentation	3.9 MB	May 12
			assembly-presentation.pdf.old	979 KB	September 7
			assembly-slides.pdf	985 KB	September 8
			assembly3.odp	2.1 MB	September 8
			assembly4.odp	2.1 MB	September 8
			description.odt	39 KB	September 2
			Hashdump-tor-notes.pdf	115 KB	March 5
			HashdumpSep22.pdf	604 KB	2 weeks ago
			tor.odt	49 KB	March 5
			tor-presentation.odp	2.9 MB	March 12

Forgejo, Gitea

Host Git source code repositories

Allow downloading release binaries

Built-in container registry

Forgejo is community-run fork of Gitea, itself based on Gogs

See also: GitLab

The screenshot displays the Forgejo web interface for a repository named 'knector / plane-game', which is marked as 'Private'. The top navigation bar includes links for 'Issues', 'Pull requests', 'Milestones', and 'Explore', along with a notification bell, a user profile icon, and a dropdown menu. Below the repository name, there are buttons for 'Code', 'Issues', 'Pull requests', 'Projects', 'Releases', 'Packages', 'Wiki', 'Activity', 'Actions', and 'Settings'. The repository statistics show '74 commits', '1 branch', '0 tags', and '424 KiB' of size. A search bar is present with the text 'Search code...'. The main content area lists the repository's structure, including folders like 'materials', 'models', 'scenes', 'scripts', and 'shaders', and files like '.gitattributes', '.gitignore', 'export_presets.cfg', 'icon.svg', and 'icon.svg.import'. Each item is accompanied by a description of the commit and the time since the last update.

Commit Hash	Commit Message	Time	
f974b2ec36	Update to Godot 4.4	5 months ago	
	materials	Make water texture seamless	last year
	models	Update to Godot 4.4	5 months ago
	scenes	Update to Godot 4.4	5 months ago
	scripts	Update to Godot 4.4	5 months ago
	shaders	Update to Godot 4.4	5 months ago
	.gitattributes	Add base Godot project files	last year
	.gitignore	Create biplane model	last year
	export_presets.cfg	Add dedicated server preset and port command-line option	last year
	icon.svg	Add base Godot project files	last year
	icon.svg.import	Add base Godot project files	last year

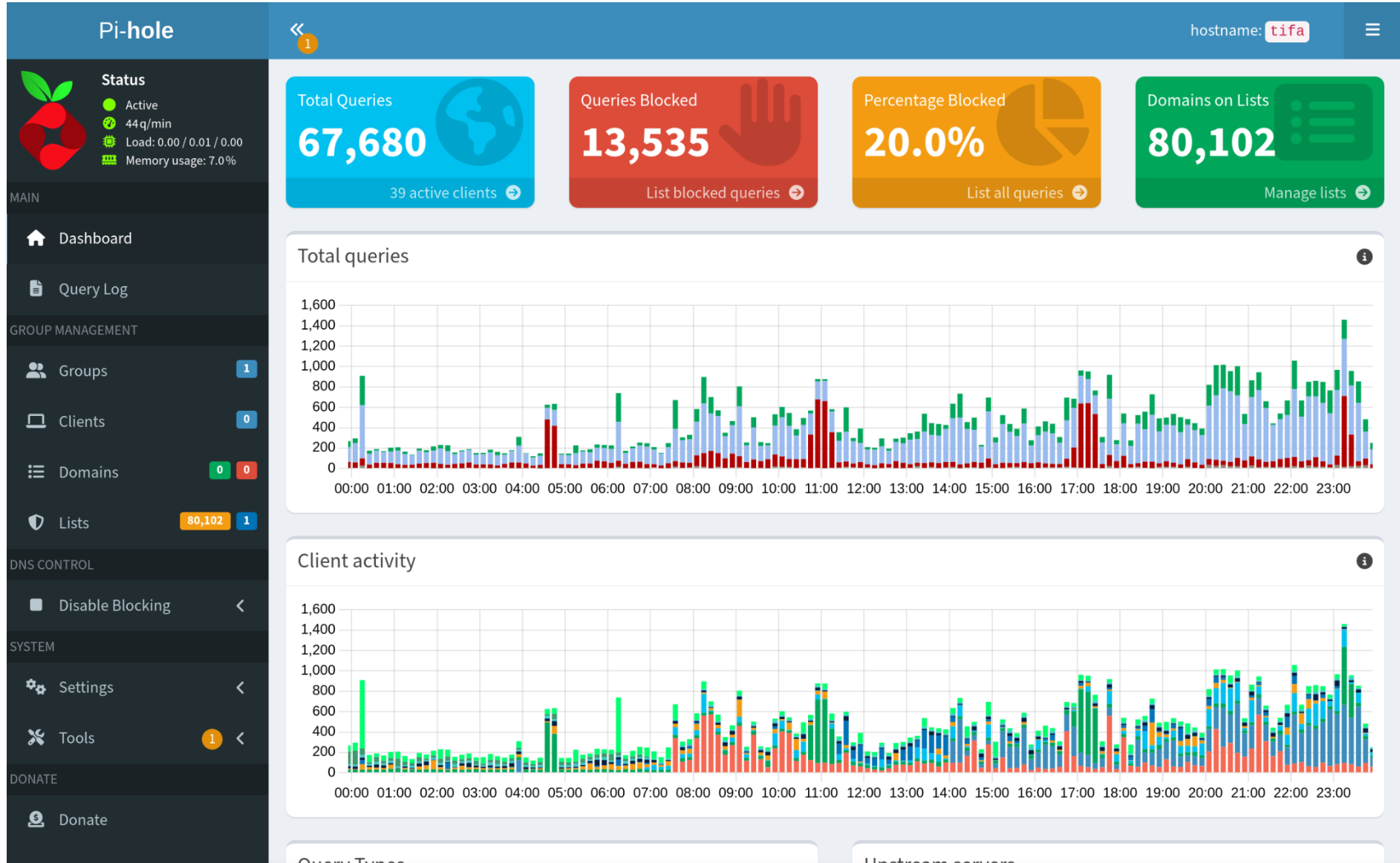
Pi-hole

Network-wide ad blocker

DNS-based blocking: apply filter rules for most devices

Allows setting custom DNS records for internal webpages

See also: AdGuard Home



For local-only password storage, see KeePassXC



Screenshot: <https://etke.cc/help/extras/vaultwarden/>

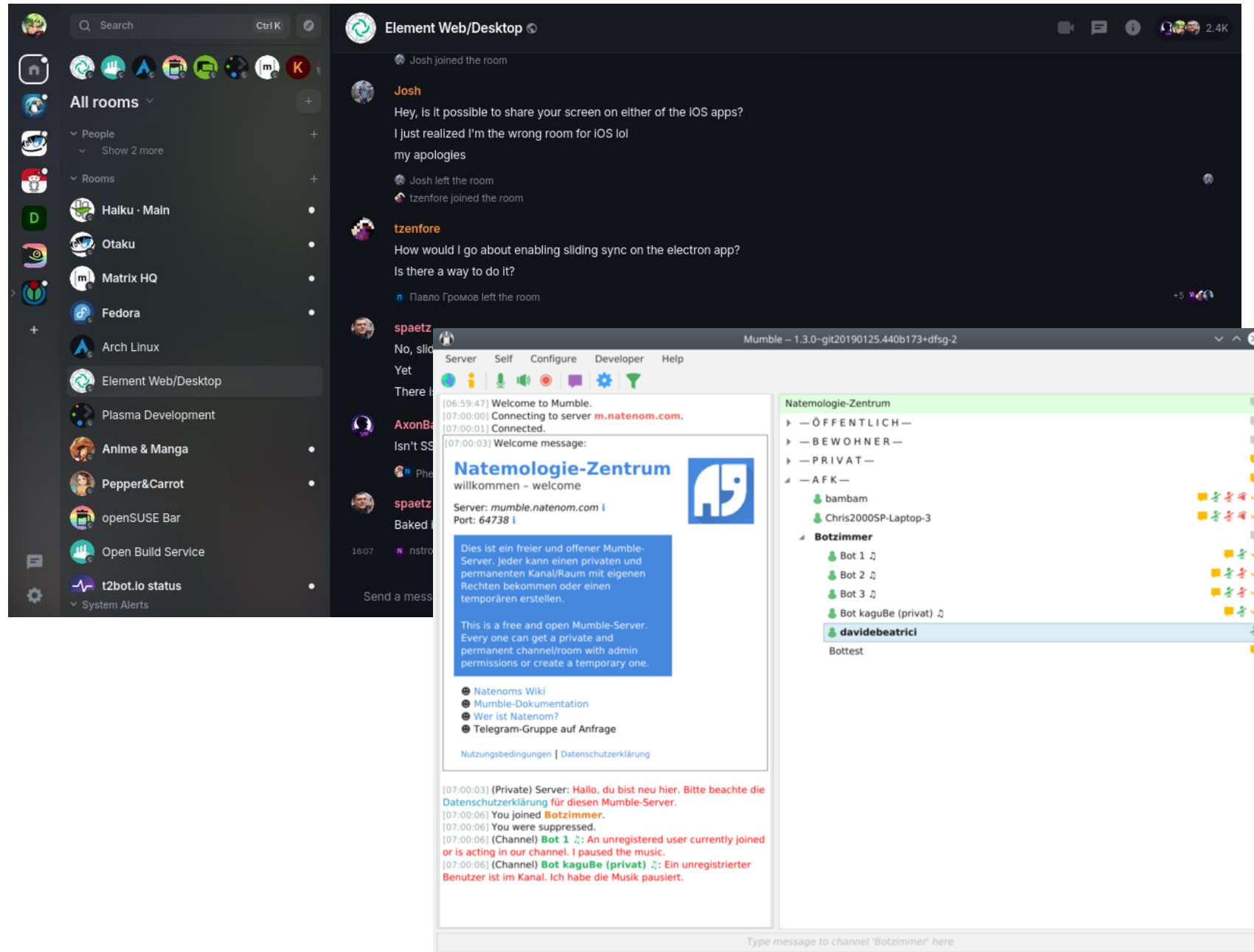
Communication

Can run your own chat servers

Matrix: like Discord or Slack,
has variety of clients + supports
video calling

Mumble: voice chat like
Teamspeak

Honorable mentions:
Rocket.Chat, Zulip, Mattermost,
Stoat (previously Revolt), Jitsi
Meet



[https://en.wikipedia.org/wiki/Mumble_\(software\)](https://en.wikipedia.org/wiki/Mumble_(software))

Email

Various software exists to run your own email server

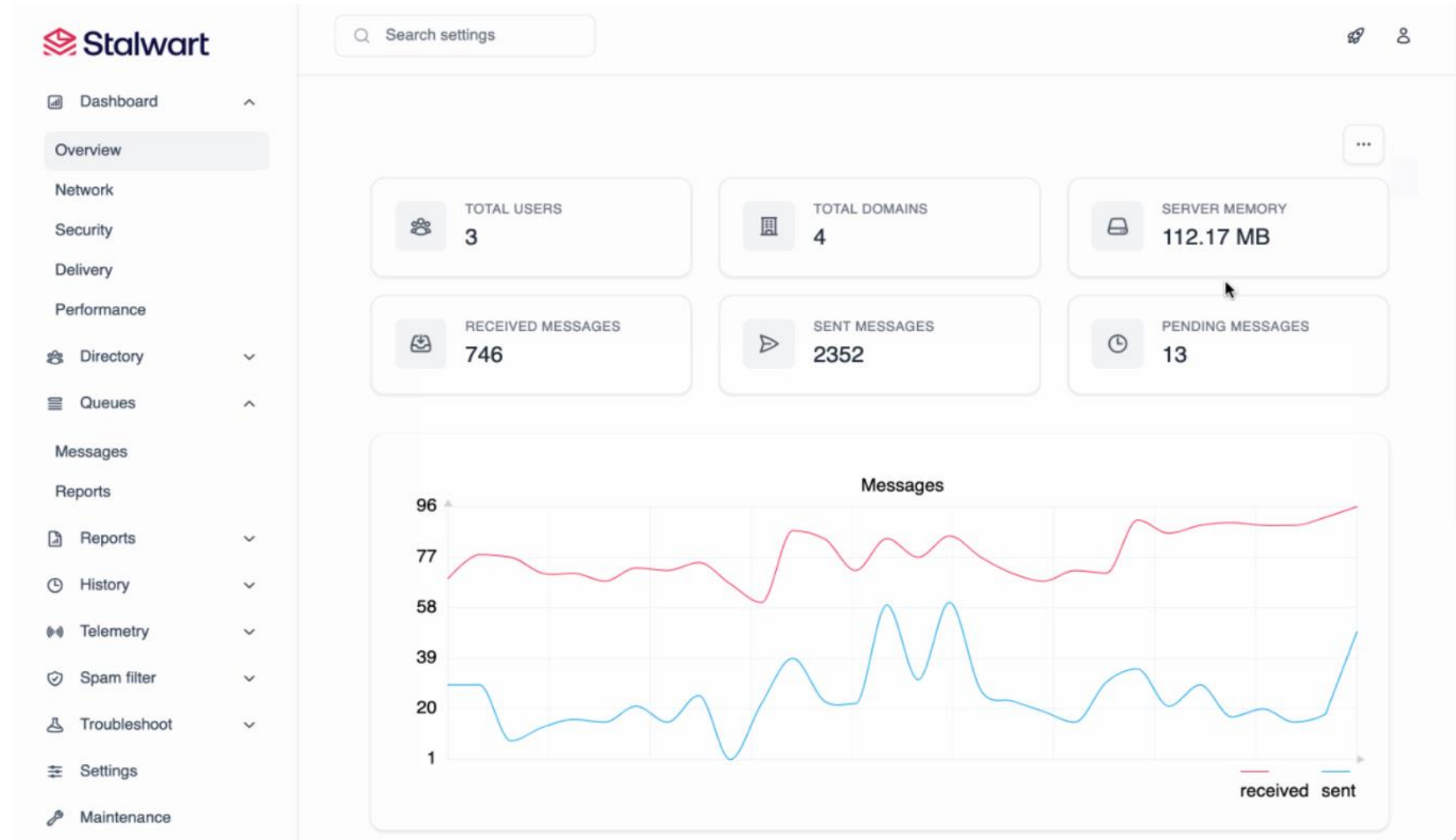
Stalwart (pictured)

Mail-in-a-Box

Mailcow

Difficult self-hosting task, due to security requirements

Many of these projects attempt to streamline setup



<https://stalw.art/slides/#/57>

User authentication

- Centralized account system simplifies access if you have many apps
- **Single Sign-On (SSO)**: consistent login flow using SAML or OpenID Connect protocols
- Lightweight Directory Access Protocol (LDAP) is a standard for user account management
- Popular solutions: Authelia, Authentik, FreeIPA, Pocket ID, Keycloak, Kanidm, Shibboleth, LLDAP, OpenLDAP



Sign in to your account

Username or email

Password



Sign In

Virtualization: Proxmox VE

Run miniature Linux environments to host server applications

Allows quick provisioning of

- Virtual machines (VMs)
- Operating system containers

Benefits: better isolation, leverage features of varied Linux distributions

Virtual machines can host other OS platforms such as Windows as well

PROXMOX Virtual Environment 9.0.10

Search

Documentation

Create VM

Create CT

root@pam

Server View

Datacenter

barret

101 (moogle)

102 (cactuar)

100 (chocobo)

localnetwork (barret)

local (barret)

Virtual Machine 100 (chocobo) on node 'barret'

No Tags

Start

Shutdown

Console

More

Help

Summary

Console

Hardware

Cloud-Init

Options

Task History

Monitor

Backup

Replication

Snapshots

Firewall

Permissions

Debian GNU/Linux 13 chocobo tty1

chocobo login: everett

Password:

Linux chocobo 6.12.48+deb13-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.12.48-1 (2025-09-20) x86_64

The programs included with the Debian GNU/Linux system are free software; the exact distribution terms for each program are described in the individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent permitted by applicable law.

everett@chocobo:~\$ fastfetch

OS: Debian GNU/Linux 13 (trixie) x86_64

Host: KVM/QEMU Standard PC (i440FX + PIIX, 1996) (pc-i440fx-10.0)

Kernel: Linux 6.12.48+deb13-amd64

Uptime: 2 mins

Packages: 406 (dpkg)

Shell: bash 5.2.37

Display (QEMU Monitor): 1280x800 @ 75 Hz in 15"

Terminal: /dev/tty1

Terminal Font: VGA default kernel font 8x16x256

CPU: QEMU Virtual version 2.5+ (2) @ 2.40 GHz

GPU: Unknown Device 1111 (VGA compatible)

Memory: 377.05 MiB / 7.75 GiB (5%)

Swap: 0 B / 1.60 GiB (0%)

Disk (/): 1.95 GiB / 29.67 GiB (7%) - ext4

Local IP (ens18):

Locale: en_US.UTF-8

everett@chocobo:~\$

Tasks

Cluster log

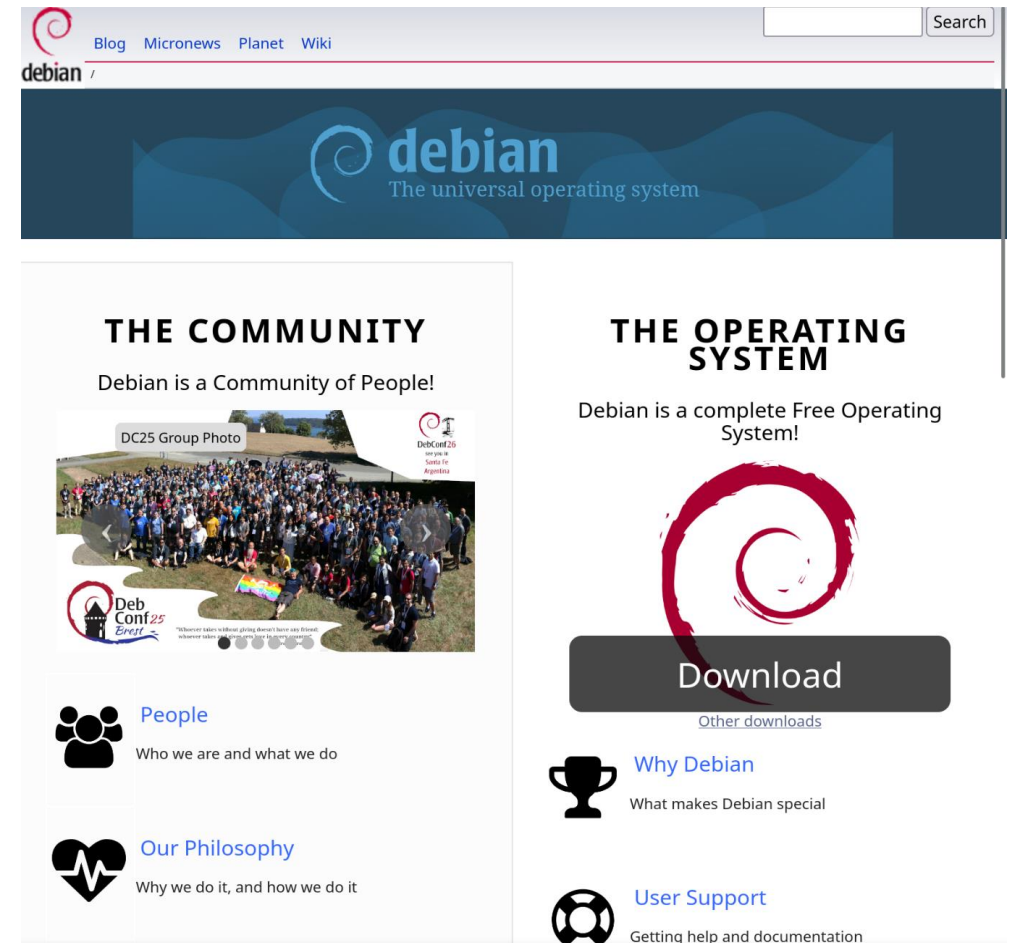
Start Time ↓	End Time	Node	User name	Description	Status	
Oct 19 20:12:24		barret	root@pam	VM/CT 100 - Console		>
Oct 19 20:09:28	Oct 19 20:11:56	barret	root@pam	VM/CT 100 - Console	OK	>
Oct 19 20:09:26	Oct 19 20:09:27	barret	root@pam	VM 100 - Start	OK	>
Oct 19 20:09:18	Oct 19 20:09:21	barret	root@pam	CT 101 - Shutdown	OK	>
Oct 19 20:08:15	Oct 19 20:09:21	barret	root@pam	VM/CT 101 - Console	OK	>

Setup



Software environment

- After finding a computer, you'll typically install a server OS on it
 - Commonly a Linux distribution (Debian, Ubuntu, AlmaLinux...)
- Some OS platforms aid in self-hosting
 - TrueNAS (free community version)
 - HexOS (paid, based on TrueNAS)
 - Unraid (paid)



Installing software

- Linux distributions provide many programs through *packages* in their *repositories*
 - Collections of software assembled by distribution maintainers
 - Includes core ones like Nginx (reverse proxy) or PostgreSQL (database)
 - Simple installation through terminal commands like "apt install nginx"
- In cases where distributions don't carry a program, there are other methods
- For example, *container images*
 - Package a server application together with the Linux OS needed to run it
 - Require a *container runtime* such as Docker or Podman
- Other programs may provide their own binaries or packages

Initial app configuration

- *Configuration files* adjust server behavior
- This may include port numbers where you can access them over the network
 - Commonly HTTP (Hypertext Transfer Protocol), the protocol of the Web
- May require IP addresses + ports for external programs, e.g. databases
- After configuring + starting program, it should be reachable over the network

```
1 <?php
2 $CONFIG = array (
3     'instanceid' => 'oc8c0fd71e03',
4     'passwordsalt' => '515a13302a6b3950a9d0fdb970191a',
5     'trusted_domains' =>
6     array (
7         0 => 'localhost',
8         1 => 'studio',
9         2 => '192.168.10.155'
10    ),
11     'datadirectory' => '/var/www/nextcloud/data',
12     'dbtype' => 'mysql',
13     'version' => '7.0.2.1',
14     'dbname' => 'nextcloud',
15     'dbhost' => 'localhost',
16     'dbtableprefix' => 'oc_',
17     'dbuser' => 'oc_carla',
18     'dbpassword' => '67336bcdf7630dd80b2b81a413d07',
19     'installed' => true,
20 );
```

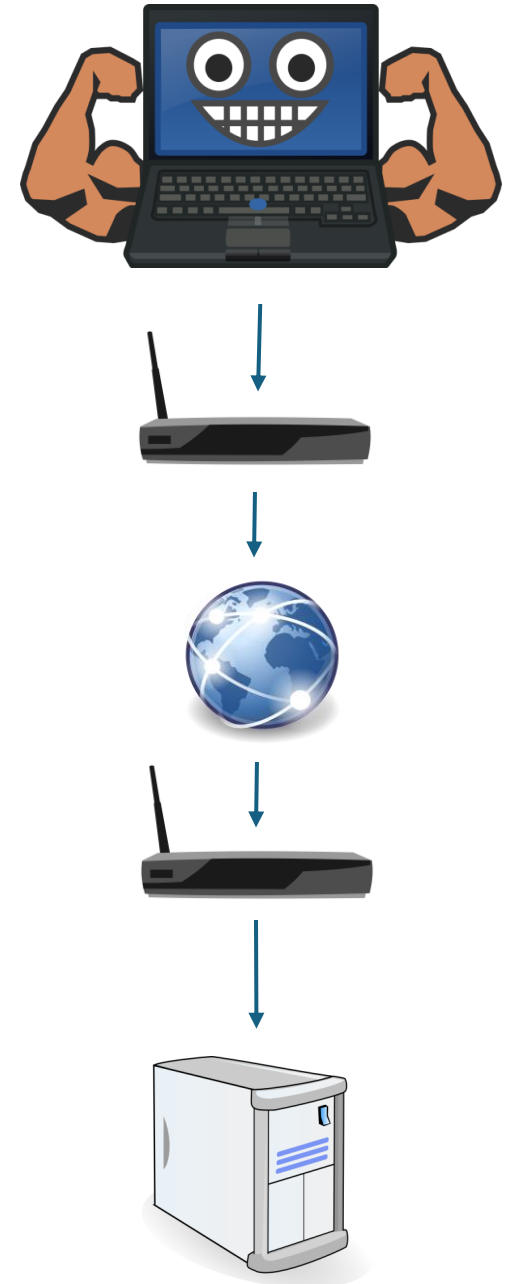
https://docs.nextcloud.com/server/stable/admin_manual/configuration_server/config_sample_php_parameters.html

The background of the image is a complex, three-dimensional network structure. It consists of numerous small, metallic-looking spheres that are interconnected by thin, dark lines. The spheres are arranged in a way that creates a sense of depth and perspective, with some appearing closer and larger than others. The overall effect is a dense, interconnected web of nodes and edges, resembling a molecular structure or a data network.

Network Configuration

Allowing others access

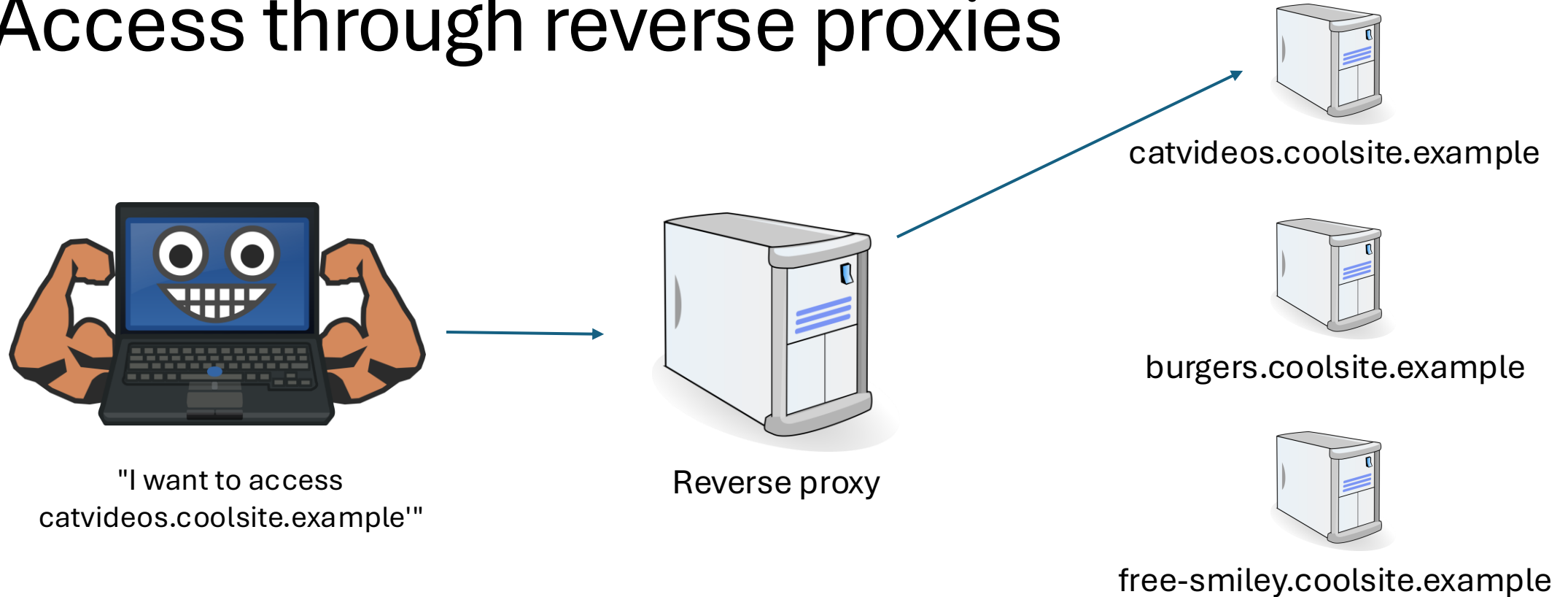
- If you're on your network, you can reach other devices on that same network.
 - But how do you allow people outside your household to connect?
- **Port forwarding**
 - Sets your router to forward traffic it receives over a specific port (often 80 and 443) to your server
 - What if that's unavailable?
- Relay servers (e.g. Cloudflare tunnels)
 - Uses an intermediary to facilitate connections to your computer without needing to open ports.
 - Your server IP remains private from people accessing your site.



Domain Name System (DNS)

- IP addresses are how computers on the Internet identify each other
- But they aren't human readable: to visit google.com, you don't enter its IP address "142.250.69.238"
- For a yearly fee, you can purchase a *domain name* on the Internet and point it toward your own server's address
 - Best to acquire domain privacy protection as well to avoid spam
- After doing so, you will want to acquire a TLS certificate to encrypt traffic to/from your domain
 - Let's Encrypt allows you to obtain certificates for free

Access through reverse proxies



- If you don't want users to remember port numbers and which machine hosts what service, reverse proxies have you covered
- Proxy receives and forwards HTTP traffic to the appropriate destination server
- Particularly allows for multiple domains & routes to be associated with one open port on a network.
 - Examples: Apache httpd, nginx, HAProxy, Envoy, Traefik, Caddy

Managing systems remotely

- Port-forwarding SSH?
 - Consideration: attack surface
 - Disallow password auth and use public-key instead – eliminate possibility of weak passwords
 - Fail2ban can ban IPs that attempt to brute-force login
- VPNs allow restricting access to apps and management ports
 - WireGuard: can open a port for outside VPN connection, public-key auth
 - TailScale: service built on WireGuard, including relay servers
 - WARP-gated Cloudflare tunnels: accessible through zero-trust auth

Conclusions

- Self-hosting is a hands-on way to learn about networking technology and server administration
- System can be simple or complex depending on your needs
- There are many communities online that provide further resources, including more applications you can run
 - <https://github.com/awesome-selfhosted/awesome-selfhosted>
 - <https://reddit.com/r/selfhosted>
 - <https://lemmy.world/c/selfhosted>

Try it yourself!

- Download Gitea for your device at the following link
 - <https://about.gitea.com/products/gitea/>
- Run a local Gitea server on your machine
 - For simplicity, use the built-in SQLite database
- Access your server at `http://localhost:3000`
 - Fill out the setup wizard to create the administrator account



Thank you

Any questions?