



Australia's
Global
University

School of Computer Science & Engineering

Trustworthy Systems Group

My Home Network

(Reducing Reliance on Multinationals)

Peter Chubb

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22 Jan 2025



What do you need?



- Backup

What do you need?



- Backup
- Printing

What do you need?



- Backup
- Printing
- Home phone (maybe)

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- Messaging and Email

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- File sharing

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- Music, videos etc

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- Home automation and monitoring
- Remote access?

Back in 1987



— Serial is king!

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- plus 2400 baud Modems
- **No internet**

Back in 1987



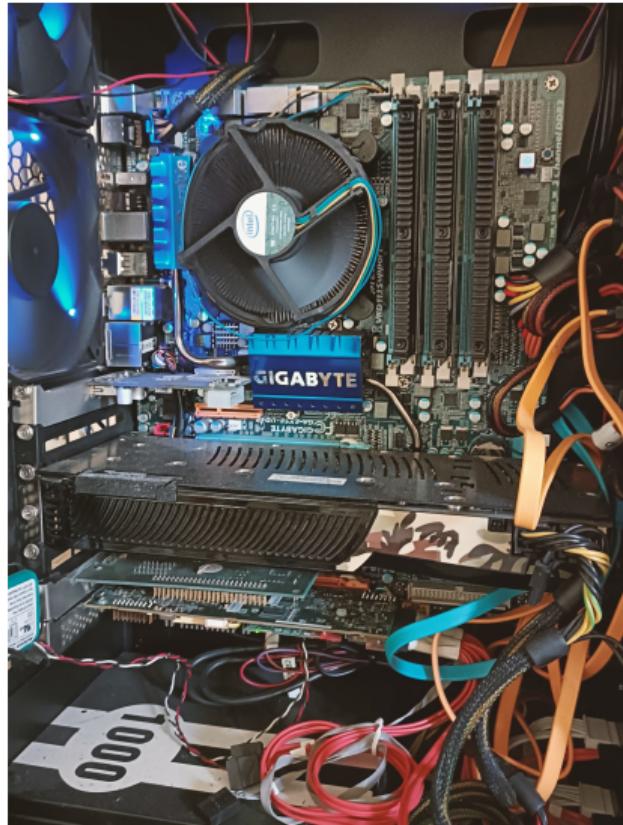
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- Backup to floppy

Back in 1987



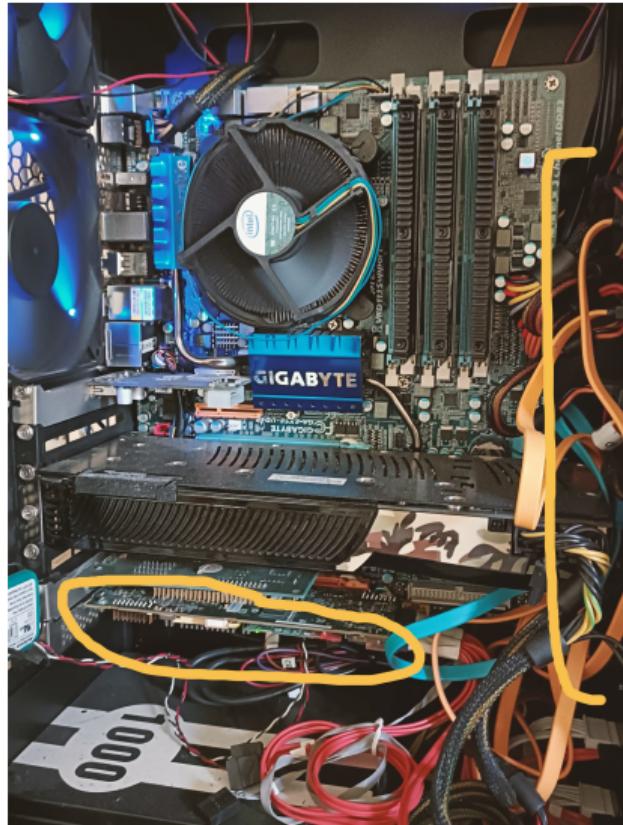
- Serial is king!
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- My hard disc was 40MB !!!

In 1990s



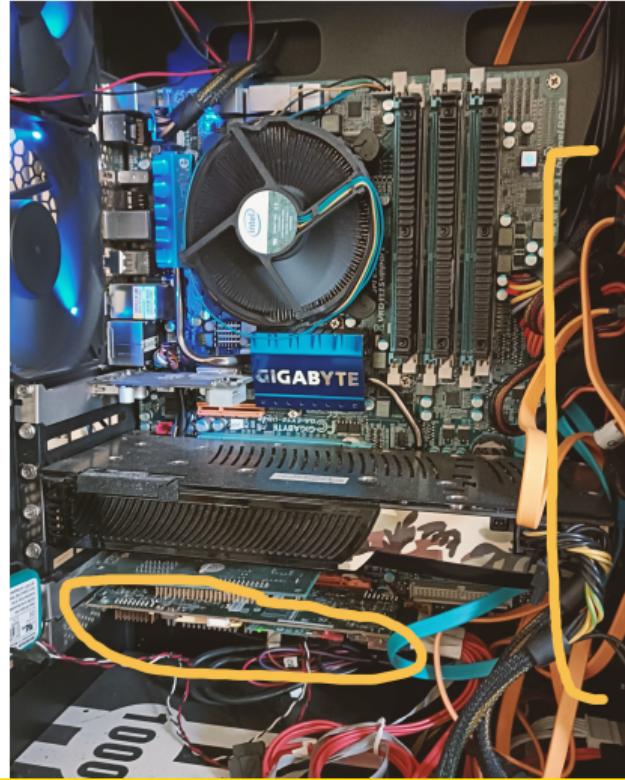
- Three “big” (Pentium) machines

In 1990s



- Three “big” (Pentium) machines
 - Lots of disc
 - Lots of RAM
 - >\$1/day to run each

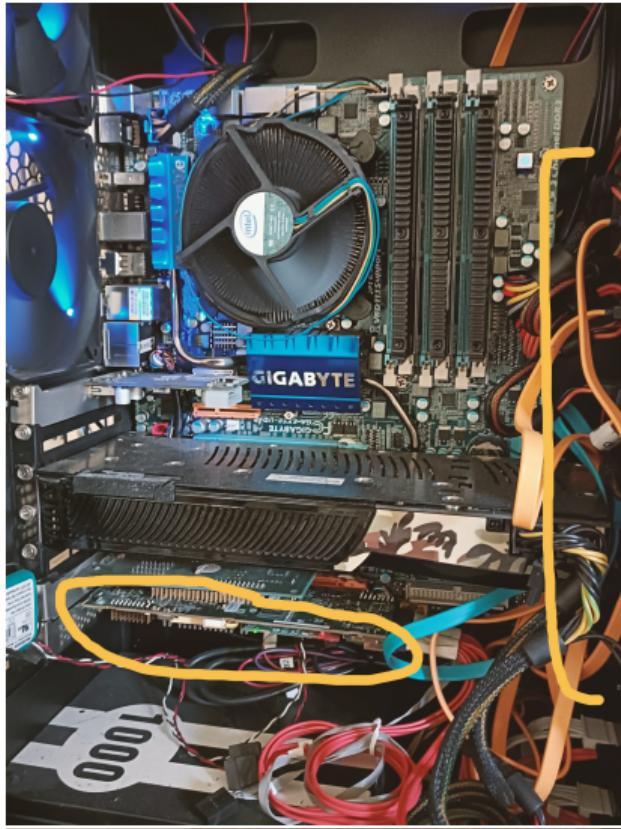
In 1990s



- Three “big” (Pentium) machines
- Back up to each other and to DAT tape



In 1990s



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- Plus *crash and burn* machines for development

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- Labtam X terminals for display on thin ethernet

In 1990s



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- Back up to each other and to DAT tape
- Plus *crash* and *burn* machines for development
- Labtam X terminals for display on thin ethernet
- dial up 56.4Kbaud to work

Early HFC days



- *Almost* static IP address
- chubb.wattle.id.au domain name
- IPv6 via AARNET broker
- Open email and ssh inwards
- Outwards email relayed via OPTUS
- `fetchmail` injected OPTUS email into my systems
- 100Mb twisted pair ethernet plus thinnet bridge for XTerminal etc

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- Got my first Laptop!



— WiFi is king!



- WiFi is king!
 - Laptops, Tablets, Linux everywhere
- NBN gives fast(ish) connection

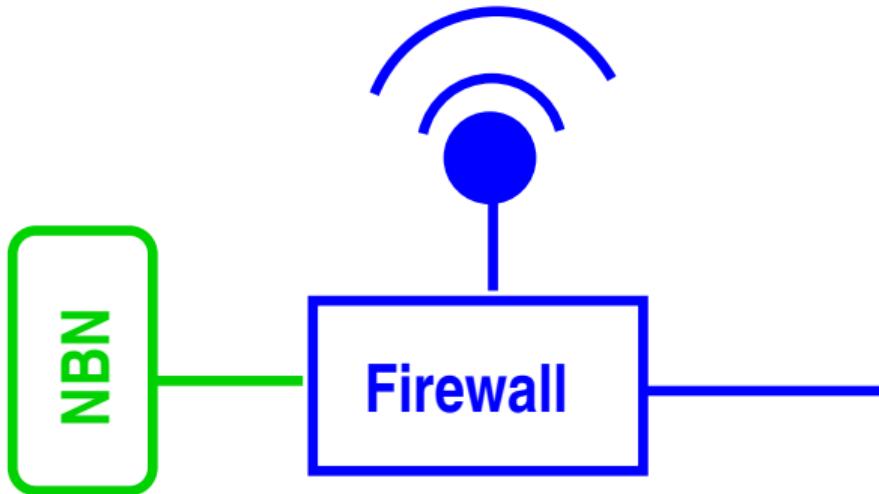


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 - Makes it easy to use cloud services



- WiFi is king!
 - Laptops, Tablets, Linux everywhere
- NBN gives fast(ish) connection
 - Makes it easy to use cloud services
- Terabytes of videos, photos, etc.

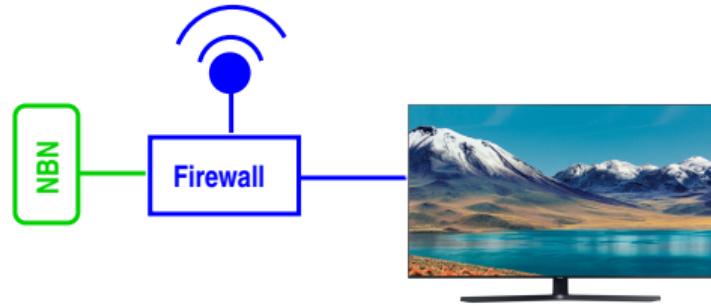
Other people's setups



⁰Picture from Samsung marketing material

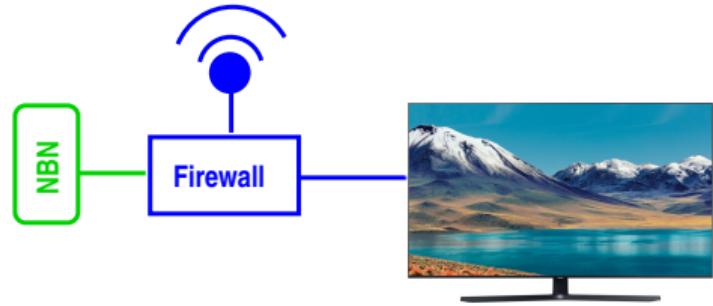
Other people's setups

- One WiFi Access point
- Backup to cloud: Onedrive™, iCloud™, Google drive™, iDrive™, etc ...
- File sharing via Dropbox
- Media from Apple Music, Youtube, Play Music etc
- Email from Google or Microsoft
- Home automation using Amazon or Google or Insteon or iHome or ...



Other people's setups

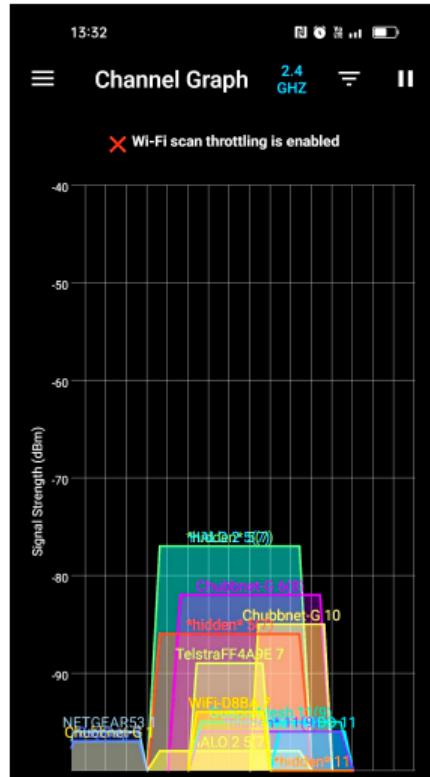
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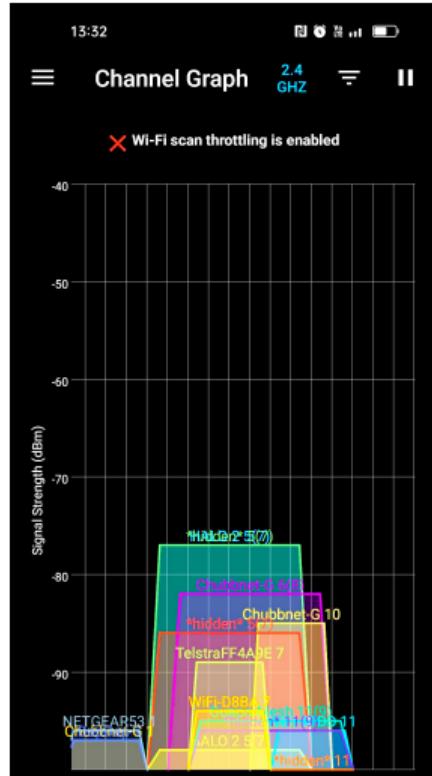
Scrounge



WiFi at Home

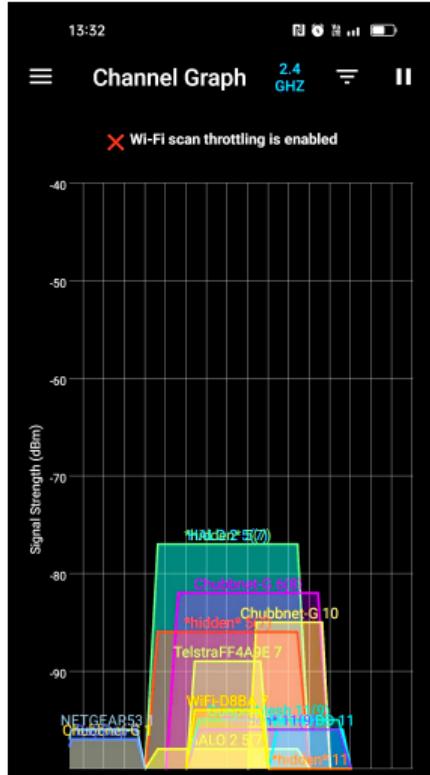


WiFi at Home



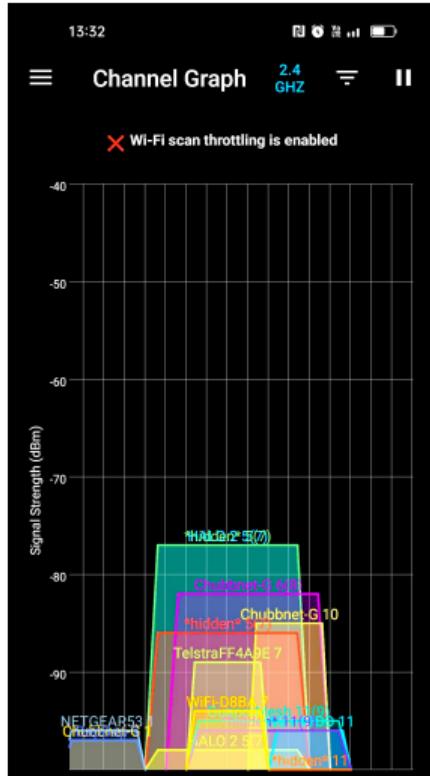
- too many neighbours
- Need 2.4GHz for IoT
- Use 5Ghz for laptops/phones/tablets

WiFi at Home



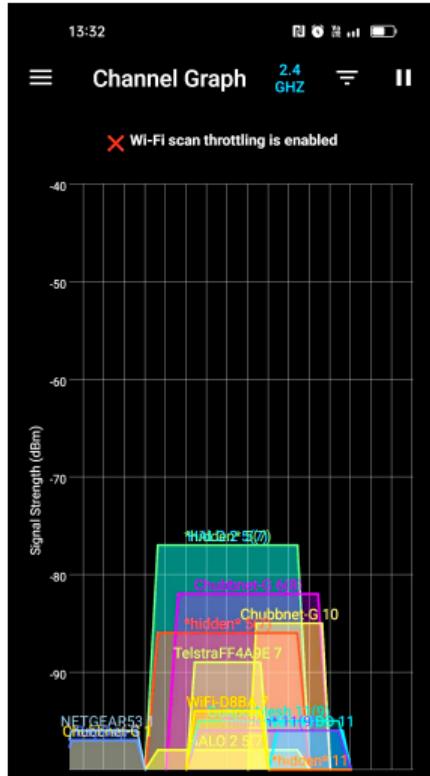
- too many neighbours
- Need 2.4GHz for IoT
- Use 5Ghz for laptops/phones/tablets
 - 5GHz doesn't penetrate brick very well

WiFi at Home

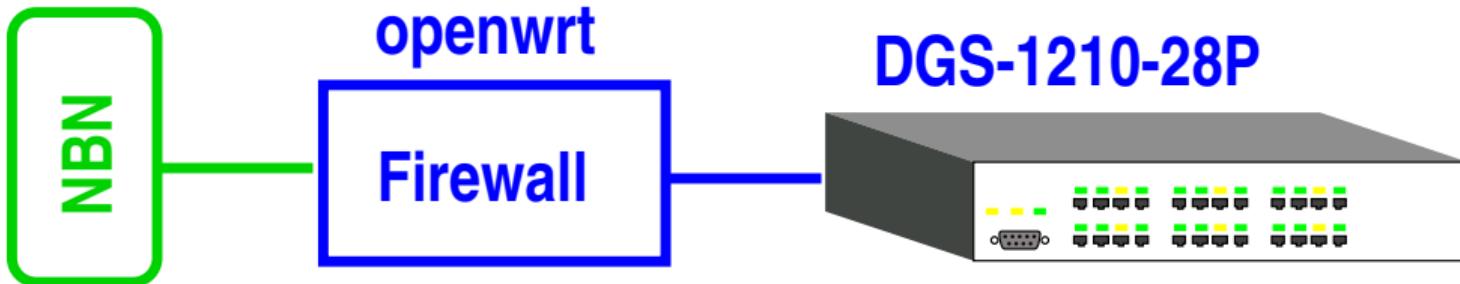


- three low powered POE access points
- Cheap 2nd hand PoE Gigabit switch

WiFi at Home



- three low powered POE access points
- Cheap 2nd hand PoE Gigabit switch
- Too many WAPs need proprietary controller software!

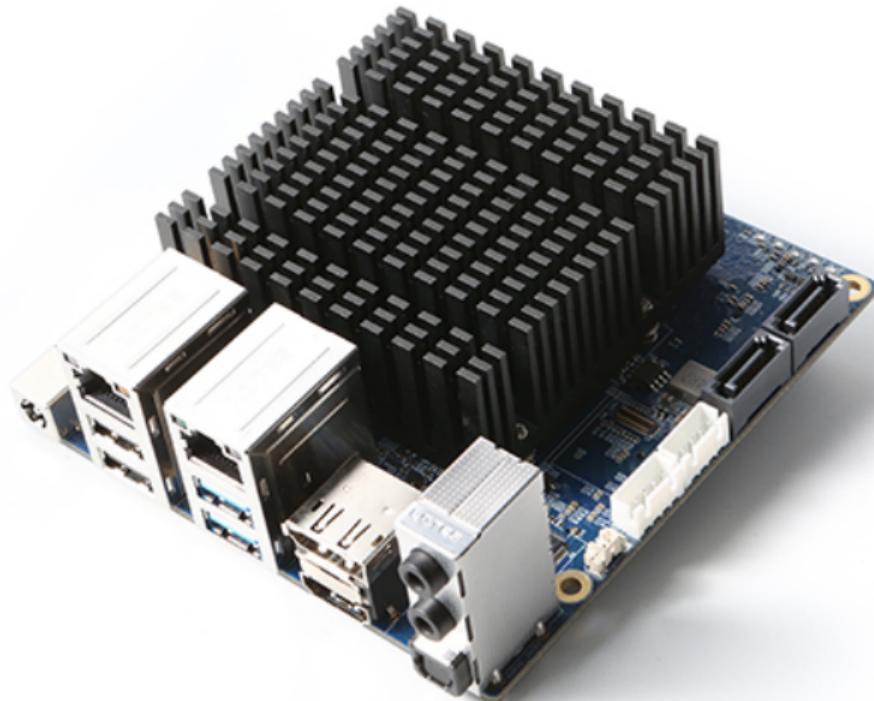


WAP

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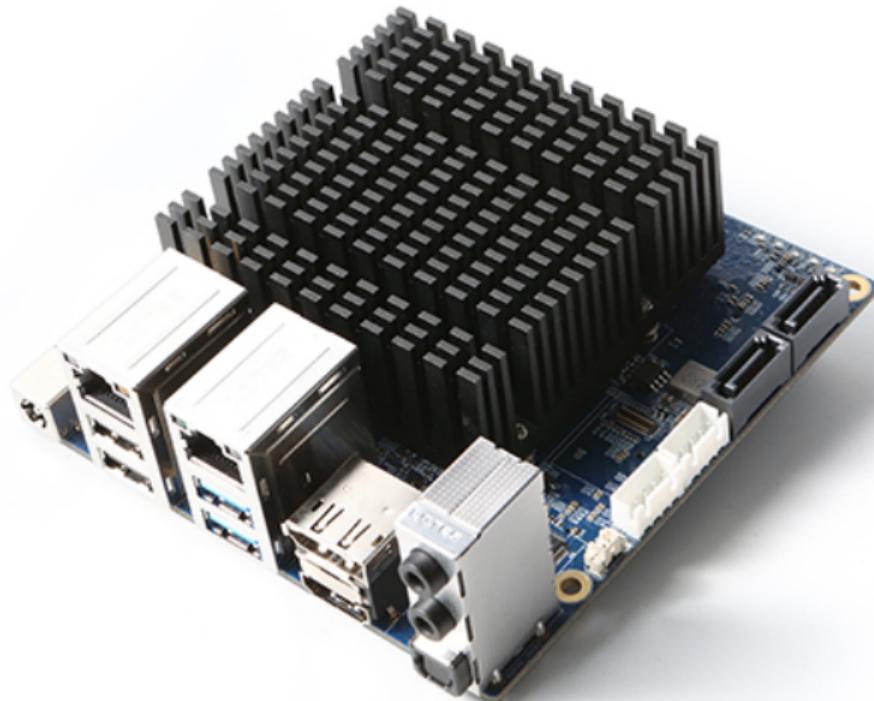
WAP

Adding some Servers



- Odroid H2
- 1Tb NVME; 32G RAM
- Average 10W; peaking at 60W:

Adding some Servers



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- 1Tb NVME; 32G RAM
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Services



h2

DNS
DHCP

LDAP

login

WiFi
MGR

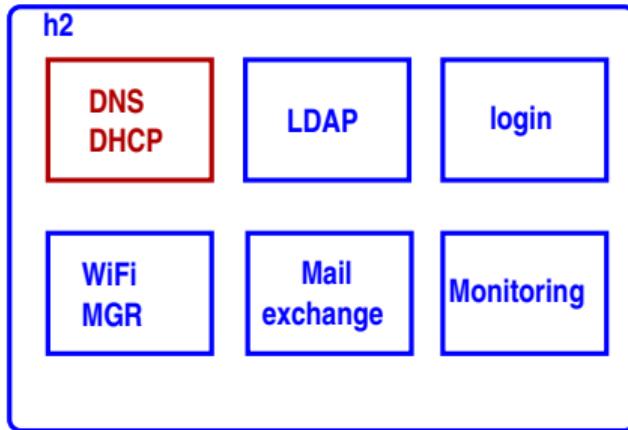
Mail
exchange

Monitoring

Many LXC
containers on the
h2

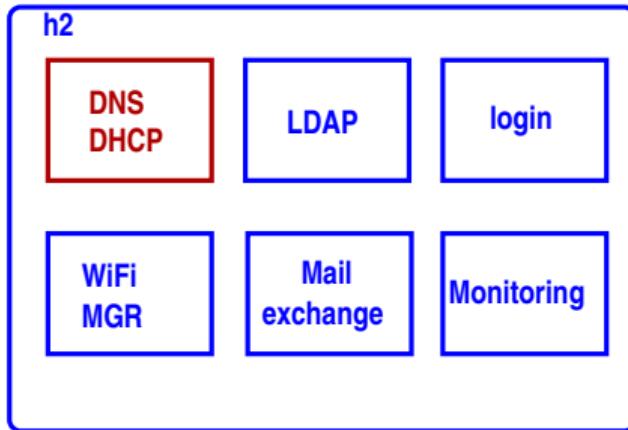
Use libvirt for
management

DNS and DHCP

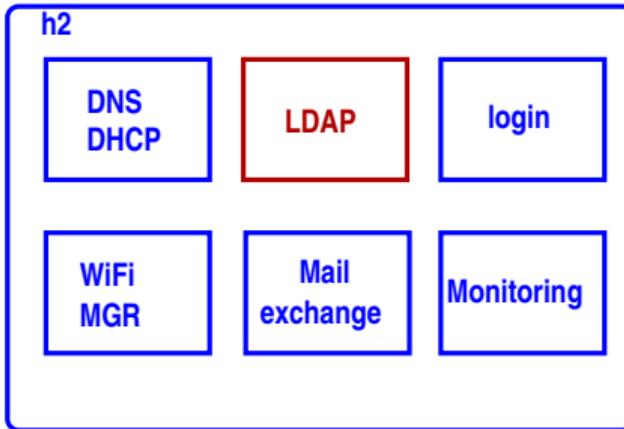


- Currently ISC dhcpcd; need to move to kea
- Trust all devices
- Use hostname from DHCP client
- Update A, AAAA, and PTR records in local DNS

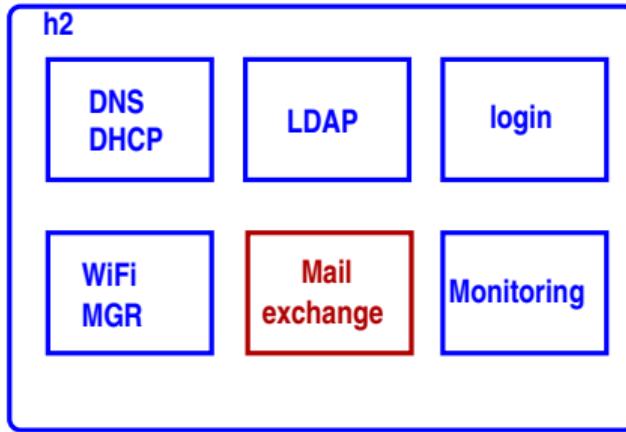
DNS and DHCP



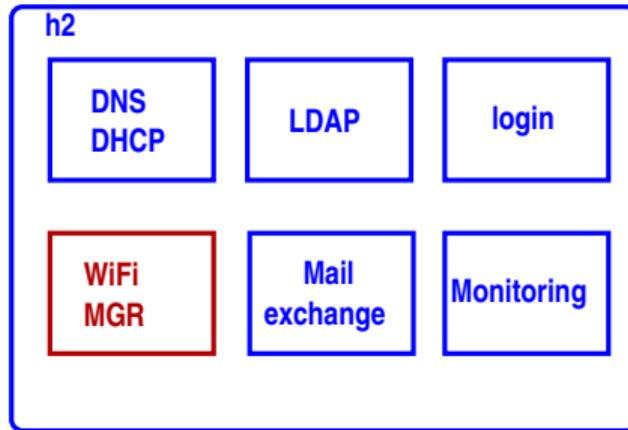
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- Trust all devices
- Use hostname from DHCP client
- Update A, AAAA, and PTR records in local DNS
 - ipv6 — only if not using privacy extensions
 - Script at <https://github.com/wom-bat/sysadmin/blob/main/ddns-ipv6>



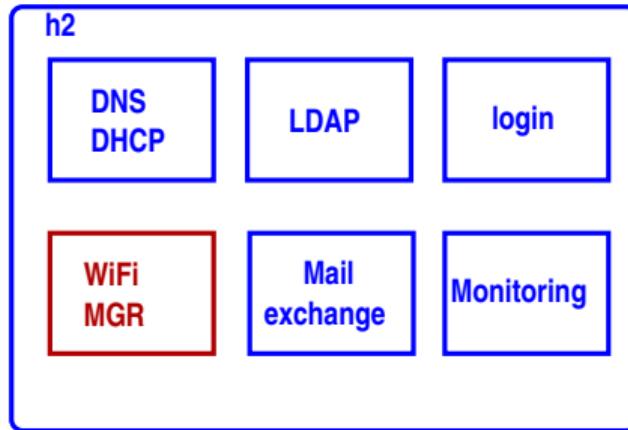
- Openldap
- Provide common login/sudo/ssh keys
- Some IOT devices can authenticate here; most cannot



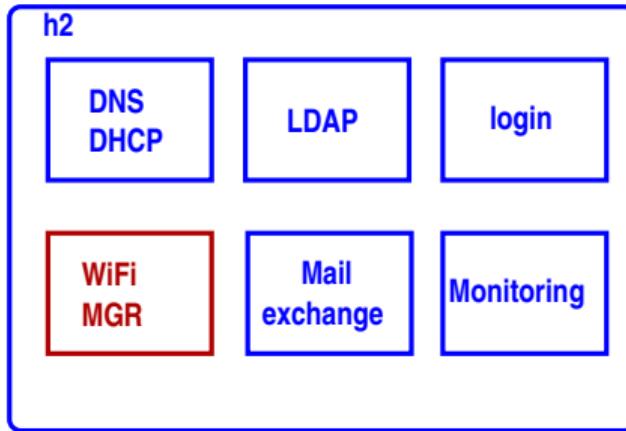
- Dovecot and exim4
- External VPS to act as MX



— WAP management tools

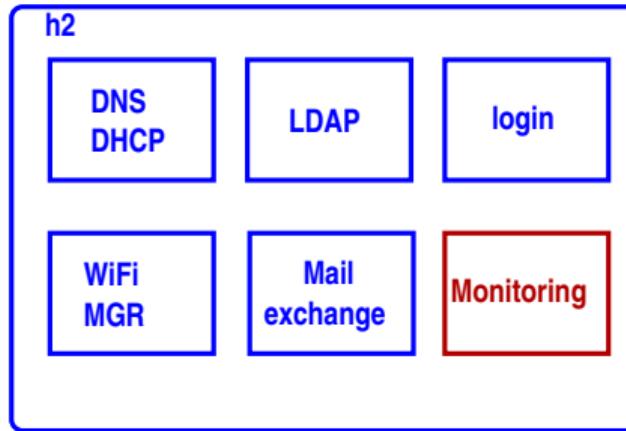


- WAP management tools
- Currently Ubiquiti



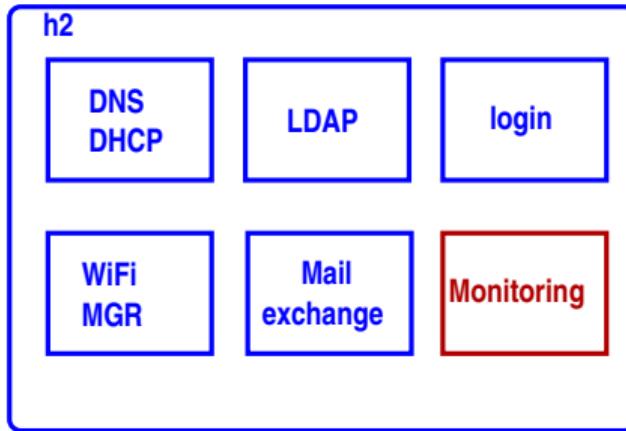
- WAP management tools
- Currently Ubiquiti
- May switch to Mikrotik on next upgrade

Monitoring



— More than one of these

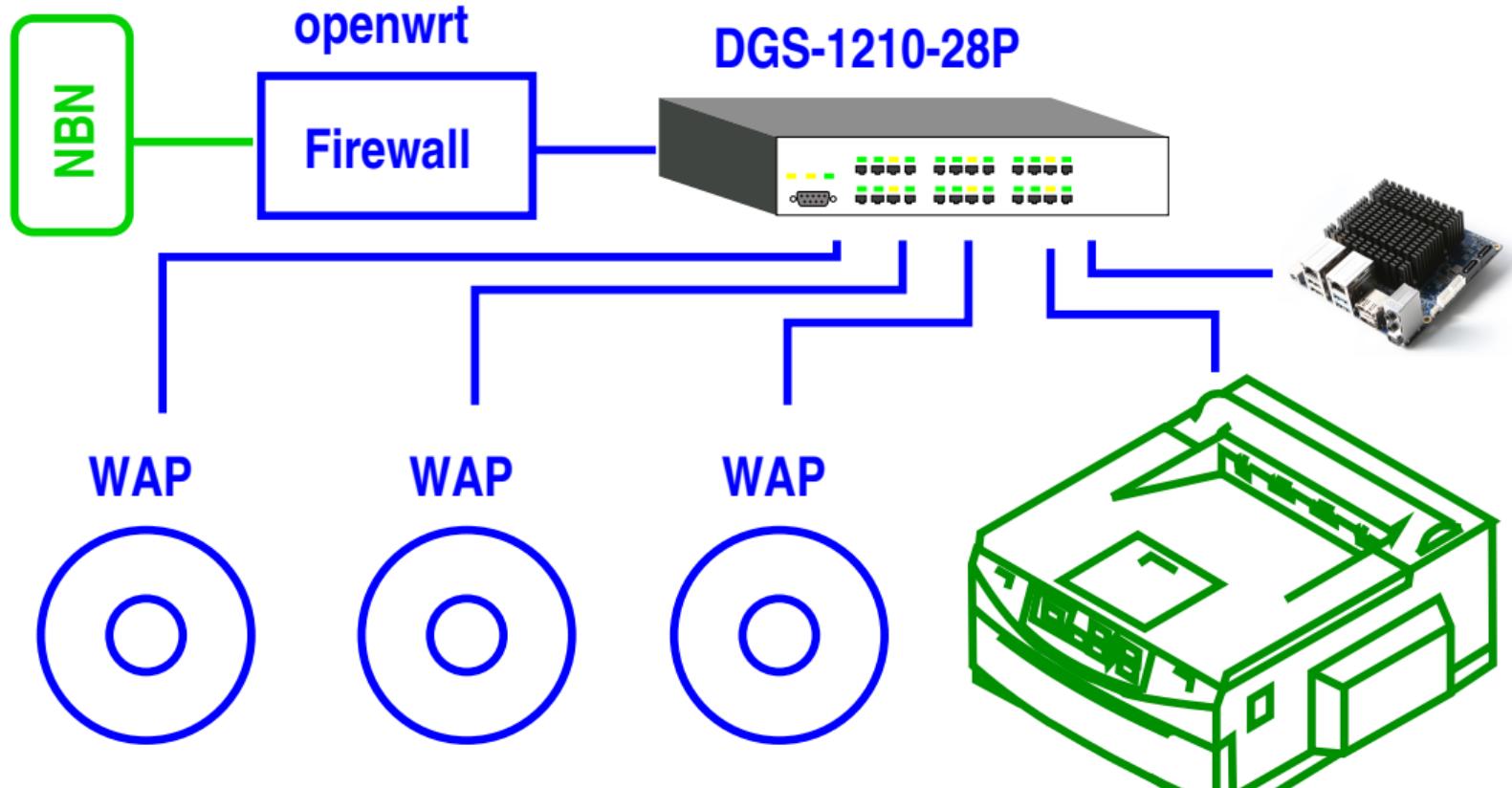
Monitoring



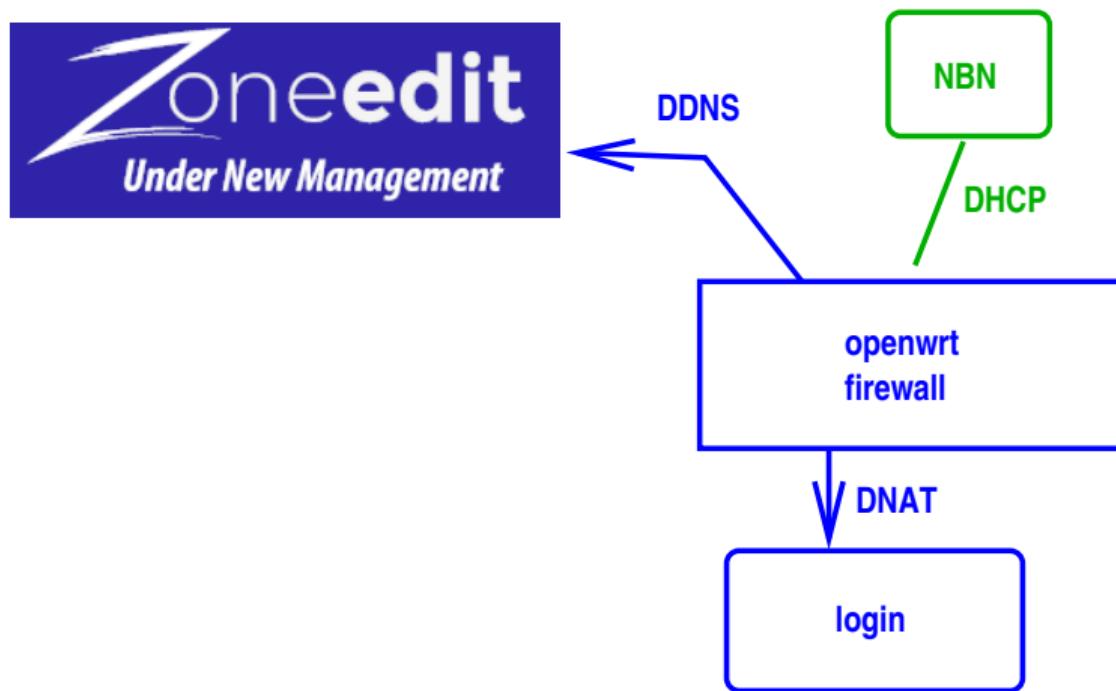
— More than one of these

- Electricity use
- weather station
- ... etc

So far



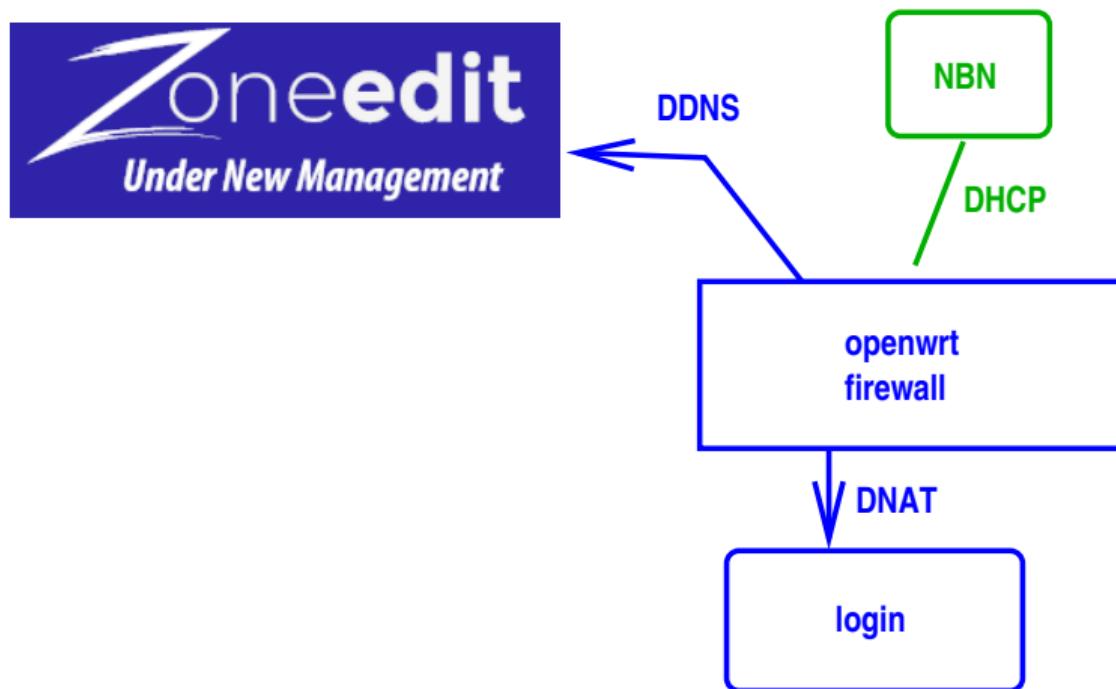
Remote Access



IPv4 only

IPv6 filtered by
FW rules —
can use static
DNS for IPv6

Remote Access

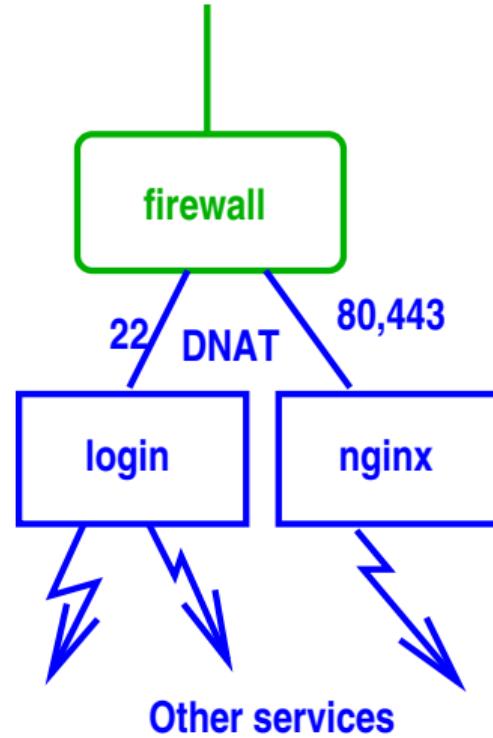


IPv4 only
IPv6 filtered by
FW rules —
can use static
DNS for IPv6
And allow
access to
other services

Remote Access: Security



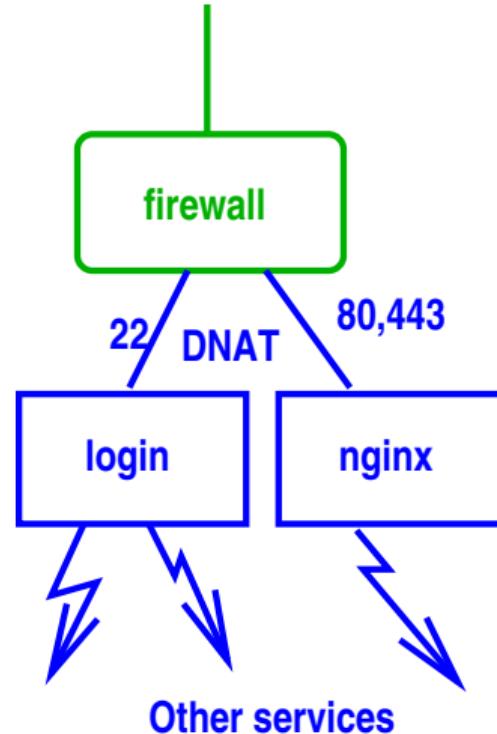
- Disallow ssh passwords from outside



Remote Access: Security



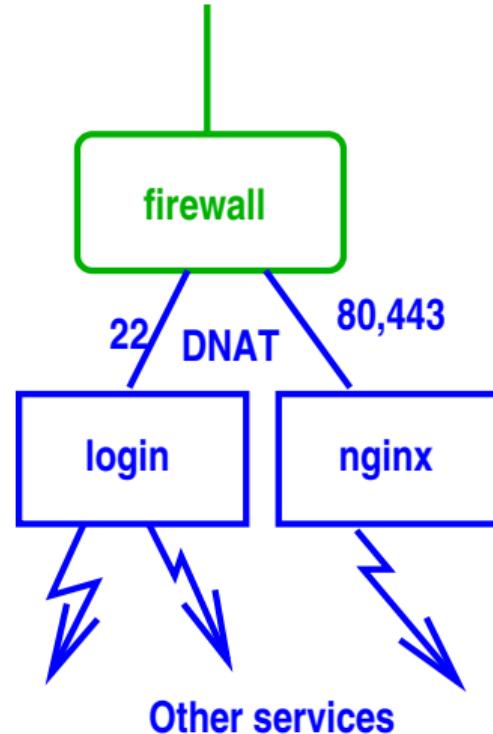
- Disallow ssh passwords from outside
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Remote Access: Security



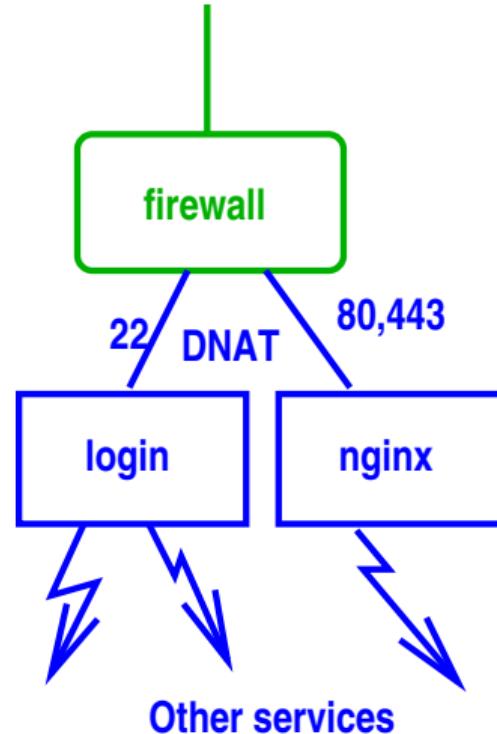
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- Internal services proxied via ssh



Remote Access: Security



- Disallow ssh passwords from outside
- Run `fail2ban` on login
- Internal services proxied via ssh
- or via `nginx` reverse proxy



Home Phone



- When on OPTUS HFC, used their phone service for Aus calls
- mynetfone for international
- Sipura SPA 3000 ATA FXS+FXO

Home Phone



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 - They died a lot

Home Phone



- When on OPTUS HFC, used their phone service for Aus calls
- mynetfone for international
- Sipura SPA 3000 ATA FXS+FXO
 - They died a lot
- Now use OBI110 plus Cazzytel

If you do not have
good backups,
you will be sorry

⁰BSD4.4 user manual

Backup



- Cheap 2nd hand NAS box
- 5x10Tb discs in Raid-6
- LVM and NVME cache
- BTRFS
- 50W, ~30c/day
- rsnapshot and TimeMachine from laptops and h2
- Linux



Image from <https://www.synology.com/img/products/detail/DS1621plus/heading@2x.png>

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- 5x10Tb discs in Raid-6
- LVM and NVME cache
- BTRFS
- 50W, ~30c/day
- rsnapshot and TimeMachine from laptops and h2
- Linux
 - heavily modified userspace



Image from <https://www.synology.com/img/products/detail/DS1621plus/heading@2x.png>

Offsite Backups



- Used to save to DVDs and carry to work



Offsite Backups



- Used to save to DVDs and carry to work
- Now have another cheap NAS at a friend's place.
- Rsnapshot and rsync nightly over IPv6



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- Now have another cheap NAS at a friend's place.
- Rsnapshot and rsync nightly over IPv6
 - Around 7TB backed up; another 30GB nightly
 - Looking to reduce this ...
- `rm -rf .delete_1234` really slow on ext4



Big mistake



Should have installed standard
distro

Big mistake



Should have installed standard
distro

Big mistake



Should have installed standard
distro

Big mistake



Should have installed standard
distro

What else on the Local NAS?



- NFS exported locally:
 - home directories
 - laptop and tablet backups
 - music and video storage
 - photographs
- replica LDAP and DNS/DHCP in VMs
- “cloud” services

Old way



- Lots of LPs for music, then CDs



Old way



- Lots of LPs for music, then CDs
- VHS tapes; then DVDs



Old way



- Lots of LPs for music, then CDs
- VHS tapes; then DVDs
- caldav server for calendars



Old way



- Lots of LPs for music, then CDs
- VHS tapes; then DVDs
- caldav server for calendars
- FTP server for file sharing





Runs on the NAS in a VM

- File sharing (like Dropbox™)
- Calendaring
- Contacts synchronisation
- Serves photographs
- Serves audio and video
- ... and more



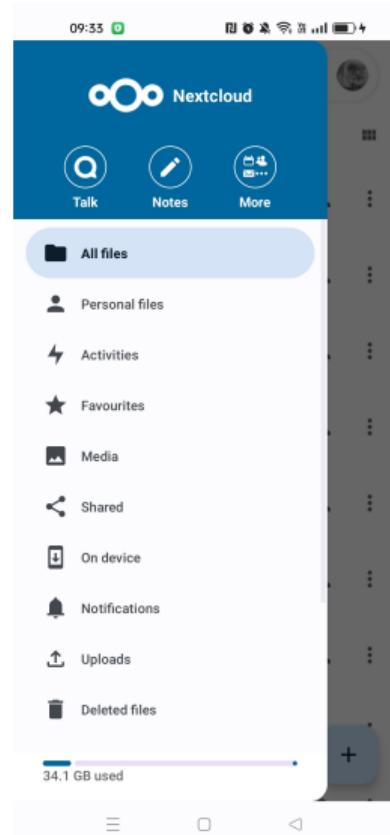
Runs on the NAS in a VM

- File sharing (like Dropbox™)
- Calendaring
- Contacts synchronisation
- Serves photographs — auto upload from phone
- Serves audio and video
- ... and more



Nextcloud

- Other nextcloud users
- HTTPS links
- DAV filesystem
 - local (linux, Windows, MaxOSX, Android) client for sync
 - Useful e.g., for password manager database





Calendaring

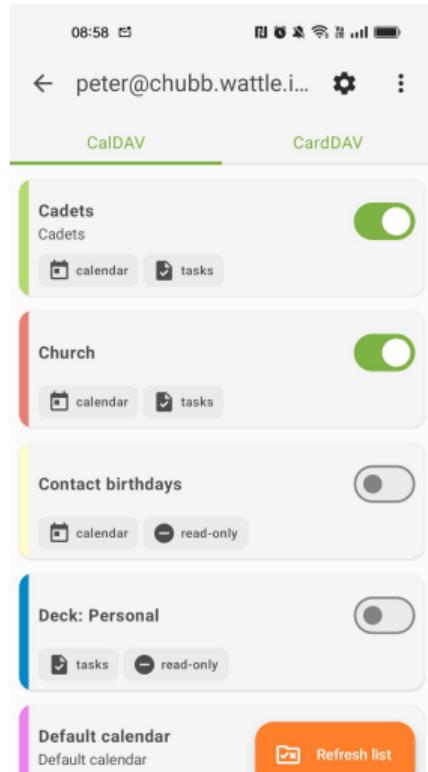
Nextcloud



The screenshot shows the Nextcloud Calendar application interface. The top navigation bar includes File, Edit, View, History, Bookmarks, Tools, and Help. The title bar shows "January 2025 - Calendar". The address bar displays the URL <https://nextcloud.chubb.wattle.id.au/index.php/apps/calendar/dayGridMonth/now>. The sidebar on the left lists "Calendars" with checkboxes for "unsw.edu.au" (checked), "KAOS" (checked), "Cadets" (checked), "Peter" (checked), "Family" (checked), and "Contact birthdays" (unchecked). The main calendar grid for January 2025 shows events for each day. Notable events include "7:30 PM call Ki..." on January 1st, "PayDay UNSW" and "New Year's Day" on January 1st, "Guiding at ANMM" on January 2nd, "Unisuper Peter P..." on January 8th, and "8:00 AM Church" and "1:00 PM St Joh..." on January 12th.

Mon	Tue	Wed	Thu	Fri	Sat	Sun
30	31	1 ● 7:30 PM call Ki... PayDay UNSW New Year's Day	2 Guiding at ANMM	3	4	5 ● 8:00 AM Church ● 1:00 PM St Joh...
6	7 ● 7:30 PM call Ki...	8	9 Guiding at ANMM Unisuper Peter P...	10	11	12 ● 8:00 AM Church

Android Integration



- nextcloud app
 - Files
 - Photo upload
- DAVx
 - Calendar and Contacts
- Both on F-Droid

- ~500GB photos
- ~3TB videos
- ~100G audio recordings
- ~2TB laptop backups (2xMacOSX, 2xLinux)

Data



- ~500GB photos — going back 50 years
- ~3TB videos
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- ~500GB photos — going back 50 years
- ~3TB videos — many self tapes
- ~100G audio recordings
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Is it up?



```
#!/bin/sh
for x in www.chubb.wattle.id.au nextcloud.chubb.wattle.id.au
do
    wget -T 10 -tries 1 -q -O - http://$x/.well-known > /dev/null
    || {
        failures="$failures $x"
    }
done
if [ "$failures" ]
then
    mail -s "$failures down!" peter@chubb.wattle.id.au <<!
$(date)
$(for x in $failures; do wget -T 10 -tries 1 -S -q -O - $x; done)
!
fi
```

Still using multinationals?



- Can't get entirely away:
 - Zoneedit for DNS services

Still using multinationals?



- Can't get entirely away:
 - Zoneedit for DNS services
 - Google for Android Play Store (try to use F-Droid instead)

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 - Facebook, LinkedIn for social interactions

Still using multinationals?



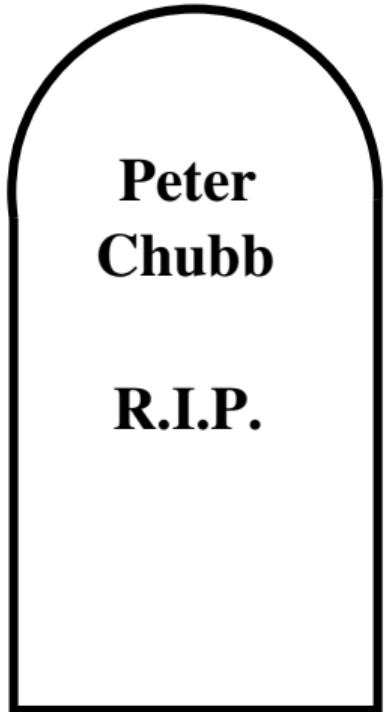
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 - Github for code

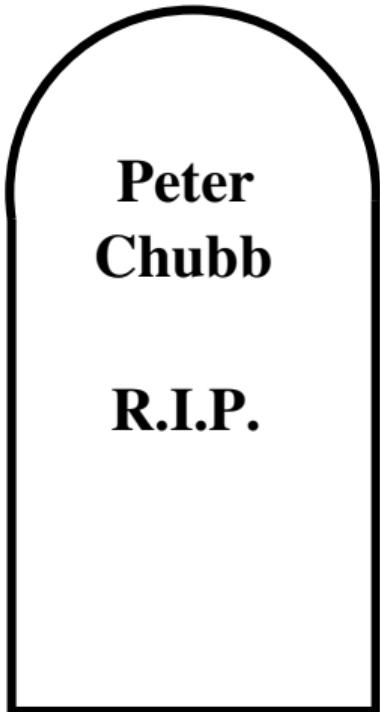
Still using multinationals?



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 - Facebook, LinkedIn for social interactions
 - Github for code
 - PayPal for payments

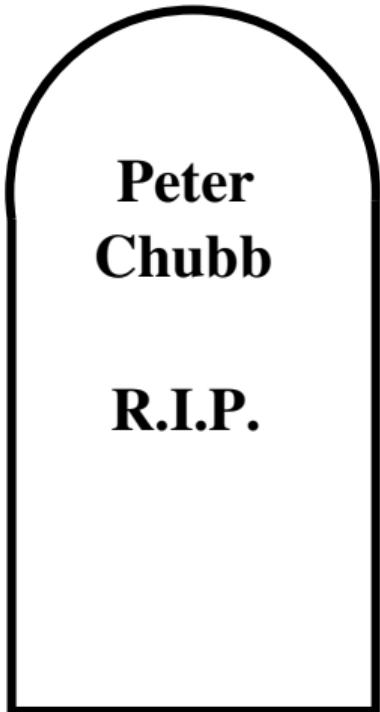
Legacy



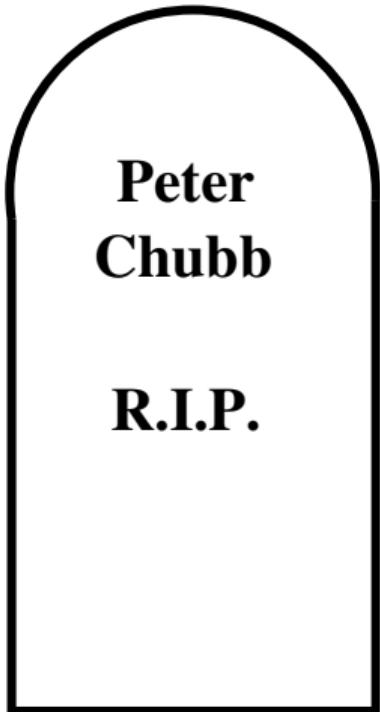


— *Good docs essential*

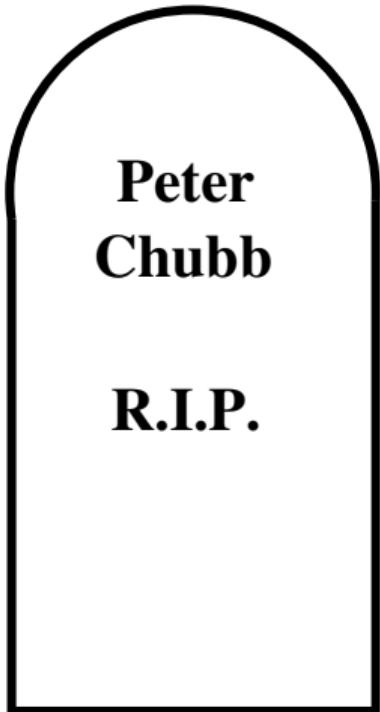
Legacy



- ***Good docs essential***
- assign a *technical heir* or two



- ***Good docs essential***
- assign a *technical heir* or two
- Make all credentials for access available to tech heir (perhaps in sealed envelope!)



- ***Good docs essential***
- assign a *technical heir* or two
- Make all credentials for access available to tech heir (perhaps in sealed envelope!)
- Teach sysadmin early!

Documentation



PLEZ RING IF AN RNSR IS REQID

*PLEZ CNOKE IF AN RNSR IS NOT
REQID.*

A. A. Milne, *Winnie the Pooh*



Documentation



— Not for you!



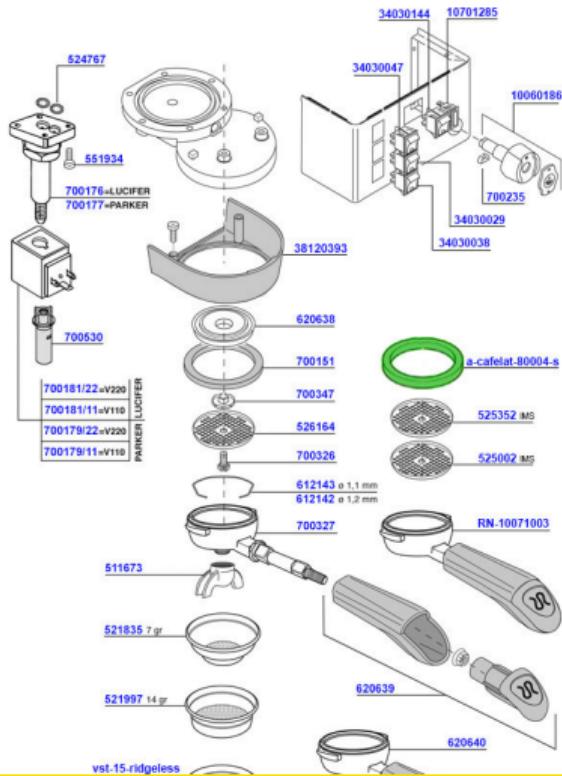
Documentation



- Not for you!
- For your technical heirs
- who will need it while not in the best mental state.



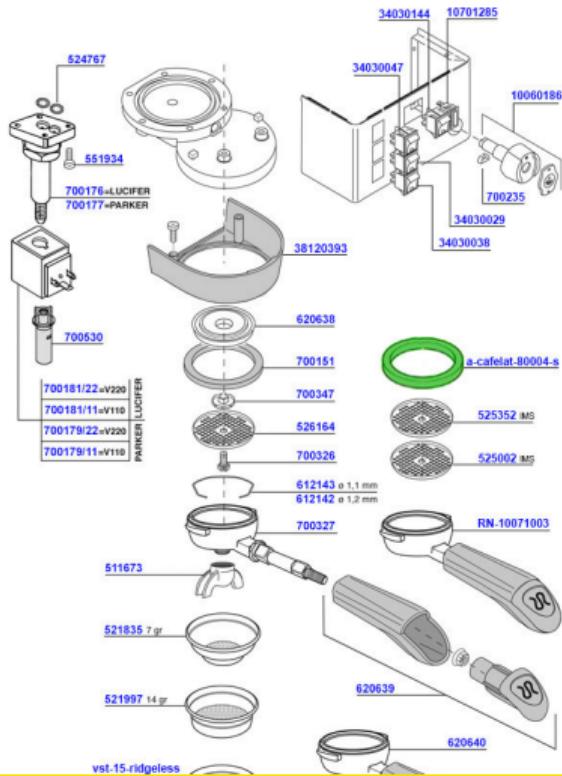
Documentation



— Two kinds:

1. Overall structure
2. Task specific

Documentation



— Two kinds:

1. Overall structure — What are all the moving parts?
2. Task specific

Documentation



— Two kinds:

1. Overall structure — What are all the moving parts?
2. Task specific — how to do xxx

Documentation



- Two kinds:
 1. Overall structure — What are all the moving parts?
 2. Task specific — how to do xxx
- Plus paper doc pointing at online resource

Documentation



- Two kinds:
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 - stored somewhere obvious

Documentation



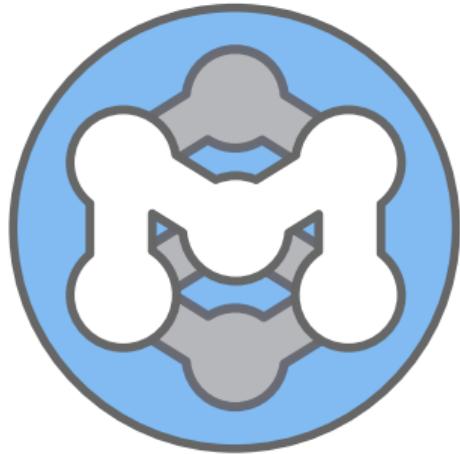
- Two kinds:
 1. Overall structure — What are all the moving parts?
 2. Task specific — how to do xxx
- Plus paper doc pointing at online resource
 - stored somewhere obvious
 - including how to boot system and access docs

Documentation



- Two kinds:
 1. Overall structure — What are all the moving parts?
 2. Task specific — how to do xxx
- Plus paper doc pointing at online resource
 - stored somewhere obvious
 - including how to boot system and access docs
 - Possibly from Backup

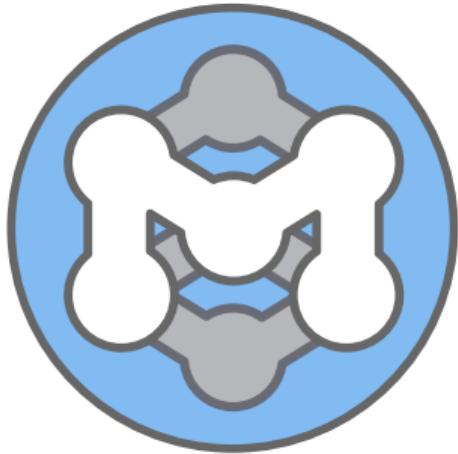
Documentation



I use a wiki.

I *try* to keep it up to date

Key pages printed out near the computers



I use a wiki.

I *try* to keep it up to date

Key pages printed out near the computers

Test it from time to time

**Peter
Chubb**

R.I.P.

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- External services (DNS, hosting, etc) all differ

Peter
Chubb

R.I.P.

- Open source licences can be bequeathed!
 - Most other licences are ***non-transferable***
- Mention digital assets in your will
- External services (DNS, hosting, etc) all differ
- Consider domain names and websites too
 - `chubb.wattle.id.au` can go to another Chubb

Legacy: Cloud services



**Peter
Chubb**
R.I.P.

- Google *Inactive Account Manager*
- Facebook *Memorialisation* under 'Personal Details'
- Github *successor settings* under 'Account'
- Paypal and LinkedIn: Manual process
- Amazon: rights expire with you

Legacy: Cloud services



**Peter
Chubb**

R.I.P.

— Make a list of services

Legacy: Cloud services



**Peter
Chubb**
R.I.P.

- Make a list of services
- Make sure your heirs know where the list is

**Peter
Chubb**
R.I.P.

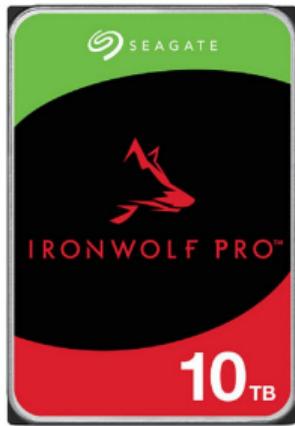
- Make a list of services
- Make sure your heirs know where the list is
- And how to access the services

In summary



- Nextcloud can do most of the heavy lifting

In summary

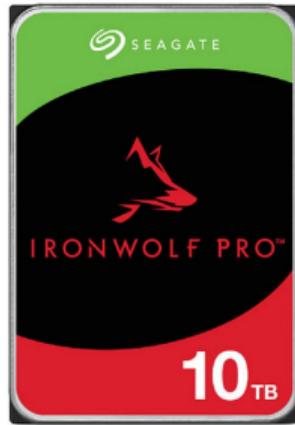


- Nextcloud can do most of the heavy lifting
- Discs are (relatively) cheap

In summary



Nextcloud

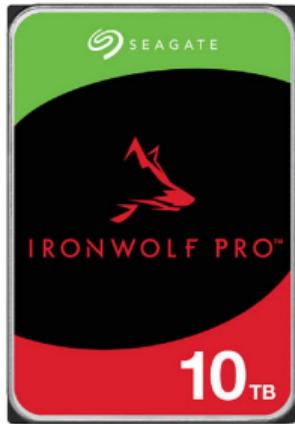


- Nextcloud can do most of the heavy lifting
- Discs are (relatively) cheap
- **backup** essential

In summary



Nextcloud



- Nextcloud can do most of the heavy lifting
- Discs are (relatively) cheap
- **backup** essential
- Consider what happens when you're no longer around.

