



School of Computer Science & Engineering
Trustworthy Systems Group

My Home Network

(Reducing Reliance on Multinationals)

Peter Chubb

`peter.chubb@unsw.edu.au`

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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- Printing
- Home phone (maybe)
- Messaging and Email

What do you need?



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- File sharing

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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**

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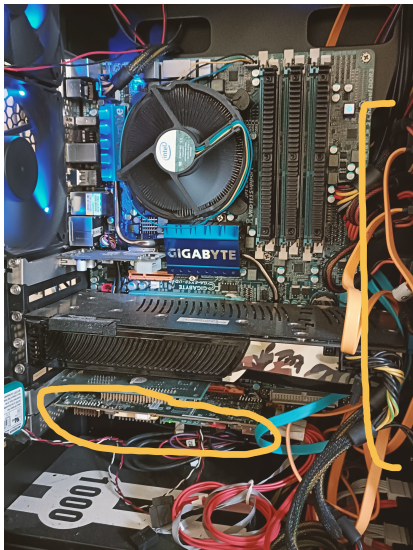
- Serial is king!
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- **No internet**
- Modded Amiga 500 plus Matt Dillon's dnet
- Backup to floppy
- My hard disc was 40MB !!!

In 1990s



- Three “big” (Pentium) machines

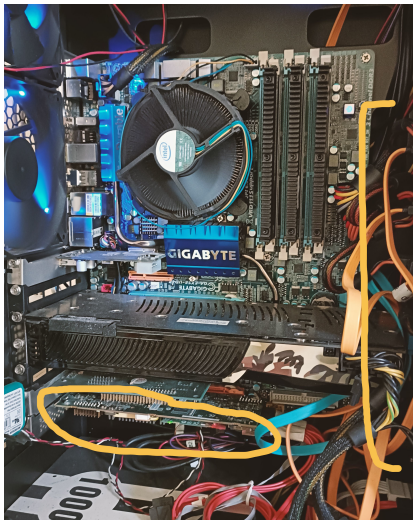
In 1990s



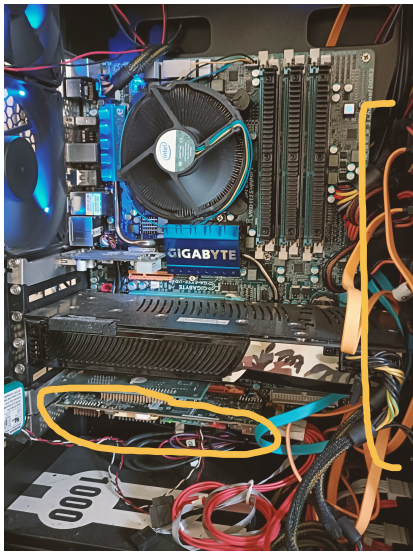
- Three “big” (Pentium) machines
 - Lots of disc
 - Lots of RAM
 - >\$1/day to run each

In 1990s

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

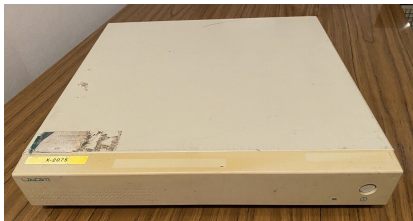


In 1990s

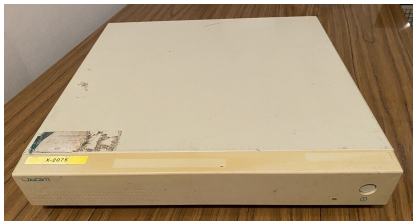


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- Plus *crash* and *burn* machines for development

In 1990s



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- Labtam X terminals for display on thin ethernet



- Three “big” (Pentium) machines
- 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

- *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

- *Almost* static IP address
- `chubb.wattle.id.au` domain name
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Early HFC days



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- `chubb.wattle.id.au` domain name
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- Outwards email relayed via OPTUS
- `fetchmail` injected OPTUS email into my systems
- 100Mb twisted pair ethernet plus thinnet bridge for XTerminal etc
- Got my first Laptop!

Today



— WiFi is king!



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

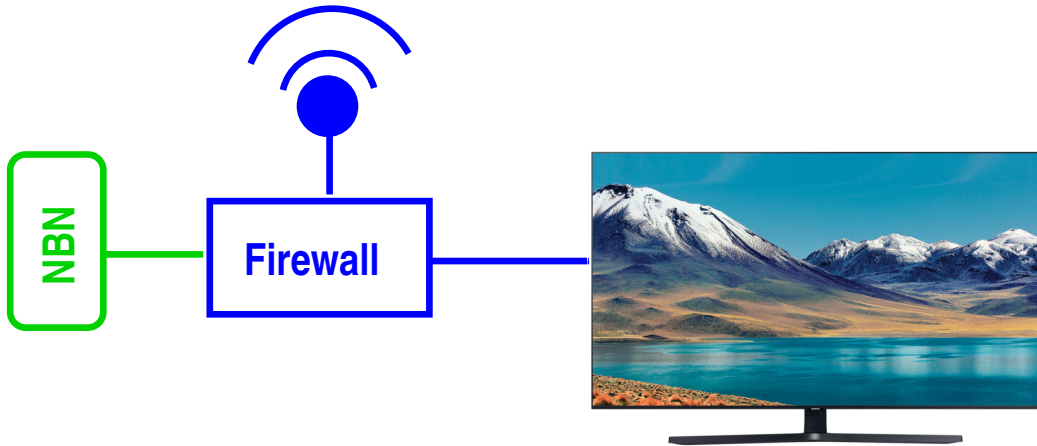


- WiFi is king!
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 - Makes it easy to use cloud services



- 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

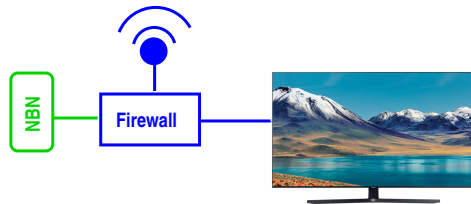


⁰Picture from Samsung marketing material

Other people's setups



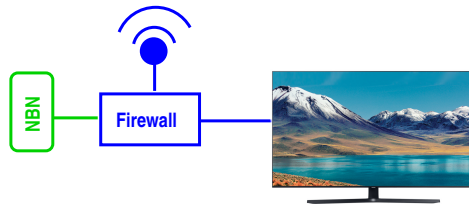
- One WiFi Access point
- Backup to cloud: Onedrive™, iCloud™, Google drive™, iDrive™, etc ...
- File sharing via Dropbox
- Media from Apple Music, Youtube, Play Music etc
- Email from Google or Microsoft
- Home automation using Amazon or Google or Insteon or iHome or ...



Other people's setups



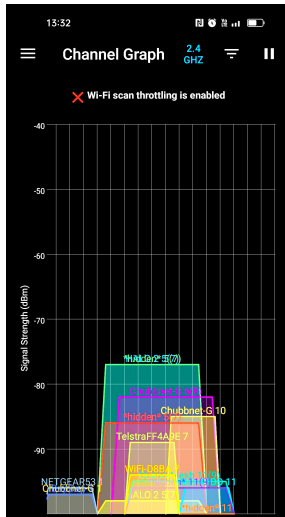
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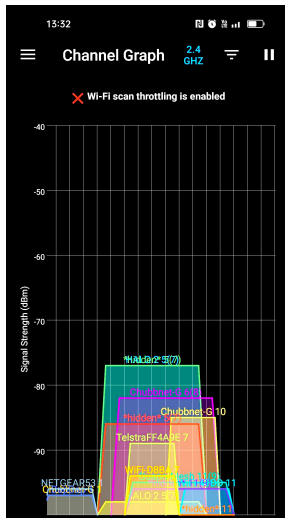
Scrounge



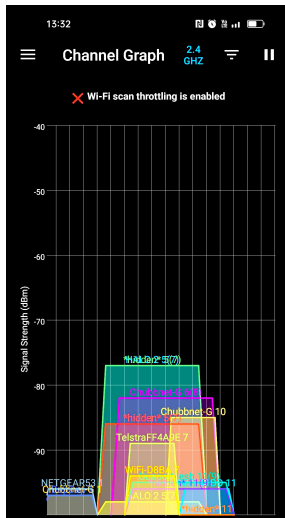
WiFi at Home



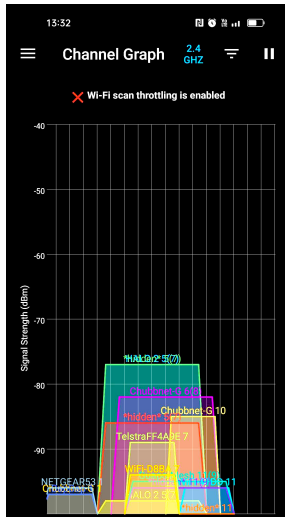
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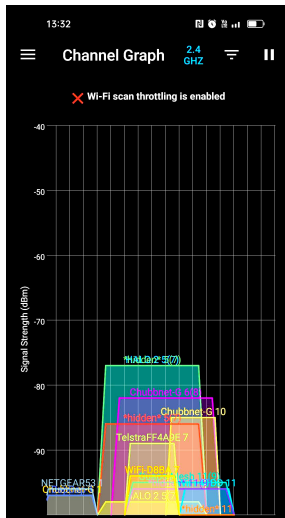
- too many neighbours
- Need 2.4GHz for IoT
- Use 5Ghz for laptops/phones/tablets



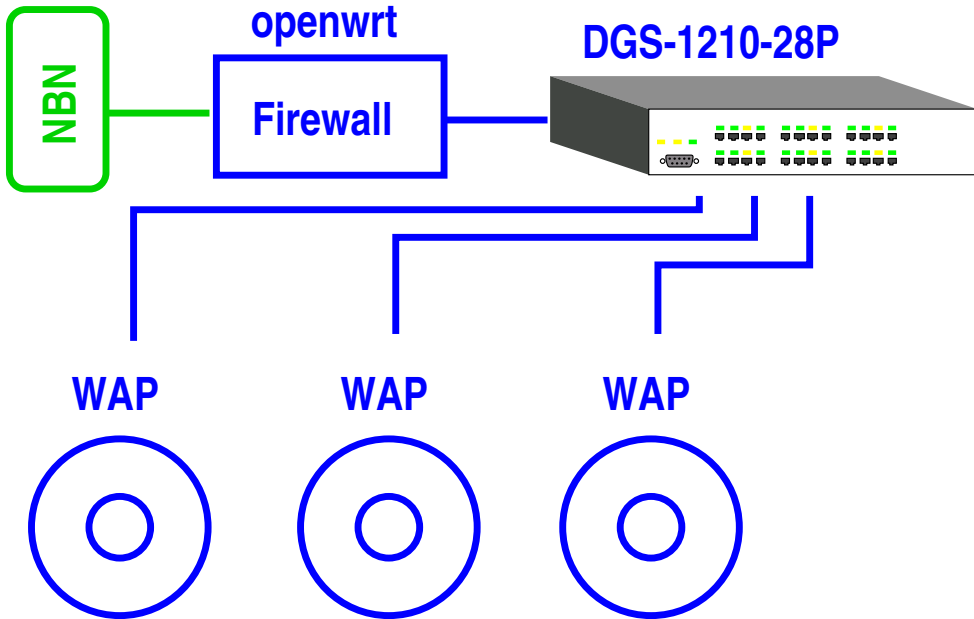
- too many neighbours
- Need 2.4GHz for IoT
- Use 5Ghz for laptops/phones/tablets
 - 5GHz doesn't penetrate brick very well



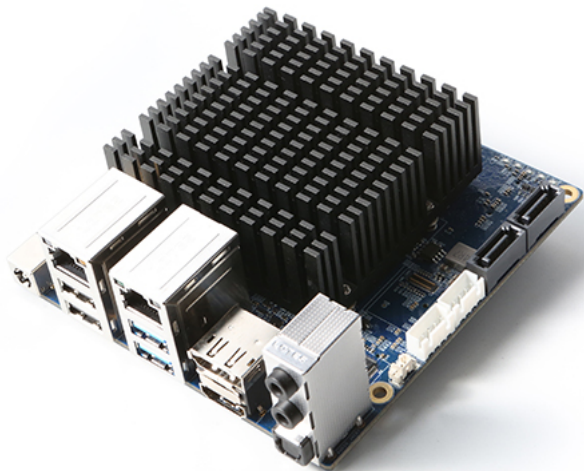
- three low powered POE access points
- Cheap 2nd hand PoE Gigabit switch



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

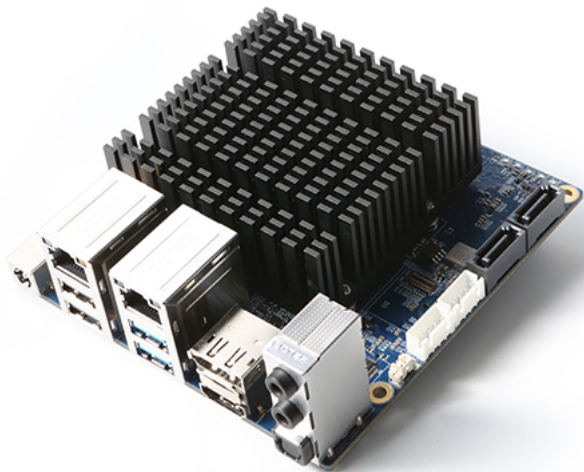


Adding some Servers

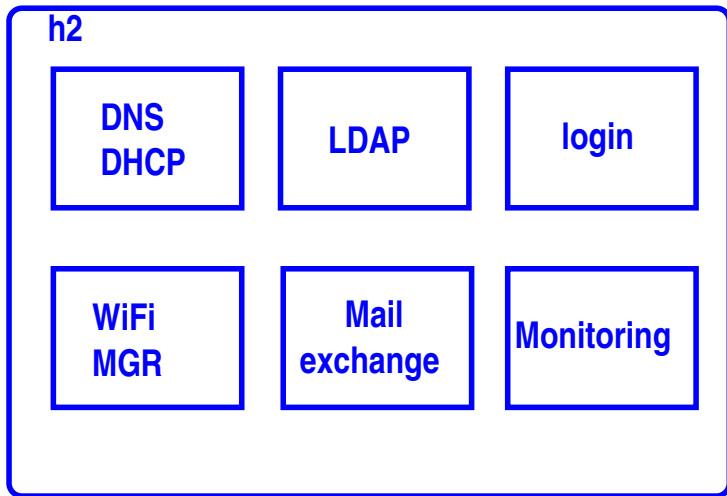


- Odroid H2
- 1Tb NVME; 32G RAM
- Average 10W; peaking at 60W:

Adding some Servers

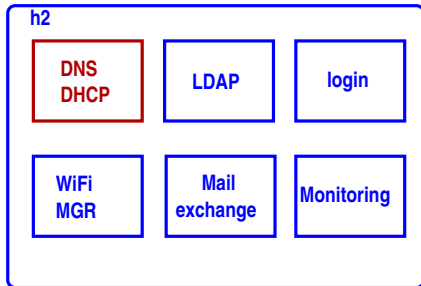


- Odroid H2
- 1Tb NVME; 32G RAM
- Average 10W; peaking at 60W: <25c/day

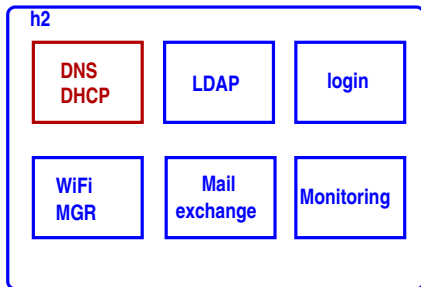


Many LXC
containers on the
h2

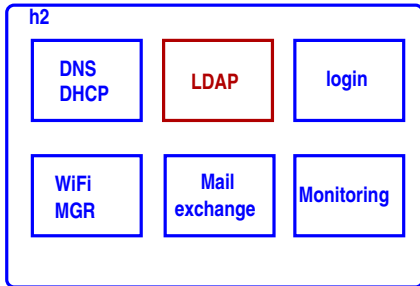
Use `libvirt` for
management



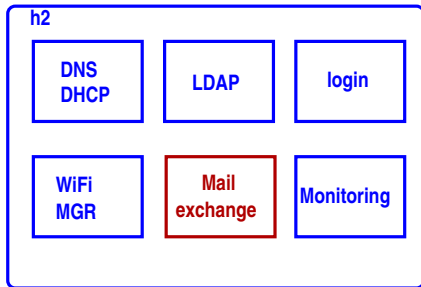
- Currently ISC dhcpd; need to move to kea
- Trust all devices
- Use hostname from DHCP client
- Update A, AAAA, and PTR records in local DNS



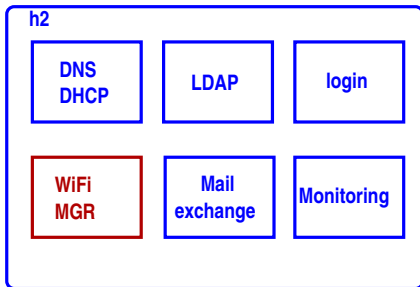
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- Update A, AAAA, and PTR records in local DNS
 - ipv6 — only if not using privacy extensions
 - Script at <https://github.com/wom-bat/sysadmin/blob/main/ddns-ipv6>



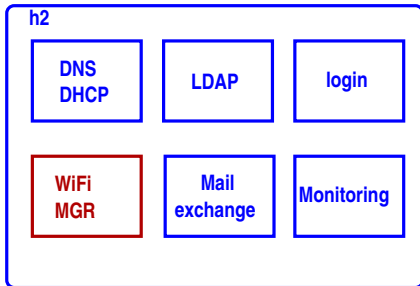
- Openldap
- Provide common login/sudo/ssh keys
- Some IOT devices can authenticate here; most cannot



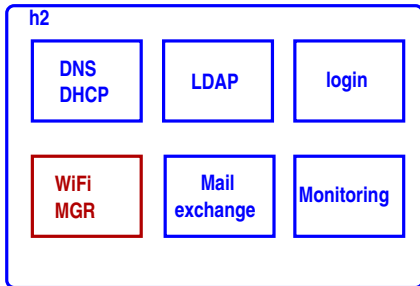
- Dovecot and exim4
- External VPS to act as MX



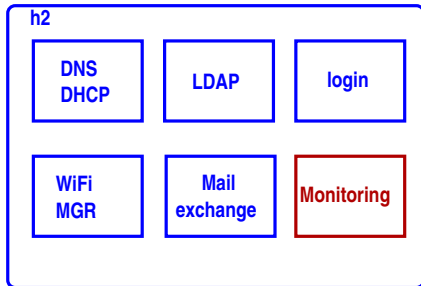
— WAP management tools



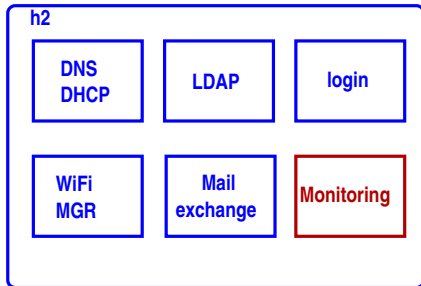
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- Currently Ubiquiti



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



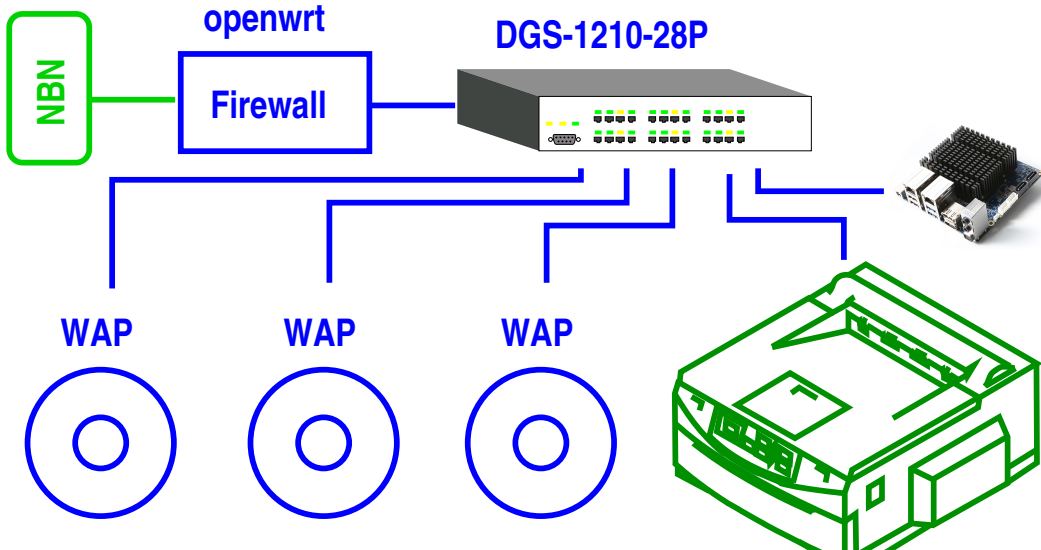
— More than one of these



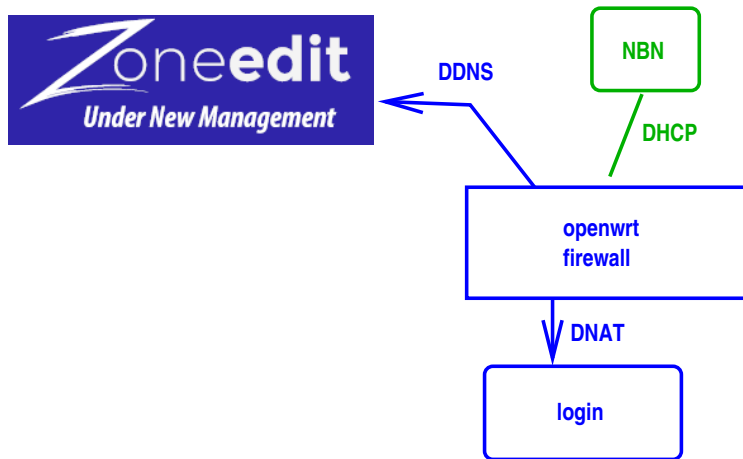
— More than one of these

- Electricity use
- weather station
- ... etc

So far



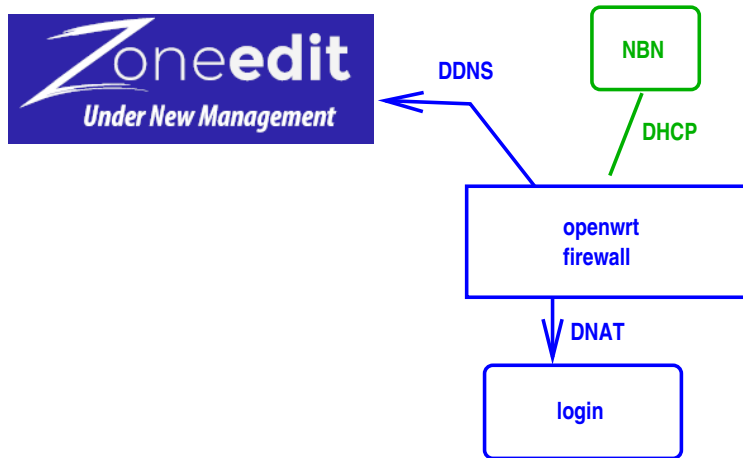
Remote Access



IPv4 only

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

Remote Access



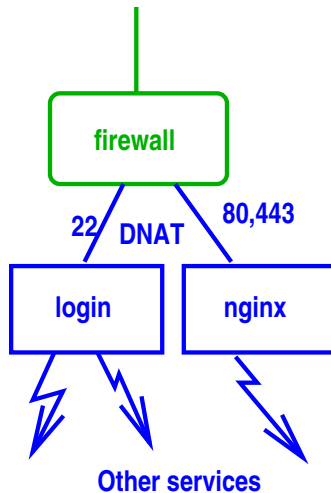
IPv4 only

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

Remote Access: Security



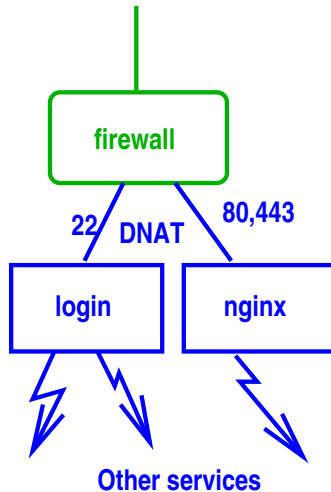
- Disallow ssh passwords from outside



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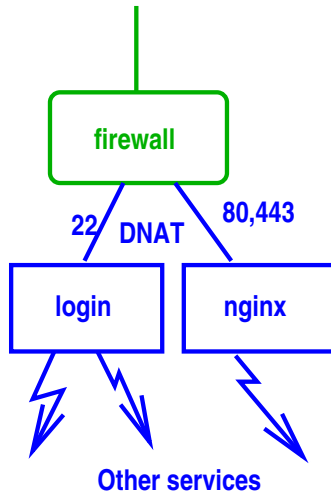
- Disallow ssh passwords from outside
- Run `fail2ban` on `login`



Remote Access: Security



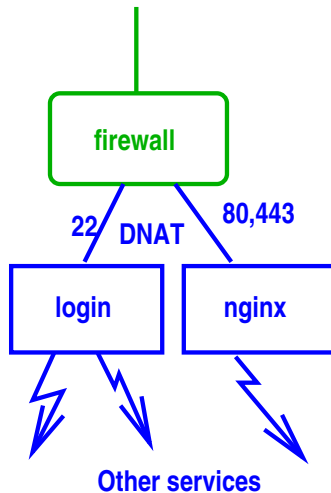
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- Internal services proxied via ssh



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



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



- 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 Crazytel

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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- LVM and NVME cache
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- 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



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- Now have another cheap NAS at a friend's place.
- Rsnapshot and rsync nightly over IPv6



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Offsite Backups



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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



CentOS



debian

Should have installed standard
distro

Big mistake



CentOS



debian



archlinux

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

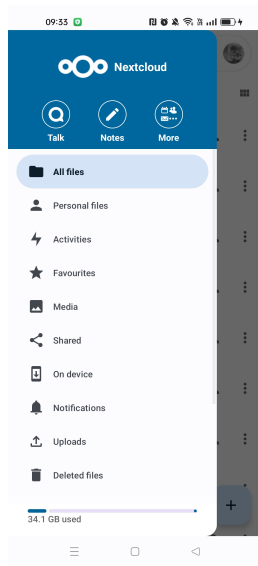
- File sharing (like Dropbox™)
- Calendaring
- Contacts synchronisation
- Serves photographs — auto upload from phone
- Serves audio and video
- ...and more



File Sharing

Nextcloud

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





Calendaring

Nextcloud



File Edit View History Bookmarks Tools Help

January 2025 - Calendar - 1x

https://nextcloud.chubb.wattle.id.au/index.php/apps/calendar/dayGridMonth/now

Guardian stage TS Nextcloud FB

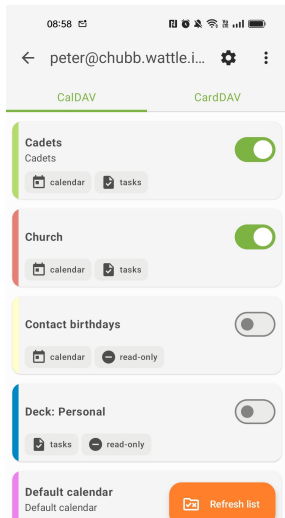
January 2025

+ Event Today

Calendars

- unsw.edu.au
- KAOS
- Cadets
- Peter
- Family
- Contact birthdays

Mon	Tue	Wed	Thu	Fri	Sat	Sun
30	31 7:30 PM call Ki...	1 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



- 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)

- ~500GB photos — going back 50 years
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- ~500GB photos — going back 50 years
- ~3TB videos — many self tapes
- ~100G audio recordings
- ~2TB laptop backups (2xMacOSX, 2xLinux)

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)

Still using multinationals?



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Still using multinationals?



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 - Github for code

Still using multinationals?

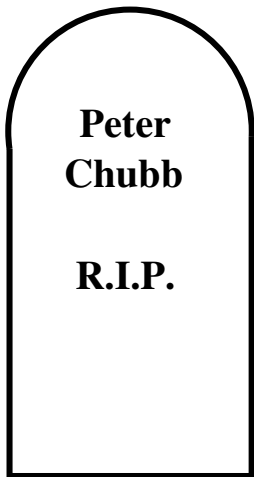


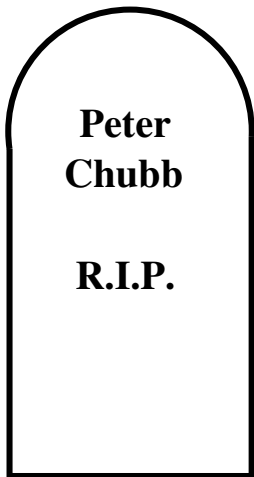
- Can't get entirely away:
 - Zoneedit for DNS services
 - Google for Android Play Store (try to use F-Droid instead)
 - Facebook, LinkedIn for social interactions
 - Github for code
 - PayPal for payments

**Peter
Chubb**

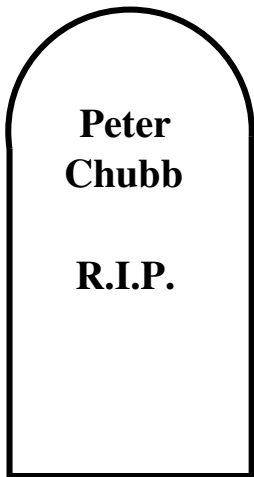
R.I.P.

— *Good docs essential*

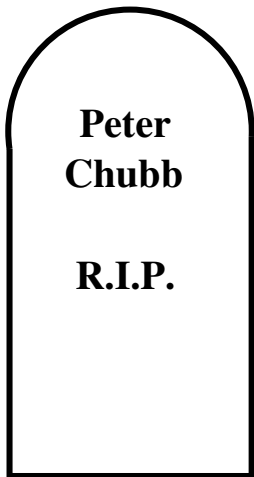




- ***Good docs essential***
- assign a *technical heir* or two



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- 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!

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!

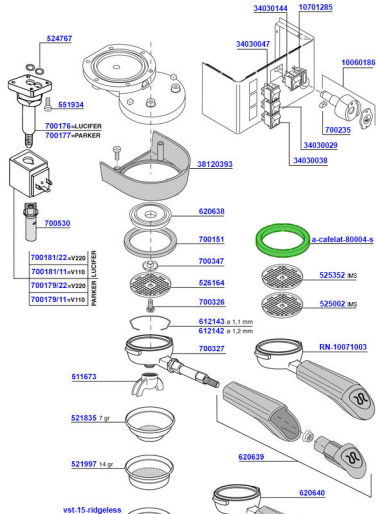


Documentation

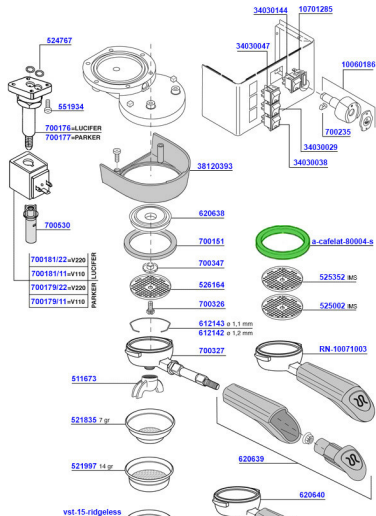
- Not for you!
- For your technical heirs
- who will need it while not in the best mental state.



- Two kinds:
 1. Overall structure
 2. Task specific



- Two kinds:
 1. Overall structure — What are all the moving parts?
 2. Task specific





— Two kinds:

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



- 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



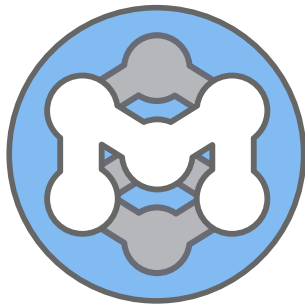
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- Two kinds:
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 2. Task specific — how to do xxx
- Plus paper doc pointing at online resource
 - stored somewhere obvious
 - including how to boot system and access docs



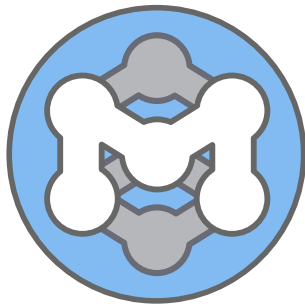
- Two kinds:
 1. Overall structure — What are all the moving parts?
 2. Task specific — how to do xxx
- Plus paper doc pointing at online resource
 - stored somewhere obvious
 - including how to boot system and access docs
 - Possibly from Backup



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

- Open source licences can be bequeathed!

A simple black line drawing of a gravestone with a rounded top and a rectangular base.

**Peter
Chubb**

R.I.P.

A simple black line drawing of a gravestone with a rounded top and a rectangular base.

**Peter
Chubb**

R.I.P.

- Open source licences can be bequeathed!
 - Most other licences are ***non-transferable***

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- Mention digital assets in your will
- External services (DNS, hosting, etc) all differ

A simple black line drawing of a gravestone with an arched top.

**Peter
Chubb**

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- External services (DNS, hosting, etc) all differ
- Consider domain names and websites too
 - `chubb.wattle.id.au` can go to another Chubb

A simple black line drawing of a gravestone with a rounded top and a vertical base.

**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

**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



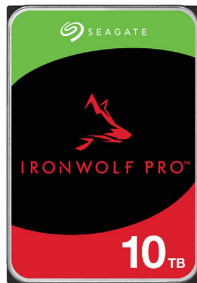
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In summary



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

