Managing campus networks

Inventory / Labels / Network diagrams & documentation / Configuration management/ Knowledge Base / Monitoring

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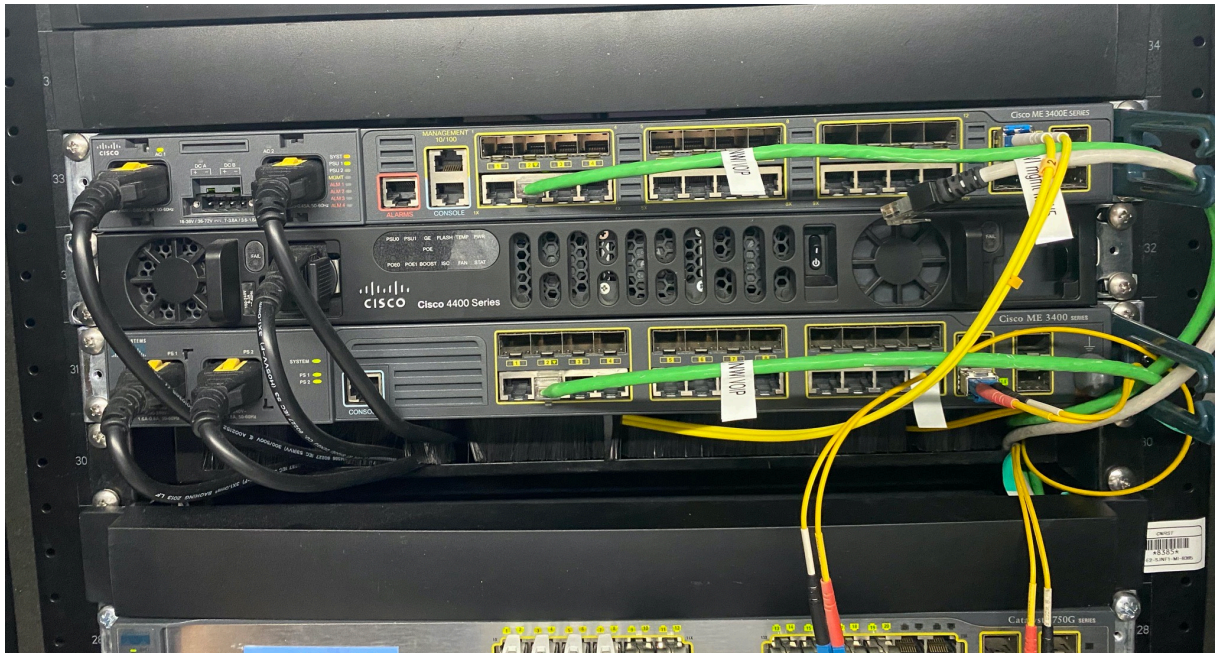
Inventory

IT asset management

- Keep tab on all hardware & software, licenses, and support / maintenance contracts on your IT infrastructure in a single place
- Proper inventory helps track the lifecycle of your assets
- A spreadsheet can be enough for small infrastructures
- Inventory Management System (IMS) recommended for most cases
- Can include IT and non-IT assets

What to inventory

- Hardware & software assets: servers, routers, switches, access points, software like CRM, ERP…
- Related info: warranty, license, support contract & POC, maintenance contract, expected EoL
- Usage and location: where is it currently deployed
- Regular self-audits to make sure inventory is up-to-date



Cable & Equipment labeling

Equipment labeling

- For small datacenters, equipment labels can be as simple as a DNS or reverse DNS name or any other unique designation for the device
- In larger datacenters, barcode/RFID tags are commonly used. They can be scanned to track assets and are usually an integral part of the Inventory Management System

Cable labeling

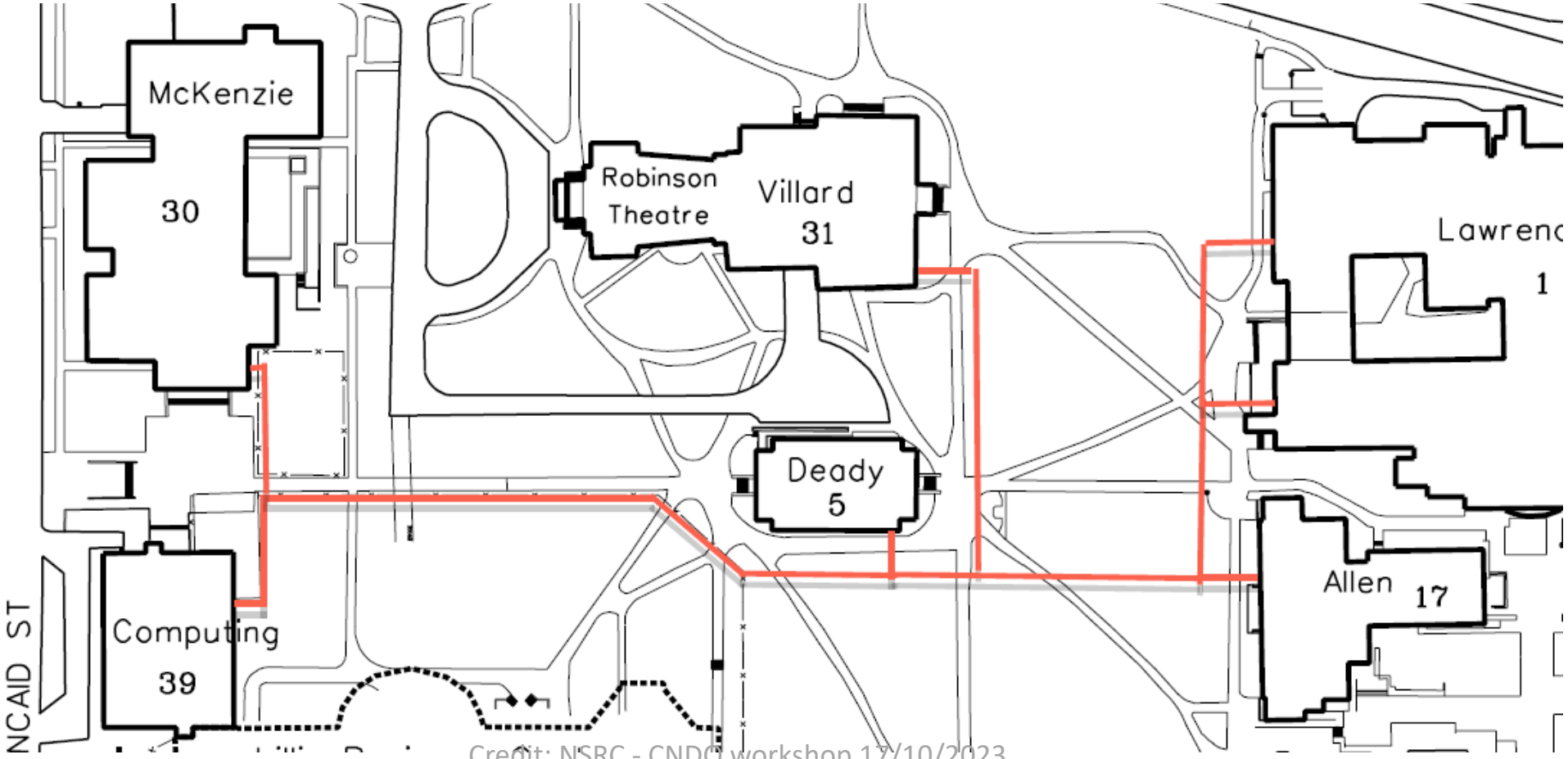
- Labeling done during installation
- Labels on both ends of the cable
- Updating labels when topology changes

Underground cables

- Labeling underground cables right after after pulling from conduit (serial numbers in addition to names)

Underground cable map

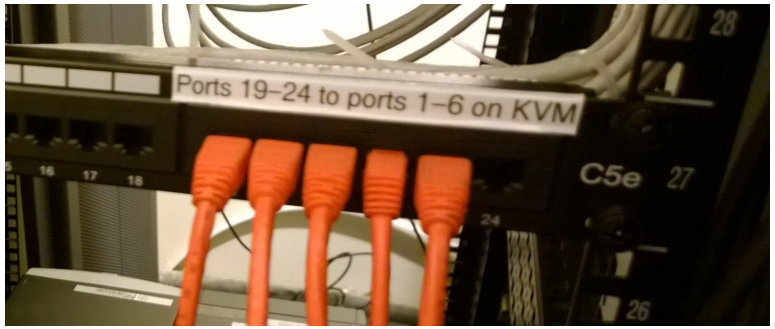
Underground conduits/cables map helps during maintenance



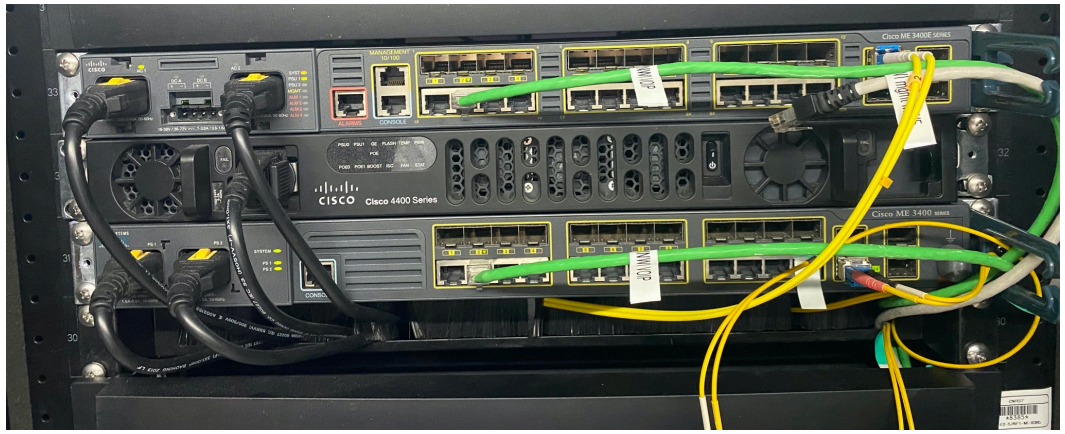
Credit: NSRC - CNDO workshop 17/10/2023

Datacenter cables

- Labeling UTP ends & patch panels during installation



- Labeling cables connecting routers/servers/switches during installation



Cable labeling standards

- For large deployments, use of a standard is highly encouraged
- Example: SUI1-FLH-0A:AC02-32:03 / AGD1-ING-1B:AD03-47:26

SUI1: University Mohammed V Suissi 1 campus

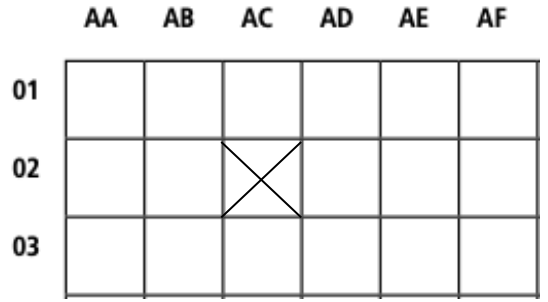
FLH: Faculty of Literature and Humanities Building

0A = Floor 0, Space A

:AC02 = Coordinates of the rack on the datacenter (figure on the right)

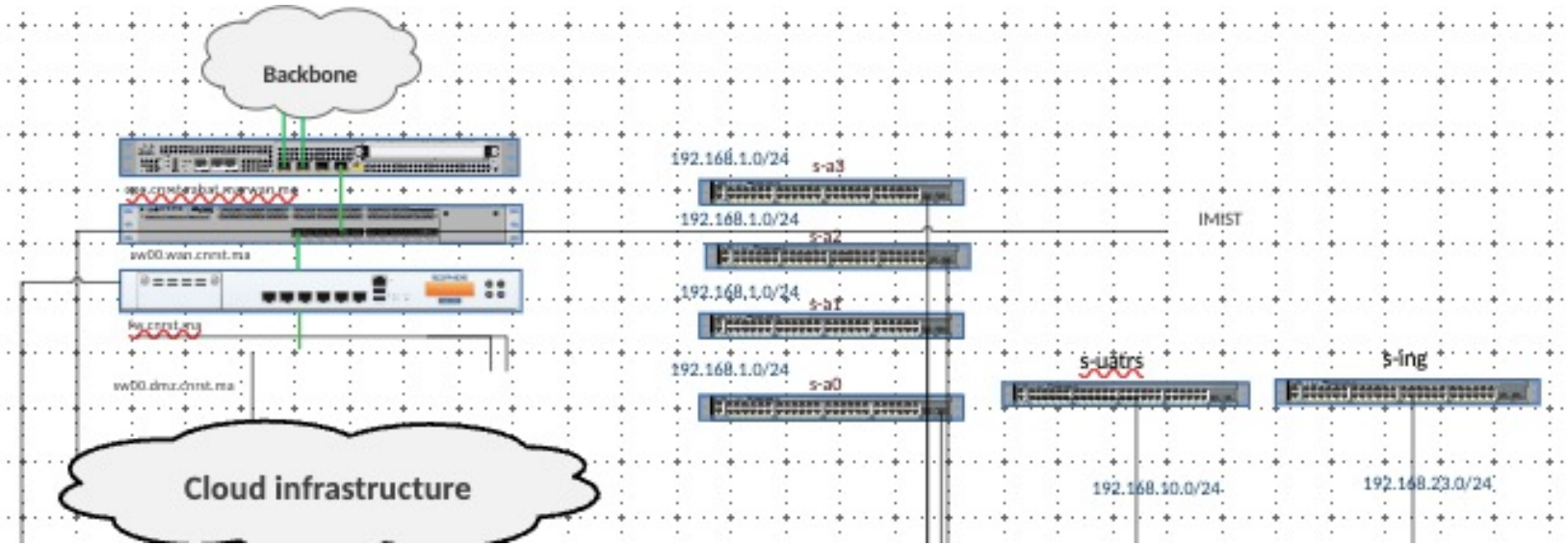
32 = located 32 rack units from the bottom of the frame

:03 = port number 03



The / SUI1-ING-1B:AD03-47:26 designates the other end of the cable which would be in the Agdal 1 campus, engineering building, first floor area B.

- For more information refer to **ANSI/TIA-606-B** or **ISO/IEC TR 14763-2-1**



Network diagrams

Network diagram tools

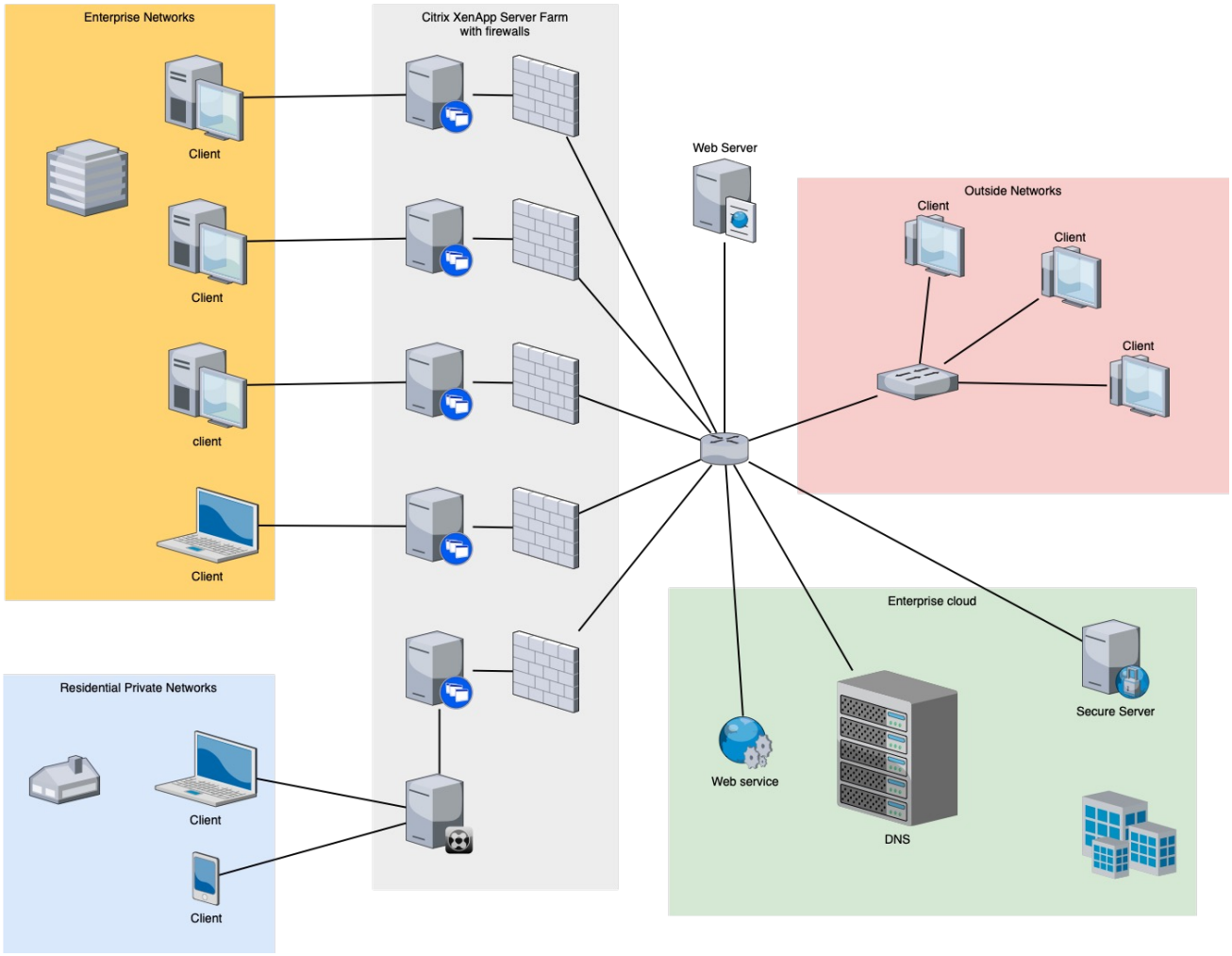
- Easiest choice: pen & paper

  => Draw then take picture
- Open source tools: draw.io (online or desktop app)

  => Can make professional looking diagrams by importing libraries

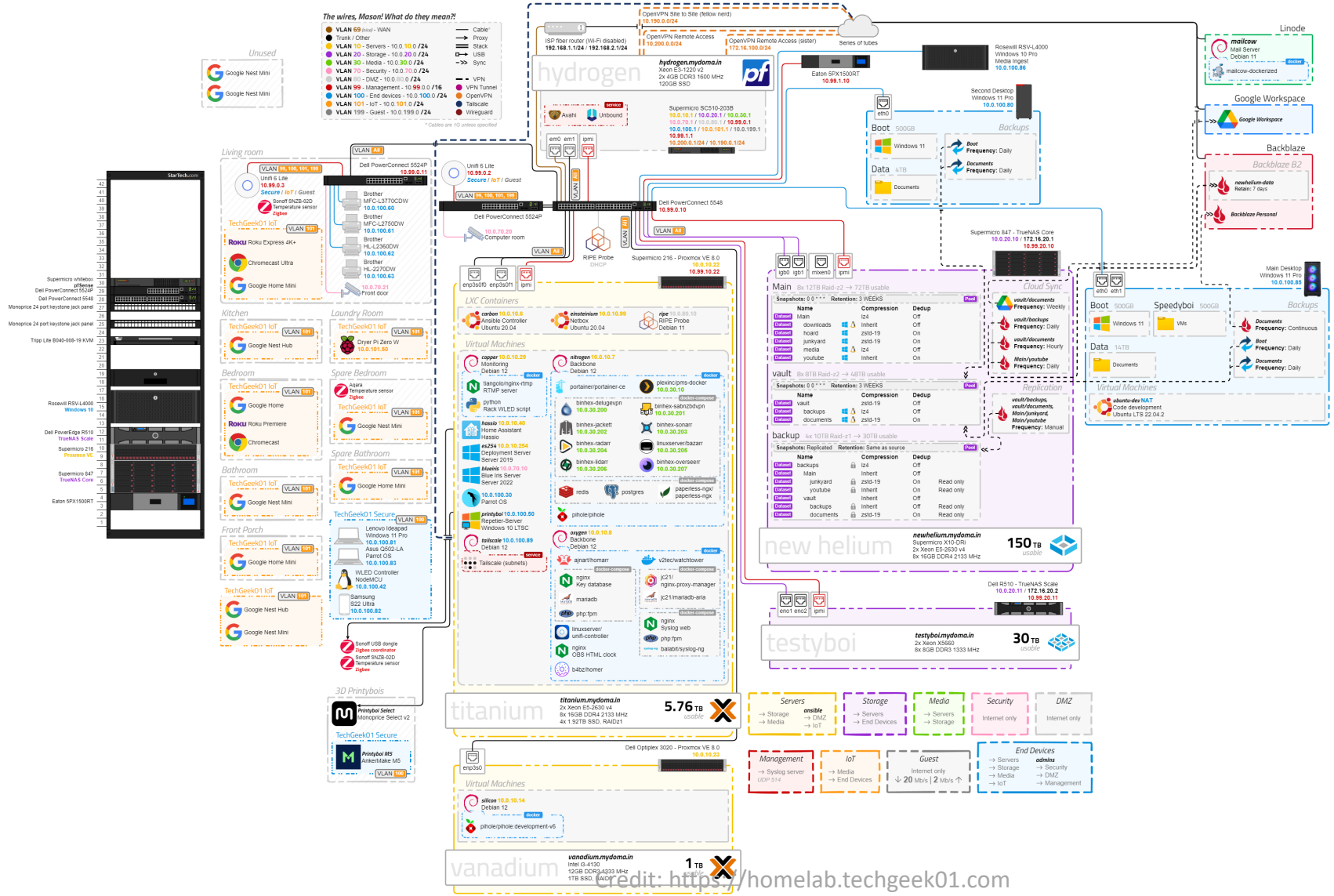
  => You can opt for simple rectangles with description inside
- Commercial tools: Visio, SmartDraw, ConceptDraw

draw.io diagrams can look basic…



Credit: https://draw.io

…or elaborate



TechGeek01's Homelab v17

I have a lot of stuff. This is a reasonable attempt to document all of that stuff.

Frequently Asked Questions

Why do you have so much stuff?
It's *Fine™*

When are you going to do *[thing]*?
Soon™

How quick is *Soon™*?
Somewhere between *Real Quick™* and ¯_(ツ)_/¯

I thought you said X was temporary. I've seen it on this diagram for *[arbitrary length of time]*!
There's nothing more permanent than a temporary solution

Do you really have that many printers?
I use two of the Brother printers on a regular basis. The rest are working, but unused, and I can't justify recycling them for scrap, so I wait until I have a friend that wants a printer, and then I magically have one less printer in my house.

You have friends to run site to site tunnels to?
Yes

How are you qualified for any of this?
I'm what you'd call a professional dumbass

Some of this looks sketchy AF
I believe the correct term is *Premium Junk™*

Nerd
Yes, thank you

Credit: https://homelab.techgeek01.com

r/networking • 2 yr. ago
sesamesesayou

What network diagram icons is everyone using these days?

Design

Looking at updating some logical/physical (connections, not rack layouts) diagrams that are quite extensive with routers/switches/firewalls/load-balancers/etc. Is anyone using some vendor agnostic Visio/drawio diagram icons?

tsubakey • 2 yr. ago

plain rectangles with text and color coding fill.

49 Reply Award Share ...

kernelroute • 2 yr. ago

This is the advice everyone should be taking.

Rectangle boxes with information inside and colour coded where necessary.

14 Reply Award Share ...

clinch09 • 2 yr. ago

This. It's so much cleaner that all of the different diagram icons. I only really use the icons for very very high level drawings.

11 Reply Award Share ...

8 more replies

Source: https://www.reddit.com/r/networking/comments/108buv8/what_network_diagram_icons_is_everyone_using/

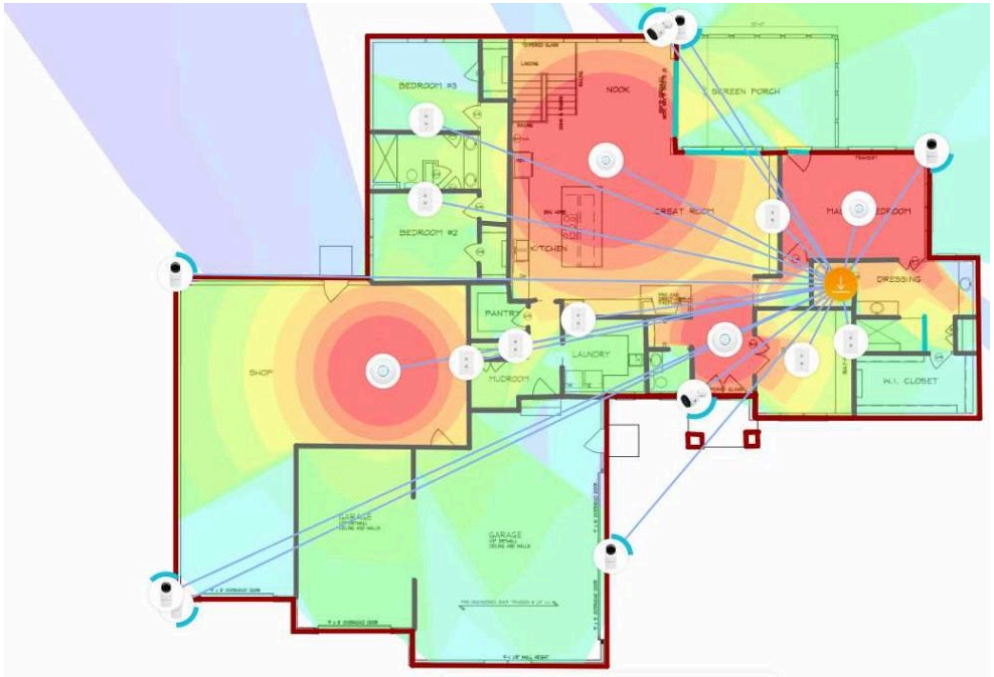
Summary

- The L1/L2 diagram can contain cable types/speeds, port numbers, VLANS/trunks and link aggregations, and spanning tree info like root bridge and priorities
- The L3 diagram can contain IP addresses and info about routing
- You can document L1/L2 and L3 together or separately
- Start simple, then build up
- Network diagram can be sophisticated using professional drawing tools, or simply hand drawn on a slip of paper

=> The important thing is to have one

Wi-Fi diagram

- Floor layouts showing the physical locations of all access points (APs), preferably with RF radiation patterns
- Might include SSIDs, their description and security mechanism, and information about the Wi-Fi controller(s)

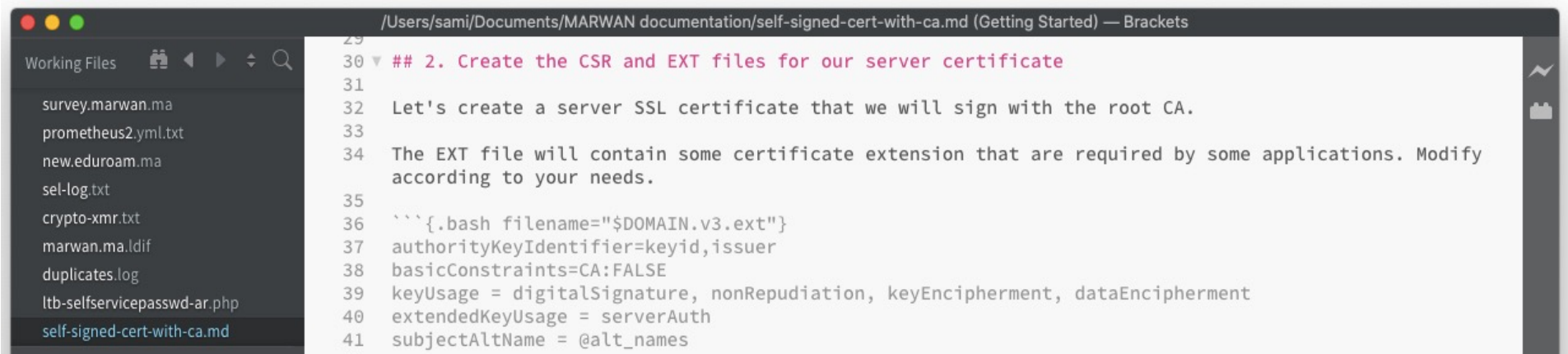


KB

Knowledge Base

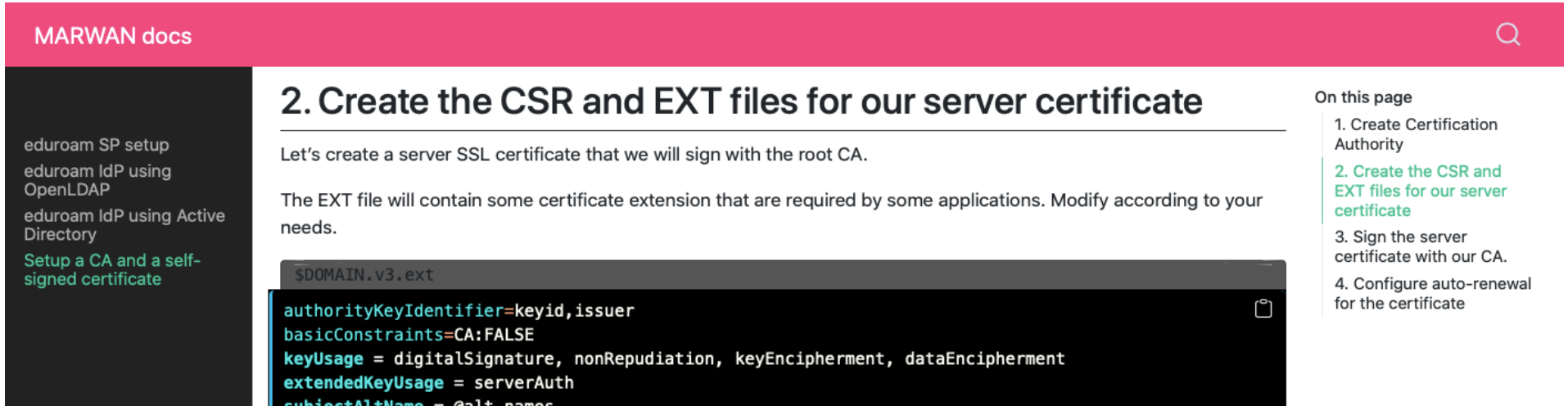
Knowledge Base intro

- An Knowledge Base (KB) is a collection of internal documents that:
  - Explain how a service was deployed
  - Explain steps to solve a certain issue
- Shared among the team
- Avoids having to solve the **same** problems **multiple** times
- Start with simple .txt or .md documents



Knowledge Base platforms

- Transition to a web platform, when your KB gets bigger
- Many available options: bookstack, wiki.js, Material for MkDocs, readthedocs, quarto, docusaurus…
- Set up authentication if KB contains sensitive info
- Most web platforms use markdown, transition from .txt to .md is easy



Documentation overview

DOCUMENT	NOTES
Inventory	Inventory of all assets and their lifecycle
Cable maps	Maps of underground conduits/cables and floor cables
Network diagram	Key network infrastructure
Knowledge Base	Contains procedures, common problems/solutions, and quick hacks. Can also be home to your documentation and diagrams
IP Address allocation	Can be a text document, a spreadsheet, or preferably an IPAM tool to facilitate coordination
WiFi layout	Floor layout of AP locations
Rack layout	Nice to have for small data centers, becomes important when running big infrastructure

Configuration management

Configuration management

- Safeguard your infra against accidental modification/deletion
- Go back to a known working config when things go wrong
- Yearly, monthly, weekly and daily copies. More than one if you make lots of changes
- Simple dated TXT files or GIT system
- Encryption needed for sensitive environments

  => Simple with GPG. Encrypt with public key. Decrypt with private key

Configuration management: What to backup

- Network equipment configuration: routers, switches, firewalls, Wi-Fi controllers

  example: copy running-config flash://switch-bld1-flr2-20250109.txt
- Core Network services: DNS server configuration and zones, DHCP server config, RADIUS server config
- LDAP server databases: OpenLDAP contains many trees, most important are config tree (cn=config) and the user database tree (dc=domain,dc=ma)

  example: slapcat -n 0 > ldap-conf.ldif saves the config tree

  slapcat -n 2 > ldap-mdb.ldif saves the user database

You can also explicitly specify the database to backup with slapcat like slapcat -b cn=config or slapcat -b dc=uni,dc=ma

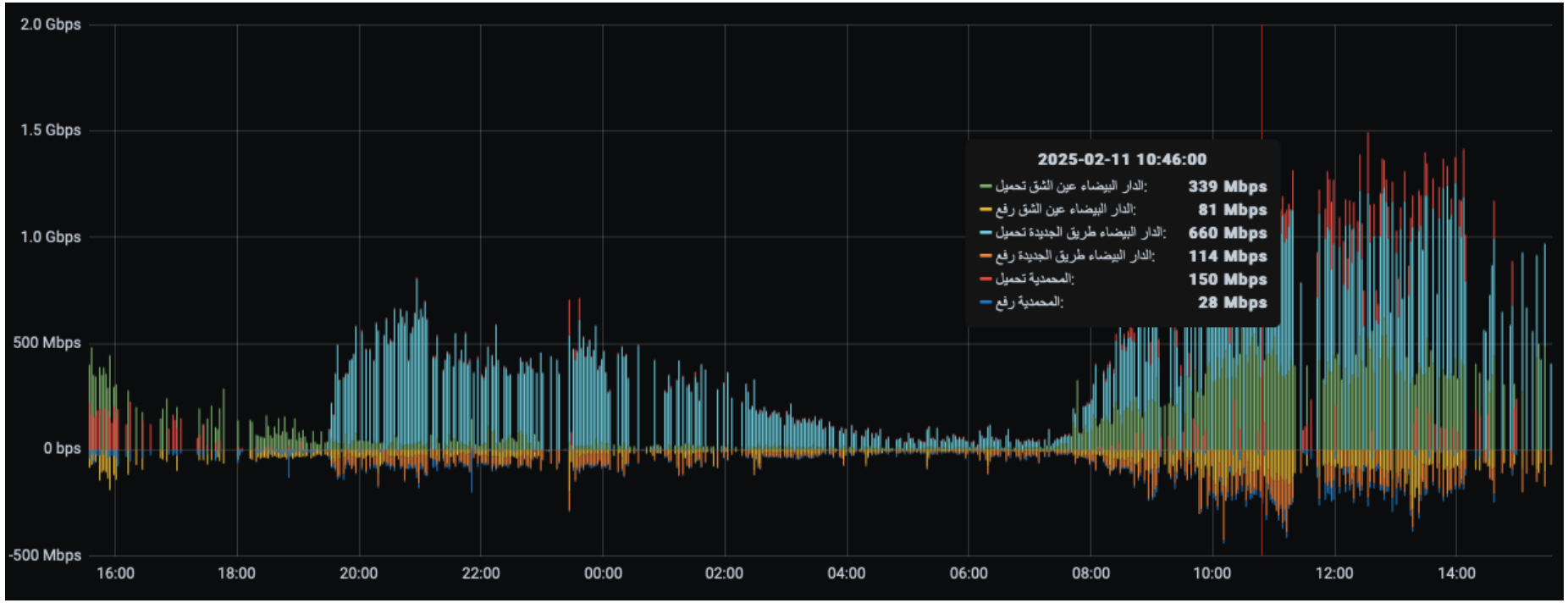
Configuration management tools

- For network equipment => RANCID tracks changes, stores configurations locally and sends an email whenever something changes
- For a more comprehensive config management => Ansible
- Ansible playbooks & CRON jobs


```
  * * * * * <command to execute>
# | | | | |
# | | | | day of the week (0–6) (Sunday to Saturday;
# | | | month (1–12)               7 is also Sunday on some systems)
# | | day of the month (1–31)
# | hour (0–23)
# minute (0–59)
```

Final thoughts

- What we've seen before covers already existing setups that don't have any sort of config management
- What we've done is **regular backups** of **existing production configs**
- In many organizations, the opposite is done: configs are first generated in a Version Control System like GIT. Then deployed to a test environment then to production
- This is recommended in a production-grade setup where interruptions are not tolerated
- It's also considered one of the first steps towards infrastructure as code


2.0 Gbps
1.5 Gbps
1.0 Gbps
500 Mbps
0 bps
-500 Mbps
16:00
18:00
20:00
22:00
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
2025-02-11 10:46:00
الدار البيضاء عين الشق تحميل: 339 Mbps
الدار البيضاء عين الشق رفع: 81 Mbps
الدار البيضاء طريق الجديدة تحميل: 660 Mbps
الدار البيضاء طريق الجديدة رفع: 114 Mbps
المحمدية تحميل: 150 Mbps
المحمدية رفع: 28 Mbps

Monitoring

Monitoring

- Practically all managed network equipment have **SNMP** (Simple Network Monitoring Protocol)
- Leverage SNMP to monitor health, generate alerts and produce graphs
- Most common software:

  => Standards/Legacy : Nagios/Icinga2 for health checks and alerts and MRTG/Cacti for graphs

  => New comers: Prometheus for health checks and alerts and Grafana for graphs

Questions ?