

NIXOS + \$60 LAPTOP = CELLULAR ROUTER

Building an LTE router with a \$60 (new!) laptop and a
single file

Colin Dean

WHO IS THIS GUY?



Colin Dean, who wears many hats

Software engineer and community builder

A topographic map of the United States showing state boundaries and elevation. The color scale ranges from light green for low elevations to brown and tan for higher elevations. The Great Lakes are visible in the upper right. A red star marks the location of Pittsburgh, which is labeled with the word "Pittsburgh" in a black serif font.

Pittsburgh

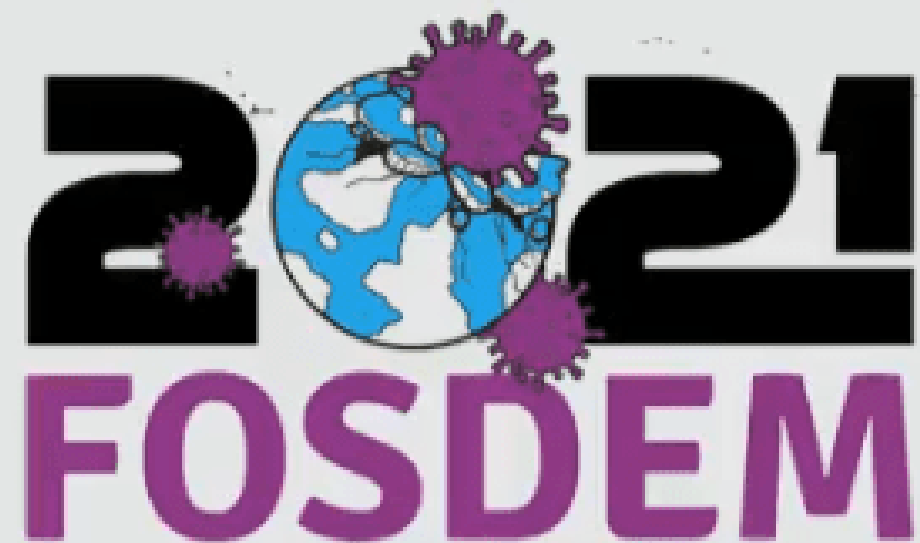
An documentation workflow loved by both Data Scientists and Engineers

Using Pandoc with VCS and CI/CD

Colin Dean

D.docs

2021-02-07

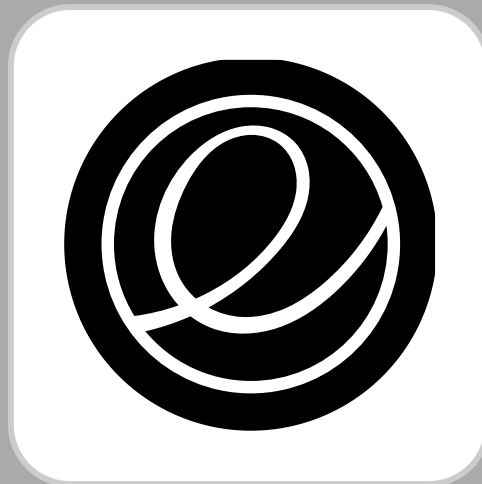




Please save your questions until the end.

Grab a piece of paper so you can write them down.

This system matures frequently despite being in development for more than a year.





NixOS

AGENDA

Problem

Diagnosis

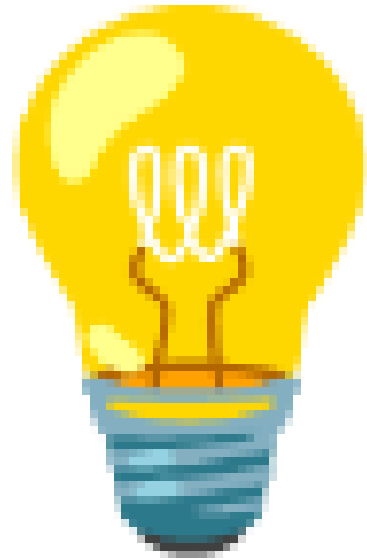
Remedy

PROBLEM

Heating or cooling an empty house is wasteful.
I do not know when packages and contractors come
and go.

DIAGNOSIS

- Need Internet, but easy options too expensive for need
- No mobile hotspot device
- No LTE modems



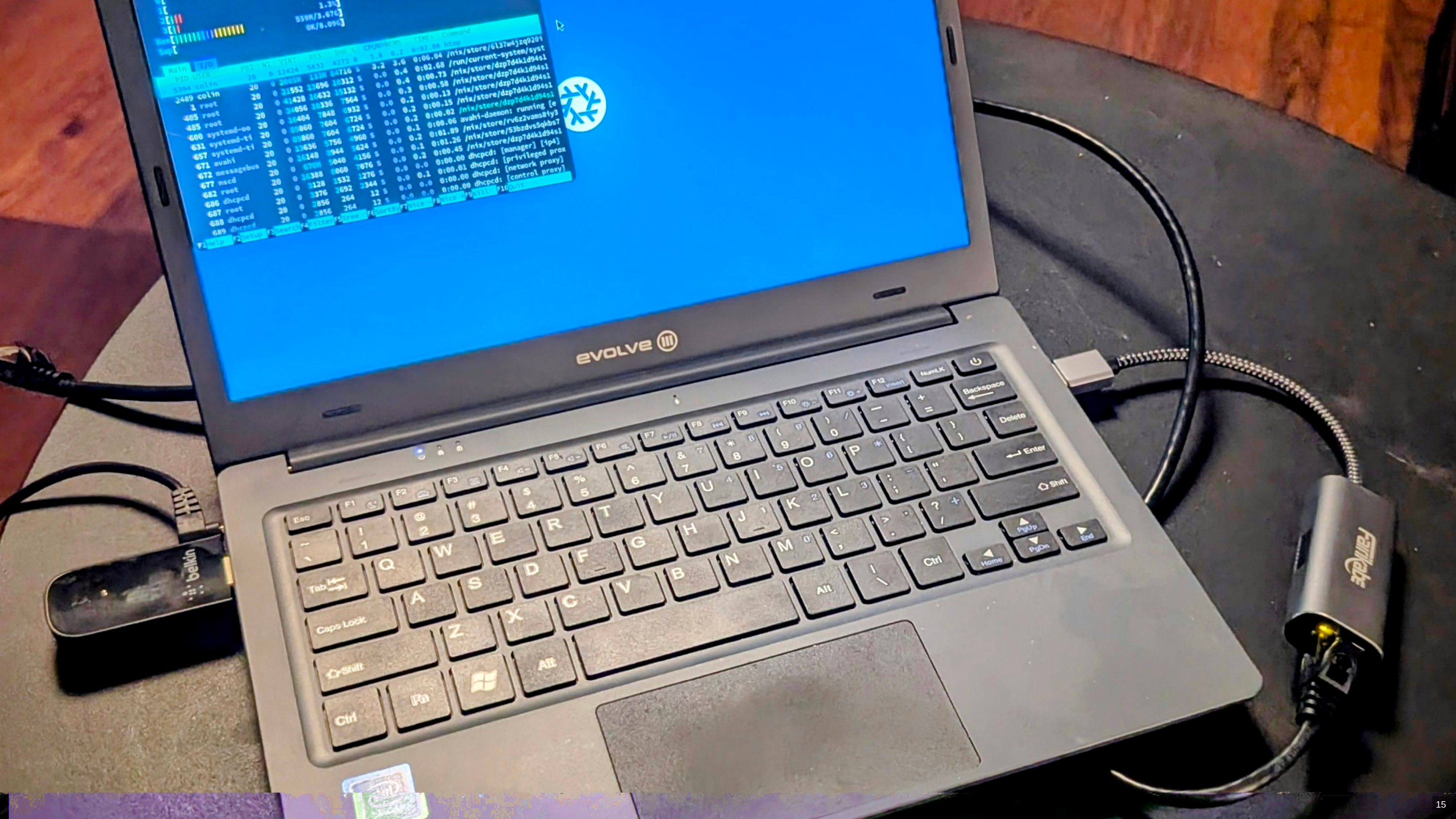
REMEDY

low-cost LTE cellular provider

low-end laptop with an LTE modem *new* \$60

Edit *only* NixOS configuration.nix

**CAN I DEFINE A
ROUTER IN *ONE*
CONFIG FILE?**



htop										
Main 1/0										
PID	USER	PPID	NI	VIRT	RES	SHR	%CPU	%MEM	TIME+	COMMAND
5304	colin	20	0	12424	5832	4272	0.0	3.2	0:02.88	htop
2489	colin	20	0	2005M	103M	84716	0.0	0.4	0:00.04	/nix/store/6l37w4jzq9201
1	root	20	0	21552	13696	10312	0.0	0.4	0:02.68	/run/current-system/syst
485	root	20	0	41428	16632	15132	0.0	0.4	0:00.73	/nix/store/dzp7d4kl94s1
485	root	20	0	34056	10336	7564	0.0	0.3	0:00.58	/nix/store/dzp7d4kl94s1
600	systemd-oo	20	0	16404	7848	6932	0.0	0.2	0:00.13	/nix/store/dzp7d4kl94s1
631	systemd-ti	20	0	89860	7604	6724	0.0	0.2	0:00.02	/nix/store/dzp7d4kl94s1
657	systemd-ti	20	0	13636	5756	4960	0.0	0.1	0:00.06	avahi-daemon: running [e
671	avahi	20	0	16148	8944	5624	0.0	0.1	0:01.89	/nix/store/rv622vams81y3
672	messagebus	20	0	670M	5040	4156	0.0	0.2	0:01.26	/nix/store/53bzdv55qkbs7
677	nscd	20	0	16388	8060	7876	0.0	0.0	0:00.45	/nix/store/dzp7d4kl94s1
682	root	20	0	3128	1532	1276	0.0	0.1	0:00.00	dhcpcd: [manager] [ip4]
686	dhcpd	20	0	3376	2692	2344	0.0	0.0	0:00.01	dhcpcd: [privileged prox
687	root	20	0	2856	264	12	0.0	0.0	0:00.00	dhcpcd: [network proxy]
688	dhcpd	20	0	2856	264	12	0.0	0.0	0:00.00	dhcpcd: [control proxy]
689	dhcpd	20	0	2856	264	12	0.0	0.0	0:00.00	dhcpcd: [control proxy]

evolve

可充电锂离子电池组

Rechargeable li-ion battery pack

型号(Model): 4982229P

额定容量(Rated Capacity): 5500mAh/41.8Wh

额定电压(Rated Voltage): 7.6V

充电限制电压(Limited Charging Voltage): 8.7V



日期(Date): 2020. 12



Z116A-SF-DD2020121500001

Evolve II Maestro Ebook
11 v2

警告

- 只能使用标配的充电器给电池充电
- 切勿拆卸电池或将电池的电极短接
- 破坏或投入火中有爆炸危险
- 电池浸水后禁止使用
- 请正确回收或处理

WARNING

- Please use the appointed chargers only
- Do not dismantle or short circuit the battery
- Destroying the battery or plunging it into fire might result in an explosion
- Stop using the battery after it is immersed in water
- Please recycle or dispose of the battery properly

VALUES

- Inexpensive hardware could fail or be stolen
- Reproducible configuration
- Minimize administration
- Short-lived: 3–4 months

CAN MY PARTNER MAKE THIS WORK IF I AM UNAVAILABLE?

- Linux or Nix? No.
- Power cycle? Yes.

NIX

hardware- configuration.nix

```
{ config, lib, pkgs, modulesPath, ... }:  
{  
  imports=[(modulesPath+"/installer/scan/not-detected.nix")];  
  boot.initrd.availableKernelModules = [  
    "ahci" "xhci_pci" "usb_storage" "sd_mod"  
    "sdhci_pci" "rtsx_usb_sdmmc" ];  
  boot.initrd.kernelModules = [ ];  
  boot.kernelModules = [ "kvm-intel" ];  
  boot.extraModulePackages = [ ];
```

```
fileSystems."/ =  
  { device = "/dev/disk/by-uuid/<uuid>";  
    fsType = "ext4";  
  };  
fileSystems."/boot" =  
  { device = "/dev/disk/by-uuid/<uuid>";  
    fsType = "vfat";  
  };  
swapDevices =  
  [ { device = "/dev/disk/by-uuid/<uuid>"; }  
  ];  
networking.useDHCP = lib.mkDefault true;  
nixpkgs.hostPlatform = lib.mkDefault "x86_64-linux";  
}
```

...nothing special. Autodetect 👍

configuration.nix

(the good parts)

```
networking.hostName = "evolve3nix1";
```

```
# Enable networking
```

```
networking.networkmanager.enable = true;
```

```
# Enable the X11 windowing system.
```

```
services.xserver.enable = true;
```

```
# Enable the GNOME Desktop Environment.
```

```
services.xserver.displayManager.gdm.enable = true;
```

```
services.xserver.desktopManager.gnome.enable = true;
```

```
environment.systemPackages = with pkgs; [  
    vim  
    wget  
    curl  
    htop  
    ethtool           # manage NIC settings  
    tcpdump           # view network traffic  
    conntrack-tools   # view network connection states  
];  
services.openssh.enable = true;  
system.autoUpgrade.enable = false;  
system.autoUpgrade.allowReboot = false;
```

```
# router bullshit
boot.kernel.sysctl = {
    "net.ipv4.conf.all.forwarding" = true;
    "net.ipv6.conf.all.forwarding" = true;

    # No IPv6 addresses for now.
    "net.ipv6.conf.all.accept_ra" = 0;
    "net.ipv6.conf.all.autoconf" = 0;
    "net.ipv6.conf.all.use_tempaddr" = 0;

    # WAN: Allow IPv6 autoconfig
    "net.ipv6.conf.wwp0s21f0u3i4.accept_ra" = 2;
    "net.ipv6.conf.wwp0s21f0u3i4.autoconf" = 1;
};
```

```
networking = {  
    interfaces = {  
        enp0s21f0u5 = {  
            useDHCP = false;  
            ipv4.addresses = [{  
                address = "10.201.1.1"; prefixLength = 24; }];  
        };  
        wwp0s21f0u3i4.useDHCP = true;  
    };  
    nat = {  
        enable = true;  
        internalInterfaces = [ "enp0s21f0u5" ];  
        externalInterface = "wwp0s21f0u3i4";  
        enableIPv6 = true;  
    };  
}
```

```
# nixos iptables firewall  
firewall.enable = true;  
# use netfilter firewall  
nftables = {  
    enable = true;  
};  
};
```

```
services.dnsmasq = {  
    enable = true;  
    alwaysKeepRunning = true;  
    settings = {  
        domain-needed = true;  
        bind-dynamic = true;  
        interface = [ "enp0s21f0u5" ];  
        dhcp-range =  
            [ "10.201.1.2,10.201.1.253,255.255.255.0,24h" ];  
    };  
};
```

```
services.kea.dhcp4 = {  
    enable = false;  
    settings = {  
        interfaces-config = { interfaces = ["enp0s21f0u5"]; };  
        lease-database = {  
            name = "/var/lib/kea/dhcp4.leases";  
            persist = true;  
            type = "memfile";  
        };  
        rebind-timer=2000;renew-timer=1000;valid-lifetime=4000;  
        subnet4 = [  
            {  
                pools = [ { pool = "10.201.1.2 - 10.201.1.253"; }];  
                subnet = "10.201.1.0/24";  
            }  
        ]  
    }  
};
```

```
networking.firewall.interfaces.enp0s21f0u5 = {  
    allowedTCPPorts = [  
        # ssh  
        22  
        # dnsmasq; dns-over-http  
        53  
    ];  
    allowedUDPPorts = [  
        # dnsmasq; dns dhcp  
        53 67  
    ];  
};
```

IN PRACTICE

LTE COVERAGE

Enough.

THROUGHPUT

Sufficient.

TAKEAWAYS

NIXOS MADE THIS *SVELTE*

/svělt/

adjective

1. Slender or graceful in figure or outline; slim.
2. **Attractively thin**; gracefully slender.
3. Refined, delicate.

The American Heritage® Dictionary of the English Language, 5th Edition

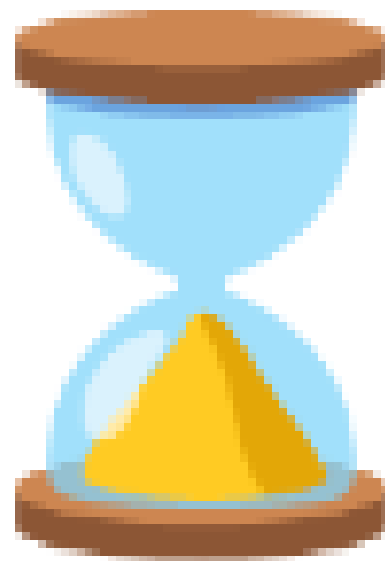
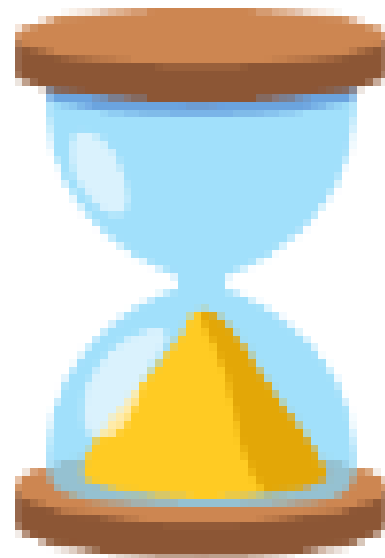
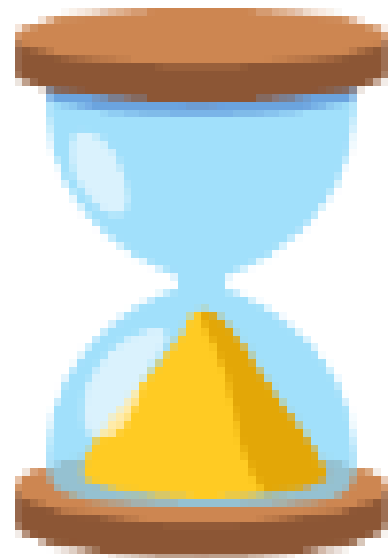
```
$ rg -v "^\\s*\\#.*" configuration.nix | rg -v "^\\s*$" | wc -l  
142
```

- 27 (Kea)
 - 10 (locale)
 - 10 (audio)
- = 95 SLOC

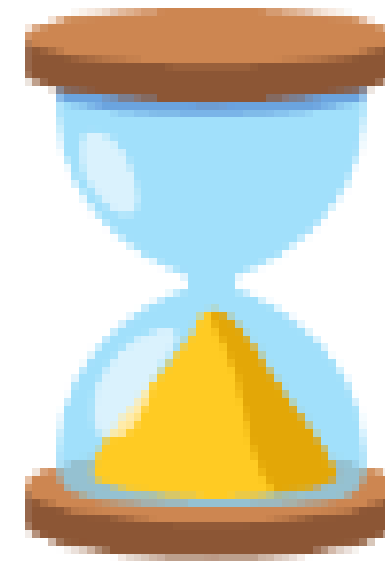
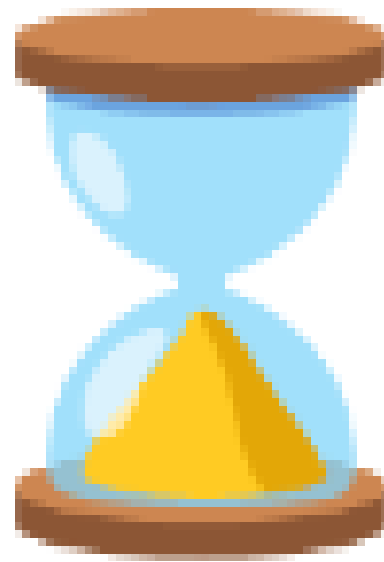
F@#K AROUND AND FIND OUT

DOCUMENT(ATION)

APPROXIMATE TIME TO BUILD



ONGOING MAINTENANCE



WHAT'S NEXT?

- Old house: Verizon -> LTE
- Matt Layher's [routnerr-3](#)

FIN

Thanks, yinz!

fediverse @colindean@mastodon.social

bsky @cad.cx

slides <https://github.com/colindean/talks>

ATTRIBUTIONS

- Relief location map of the USA (without Hawaii and Alaska), Uwe Dederling, 2010.
- Evolve3 Maestro desk picture by Colin Dean, 2024.
- Evolve3 Maestro internal picture by Colin Dean, 2022.
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SEE ALSO

- [Evolve III Maestro 11.6” Laptop Computer - Dark Grey](#), Micro Center website.
- [Review: Evolve III Maestro E-Book 11.6”](#) by [see_spot_ruminate](#) on /r/linuxhardware, March 2022.
- [mdlayher's homelab routerr-2](#)