

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 elevation contours and state boundaries. The map uses a color gradient from green (low elevation) to brown (high elevation). A red star is placed on the western side of Pennsylvania, near the Ohio border, to indicate the location of Pittsburgh. The Great Lakes and the Atlantic Ocean are also visible.

Pittsburgh

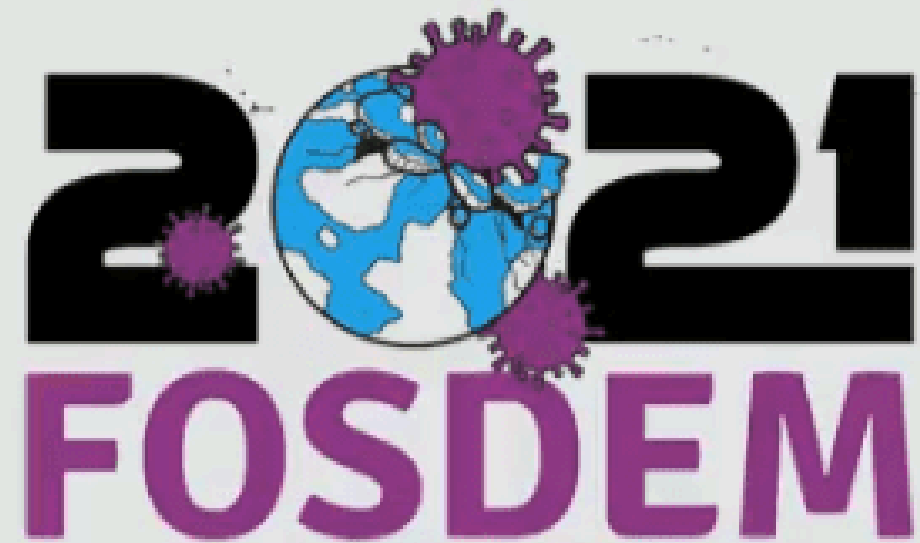
An documentation workflow loved by both Data Scientists and Engineers

Using Pandoc with VCS and CI/CD

Colin Dean

D.docs

2021-02-07

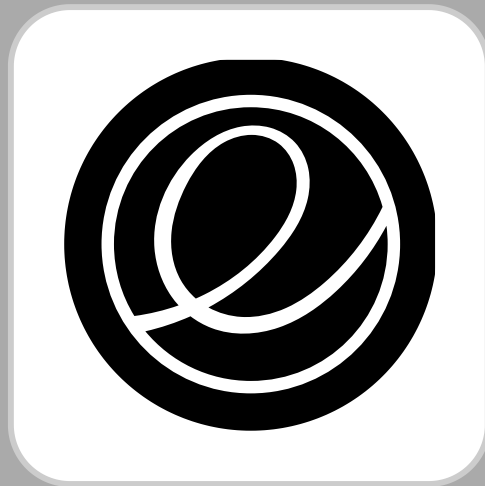




Please save your questions until the end.

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

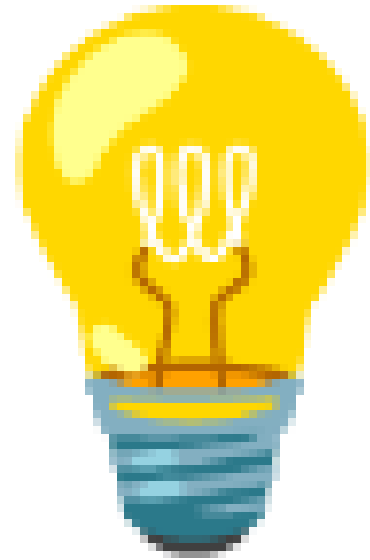
Remedy

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?**


```
1.30]
559H/3.676]
OK/8.096]
Command
0:02.88 htop
PID USER      NI  TTY          PR      CPU     MEM     CPU/MEM  TIME+ Command
-----
6384 colin    20  0 12424 5832 4272 R   3.2  3.6  0:00.04 /nix/store/6l37w4jzq9201
2489 colin   20  0 20058 1038 8476 S   0.0  0.4  0:02.68 /run/current-system/syst
1 root      20  0 41428 16632 15132 S  0.0  0.4  0:00.73 /nix/store/dzp7d4k1d94s1
485 root    20  0 34856 10336 7564 S   0.0  0.3  0:00.58 /nix/store/dzp7d4k1d94s1
485 root    20  0 16404 7848 6932 S   0.0  0.2  0:00.13 /nix/store/dzp7d4k1d94s1
600 systemd- 20  0 89860 7604 6724 S   0.0  0.2  0:00.02 /nix/store/dzp7d4k1d94s1
631 systemd-ti 20  0 89860 7604 6724 S   0.0  0.2  0:00.06 avahi-daemon: running [e
657 systemd-ti 20  0 89860 7604 6724 S   0.0  0.1  0:01.89 /nix/store/rv6z2vams8iy3
671 avahi    20  0 89860 7604 6724 S   0.0  0.2  0:01.26 /nix/store/53bzdv5sqkbs7
672 messagebus 20  0 13636 5756 4960 S   0.0  0.1  0:01.45 /nix/store/dzp7d4k1d94s1
677 nscd     20  0 16148 8944 5624 S   0.0  0.1  0:00.45 /nix/store/dzp7d4k1d94s1
682 root    20  0 6708 5040 4156 S   0.0  0.2  0:00.00 dhcpd: [manager] [ip4]
686 dhcpd   20  0 16388 8060 7876 S   0.0  0.0  0:00.01 dhcpd: [privileged prox
687 root    20  0 3128 1532 1276 S   0.0  0.0  0:00.00 dhcpd: [network proxy]
688 dhcpd   20  0 3376 2692 2344 S   0.0  0.0  0:00.00 dhcpd: [control proxy]
689 dhcpd   20  0 2856 264 12 S   0.0  0.0  0:00.00 dhcpd: [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



Evolve III 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
```

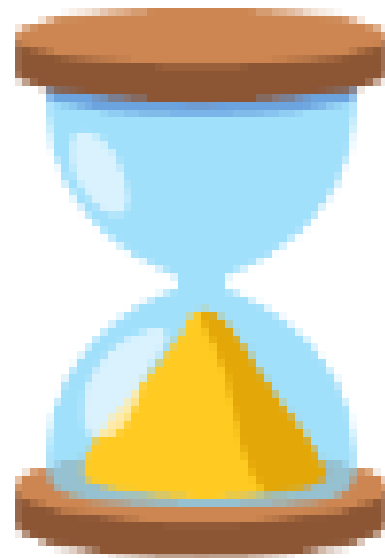
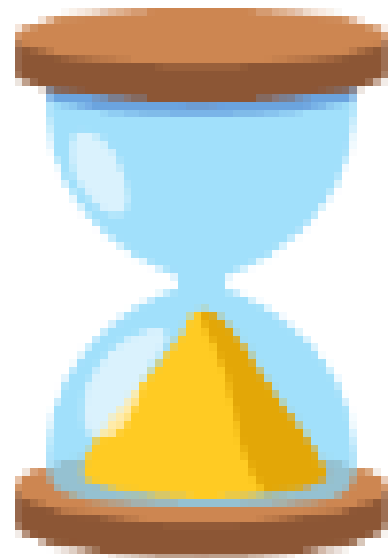
- 27 (Kea)
- 10 (locale)
- 10 (audio)

= 95 SLOC

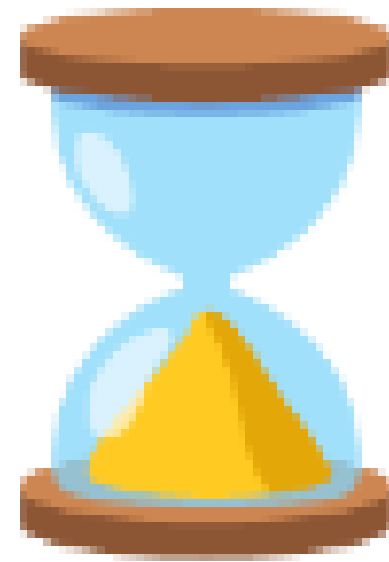
F@#K AROUND AND FIND OUT

DOCUMENT(ATION)

APPROXIMATE TIME TO BUILD



ONGOING MAINTENANCE



WHAT'S NEXT?

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

FIN

Thanks, yinz!

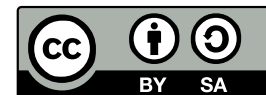
fediverse @colindean@mastodon.social

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 routnerr-2](#)