



# PrivacySafe



**GNUHealth**  
FREEDOM AND EQUITY IN HEALTHCARE

<https://privacysafe.ai/health>



# Who Is This Guy?

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- Lecturer at Yale Law School, Cybersecurity
- Founder and head researcher at Yale Privacy Lab
- Editor of *The Privacy Issue*, a new press outlet
- Founded PrivacySafe in Sep. 2019, privacy-by-design IoT appliances



**Please reach out to me with questions!**

# What Is PrivacySafe?

**PrivacySafe is a company that develops products from Free Software and Open Hardware components.**

- Our products are built on the new BeagleBoard.org BeagleBone<sup>®</sup> AI.
- We're developing a **GNU Health Edition**, to bring BeagleBone support to GNU Health Embedded.
- BeagleBone AI is OSHW Certified, but we are also evaluating other boards for future hardware targets.



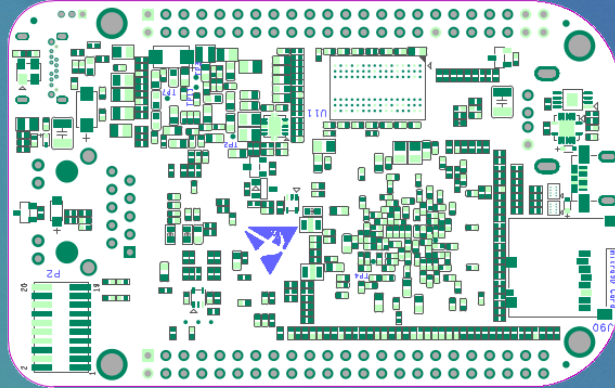
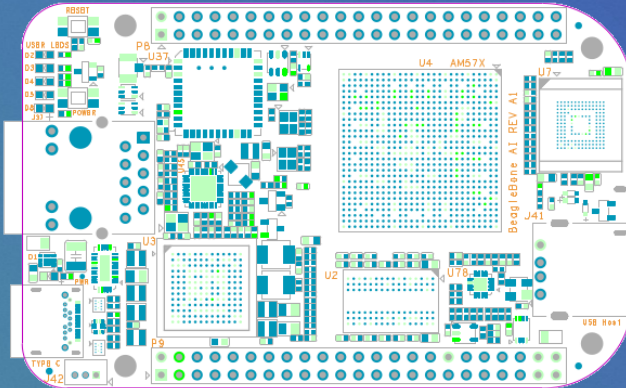
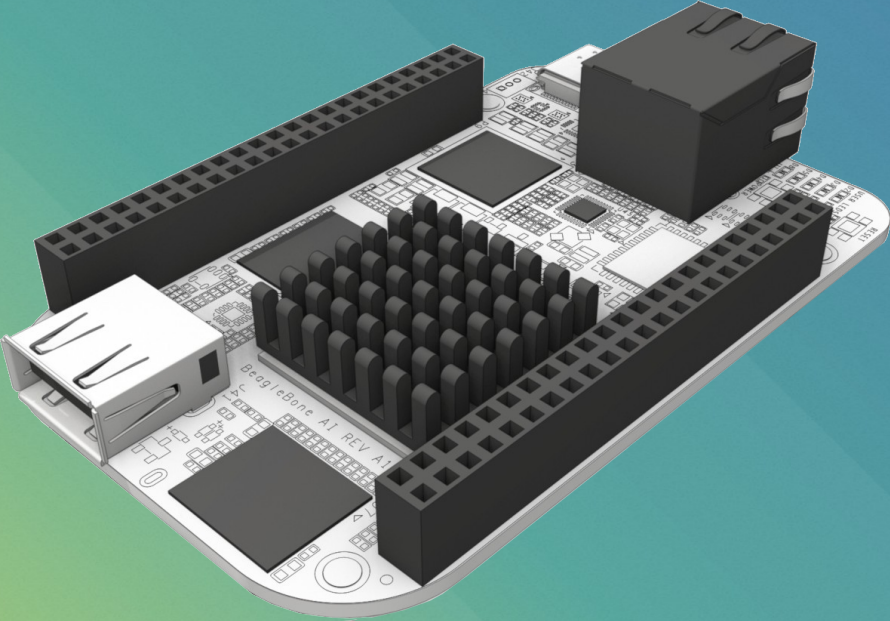
# What Is GNU Health Embedded?

**GNU Health is a Free/Libre Health and Hospital Information System that runs on single-board computers as “GNU Health Embedded”**

- GNU Health Embedded currently targets Raspberry Pi 3.
- The GNU Health Embedded team develops images based on openSUSE and update images often (last Feb. 24, 2020).
- Support for the extremely popular Raspberry Pi is still important, even with support for BeagleBone AI.



# BeagleBoard.org BeagleBone® AI Open Hardware



Basically, we're building a Debian-based version of GNU Health Embedded and targeting the most libre and privacy-respecting single-board computer we can find.

Additionally, we want to bundle GNU Health with privacy tech like Tor and a new set of privacy-by-design protocols called 3NWeb as a backend for our PrivacySync service. Specifics will be ironed out in the next 4 months.

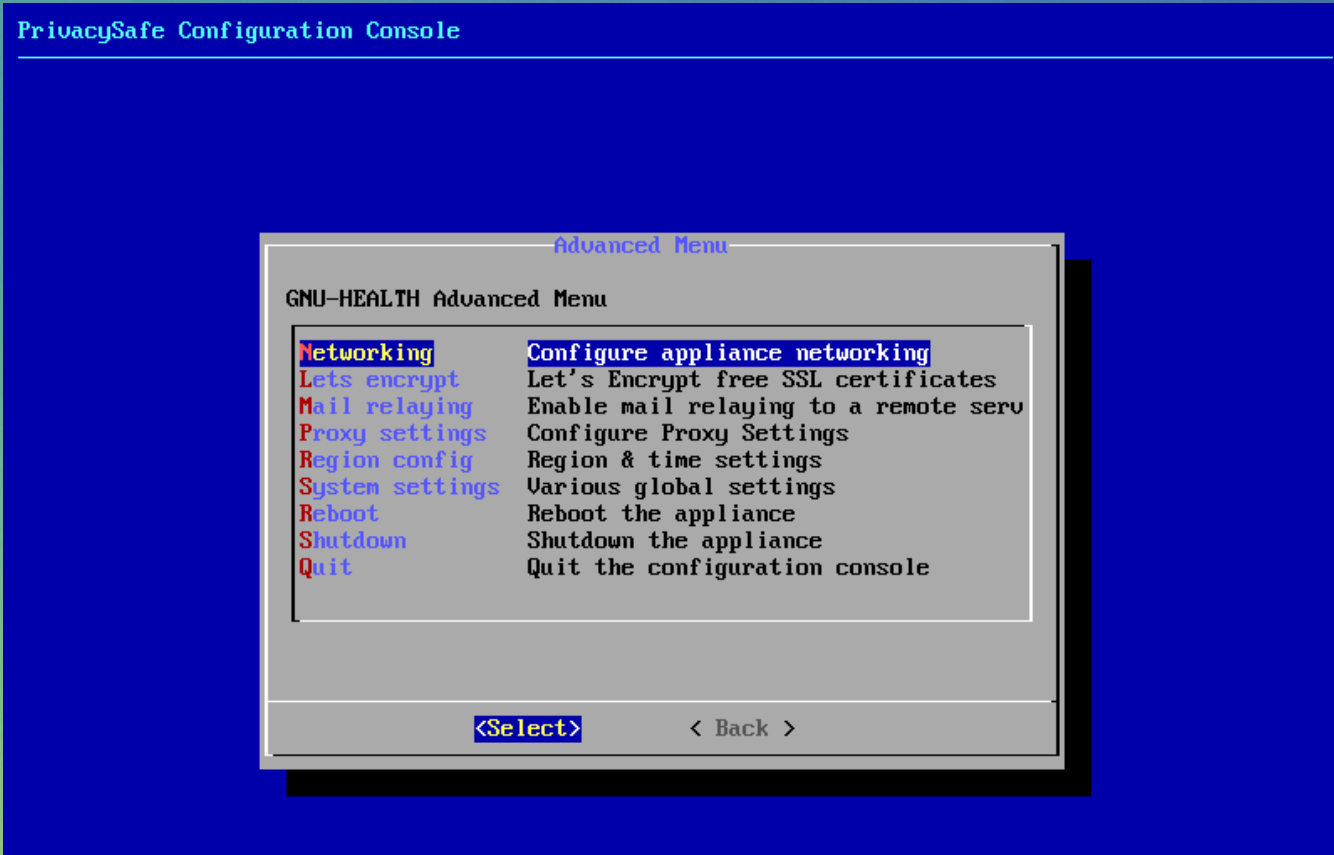


# OS Design Choices

**Disclaimer: We are very much open to community feedback and advice, and our current direction may change.**

- Debian GNU/Linux Stretch (9.12) with Turkey GNU/Linux mods
- Latest GNU Health (3.6.3) and Tryton SAO Web UI (planned)
- Let's Encrypt config for SSL/TLS and easy networking setup
- Cloud 9 IDE gives users a rich dev environment and a CLI

We're building off of the excellent work of Turnkey GNU/Linux on user-friendly dialogs and menus for Debian-based appliances. This configuration console can be launched via SSH.





We want to deliver services via the Web browser, but also need to be careful from a security perspective. Cloud 9 IDE may only be turned on by default for our Dev Kit versions.

The screenshot displays the Cloud9 IDE interface on a BeagleBone. The top menu bar includes options like File, Edit, Find, View, Goto, Run, Tools, and Window. The main workspace is divided into several panels:

- Workspace:** A file explorer on the left showing a directory structure with folders like .gnupg, .local, .nano, .thumbnails, bin, Desktop, gnuhealth, and various configuration files.
- Preview:** A central browser window showing the website for "PrivacySafe GNU Health Appliance". The page features the GNU Health logo (a house with a sun and people) and the text "FREEDOM AND EQUITY IN HEALTHCARE". Below the logo, the heading "PrivacySafe GNU Health Appliance" is prominently displayed, followed by a section for "Development Kit Release".
- Terminal:** A terminal window at the bottom shows a shell prompt where the user has run the command `ls`. The output lists several files: `attach gnuhealth gnuhealth-3.6.3 gnuhealth-3.6.3.tar.gz.sig gnuhealth-latest.tar.gz`.

On the right side of the IDE, there are panels for "Outline" and "Debugger". The overall interface is dark-themed.

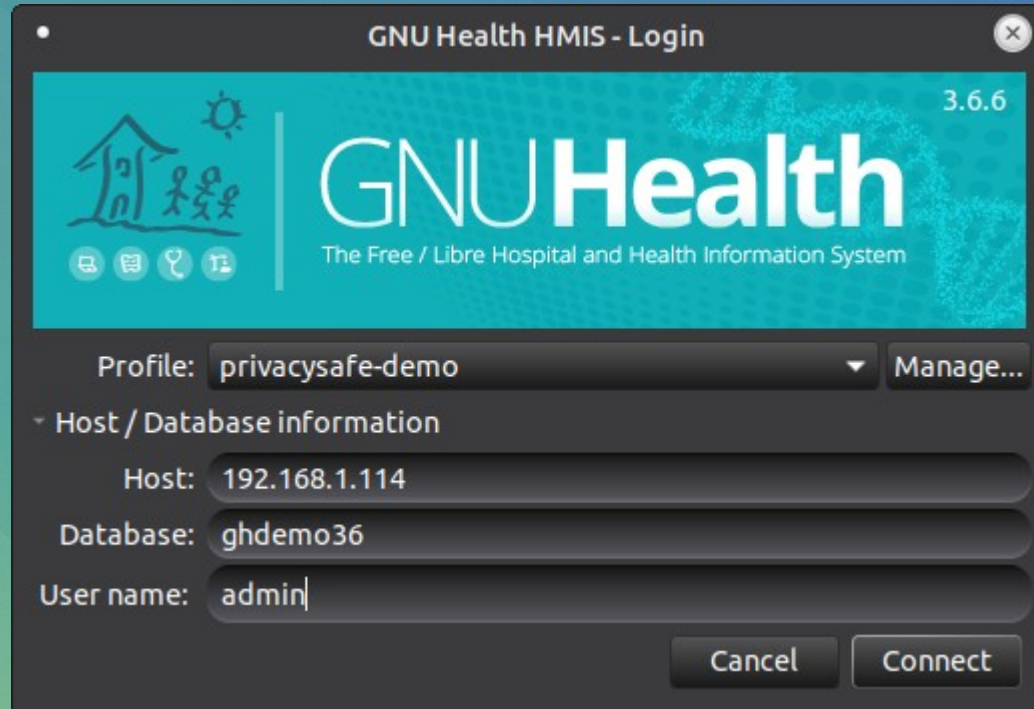
# GNU Health Embedded Use Cases

- Domiciliary Units (aka “homes”)
- Nursing
- Academia
- Personal Health Record
- Quarantined Populations ← especially timely re: COVID-19




Image Source: NPR.org

Login to GNU Health appliance is done via the GNU Health client.



GNU Health HMIS - Login

3.6.6

 GNU Health  
The Free / Libre Hospital and Health Information System

Profile:  Manage...

Host / Database information

Host:

Database:

User name:

Cancel Connect

- Party
  - Configuration
  - Parties
    - People
    - Parties assoc
    - Addresses
    - Contact Mechar
    - Categories
  - Product
  - Financial
  - Currency
  - Inventory & Stock
  - Purchase
  - Calendar
  - Health
    - Patients
    - Books of Life
    - Genetics
    - Appointments
    - Prescriptions
    - Laboratory

Conditions  People

Name: Ana Isabel      Family names: Betz      PUID:

Active:

Person:       Patient:       Health Prof:       Ins:

Demographics

DoB:       Age: 39y 6m 16d

Gender:

Mother:       Father:

Marital Status:       Citizenship:

Residence:       Ethnicity:

Occupation:       Education:

Alternative IDs:       Main address:

- Party
  - Configuration
  - Parties ★
    - People ★
      - Parties assoc ★
      - Addresses ★
      - Contact Mechar ★
      - Categories ★
    - Product
    - Financial
    - Currency
    - Inventory & Stock
    - Purchase
    - Calendar
  - Health
    - Patients ★
      - Books of Life
      - Genetics
      - Appointments ★
      - Prescriptions ★
      - Laboratory

Conditions × People × Patients ×

Search bar



Search

Patient	Age	PUID	Ho
Luna	4y 3m 13d	FVJ324FPW	
unidentified patient	6y 1m 20d	NN-KBU697CKU	<input type="checkbox"/>
Ana Isabel Betz	39y 6m 16d	GNU777ORG	<input checked="" type="checkbox"/>
Caput, Bonifacio	97y 11m 23d	GHE620VFX	<input type="checkbox"/>
Carlos, Roberto	24y 1m 28d	CKW388XKK	<input type="checkbox"/>
Zenon Betz, Matt	10y 0m 0d	97234436	<input type="checkbox"/>

- ▼ Conditions
- Conditions ★
- Pathology (★)
- Categories
- ▼ Genetics
- Disease Ge ★
- Gene Varia ★
- Gene Varia ★
- Protein rel: ★
- ▶ Dx Imaging
- ▶ Functioning a
- ▶ Procedures
- ▶ Laboratory
- ▶ Institutions
- ▶ Medicaments
- ▶ Immunizatio ★
- ▼ Federation
- Federation ★
- Node Confi ★
- Federation ★
- ▶ Misc

Conditions



Coronavirus

Name	Code	Main Category
Coronavirus infection, unspecif	B34.2	I Certain infectious and parasit
Coronavirus as the cause of dis	B97.2	I Certain infectious and parasit

# COVID-19 Brainstorming

- Open Science resources (nextstrain.org, others?)
- Quarantine Updates
- Localized Information
- Statistics
- “Flatten The Curve” Advice

## Genomic epidemiology of novel coronavirus (hCoV-19)

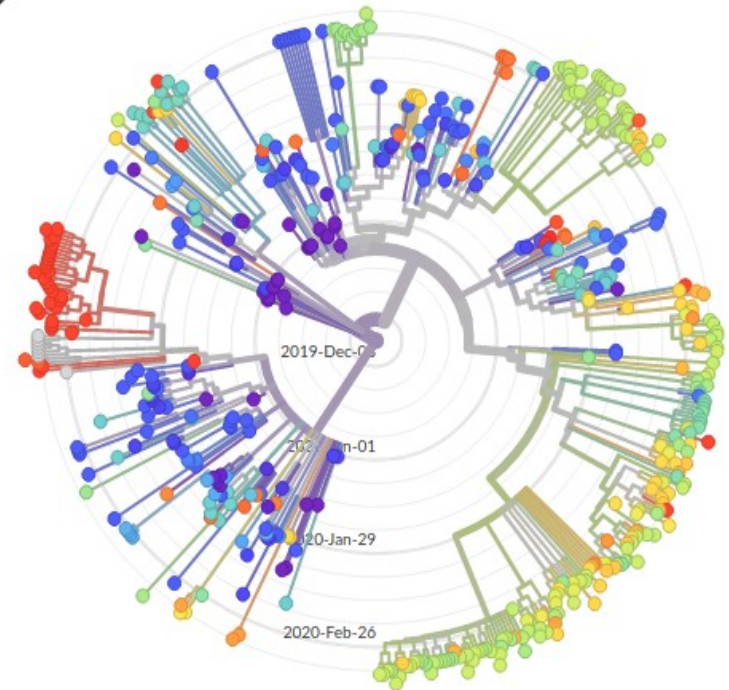
Built with [nextstrain/ncov](#) using data from [GISAID](#).

Showing 512 of 512 genomes sampled between Dec 2019 and Mar 2020.

Phylogeny

Admin Division ▼

RESET LAYOUT



# Challenges & Food For Thought

- **BeagleBone vs. Raspberry Pi:** BeagleBone can be set up very quickly, acting as a WiFi access point out-of-the-box and with a Web browser-based config, as well as USB Storage Gadget. Raspberry Pi has an easy, headless CLI/dialog setup via Raspbian, but it's not available on openSUSE (builds use a display manager).
- **Containers:** We'd like to move toward using either Docker or LXD/LXC. The current GNU Health Docker images need updating, and it may make sense to start fresh with LXD.
- **Addressing / Certs:** We need to create helpful UIs for config of DNS options, TLS certs, and Tor .onion hidden services. We have yet to get GNU Health Client / Tryton running over Tor but that is an important goal for privacy reasons.



# Resources: BeagleBoard & GNU Health

- **Official BeagleBone AI Wiki**
- **BeagleBone AI Survival Guide**
- **Official GNU Health Wiki**
- **Testing GNU Health**
- **GNU Health Demo Database**
- **Unofficial GNU Health Debian Repos**



# THANK YOU!

- Luis Falcón and the GNU Health / GNU Solidario teams
- Jason Kridner and the BeagleBoard.org team
- The GNU Health Embedded team
- Our PrivacySafe customers and supporters

We're starting small but we're taking big steps.



Let us know what you think! <https://privacysafe.ai/contact>