

# FOSSCOMM 2021



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## MyGNUHealth and the GNU Health Ecosystem. The Importance of Free/Libre Software in the Public Health sector

Luis Falcon, MD



# Agenda

- **About GNU Health**
  - History of the project & community
- **The GH ecosystem components**
  - The GNU Health Federation and its components
- **MyGNUHealth**
  - The GH Personal Health Record
- **MyGNUHealth technical infrastructure**
  - Framework and integration w/ GH Federation
- **Q&A**
  - Questions and answers



# About me

**Luis Falcón**

President, GNU Solidario

Author of GNU Health

[falcon@gnuhealth.org](mailto:falcon@gnuhealth.org)

## Education

- Computer Scientist
- Physician
- Genomics & Medical Genetics

## Activism

- Social Medicine
- Animal Rights

# History of GNUHealth and Community







- **GNU Solidario**
  - Is the NGO behind GNUHealth
  - Non-for-profit organization
  - Works globally
  - Focused on Social Medicine
- **Official GNU Project**
  - GNUHealth is an official GNU project
  - Hosted at GNU Savannah
  - Many mirrors around the World
  - International community

# From GNU Solidario



Group pic from **GNUHealthCon 2018** in Canary Islands



FOSSCOMM 2021  
November 13, Greece

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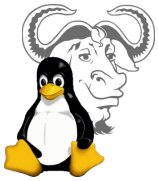
# Official GNU Package

Official GNU Package, from the Free Software Foundation

Open Documentation

Relies on free technology

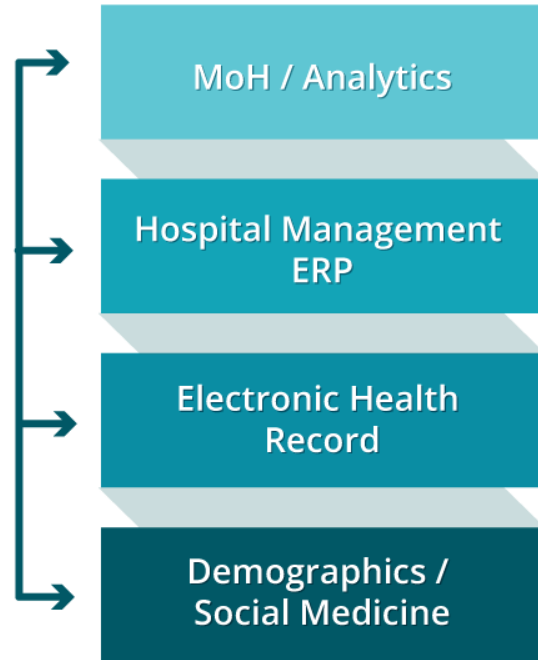
Friendly community



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# GNU Health ecosystem



GNUHealth

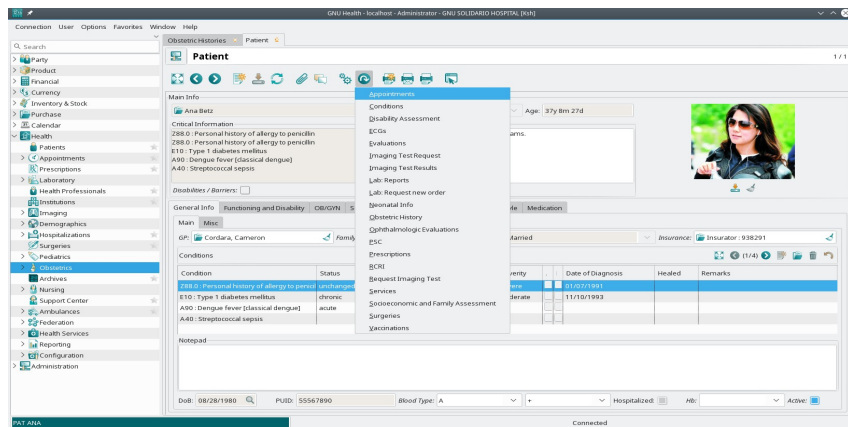


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# GNU Health Hospital Management snapshots

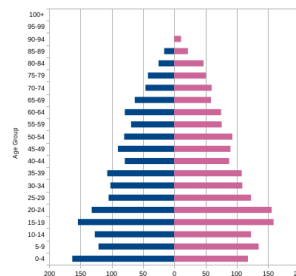
Print Date: 10/11/2014 at 18:57:01




## GNU Health Summary Report

### Population Pyramid

	♀	♂	Σ
Population	2131	1998	4129





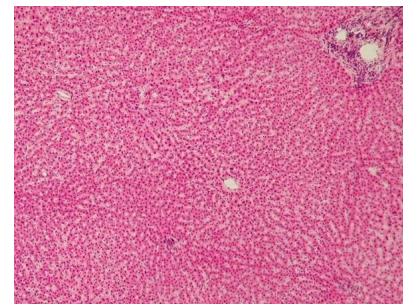
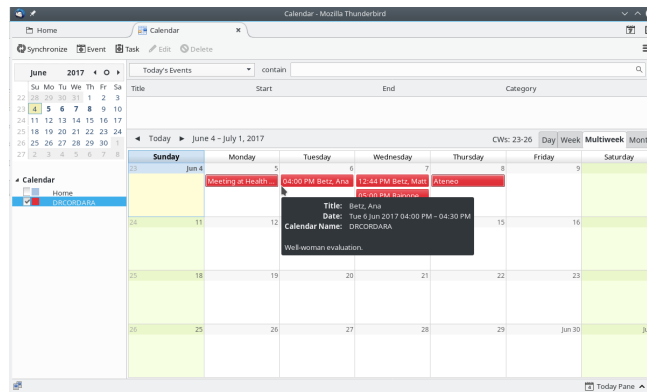
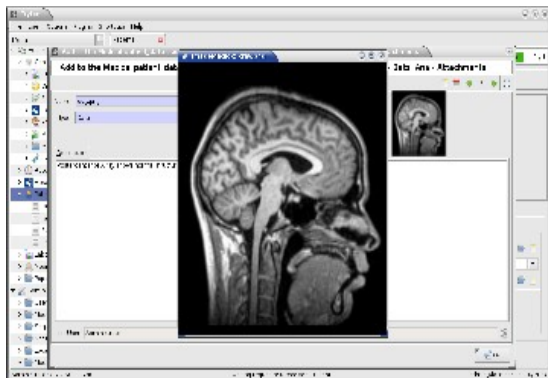
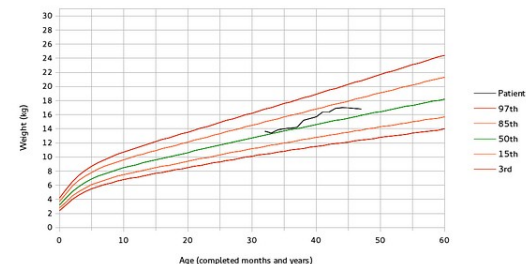
**Name :** Matt  
**Mother :** Betz, Ana  
**Mother's PUID :** 55567890  
**DoB :** 2010-03-15  
**16:18:09**

**9876894**



**Male**

**3600 gr and 52 cm**



# GNU Health + Orthanc PACS Server

- Artikel
- Währungen
- Health
  - Books of Life
  - Patients
  - Appointments
  - Prescriptions
  - Health Professionals
  - Institutions
- Imaging
  - Orthanc
    - Patients
  - Studies
  - Dx Imaging - New
  - Dx Imaging Requests
  - Dx Imaging - Results

**Studies**

Patient: PHENIX Description: CT2 TÊTE, FACE, SINUS

Date: 27.09.2005 Institution: HUG

Referring Physician: CHIR-PED^CHIR-PE ID: 1361

UUID: 49974143-ec23cb52-6b2a1c46-14d5daa0-0822ce1a URL:

Server: Orthanc\_Demo Test:

Orthanc Demo - Patient - Study - Series

Filter items...

Patient	Study	Series
BRANIX PatientID: Tuesday, March 1, 1940 PatientID: 5796 PatientID: 6990	IRM cérébrale, neuro-crâne AccessionNumber: 9 InstitutionName: TGFHFCQcN4Y0BduJ255X ReferringPhysicianName: aMNA723295 RequestedProcedureDescription: IRM cérébrale, neuro- StudyDate: Friday, December 1, 2009 StudyID: 218211405 StudyInstanceID: 2.16.840.1.113689.8.92.20.1211.1000	T1DIFFE/C StudyInstanceID: 2.16.840.1.113689.8.92.20.1211.1000 SeriesInstanceID: 2.16.840.1.113689.8.92.20.1211.1000 SeriesNumber: 801 SeriesDescription: IRM

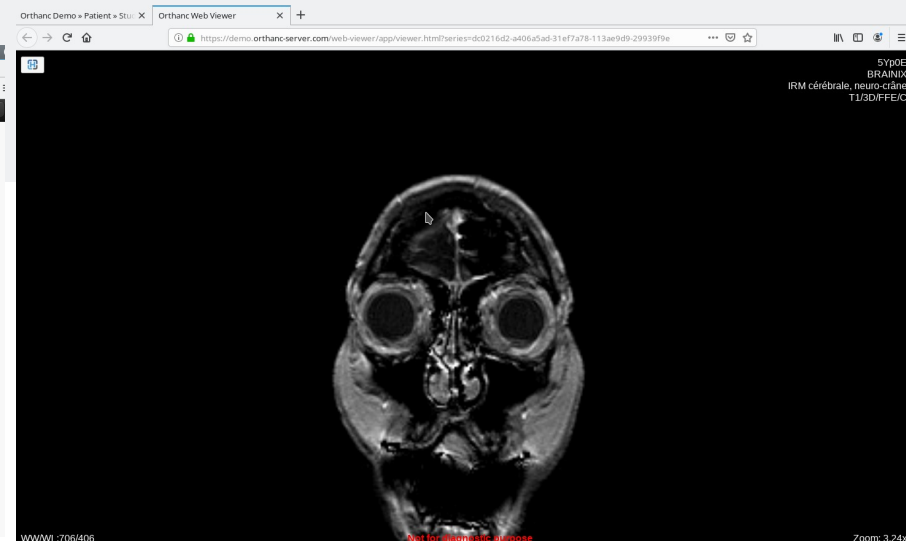
Send to DICOMweb server

Transfers accelerator

Orthanc Web Viewer

Interact

Instance
Instance 1 SOPInstanceID: 1.3.46.870989.11.0.0.11.4.2.0.8743.5.5396.2006120114483570701 TemporalPositionIdentifier: 1
Instance 2 SOPInstanceID: 1.3.46.870989.11.0.0.11.4.2.0.8743.5.5396.2006120114483564700 TemporalPositionIdentifier: 1
Instance 3 SOPInstanceID: 1.3.46.870989.11.0.0.11.4.2.0.8743.5.5396.2006120114483557699 TemporalPositionIdentifier: 1
Instance 4 SOPInstanceID: 1.3.46.870989.11.0.0.11.4.2.0.8743.5.5396.2006120114483550698 TemporalPositionIdentifier: 1
Instance 5 SOPInstanceID: 1.3.46.870989.11.0.0.11.4.2.0.8743.5.5396.2006120114483543697 TemporalPositionIdentifier: 1
Instance 6 SOPInstanceID: 1.3.46.870989.11.0.0.11.4.2.0.8743.5.5396.2006120114483535696 TemporalPositionIdentifier: 1
Instance 7 SOPInstanceID: 1.3.46.870989.11.0.0.11.4.2.0.8743.5.5396.2006120114483539095 TemporalPositionIdentifier: 1
Instance 8 SOPInstanceID: 1.3.46.870989.11.0.0.11.4.2.0.8743.5.5396.2006120114483521694 TemporalPositionIdentifier: 1



ORTANC

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# GNU Health around the world



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# GNUHealth

The Free / Libre Hospital and Health Information System



## Social Medicine & Health Informatics



# GNU Health in Laos

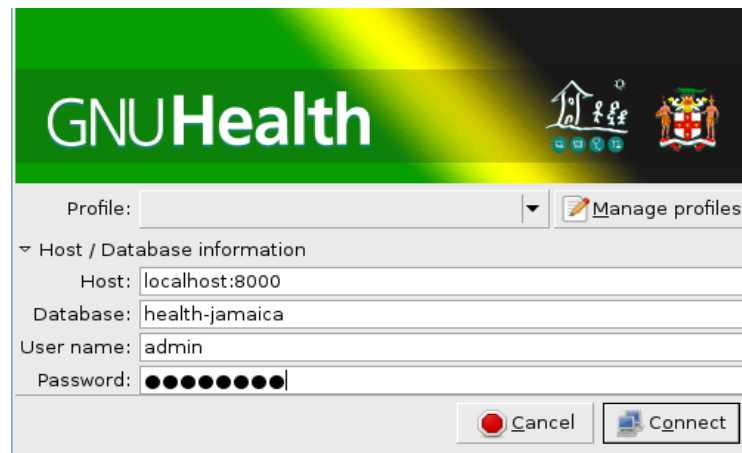


# Jamaica Govt. Adopts GNU Health



Started as a joint project between Government of Jamaica Ministry of Health and GNU Solidario

Local team

Sustainability and independence



GNUHealth

Profile:    Manage profiles



▼ Host / Database information

Host:

Database:

User name:

Password:

 Cancel  Connect



# GNU Health in the heart of Africa



<http://health.gnu.org>

# Clinics and Laboratories in Africa

## GNU Health Implementation in Africa

- Ghana, Gambia, Cameroon, Gabon, Congo, Tanzania, Kenia, etc.





# AIIMS, largest hospital in Asia



# Red Cross Mexico





# United Nations University



# World Health Organization - WHO



Immunization schedules

Malaria, TB and HIV modules

List of Essential Medicines

Tropical diseases

ICD-10 ICPM

Pediatric growth charts



Training session to WHO officials from western Africa



GNU Health implementation with WHO at Bafia general hospital

# Argentina: COVID-19 Observatory



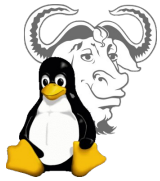
IP COVID 19 -791 Dr Sassetti, Fernando

Universidad Nacional de Entre Rios

Implementación de un sistema de información sanitario basado en software libre (GNU Health) para la gestión de epidemias en municipios

# Official GNU Package

Official GNU project  
Open Documentation  
Relies on free technology  
Friendly community



PostgreSQL



**WIKIBOOKS**  
Open books for an open world

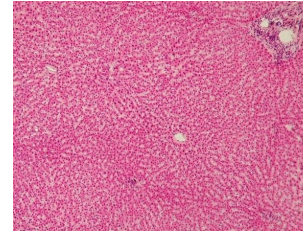
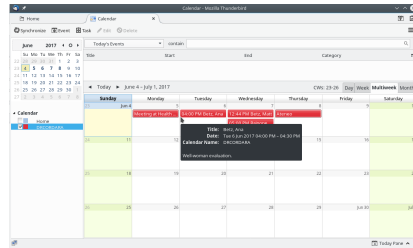
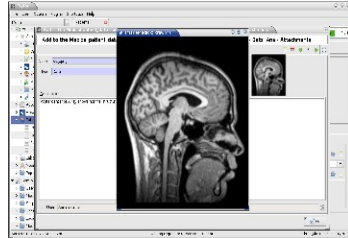
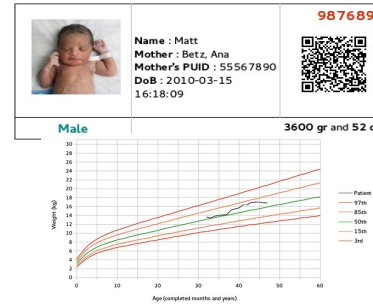
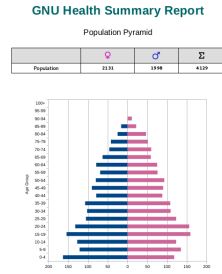
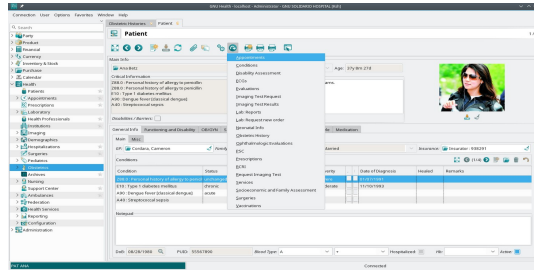


# GNUHealth ecosystem components





# GNUHealth HMIS component



MoH / Analytics

Hospital Management  
ERP

Electronic Health  
Record

Demographics /  
Social Medicine

GNUHealth

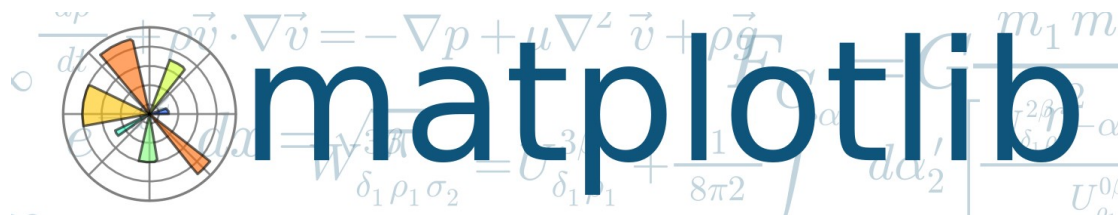
# MyGNUHealth: The Libre Personal Health Record



Empowering the person to be an **active member** in the **System of Health**



# MyGNUHealth: Technology



# Python3 as main language



Python 3 is the main language used in most of GNU Health ecosystem components

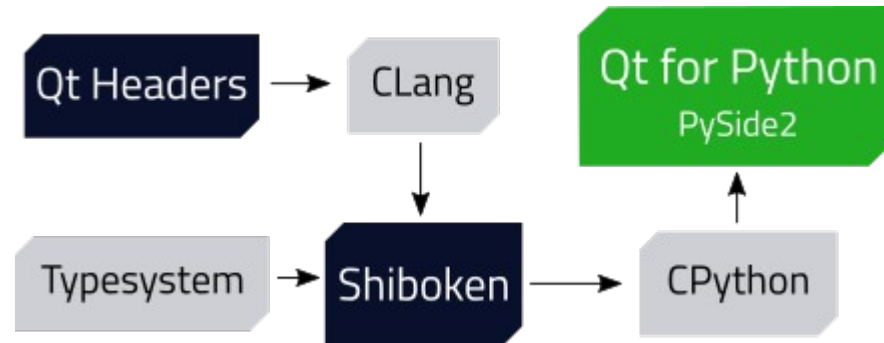
Most packages can be found at the **Python Package Index (PyPi)**



# Qt for Python (PySide2)



MyGNU Health is a Python3 application that uses the Qt framework



Source: <https://doc.qt.io/qtforpython/shiboken2/shibokengenerator.html>

# MyGNUHealth is a convergent application

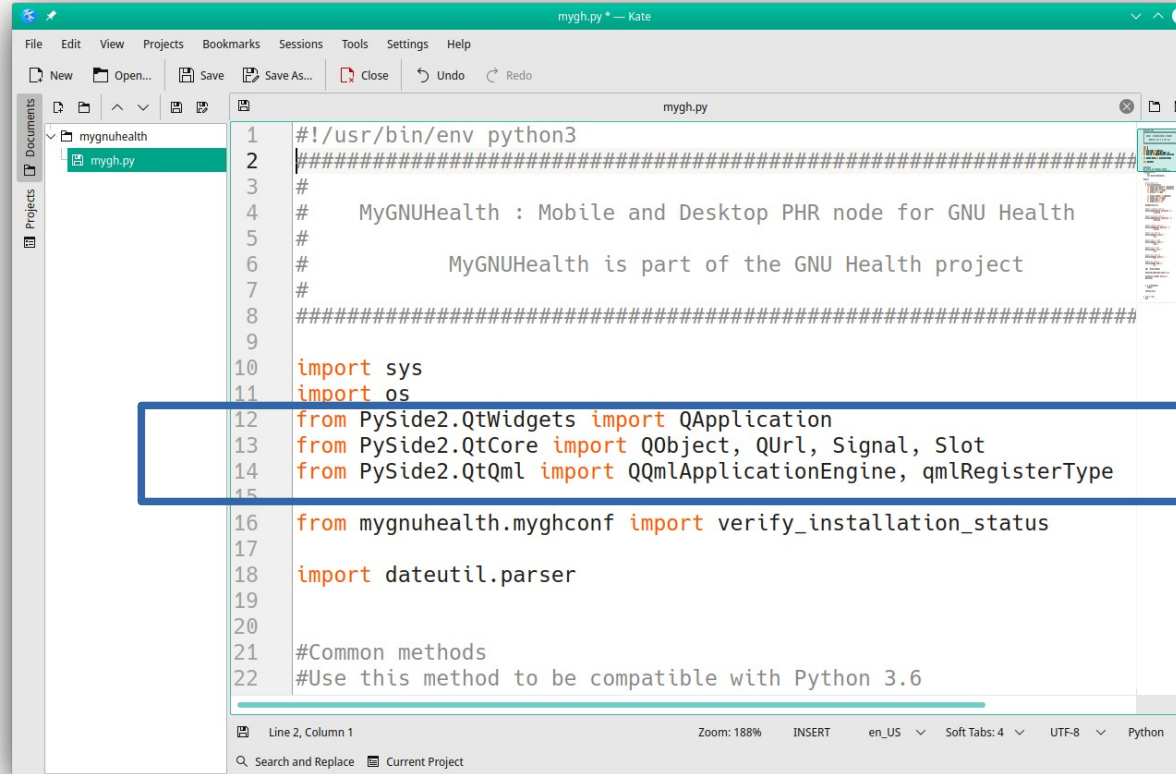


Set of QtQuick components to create convergent applications

Built on top of the QML language

MyGNUHealth is convergent. It adapts very well to desktops and mobile devices.

# Qt for Python (PySide2)

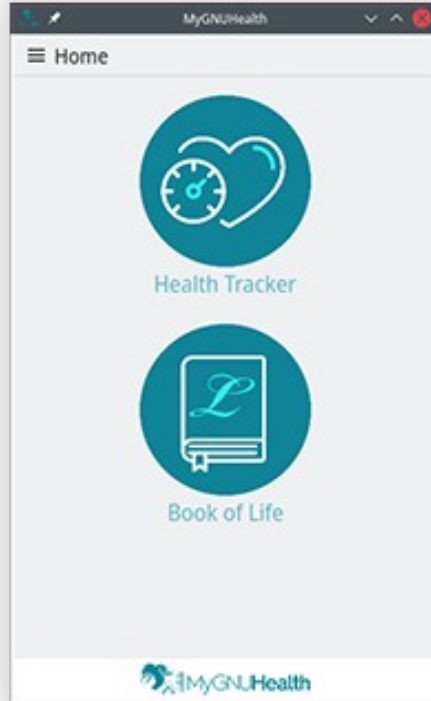


```
1  #!/usr/bin/env python3
2  #####
3  #
4  #   MyGNUHealth : Mobile and Desktop PHR node for GNU Health
5  #
6  #   MyGNUHealth is part of the GNU Health project
7  #
8  #####
9
10 import sys
11 import os
12 from PySide2.QtWidgets import QApplication
13 from PySide2.QtCore import QObject, QUrl, Signal, Slot
14 from PySide2.QtQml import QQmlApplicationEngine, qmlRegisterType
15
16 from mygnuhealth.myghconf import verify_installation_status
17
18 import dateutil.parser
19
20
21 #Common methods
22 #Use this method to be compatible with Python 3.6
```

# MyGNUHealth running on Desktop



# MyGNUHealth on Desktop





# MyGNUHealth on the PinePhone



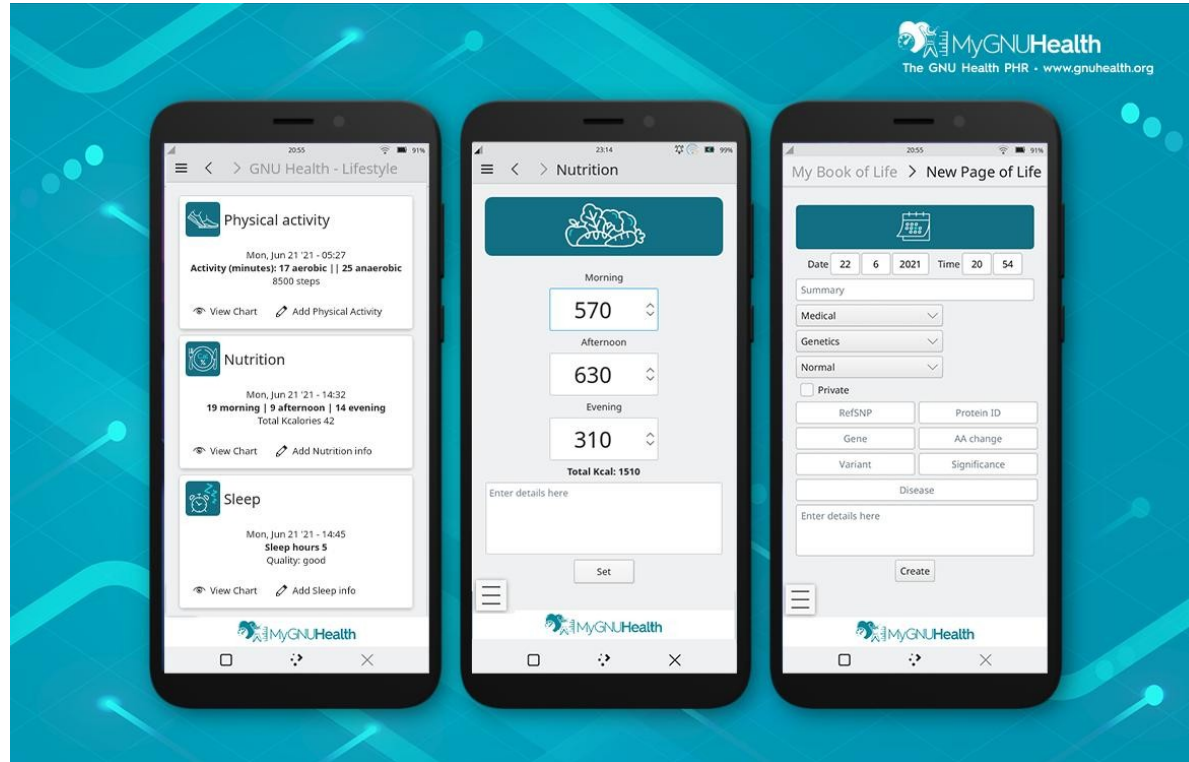
Hardware: PinePhone (“Braveheart”)

Qt5

Kirigami (set of QtQuick components)



# MyGNUHealth on the PinePhone



# MyGNUHealth running on the PinePhone



Current development environment:

Hardware: PinePhone (“Braveheart”)

Qt5

Kirigami (set of QtQuick components)



# Local Storage



MyGNU Health uses TinyDB for storage

Document oriented Database

JSON encoded

Python3 compatible

Platform independent

Easy to port from one device to another

# GH Federation and MyGNUHealth



Nodes

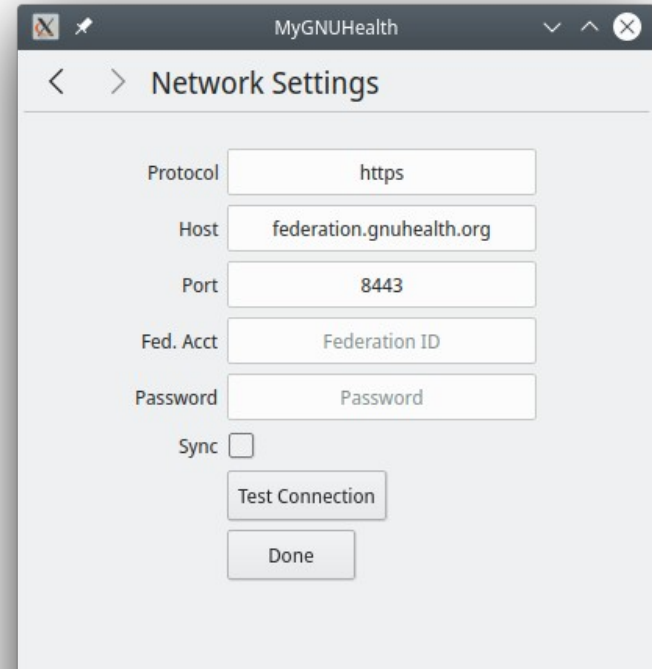
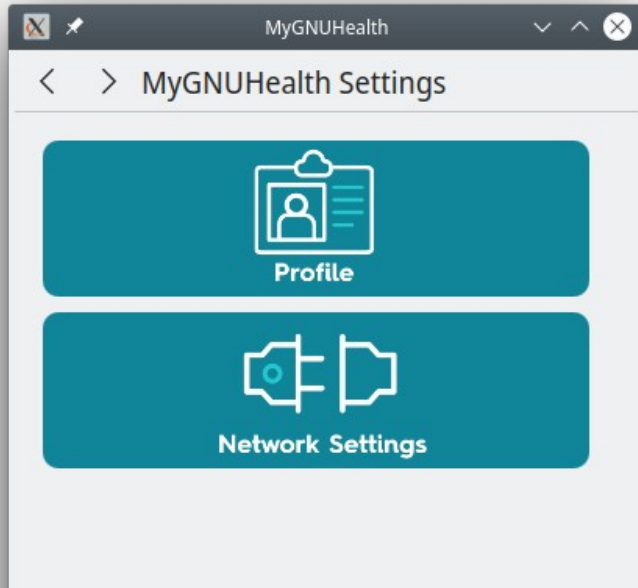
Message Server

Information System





# Coupling with GH Federation





# MyGNUHealth nodes in the GH Federation

GNUHealth  
The Free/Libre Health and Hospital Information System



## Highlights

Every person is a node

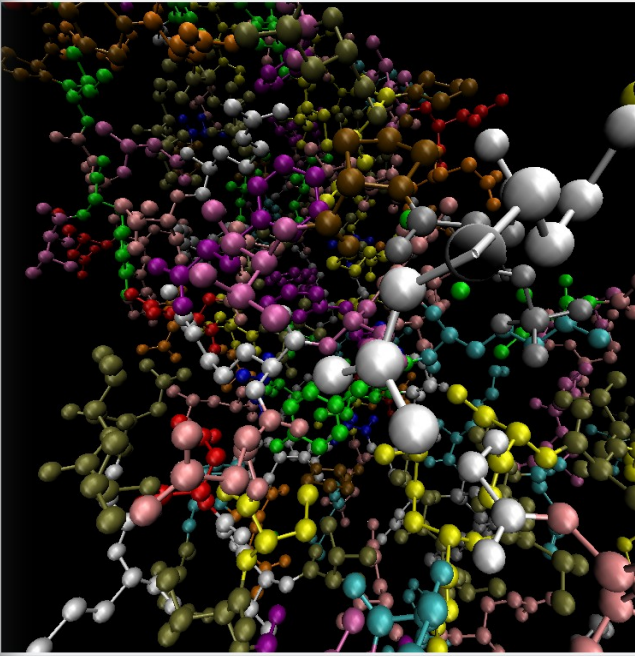
Realtime update with her health professional

Person is in control of what to share

Decrease the burden in the public health system

The person is now an active member in the public health system

# GNUHealth in Medical Genetics and Cancer Research



GNU Health - admin@localhost/genetics - Administrator - GNU SOLIDARIO HTAL [Euro]

Window Help

Variant Phenotypes 17 / 40

Variant Phenotypes

BRCA1

Gene & Protein	Variant	Phenotype
BRCA1 (P38398):breast cancer 1, early onset	VAR_007778: p.Thr102Ile	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_007781: p.Val1047Ala	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_007782: p.Pro1150Ser	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_007796: p.Ala1708Glu	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_007799: p.Met1775Arg	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_020679: p.Glu10Lys	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_020680: p.Glu23Lys	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_020683: p.Asp749Iyr	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_020690: p.Ser1187Ile	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_020691: p.Gln1200His	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_020692: p.Arg1204Ile	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_020693: p.Lys1207Asn	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_020695: p.Ser1217Tyr	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_063212: p.Met1775Lys	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_075666: p.Arg1699Trp	DI-02602:Breast cancer
BRIP1 (Q9BX63):BRCA1 interacting protein C-t	VAR_020896: p.Pro47Ala	DI-02602:Breast cancer
BRIP1 (Q9BX63):BRCA1 interacting protein C-t	VAR_020900: p.Met299Ile	DI-02602:Breast cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_007757: p.Cys61Gly	DI-01655:Ovarian cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_020702: p.Cys1697Arg	DI-01655:Ovarian cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_075666: p.Arg1699Trp	DI-01655:Ovarian cancer
BRCA1 (P38398):breast cancer 1, early onset	VAR_020679: p.Glu10Lys	DI-01559:Breast-ovarian cancer, familial, 1
BRCA1 (P38398):breast cancer 1, early onset	VAR_020680: p.Glu23Lys	DI-01559:Breast-ovarian cancer, familial, 1
BRCA1 (P38398):breast cancer 1, early onset	VAR_020690: p.Ser1187Ile	DI-01559:Breast-ovarian cancer, familial, 1
BRCA1 (P38398):breast cancer 1, early onset	VAR_020691: p.Gln1200His	DI-01559:Breast-ovarian cancer, familial, 1
BRCA1 (P38398):breast cancer 1, early onset	VAR_020695: p.Ser1217Tyr	DI-01559:Breast-ovarian cancer, familial, 1
BRCA1 (P38398):breast cancer 1, early onset	VAR_020696: p.Phe1226Leu	DI-01559:Breast-ovarian cancer, familial, 1
BRCA1 (P38398):breast cancer 1, early onset	VAR_020697: p.Arg1243Gly	DI-01559:Breast-ovarian cancer, familial, 1
BRIP1 (Q9BX63):BRCA1 interacting protein C-t	VAR_023700: p.Gln255His	DI-01603:Fanconi anemia complementation gr
BRIP1 (Q9BX63):BRCA1 interacting protein C-t	VAR_023702: p.Ala349Pro	DI-01603:Fanconi anemia complementation gr
BRIP1 (Q9BX63):BRCA1 interacting protein C-t	VAR_023703: p.Trp647Cys	DI-01603:Fanconi anemia complementation gr
BRIP1 (Q9BX63):BRCA1 interacting protein C-t	VAR_023704: p.Arg707Cys	DI-01603:Fanconi anemia complementation gr

Connected

VMD 1.9.4a12 OpenGL Display

lhm: vmd - Konsole <2>

File Edit View Bookmarks Settings Help

```

Info) Angles: 0 Dihedrals: 0 Improvers: 0 Cross-terms: 0
Info) Bondtypes: 0 Angletypes: 0 Dihedraltypes: 0 Improptypes: 0
Info) Residues: 224
Info) Waters: 3
Info) Segments: 1
Info) Fragments: 5 Protein: 2 Nucleic: 0
0
    
```

# Real-time observatory and reporting



# GNU Health Federation Community Hub



Community public server in Munich  
Demo and test environment  
Main Federation components:

- \* HMIS node and PostgreSQL
- \* Thalamus message server
- \* Person / Patient Master Index HIS
- \* openSUSE Leap OS

The GNU Health Federation Community Hub allows developers, health practitioners and research institutions from all over the world to learn, test and develop their nodes & integrate them in the Federated network.



# Academia



United Nations University, Kuala Lumpur, Malaysia



Univ. Palermo, Italia

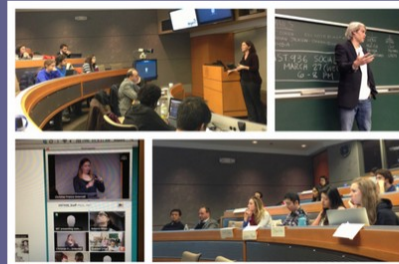


Universidad de Entre Rios, Argentina

## HST.936: Global Health Informatics to Improve Quality of Care

The 2015 iteration of our course will focus on Public Health Emergencies and Humanitarian Crises.

Classes begin: February 6, 2015  
Fridays 9am – 11am ET (GMT -5)  
Room: 09-057



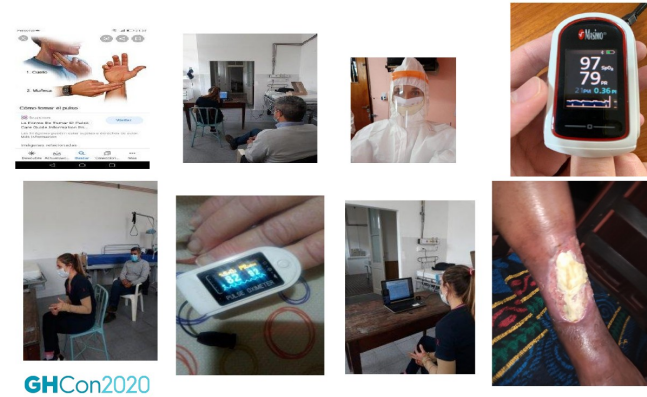
Harvard / MIT, Boston, United States



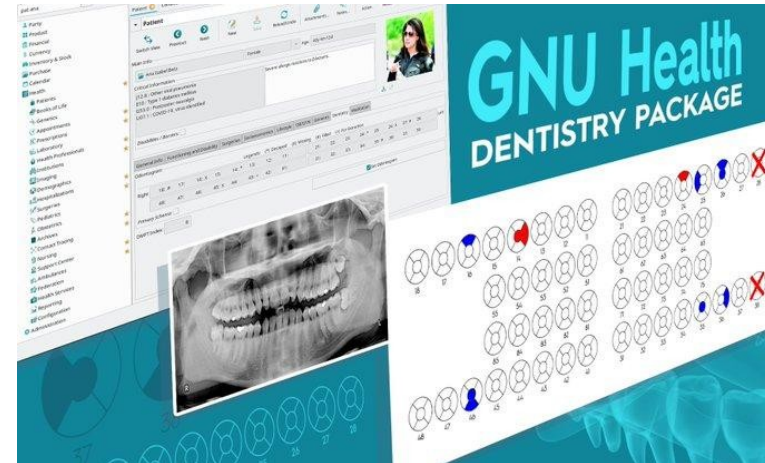
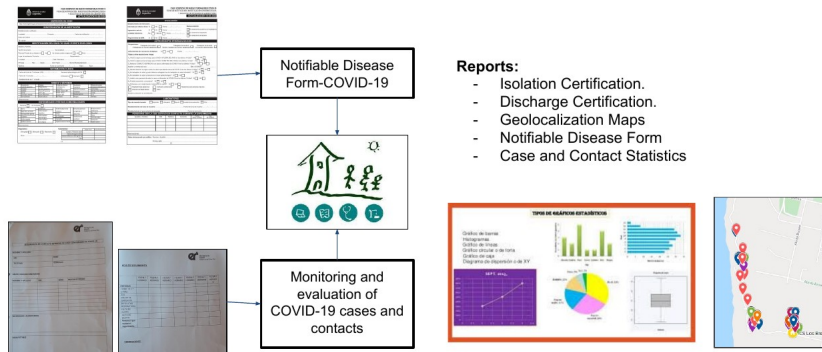
**UNIVERSIDAD DE CIENCIAS MÉDICAS**  
**Matanzas**

Univ. Matanzas, Cuba

# Entre Ríos National University - UNER



## GNU Health COVID-19 Module





# IFMSA Bangladesh



3500+ Bangladesh medical students

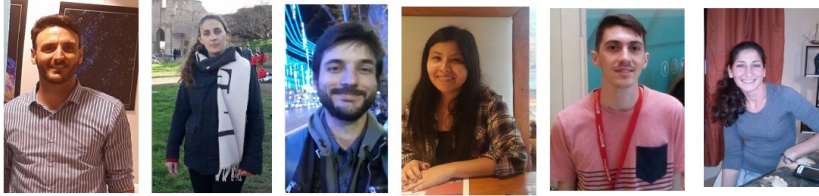
65 universities

Focused on Primary Care

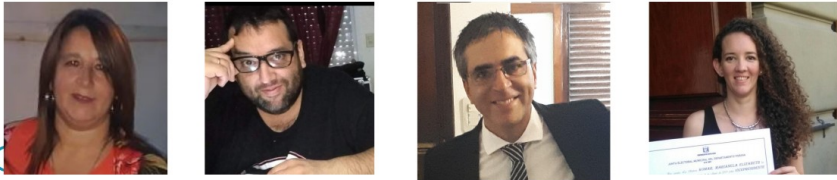
Exclusive use of Free/Libre Software

# Alianza UNER

## 1- Operative Team



## 2- Municipalities Team



## 3- Support staff



## 4 - Researchers



# Cancer as result of social injustice



NATALIA LUXARDO es investigadora del Conicet en el Área Salud y Población del Instituto Gino Germani. Profesora en la carrera de Trabajo Social de la Universidad de Buenos Aires. Se dedica al desarrollo de investigaciones transdisciplinarias y colaborativas en los territorios, desde escalas de la indagación micro y centrada en poblaciones estigmatizadas y en contextos de vulnerabilidad y exclusión. Su línea de trabajo desde las últimas décadas versa sobre diferentes dimensiones relativas a las inequidades sociales, especialmente en salud.

FERNANDO SASSETTI es bioingeniero (Universidad Nacional de Entre Ríos). Magíster en Gestión de Sistemas y Servicios de Salud (Universidad Nacional de Rosario) y doctor en Ingeniería (Universidad Nacional del Litoral). Es docente adjunto de Organización de los Sistemas de Salud de la carrera de Bioingeniería en la Facultad de Ingeniería (UNER). Participa como investigador en diversos proyectos liderados por Natalia Luxardo vinculados con el abordaje del cáncer en Argentina.



Dra. Natalia Luxardo  
Univ Buenos Aires  
CONICET



Dr. Fernando Sasseti  
Univ Entre Ríos  
Cátedra Salud Pública



Trailer documentary : <https://vimeo.com/524433855>

GNU Health was used to collect and process the demographic, clinical, epidemiological and socio-sanitary information from the participating centers

# Social Medicine



*“Medicine is a Social Science, and politics  
nothing but medicine at a larger scale”*

***Rudolf  
Virchow***



[www.gnuhealth.org](http://www.gnuhealth.org)



[@gnuhealth](https://twitter.com/gnuhealth)



[info@gnuhealth.org](mailto:info@gnuhealth.org)