

# GNU Health Federation

Building large, nationwide public health networks

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# About GNU Health

The background features abstract geometric shapes in two shades of green. On the left, a large teal shape with a hexagonal-like form contains the text. To its right, a darker green shape also has a hexagonal-like form. These shapes are separated by white space, creating a modern, geometric design.

# Freedom and Equity in Healthcare

**GNU Health is, first and foremost, a Social Project**



**...with really cool technology**



# From GNU Solidario



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



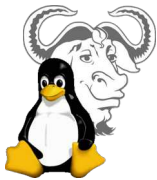
# Official GNU Package

Official GNU Package, from the Free Software Foundation

Open Documentation

Relies on free technology

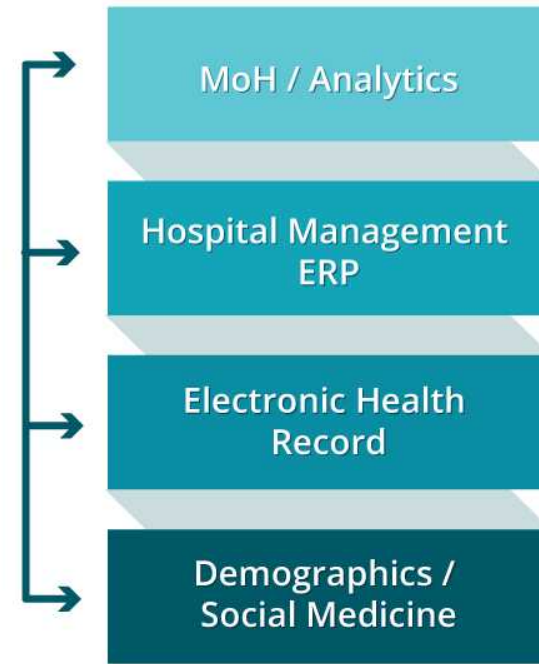
Friendly community



# GNU Health Ecosystem

The background features abstract geometric shapes in two shades of green. A large teal shape occupies the left and top portions, while a darker green shape is on the right. A white diagonal line separates the two green areas.

# Main areas / functionality



GNUHealth



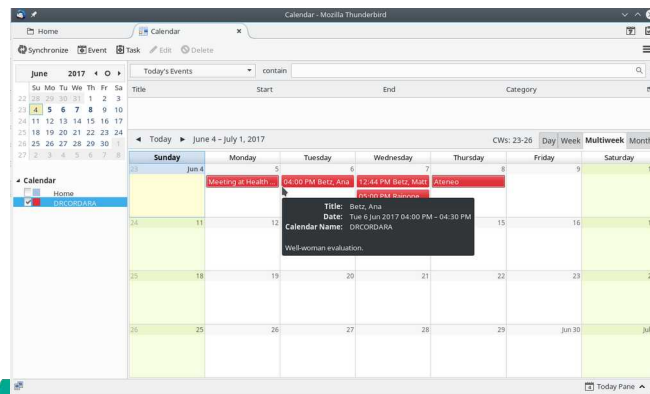
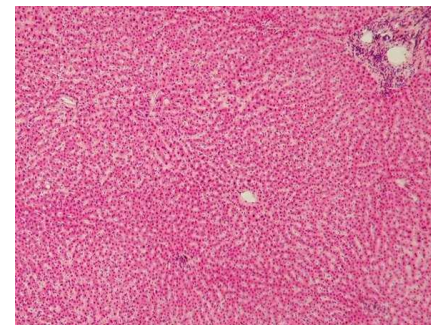
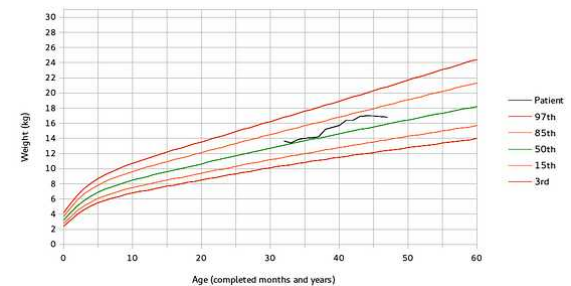
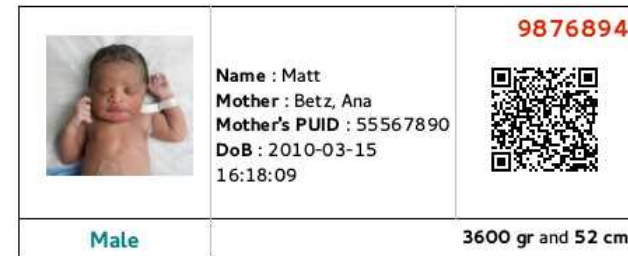
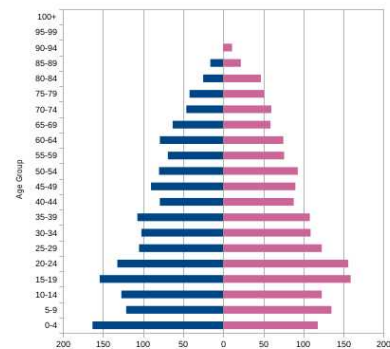
# Projects from GNU Health ecosystem







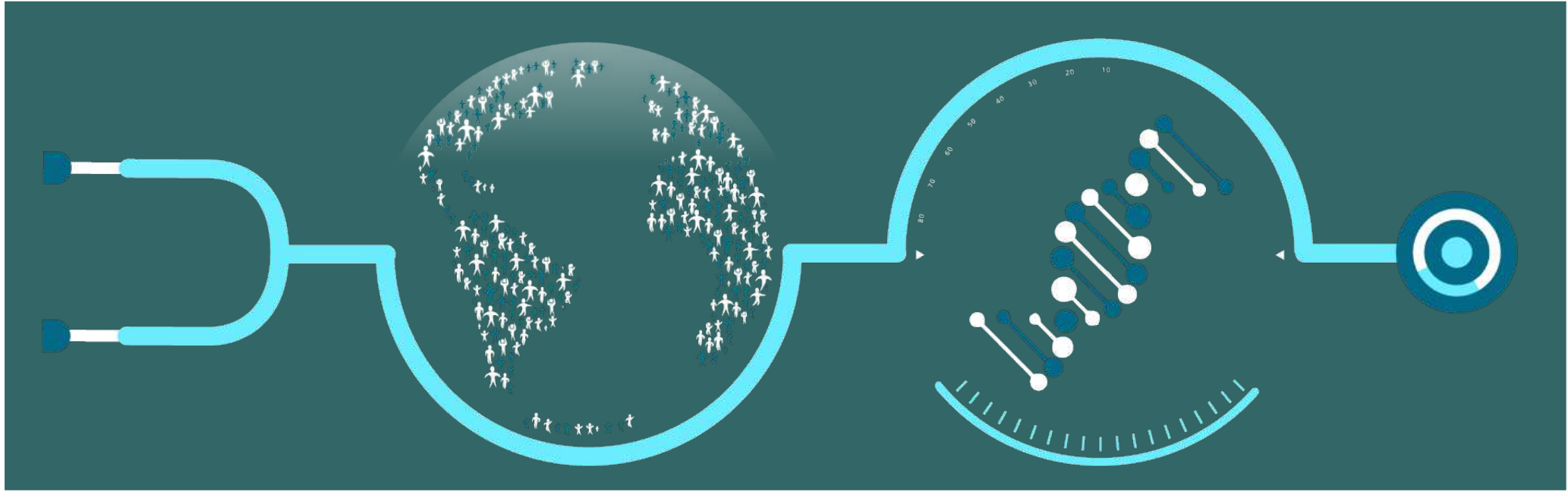
	♀	♂	Σ
Population	2131	1998	4129



The logo consists of two large, overlapping hexagonal shapes. The left hexagon is a dark teal color and contains the text 'GNU Health Federation' in white. The right hexagon is a medium green color and is partially obscured by the teal one. The background is white.

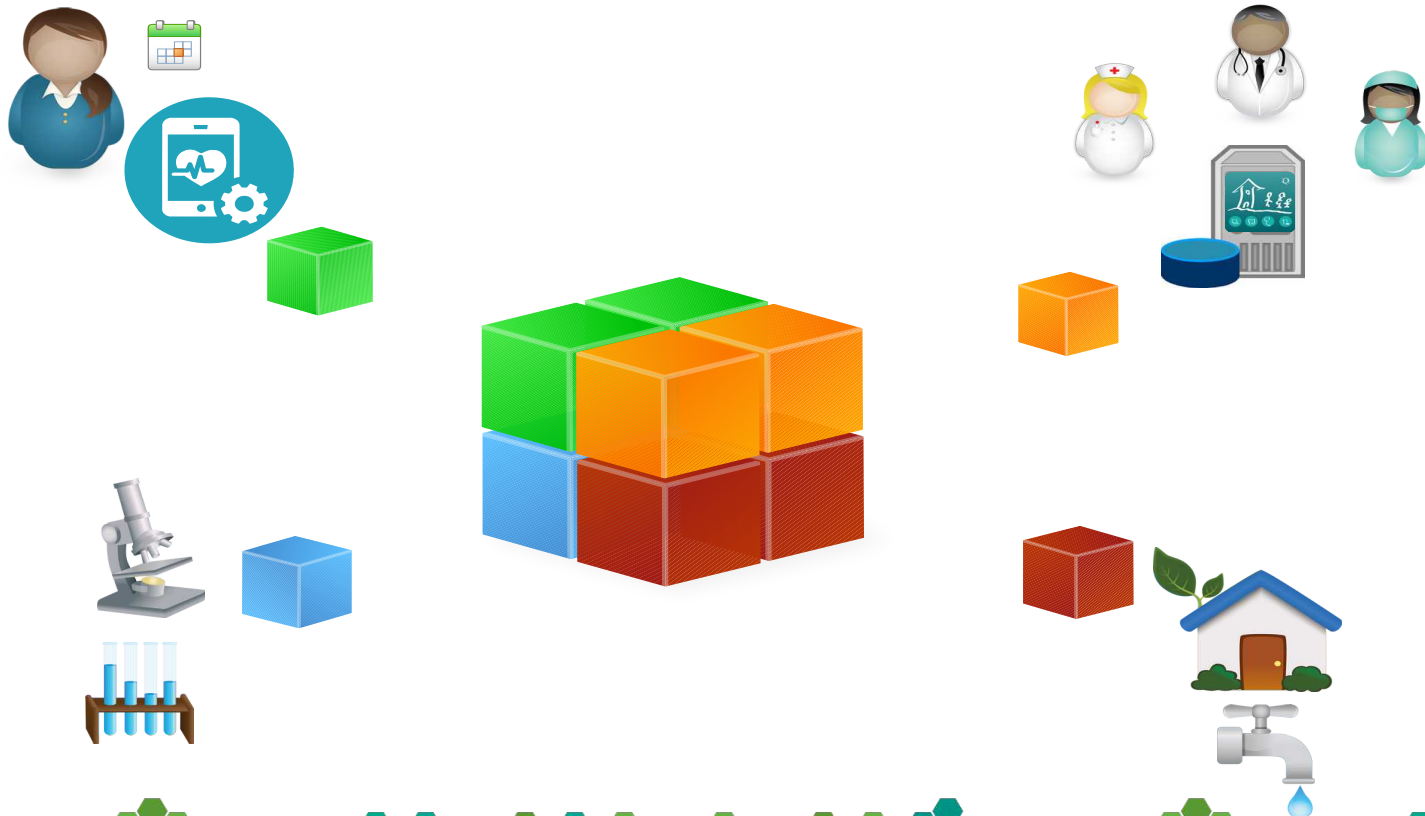
# GNU Health Federation

# The GNU Health Federation



# Network of independent health nodes

Distributed, autonomous, scalable, heterogeneous, secure, accessible



# GNU Health Federation components



Nodes

Message Server

Information System

# Federation and the GH Book of Life



## Pages and Books of Life

Each page represents a relevant event in on a person life

Types of pages: **Demographical, Medical, Biographical and Social**

With their own categories, for instance :

- \* **Social** : Exclusion, Stress, lifestyle, family, violence, food, ...
- \* **Medical** : Health condition, encounter, **genetics**, lab, surgery,...

Linked to HMIS processes (evaluations, health conditions, genetics...)

Easy to write and read by health professionals and patients

Easy to process by machines (industry and health coding standards)

Integrates and contextualizes the information





# Transdisciplinary approach to health



A GNU Health book of life is made of

**Multiple pages** and **sources** of information coming from the **person** and

a **transdisciplinary** team on

**multiple health centers** and nodes

at different times and contexts.

**The GH Federation Health Information System** aggregates the information to provide a holistic and unique picture of the person and her health history and status



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# Building Large Public Health Networks

# Case: GNU Health in Cancer research

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

Window Help

Variant Phenotypes

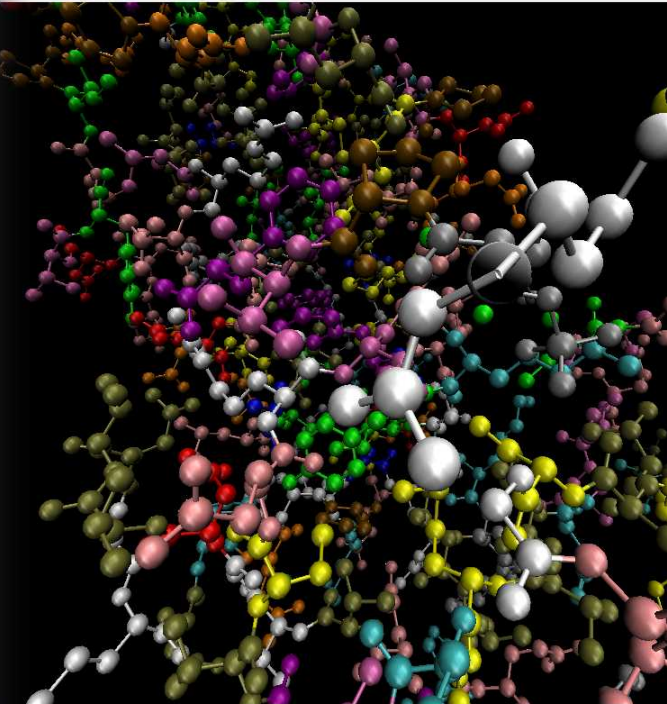
Variant Phenotypes 17 / 40

BRCA1

Gene & Protein	Variant	Phenotype
BRCA1 (P38398):breast cancer 1, early onset	VAR_007778:p.Thr1025Ile	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.Asp749Tyr	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



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
```

# Contextualized patient information

**Federation Account :** ESPGNU777ORG

**Gene :** BRCA1 (breast cancer 1, early onset)

**Locus :** 17q21

**Protein code :** P38398 . **URI :** <https://www.uniprot.org/uniprot/P38398>

**Natural variant :** VAR\_007757 // **p.Cys61Gly**

**Phenotypes:** DI-02602: **Breast Cancer** . MIM Code : 114480

DI-01655: **Ovarian Cancer** . MIM Code: 167000

**Onset age :** -

**Family history:** **Mother :** C50.1 Malignant neoplasm central portion of the breast

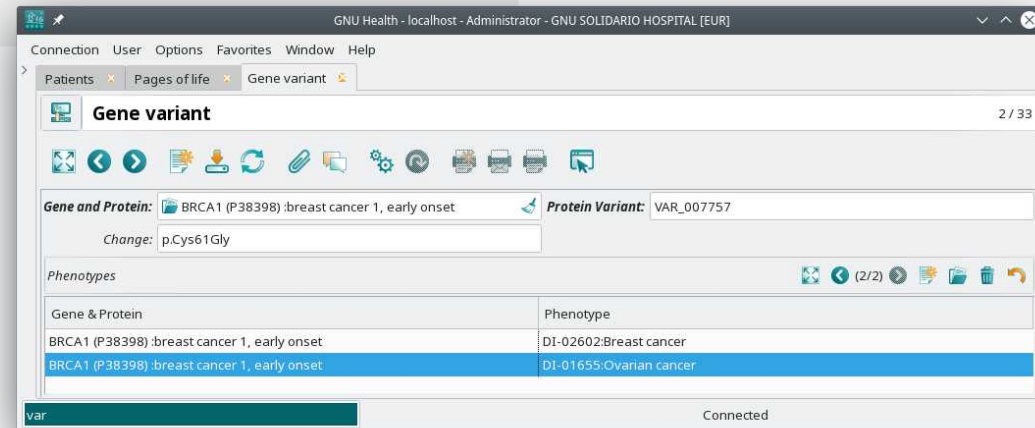
**Grandfather (maternal):** Q87.4 Marfan Syndrome

**Medical History:** Type 1 Diabetes (7y) / allergic to  $\beta$ -lactams // appendectomy (13y)

**Lifestyle:** Ex-smoker //...

Genetics  
+  
Family history  
+  
Lifestyle  
+  
Socioeconomics

The GNU Health Federation can be the answer to many **genetic natural variants of unknown clinical significance !**



# Interaction between nodes / actors

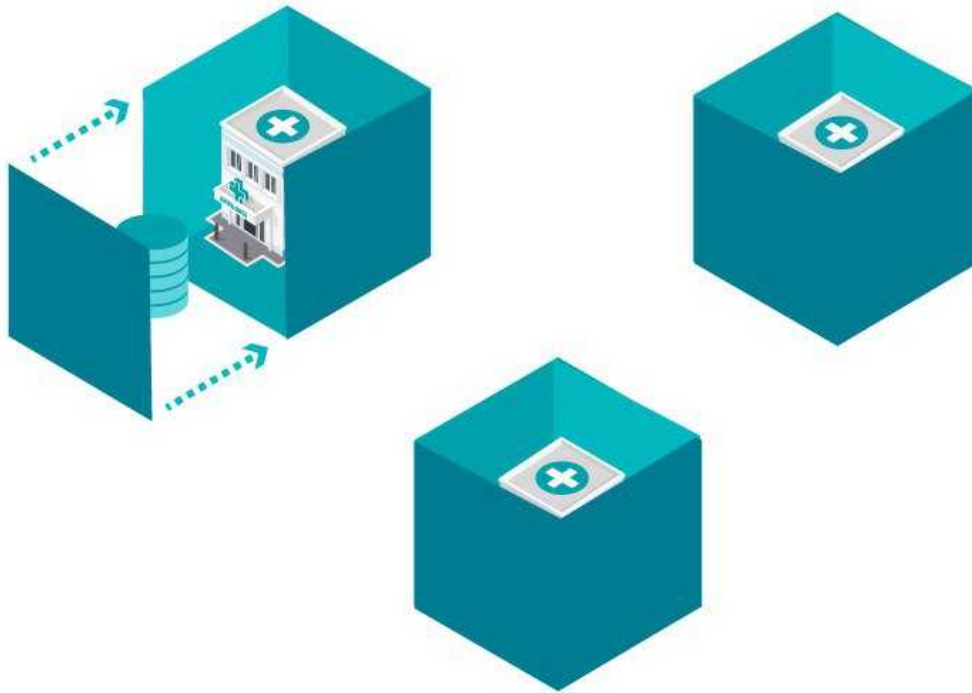
The patient, the doctor, nurse, research institution can enter their domain information, and **access** to the **latest version anytime, anywhere**



# Machine readable, Human readable

https://federation.gnuhealth.org:8443/pols/ESGNU777ORG/9b04958d-c4cc-4c05-b8bf-93f7232194a8	
200%	
JSON Raw Data Headers	
Save Copy Collapse All Expand All Filter JSON	
_id:	"9b04958d-c4cc-4c05-b8bf-93f7232194a8"
age:	""
author:	"Dr. Cameron Cordara"
book:	"ESPGNU777ORG"
creation_info:	
node:	"SPAIN-LASPALMAS-GNUSOLIDARIO-GRAL_HOSPITAL"
timestamp:	"2018-11-13 16:52:50.309425"
user:	"ITPYT999HON"
gene:	"BRCA1 (P38398) :breast cancer 1, early onset"
medical_context:	"genetics"
modification_info:	
node:	"SPAIN-LASPALMAS-GNUSOLIDARIO-GRAL_HOSPITAL"
timestamp:	"2018-11-13 16:57:03.072608"
user:	"ITPYT999HON"
natural_variant:	"p.Cys61Gly"
node:	"GNU SOLIDARIO HOSPITAL"
page_type:	"medical"
relevance:	"important"
summary:	"Susceptibility :Mother : C50.1 Malignant neoplasm central portion of the breast"

# Challenge: Health Information SILOS



The information is locked

Different health histories at each institution, most of them obsolete / not updated

Health professionals and patients can not share medical information

Opposes team work among health professionals and patients

Takes away precious time from the health professional



# A proposal to our governments

## Unique ID & history

Person demographics and **medical history up-to-date** no matter the health institution she goes across the country

## Improve quality of care

Health professionals have better and timely patient information. Saving time and providing better healthcare

## Empower the community

The person is now an active player in the system of health



**Public Money, Public Code !**

**Libre Software:** No hidden code, no blackboxes in healthcare.

The health software will be a **public good**.

**Save millions of euros** in licenses that can go to improve the public health system.



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GNU Health + openSUSE

# Professional support for GNU Health

Leap can be switched to **SuSE Linux Enterprise (SLE)**

Professional support

Large installations

Mission critical deployments



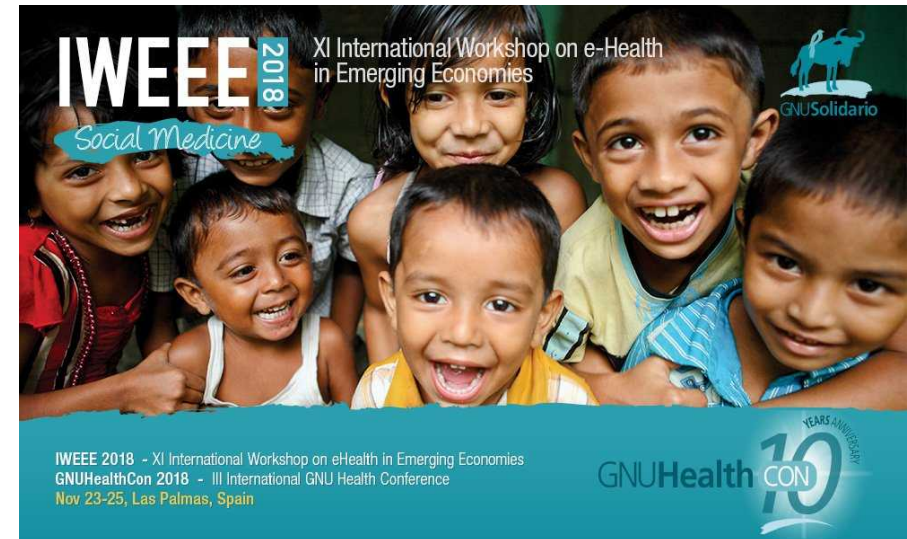
# openSUSE commitment to GNU Health



Sponsor of GNUHealthCon / IWEEE

Provides **Raspberry Pi computers & images** for GNU Health projects **around the world**

GNU Health invited to openSUSE events



# 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 practioners** and **research institutions** from all over the world to learn, test and develop their nodes & integrate them in the Federated network.

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# Some projects around the World



# From clinics in the African rainforest



<http://health.gnu.org>

# To the largest hospitals in Asia





# GNU Health and the World Health Organization - WHO



Malaria, TB and HIV modules

Essential list of medicines

Neglected Tropical  
Diseases

ICPM



WHO Immunization schedules

ICD-10

Pediatric growth charts



Training sessions with WHO Africa regional officers



GNU Health implementation at Bafia district Hospital, Cameroon with the World Health Organization

# Jamaica Public Health System



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

# Red Cross / Cruz Roja



Cruz Roja Mexicana uses GNU Health  
Over 300,000 evaluations / year



# GNU Health at Laos public health



# Join the GNU Health Alliance !

GNU Health Alliance of Academic and Research Institutions



# GNUHealth

A L L I A N C E

OF ACADEMIC AND RESEARCH INSTITUTIONS



# GNU Health and the Academia



United Nations University, Kuala Lumpur, Malaysia



University of 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



Univ. Palermo, Italy

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



Univ. Matanzas, Cuba



# Happy and Healthy Hacking !

Health must remain a non-negotiable human right



GNU Solidario first project :Santiago del Estero, **Argentina**, 2006