Rural Telemedicine Systems for Primary Healthcare in Developing Countries

Hispanic-American Health Link

http://www.ehas.org

Participant institutions

- **Spain:**
  - **Group of Bioingeniering and Telemedicine (GBT) of the Polytechnical University of Madrid**
  - **The NGO Engineering Without Borders (ISF)**
  - **The Foundation for the Cooperation and International Health Carlos III (FCSAI)**
  - **The University Carlos III of Madrid (UC3M)**
- **Peru:**
  - **Pontifical Catholic University of Peru (PUCP)**
  - **Peruvian University Cayetano Heredia (UPCH)**
  - **Andean organism of Health - Agreement Hipólito Unanue**
- **Colombia:**
  - **University of the Cauca (UniCauca)**
- **Cuba:**
  - **Network Telematics of Medical Information of Cuba (Infomed)**
  - **Center of computer science development for the public health (CEDISAP)**
- **Portugal:**
  - **Institute of Hygiene and Tropical Medicine**
- **United Kingdom:**
  - **London School of Hygiene & Tropical Medicine**

Objective of *ehas* program

To start up national conditions to employ appropriated telemedicine systems for rural primary health care (low cost and adapted to local needs)

The *ehas* proposal

- Appropriated telemedicine systems
  - Information services for rural healthcare needs
  - Appropriated and low cost communication technology

The *ehas* services

: Voice communication

: e-mail

: Distance training

: Electronic publications

: Distance consultation

: Access to remote health information

: Support for epidemiological surveillance

: Support for drug delivery

The *ehas* technology

Developed by *ehas* partners and mainly based on:

: Radiocommunication

: Solar energy

: Free software

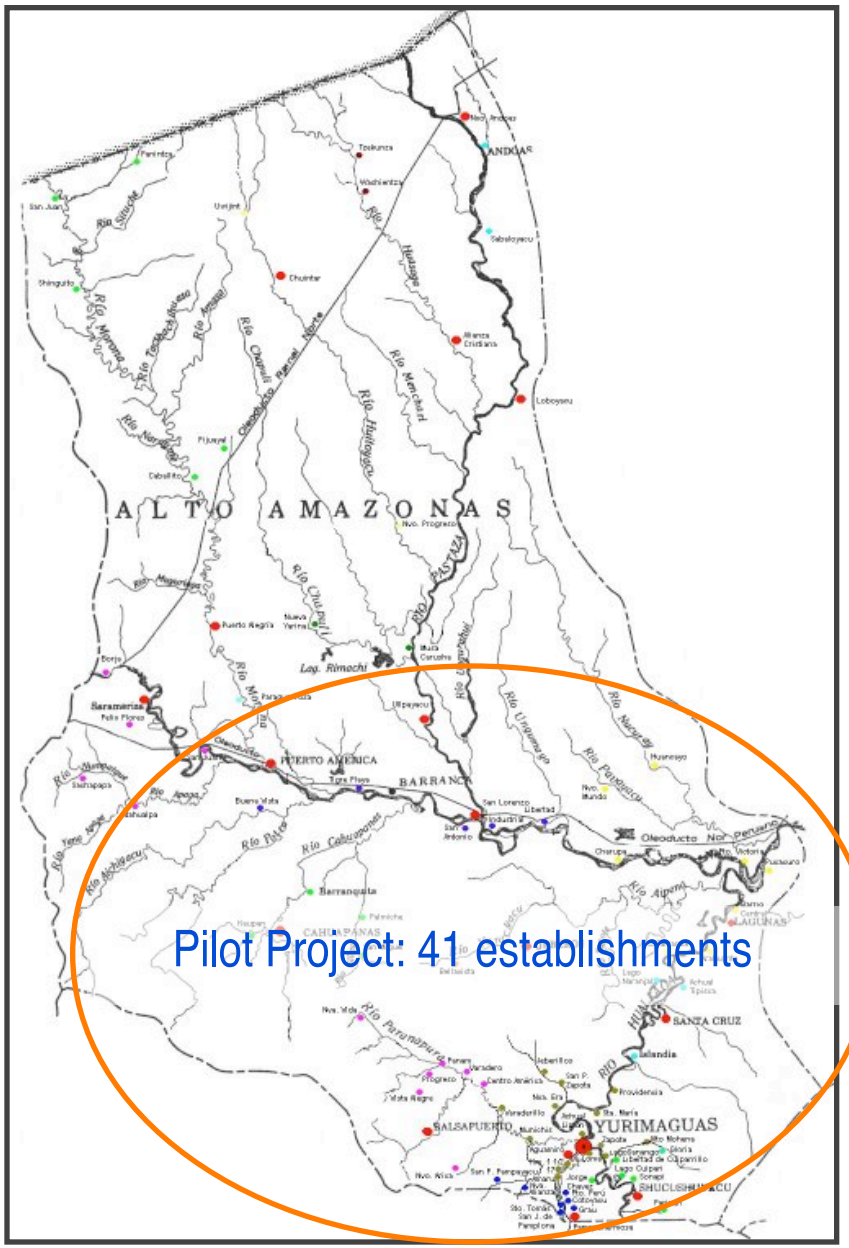
Pilot Project Alto Amazonas

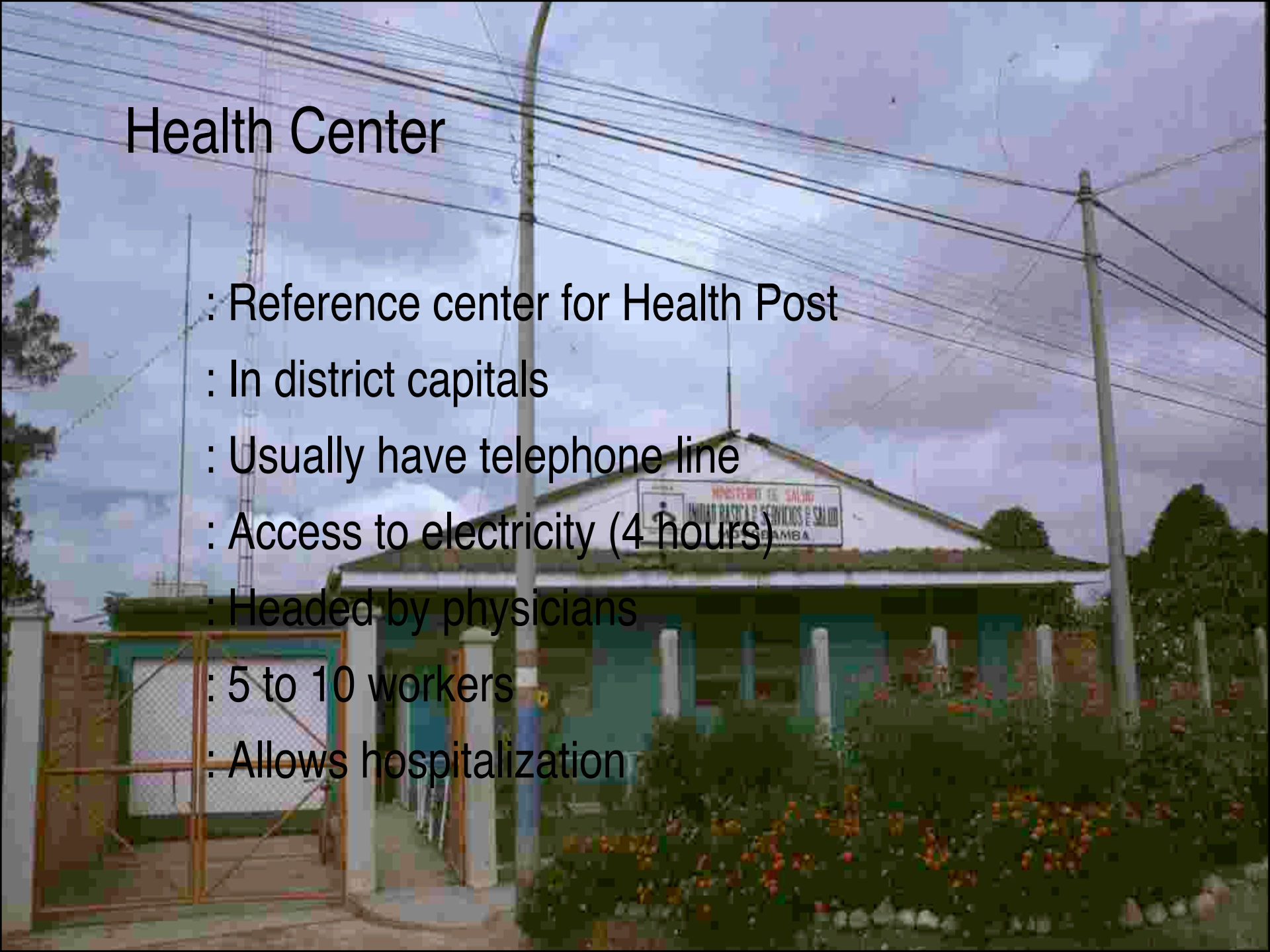
Peru

Loreto Departament

Alto Amazonas Province

Total: 93 health establishments





Health Center

: Reference center for Health Post

: In district capitals

: Usually have telephone line

: Access to electricity (4 hours)

: Headed by physicians

: 5 to 10 workers

: Allows hospitalization

Health Post

: Lowest in the hierarchy

: Managed by Health Center

: Small towns

: Difficult access

: No telephone lines

: No electricity

: 1 worker (infirmary technician)

: Low trained personnel

Problem situation in Alto Amazonas

: Scare infrastructures

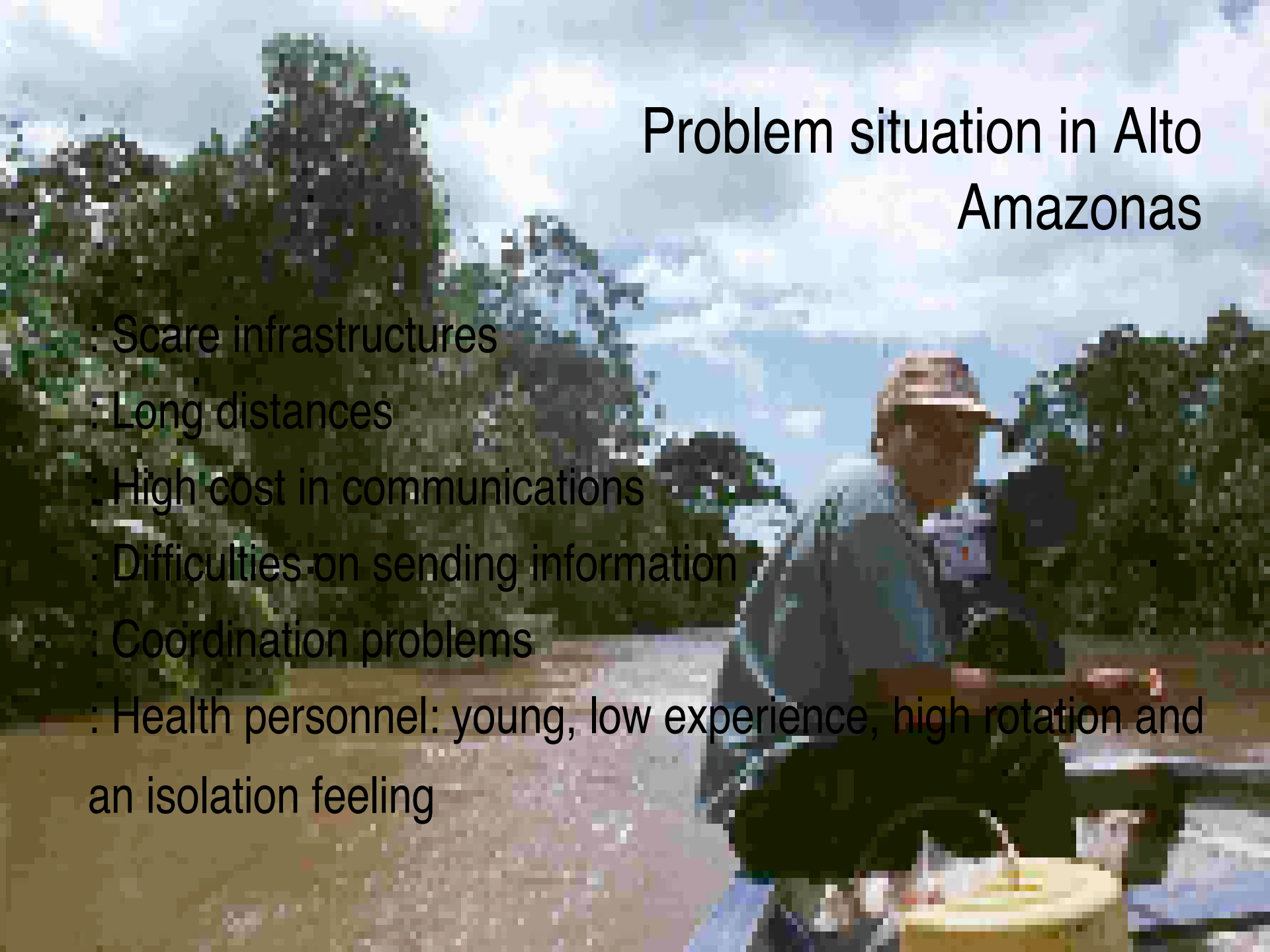
: Long distances

: High cost in communications

: Difficulties on sending information

: Coordination problems

: Health personnel: young, low experience, high rotation and an isolation feeling



The equipment at the Health Posts

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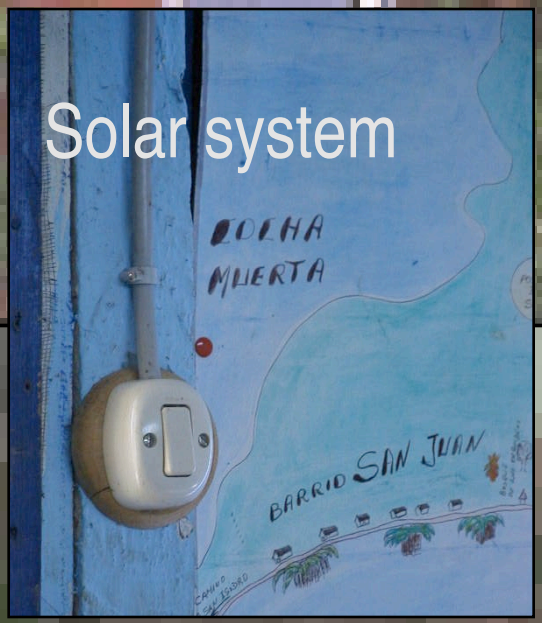


Solar system

Tower and antenna

The equipment at the Health Center

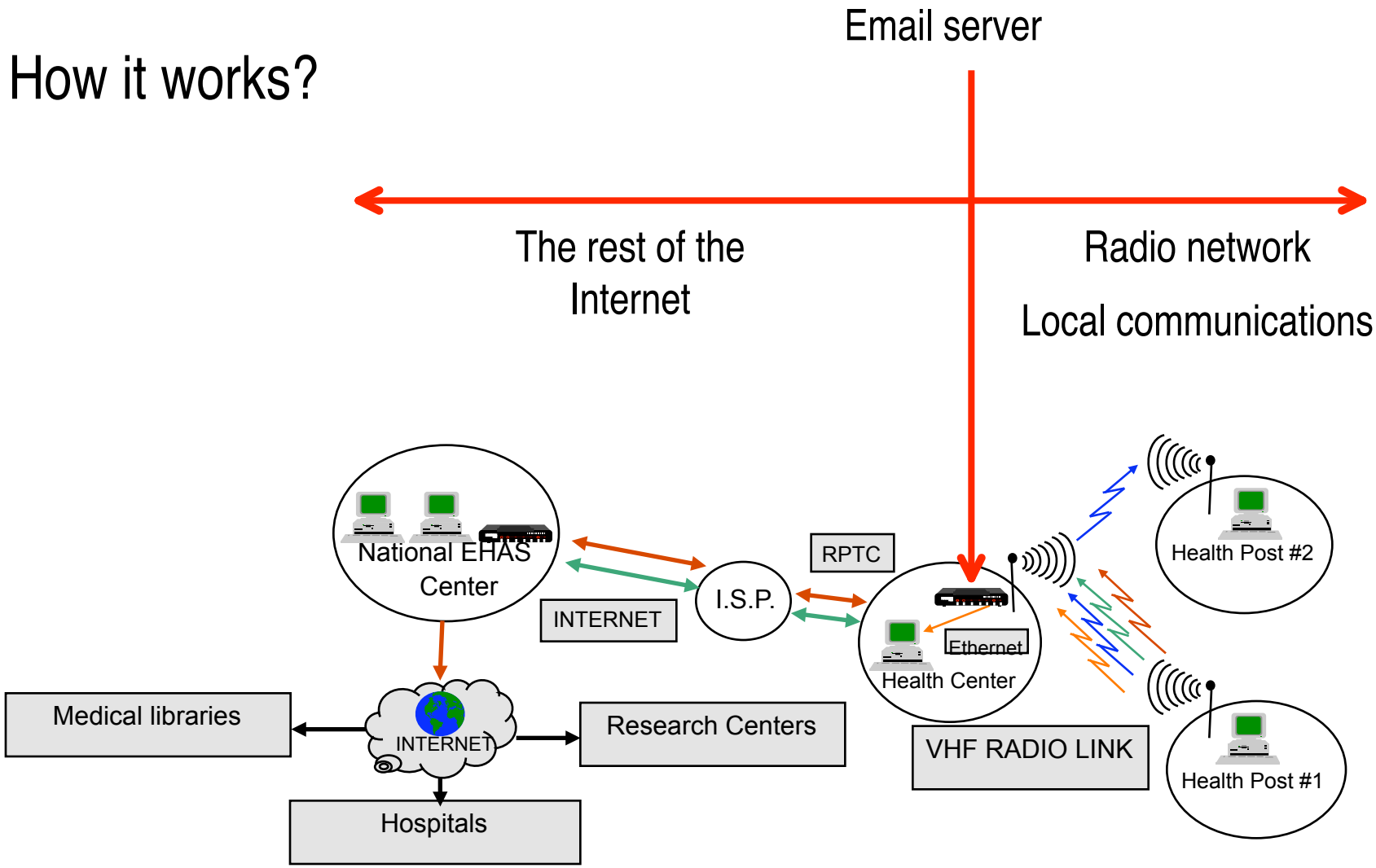
Laptop, VHF radio, printer, and...

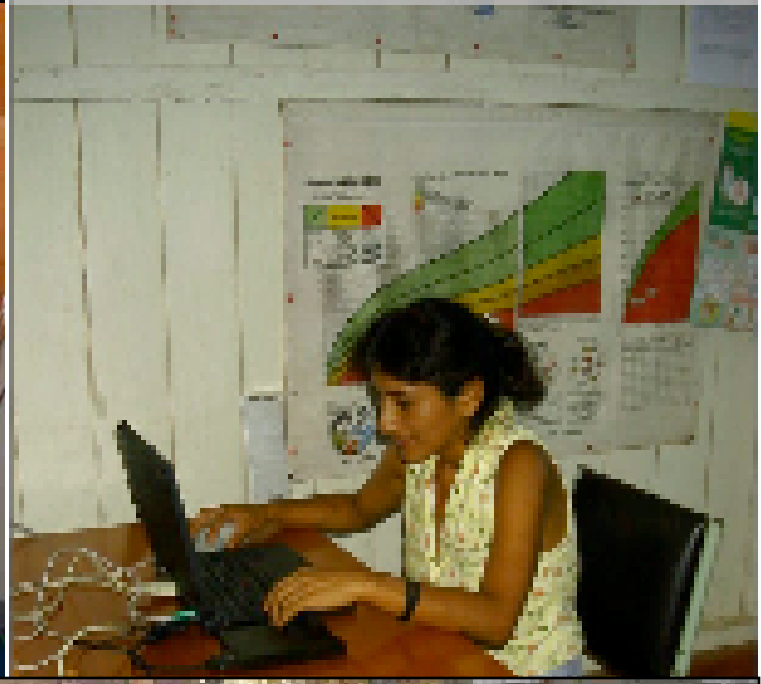
Battery loader

Email server

Battery group

How it works?


Email server
The rest of the Internet
Radio network
Local communications
National EHAS Center
INTERNET
I.S.P.
RPTC
Ethernet
Health Center
Health Post #2
Health Post #1
VHF RADIO LINK
Medical libraries
INTERNET
Research Centers
Hospitals



Uses of the system


There are local contributions from the province government, the local councils and the communities


Training in the use of computers

There is a continuous work on organizational changes

Some evidences (I)

: Use of the system (percentage of high use)

4 Voice: 84%

4 email: 27%

4 Computer:73%

: Usefulness for consultation

4 Consultations per establishment have increase 700%

: Usefulness for distance training

4 Appropriated distance training for 95%

Some evidences (II)

: Acceptance

4 Users: the system improves their jobs, reduces their tasks and allows a better healthcare

4 Management: the system is appropriated and useful

Some conclusions

- Good evidences of positive impact in healthcare system
- But, more organizational changes are needed into the Alto Amazonas healthcare system, and
- The local maintenance program has to be improve

EHAS technology now

HF

- Use of soundcard as modem.
- New QPSK modulation.
- 2400 bps over noising HF channels
- Email.
- Software based on Linux.

VHF

- Use of soundcard as modem.
- PSK modulation.
- 9600 bps over 12.5 kHz VHF/UHF radio channels.
- Email.

EHAS technology now

WiFi

RadioLinks installed in Colombia

Use of Teletronics CPE routers (www.teletronics.com/tii/products/routers/cpe.html)

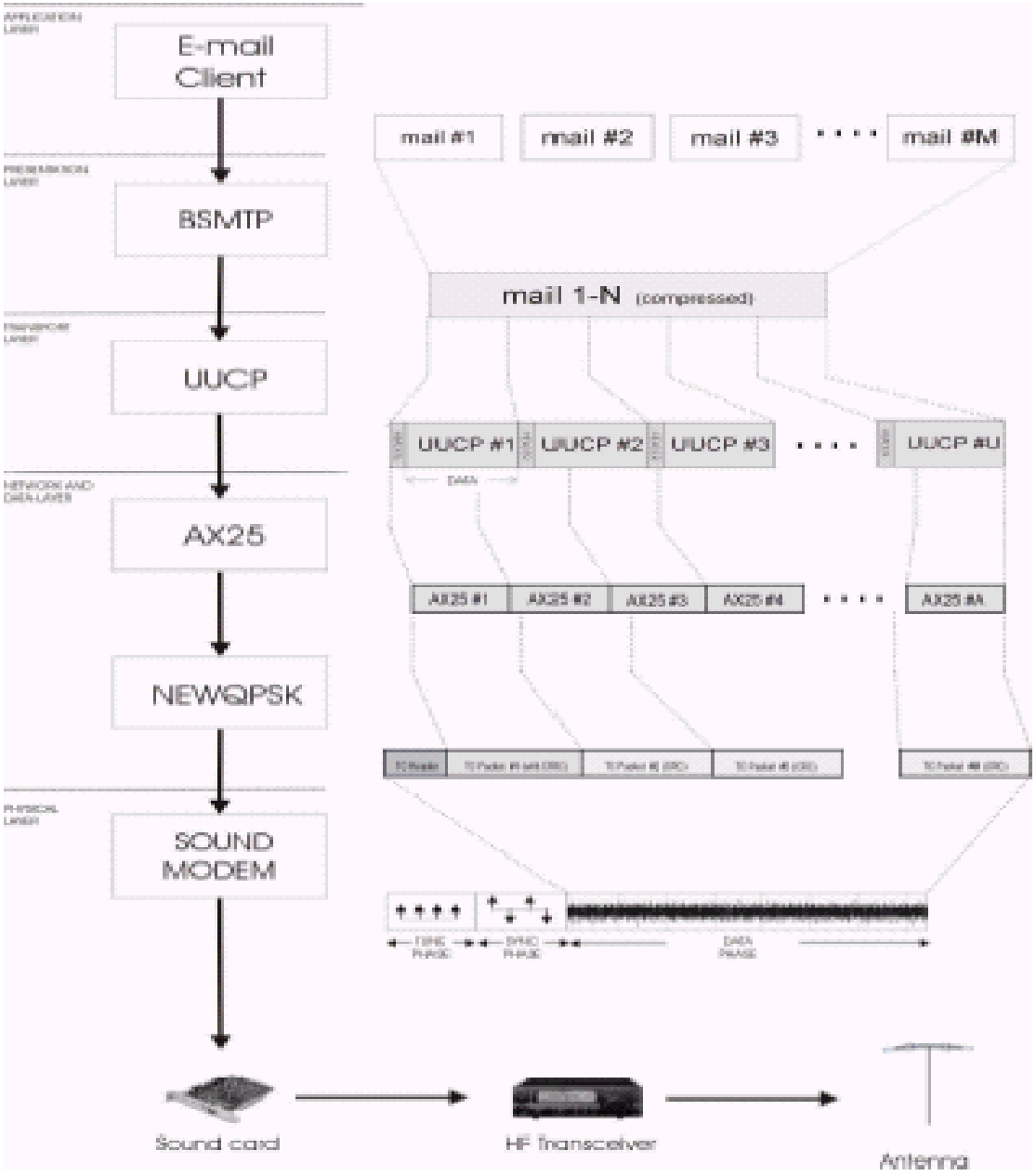
On Research

1. WiFi:

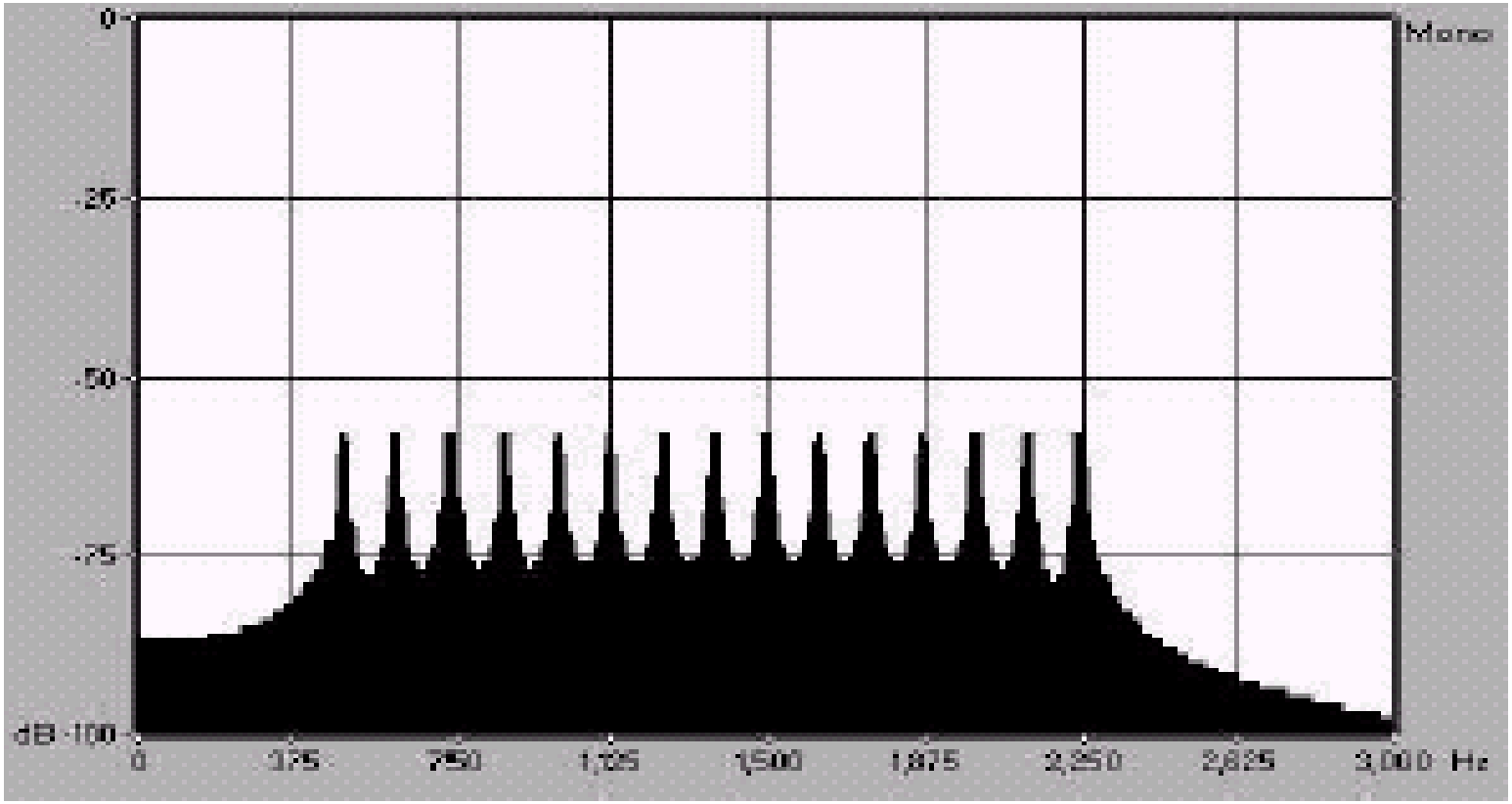
2. Design of solar wireless routers
3. QoS for Voice transmission over wireless networks
4. Interconexion of VoIP and PSTN

2. HF:

7. Improvement of Newqpsk modem
8. Testing of new M-PSK based modulations
9. Implementation of a chat system to communicate with system like Yahoo Messenger, MSN.


E-mail Client
BSMTP
UUCP
AX25
NEWQPSK
SOUND MODEM
mail #1
mail #2
mail #3
mail #M
mail 1-N (compressed)
UUCP #1
UUCP #2
UUCP #3
UUCP #U
DATA
AX25 #1
AX25 #2
AX25 #3
AX25 #N
AX25 #A
DATA PHASE
Sound card
HF Transceiver
Antenna

OFDM Spectrum of newQPSK



On Research:

3. Lightning Protection:

Polyphaser

Test a two models using ESD high voltage generator:

4. in the IS-B50, at voltages less than 3.7 kV, the current flow through the protector (from antenna side to equipment side).
5. the IS-C50 worked fine, none time (at voltages: 2, 3, 5, 10 y 20 kV) the current flow through the protector, the fuse work at 3.7 kV or more, before no
6. IS-C50 modificated (short circuited its lines) was the worse. Al the time, the current flow across it

Preliminar Conclusion:

the ideal protector should have nothing (paralell lines) between antenna and radio like the IS-C50.

Response of Maker:

Polyphaser devices are tested using 8/20 us wave (IEC-6100-4-5). Your generator use 1/30 ns

Last news!!

- 03/11/2003 Meeting of all partners for take decisions about @LIS Proyect
- 20/01/2004 EHAS finalist in the Stockholm Challenge: http://www.challenge.stockholm.se/finalists.asp?Ar=2003&key=39KV85332