Wireless **T**echnologies for isolated r**U**ral communities in developing **C**ountries based on cellul**A**r 3G femtocell deployme**N**ts

Josep Vidal - TSC

SEVENTH FRAMEWORK PROGRAMME

www.ict-tucan3g.eu

Summary

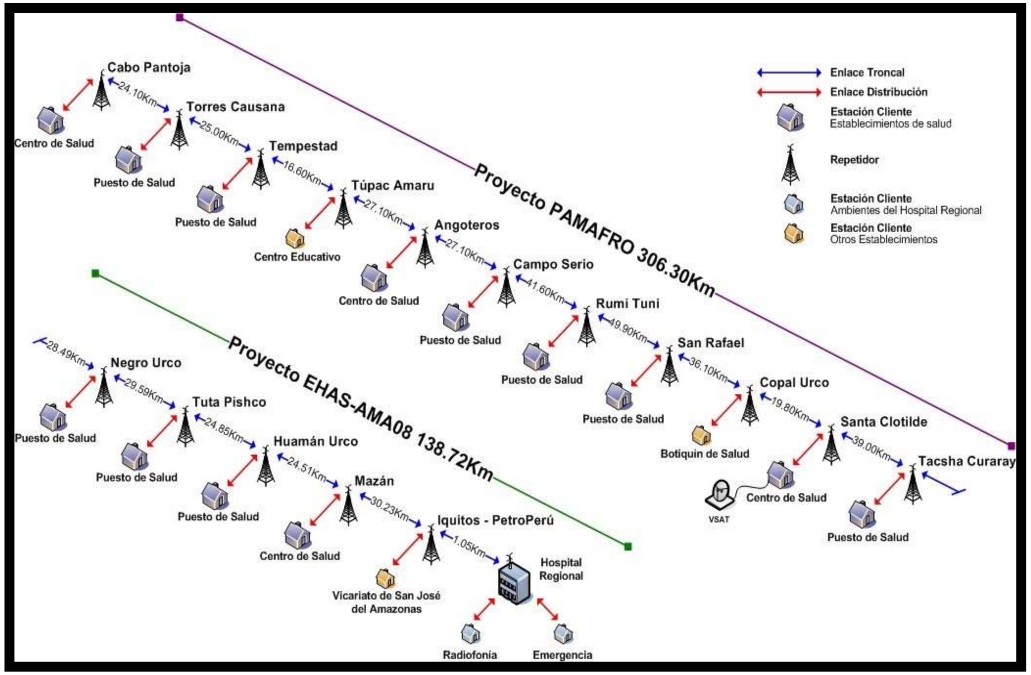
- Why do we need the project?
- Objectives
- TUCAN3G approach and measurable criteria
- Role of partners
- Highlight on the technical activities

TUCAN3G: Why do we need the project?

- Rural communities in developing countries suffer from a lack of communication services, sometimes replaced by an expensive and difficult-to-maintain public satellite phone, usually subsidized by Government, without data services.

TUCAN3G: Why do we need the project?

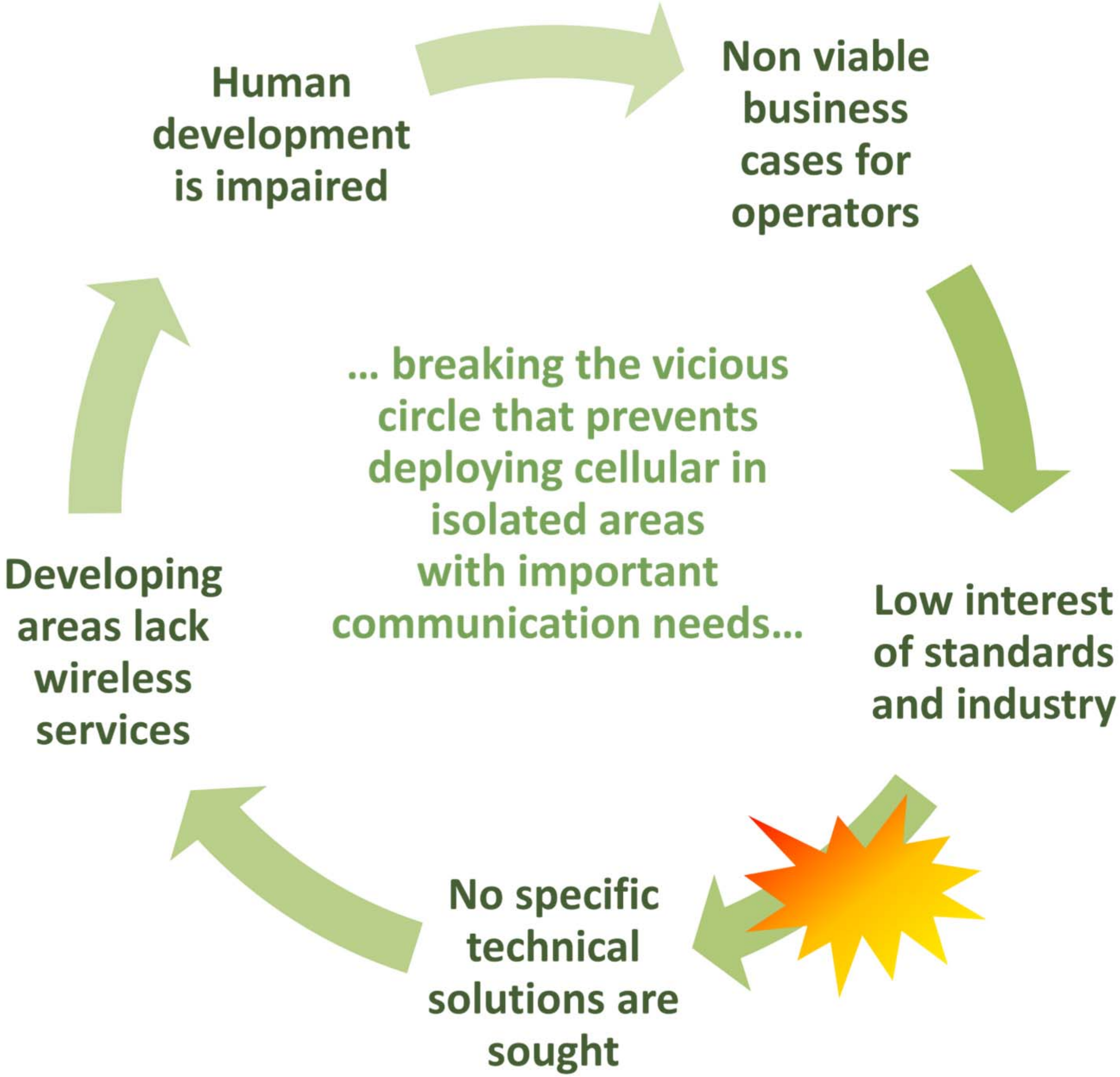
- In some communities, WiFi or WiMAX provides wireless Internet and voice coverage to a restricted number of inhabitants for health and educational services. The tradeoff cost-effectiveness is quite disadvantageous.



TUCAN3G: Why do we need the project?

- In larger towns, cellular telephony has a limited access to Internet (GSM, GPRS) or no access at all, due to low capacity backhauling. However, this has not prevented a quick and successful adoption of cellular technologies (e.g. Sta Clotilde).

Breaking good...



Challenges

In rural areas of developing countries, voice and Internet access must converge with the help of cellular technologies, but three difficulties need to be solved:

1. Backhaul capacity
2. Cost of base stations
3. Business models adapted to people with lowest incomes

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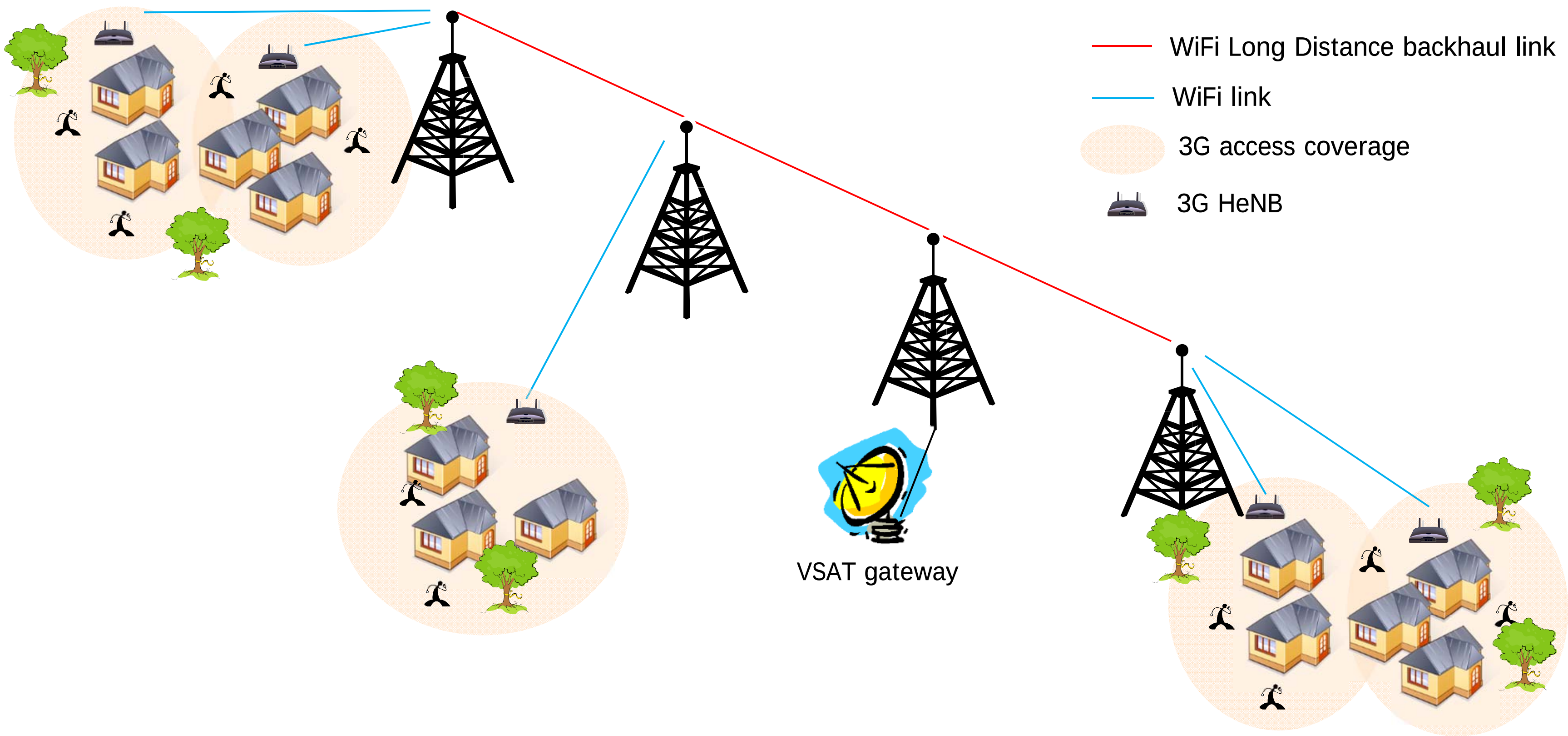
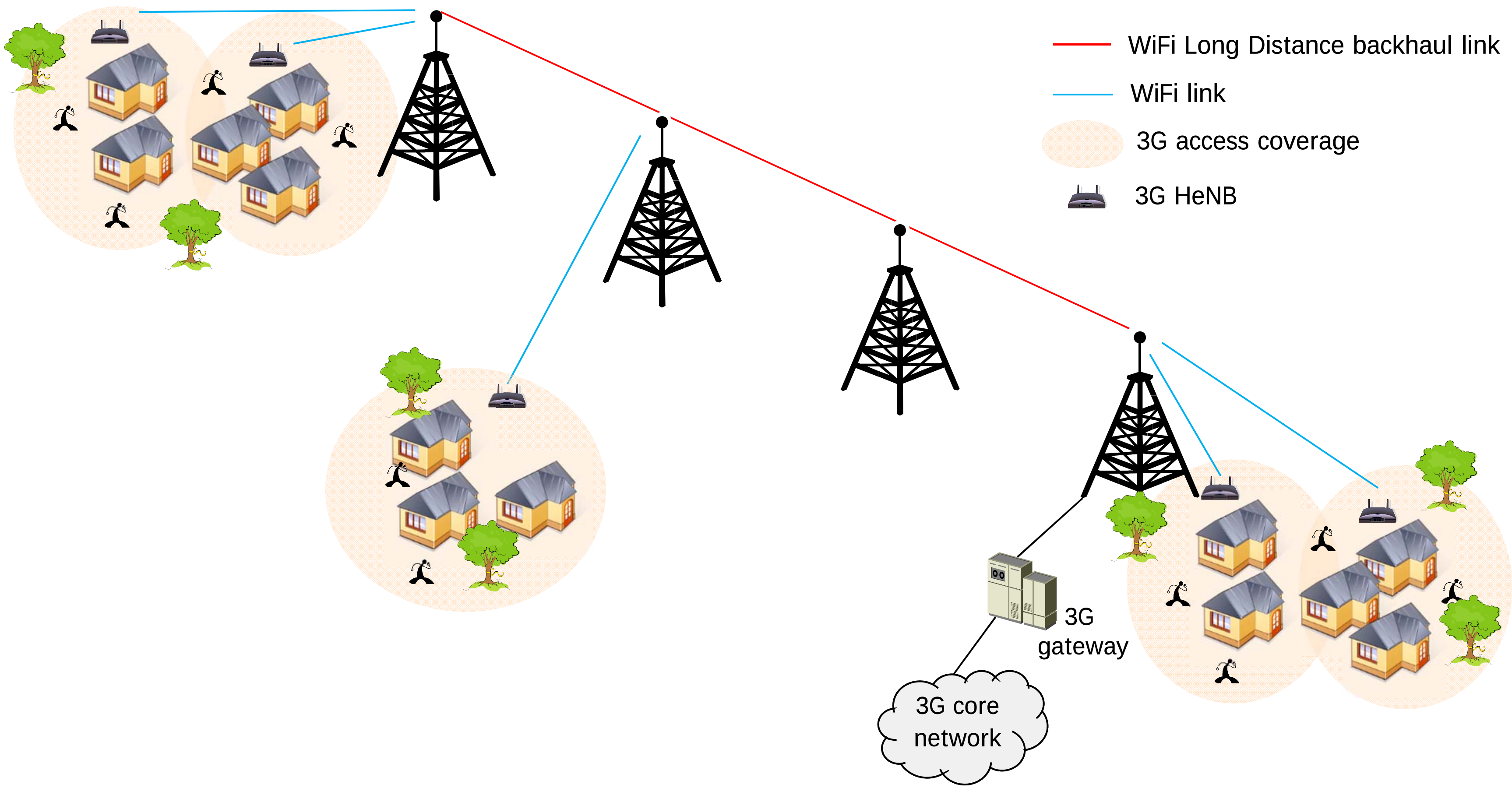
Objectives of TUCAN3G

1. Finding a suitable business model
2. Enhancing the access network using femtocells
3. Enhancing the transport network using WiFi-WiMAX-VSAT backhauling
4. Checking the viability through demonstration platform

Scenario: Napo river



Scenario: Yurimaguas region



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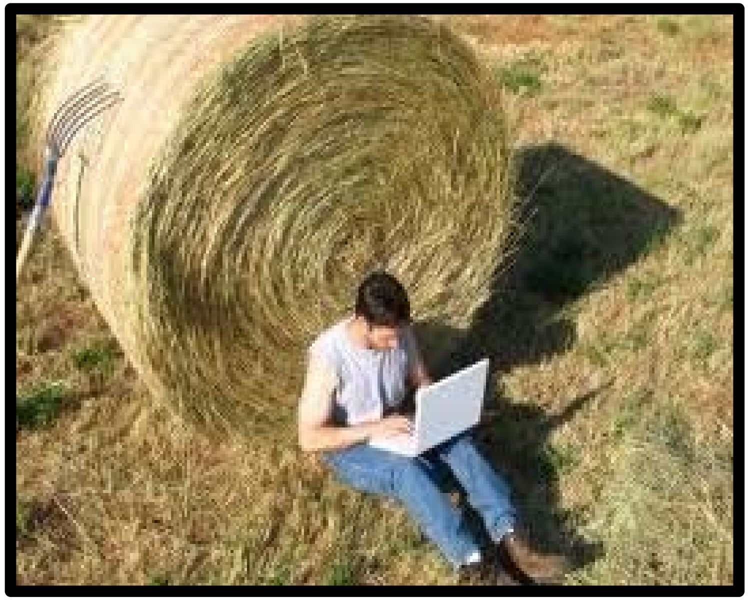
Measurable criteria

Expected benefits of the TUCAN3G results are…

- Reduced CAPEX/OPEX by improved self-organizing and energy-efficiency resource management in access and transport networks
- Profitable business case for operators in rural development (based on low-cost yet scalable access and backhaul technologies)
- Implementation in a real environment with verification plans



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The partnership

Duration: 30 months
3 EC countries and 2 third countries

Education/Research Institutes

Governmental Agency

Manufacturer

Network operators

Technology providers

Technology exploitation consultants

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Highlight on Access Network Optimization

Workpackage activities

4A1: Network dimensioning

- Dimension the UMTS/HSPA access network elements according to the requirements

- Calculate backhaul bandwidth needed and energy provision equipment

4A2: Femtocell network optimization and monitoring

- Propose distributed non-supervised methods for network monitoring and optimization under energy consumption and service constraints

4A3: Access and transport network interoperability

- Define procedures allowing effective control of multiple flows when the access network is connected to a variable quality transport network
- Evaluate different possibilities for transport network offloading

Objective

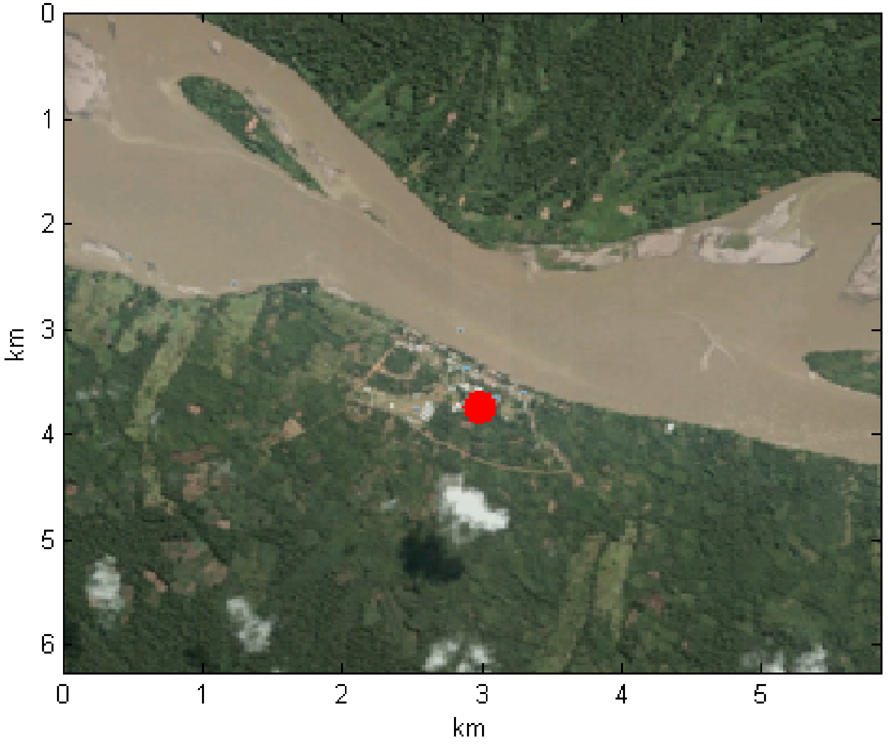
- The objective is to optimize the number of network items, satisfying the network's requirements in terms of coverage and QoS.
- Network dimensioning exercise is done for different five locations over a period of five years.
- Network dimensioning provides for each location and year:

Access Network (UMTS) — items 1–2:

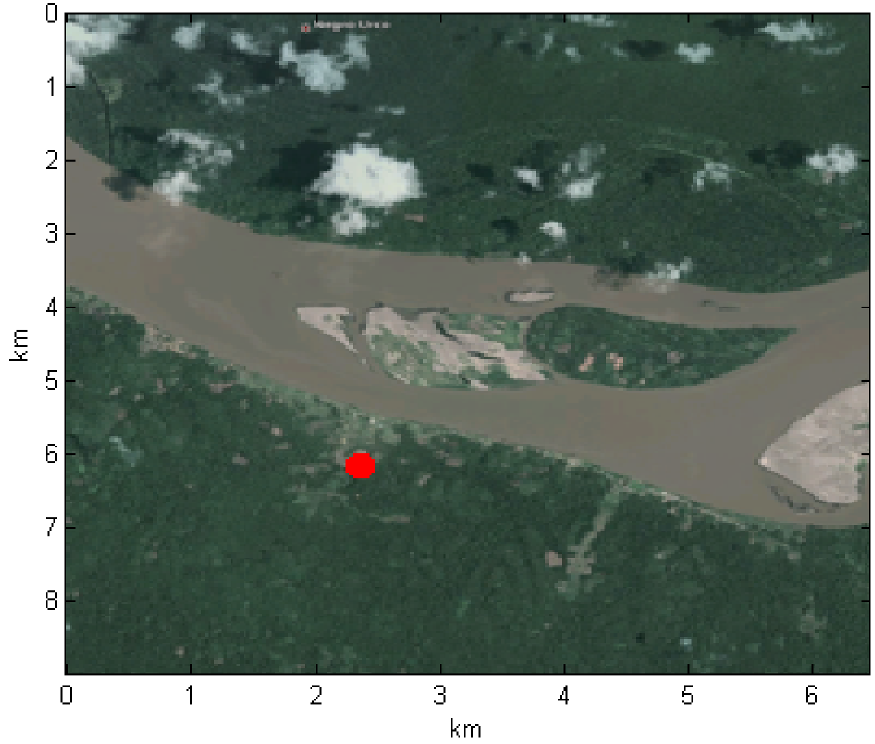
1. Adopted scenario (number of HNB, antenna type)
2. Type of HNB/s
3. Backhaul capacity
4. Number of solar panels and batteries

Locations where the networks will be deployed

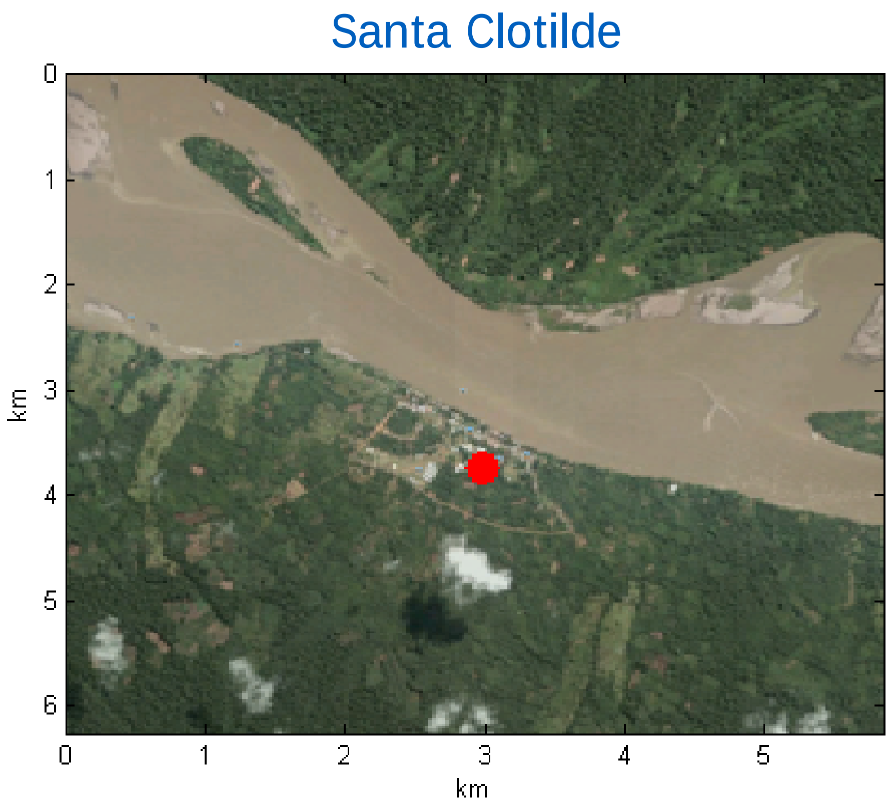
Santa Clotilde

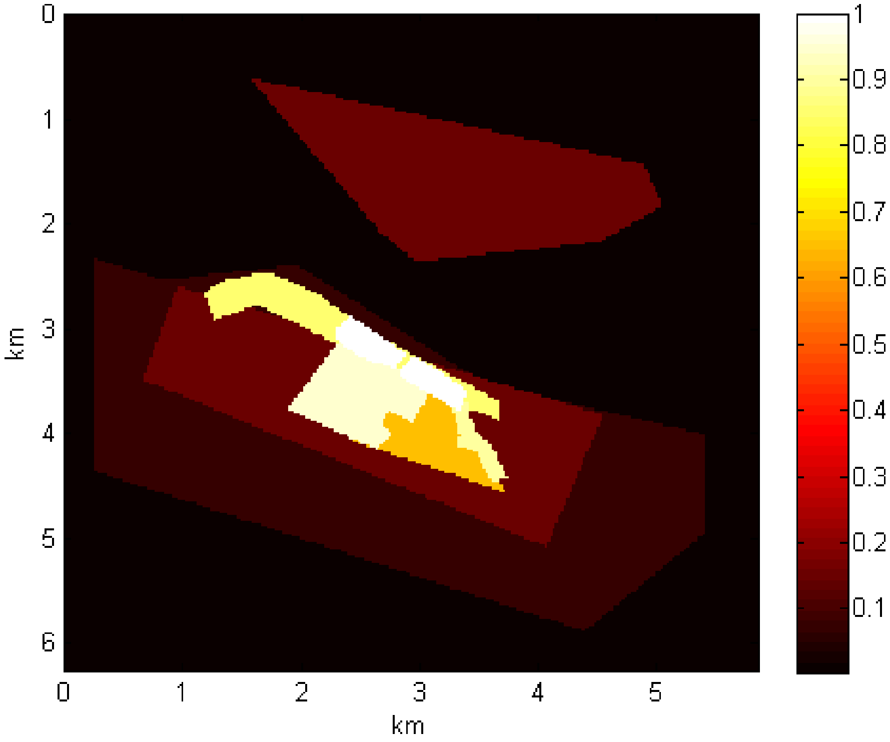


Negro Urco



Intensity of traffic generation around HNB(s)





Traffic, channel and system assumptions

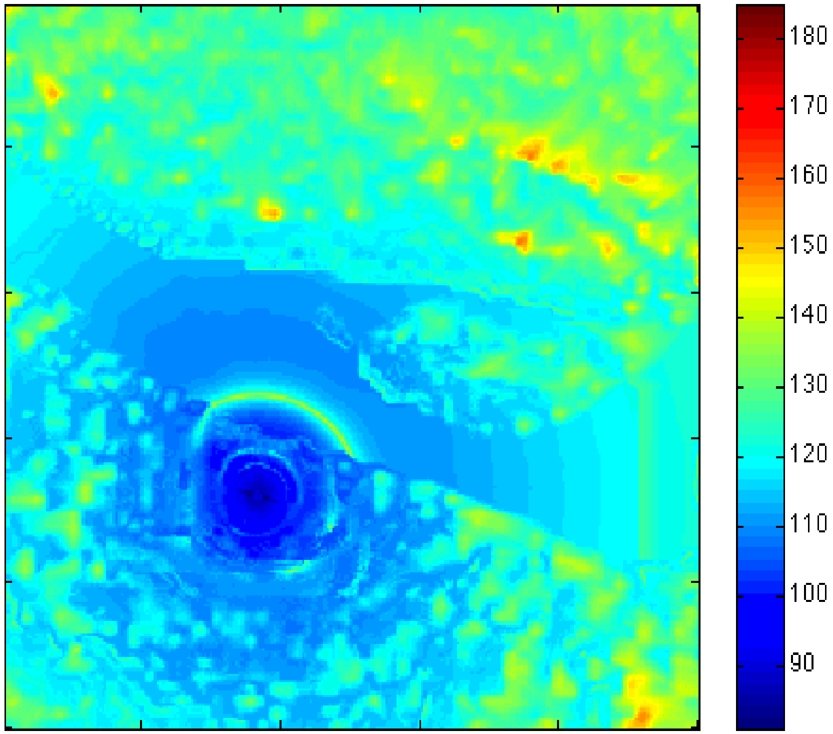
- Network planning requires the capturing parameters of:

    1. Traffic patterns
    2. Possible technical scenarios
    3. Ip.access Home Node B specifications
    4. 3G air interface
    5. Propagation channel at 850 MHz

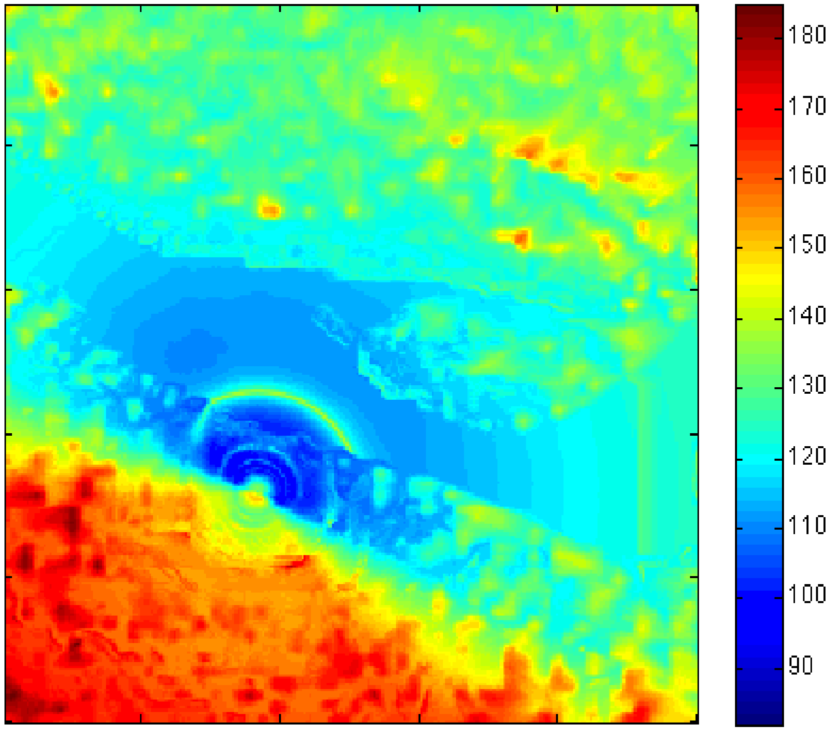
Path loss…

ITS Irregular Terrain Model – RadioMobile

- Path loss depend on the antenna pattern, its height and downtilt.



Negro Urco. Isotropic antenna



Negro Urco. Antenna with azimuth beamwidth of 180º

Workpackage activities

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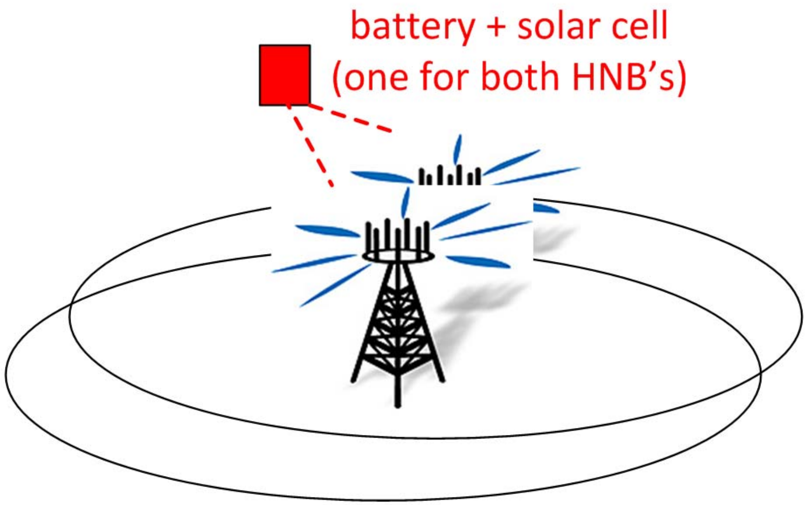
Example scenario



1-tier network:

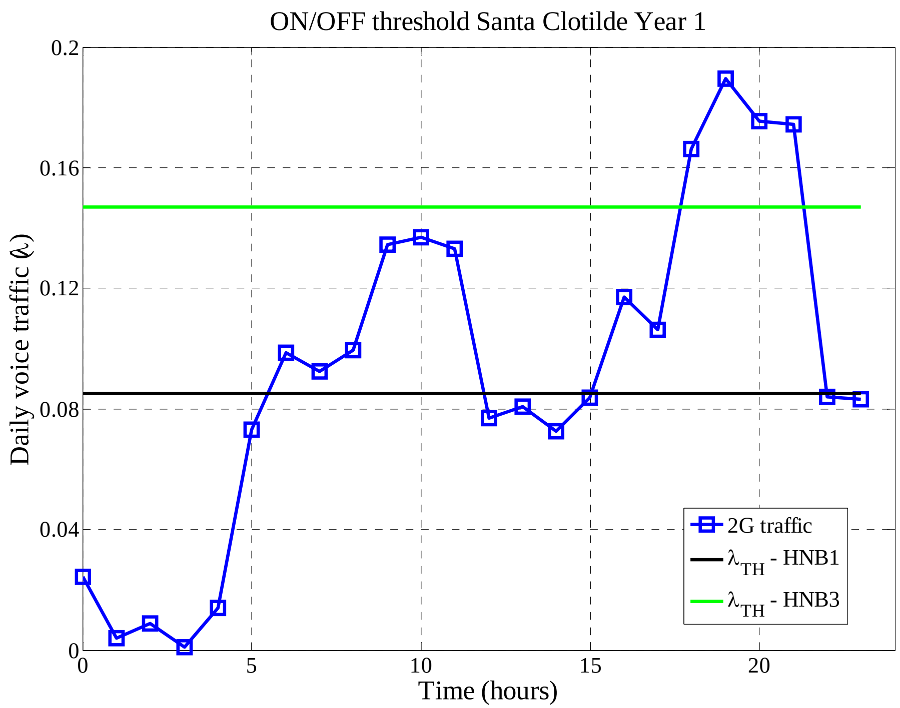
- Only HNB's are deployed located at the same position

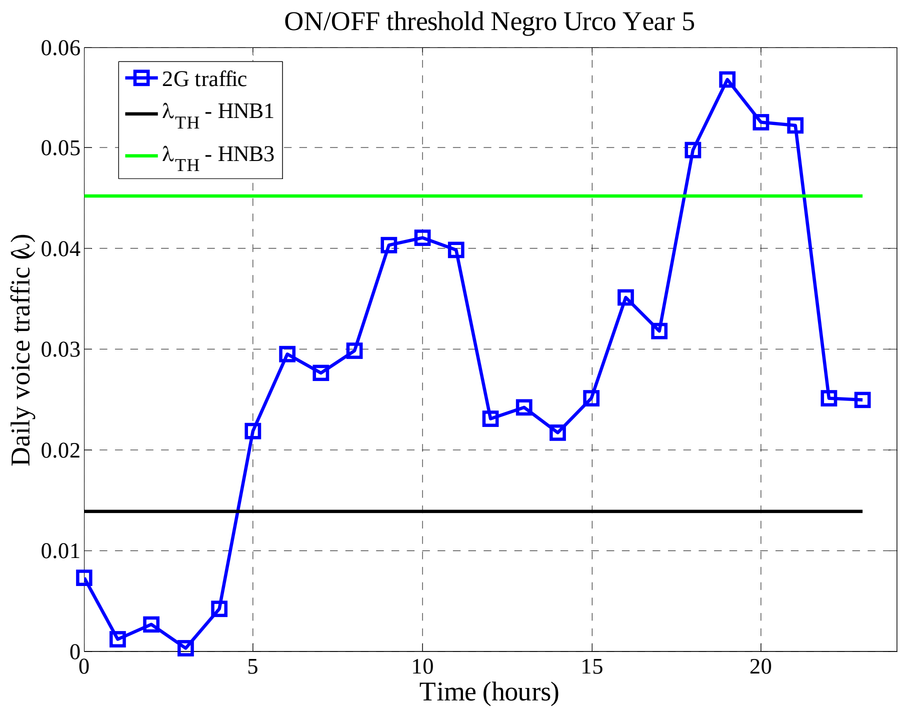
Technical issues to be taken into account:

- Total overlapping of coverage areas
- HNB's share the same battery and solar cell
- If a HNB is switched OFF, then all the subscribers located at the coverage area should be served by other HNB's that remain active (no cell expansion is needed since the coverage areas are the same)

Results for voice traffic

λ threshold for ON/OFF switching





HNB1: HNB S-Class 16
HNB2: HNB E-Class 24
HNB3: HNB E-Class 24*

By using HNB3, both in Santa Clotilde and Negro Urco (for years 1 and 5, respectively), only 16% of the time the second HNB is required.

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