

RIPE

Alternative Network Deployments

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Context of the Informational Draft

- Alternative Network Deployments document is being worked in the IRTF GAIA working group, whose aims is:
- *"...to document and share deployment experiences and research results to the wider community through scholarly publications, white papers, Informational and Experimental RFCs, etc."*

Motivation

- First attempt to make a taxonomy on emerging models at the IRTF from the GAIA group, addressed (but not limited) to:
 - **Independent community organisations** bringing alternative topology, infrastructure and business models as the only mean to get connected to the Internet.
 - **Setting a precedent** for civil society members of the developing (underserved) regions to be more active in the search for affordable Internet.
- Provide an essential piece of information for bridging the digital divide accounting 4+ Billion people.



Free communication from a practical perspective

A free network

- Proposed by the **Free Network Foundation**: a network that *equitably grants the following freedoms to all*:
 - **Freedom 0** - The freedom to communicate for any purpose, without discrimination, interference, or interception. (security)
 - **Freedom 1** - The freedom to grow, improve, communicate across, and connect to the whole network. (scalability)
 - **Freedom 2** - The freedom to study, use, remix, and share any network communication mechanisms, in their most reusable forms. (openness - reusability)

guifi.net principles of Free, Open and Neutral Networks

- Freedom to use the network for any purpose but to harm the network itself: including the services.
(neutrality)
- Right to fully understand the network and its components as well as to spread out gained knowledge (openness, security)
- Right to offer public or private services (security, openness)
- Right to join the network and extending the inherited set of rights to anyone else (respecting this terms)

Levers

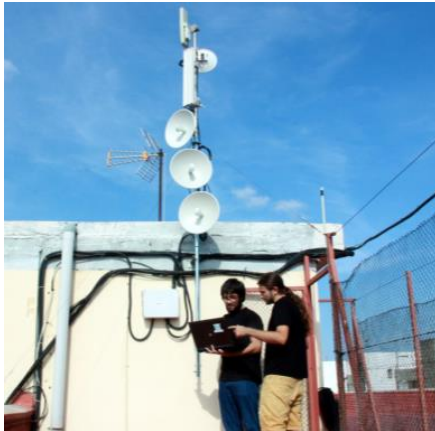
- Do-it-yourself/Makers community
- Low-cost, commodity and open source technologies
- Public Institutions: Universities, Independent organisations
 - Governance challenges

Real world examples

[Pietrosemoli E.] [Simo J.] [Baig R.]



Fig. 1. Installation of a 12 meter pole for a 5 GHz antenna to provide Internet connectivity to a school in Udot, Chuuk, Federated States of Micronesia



(a)



(b)



(c)

Fig. 3. a) Supernode in a rural zone in Guifi.net (Spain); b) Deployment of a WISP (Airjaldi): connecting a series of Common Service Centers in Ranchi district (India) with stable links of 1Mbps; c) Tucan3G project: a user connecting through an Alternative Network in San Juan (Peru).

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What are alternative networks?

Networks that do not share characteristics of mainstream network deployments.

- Are not top-down controlled networks with central authority (**openness**)
- Have no infrastructure with substantial investment (actually, relatively small scale — **scalability**)
- Have no exclusive participation of an "elite" of network and technology designers (**openness**).
- Have no central authorities allowed to intervene communications (**security**)



Alternative Networks also apply to ...

- Developed regions: increasing literacy and connectivity in developed regions since it is not 100%.
- Bridging the digital divide:
 - Increasing availability and affordability of the network infrastructure.
 - Tackling digital literacy
 - Adapting the regulatory framework for the masses
 - Popularising content and services

Including Rural Zones into mainstream nets.

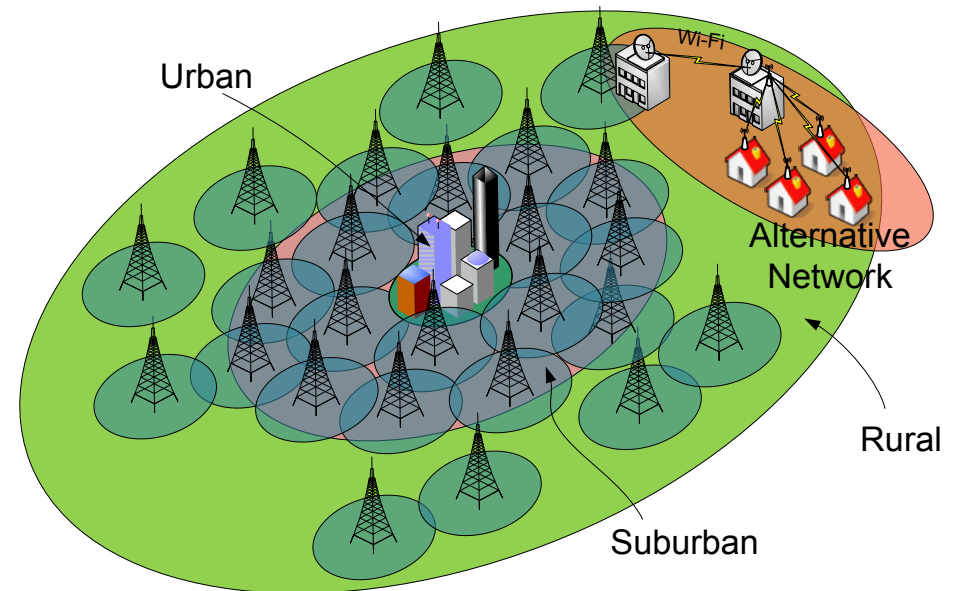
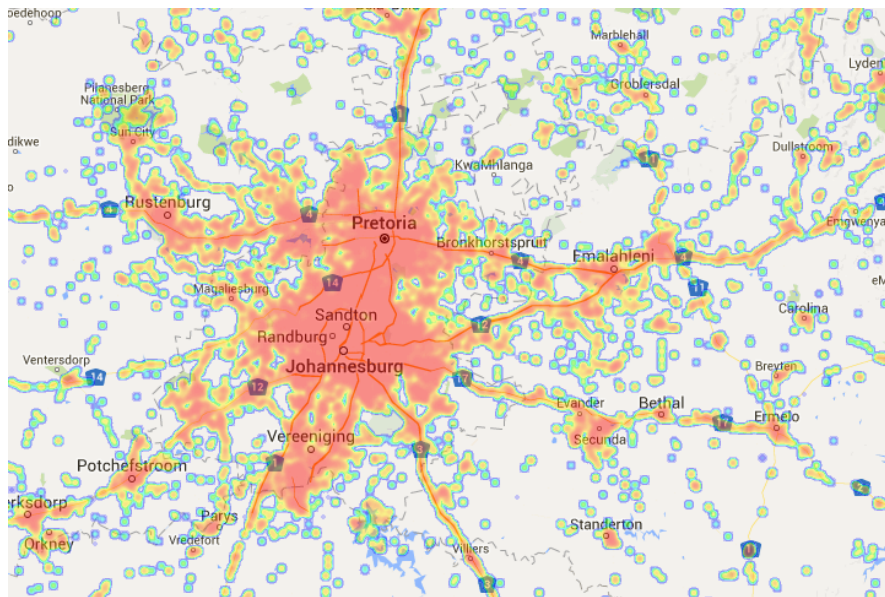
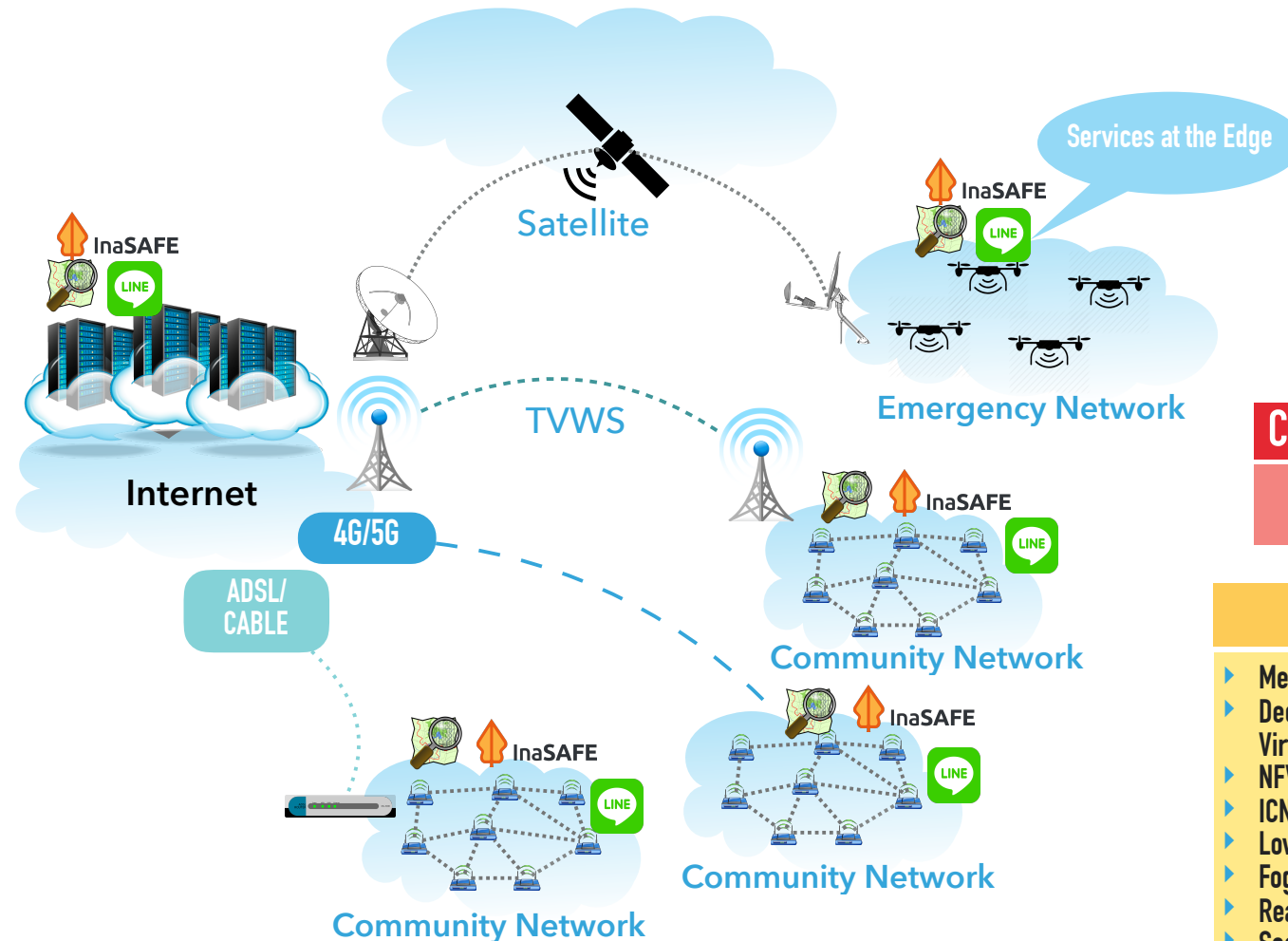


Fig. 2. Urban, suburban and rural zones: a) mobile network coverage map in Johannesburg (<http://opensignal.com/>) b) scheme of the network, including an Alternative Network for an underserved rural area.



Community Networks

Guifi.net, TakNet, PAWS

R&D

- ▶ Measurement Studies
- ▶ Decentralised Cloud + Lightweight Virtualisation
- ▶ NFV / SDN
- ▶ ICN (Pursuit, NDN)
- ▶ Low Cost Backhaul Solutions
- ▶ Fog/Edge Computing
- ▶ Real Deployments
- ▶ Socio-economics

Tools



Projects



What are the challenges for the integration?

- Backhaul links to provide enough bandwidth for communities
- Inclusion of new technological paradigms to encourage localised services such as
 - Information Centric Networking
 - Massive caching
 - Locally managed services
 - Other recent technologies: Service-Centric Networking (SCN), Software-Defined Networking (SDN), Delay Tolerant Network (DTN) and novel wireless access technologies such as TV whitespace.
- Find community sustainable business models and Internet growth pattern.



<http://rife-project.eu>

Why ICT is different in non-developed regions?

- The availability of "proper" both national and international bandwidth, as well as equipment
- Affordability of services and the devices required to access the ICTs
- The instability and or lack of power supply
- The scarcity of qualified staff
- The existence of a policy and regulatory framework that hinders the development of alternative models

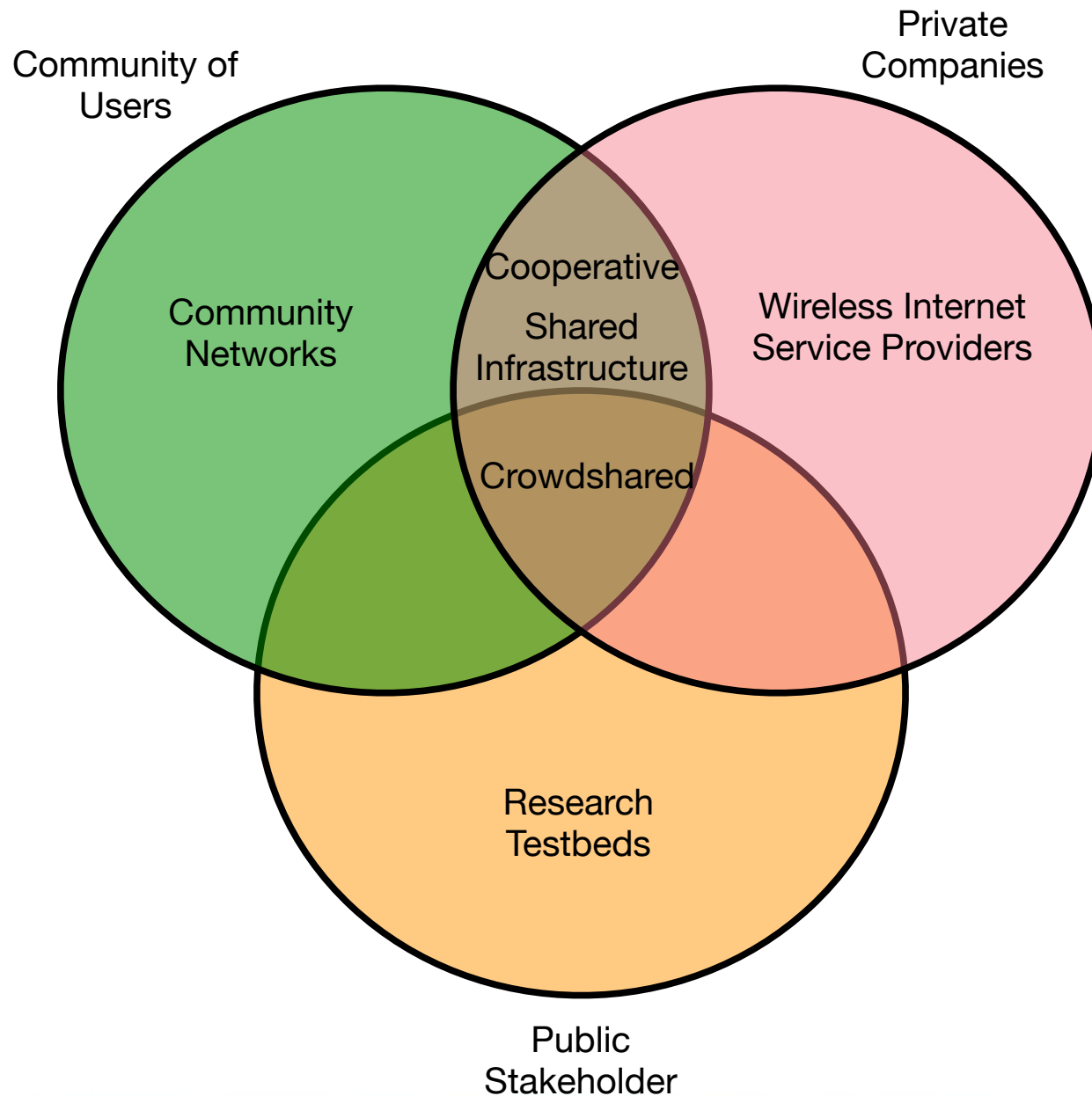
Characterising rural areas

- Low per capita income. Dealing with the well-known "less than 5% income to afford Internet connection"
- Scarcity or absence of basic infrastructure: electricity, water and access roads
- Low population density and distance (spatial or effective) between population clusters
- Underdeveloped social services, such as healthcare and education.
- Lack of adequately educated and trained technicians
- Harsh environments leading to failure in electronic communication devices

Classification of Alternative Networks

- Promoters: community of users "Crowdshared Approaches", a public stakeholder, private company, academy entity
- Purpose: reducing the initial CAPEX (for the network, the end user, or both); providing additional sources of capital (beyond the traditional carrier-based financing); reducing OPEX; reducing hurdles to adopt (digital literacy); research purposes; sharing resources.
- Governance: Centralised or distributed.
- Technologies employed: **Standard Wi-Fi** which can also be modified for long distances (WiLD); **IEEE 802.16 compliant systems** over non-licensed bands; **IEEE 802.22** Dynamic Spectrum Solutions (e.g. based on the use of white spaces); The use of **low-cost optical fibre** is also possible.
- Scenarios: urban and rural areas, with a special significance in developing countries.

Classification of Alternative Networks



Taxonomy of AN — salient characteristics

	Commercial model / promoter	Goals and Motivation	Administration	Technologies	Typical scenarios
Community Networks	Community	To reduce hurdles To serve underserved areas To grant network neutrality	Distributed	Wi-Fi Optical Fiber	Urban Rural
WISPs	Company	To serve underserved areas To reduce CAPEX in Internet access	Centralized	Wireless in unlicensed frequencies	Rural
Shared Infrastructure Model	Shared: companies and users or local public institutions	To eliminate a CAPEX barrier to operators To lower the OPEX supported by the community To serve underserved areas	Distributed	Wireless in non-licensed bands Low-cost fiber	Rural areas (mainly in developing regions)
Crowdshared approaches	Community Public stakeholders Private companies	To share connectivity and resources	Distributed	Wireless	Urban Rural
Testbeds for research purposes	Research / academic entity	Research	Centralized initially, but it may become distributed	Wired Wireless	Urban Rural

Thank you!

“The fear of failure is the main obstacle to great achievements.”

— when asked about the main obstacle on Internet adoption in developing regions

–Prof. Ermanno Pietrosemoli (ICTP, Italy)
(World record for long-distance Wi-Fi transmission,
Jon Postel Service award on behalf of the Latin-American Networking school)

