

BHUTAN :A case study



On the use of Wi-Fi and VoIP for rural communications

ITU University Summer Programme, Geneva

July 8, 2003

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Agenda

- Background on country and project
- Choice of technology
- Pilot project
- Outcome and Recommendations
- Conclusion

Country Background

- Situated in the heart of the Himalayan range
- Land-locked country, bordered by Tibet and India
- Population of approximately 650,000 dispersed over a total area of about 38,500 square kilometers.
- Has one of the world's smallest and least developed economies
- Teledensity is roughly 3.38 telephones per 100 inhabitants.
- Rural population comprise 79% of total population

Company Background

- Bhutan Telecom is the sole provider of telecom and Internet services. It provides domestic and international telephony, Internet, fax, pay phone, telex, leased line services, and HF communications in rural areas.
- It is a public, state-owned corporation and has 600 employees.
- Totally digital network with satellite earth station for international calls, VSAT network for back-up and backbone is 34Mbps digital microwave radio



Project Background

- BT's Universal Service Obligation (UAO)
- DIT's Global Information Infrastructure (GII)
- MasterPlan based on DRMASS –TDMA Rural radio system
- Needed an cost effective alternative

Challenges

- mountainous terrain
- the lack of infrastructure
- Line of sight (Line of sight) over long distances not possible, also villages are often hidden
- Unreliable or a complete lack of power

Choice of technology (FG7 findings)

Existing

- VHF radio
- WLL
- VSAT
- Digital satellite radio
- PHS-WLL

Emerging

- GSM 400
- CDMA450
- IMT-2000
- Wireless routers
- Two-way satellite Internet access

Choice of technology

- Preferably wireless due to terrain
- Has to be cheap
- Has to consume less power
- Interoperability between PSTN and other supplier's equipment
- Remote network management
- Simple, small, modular and scalable
- Long life cycle

And the winner was :

- Most promising: IP technology since this allows for the coupling of voice and data services over one network
- IEEE802.11b
 - Limited local tests
 - Relatively cheap equipment and falling prices
 - Easy and fast to install
 - More established than IEEE 802.11a (year 2001)
 - Scalable
 - Low power consumption
 - Wi-fi compliance allows the use of other vendor cards

Fears

- Not proven
- SIP vs H323
- Pace of technological change makes equipment obsolete
- Ruggedness of equipment for rural use
- Degradation of voice quality due to delay (esp on multihops)
- Long call set-up time (complex protocol procedures)
- Bandwidth constriction in the future
- Telephone Numbering and Billing
- Environmental impact on performance

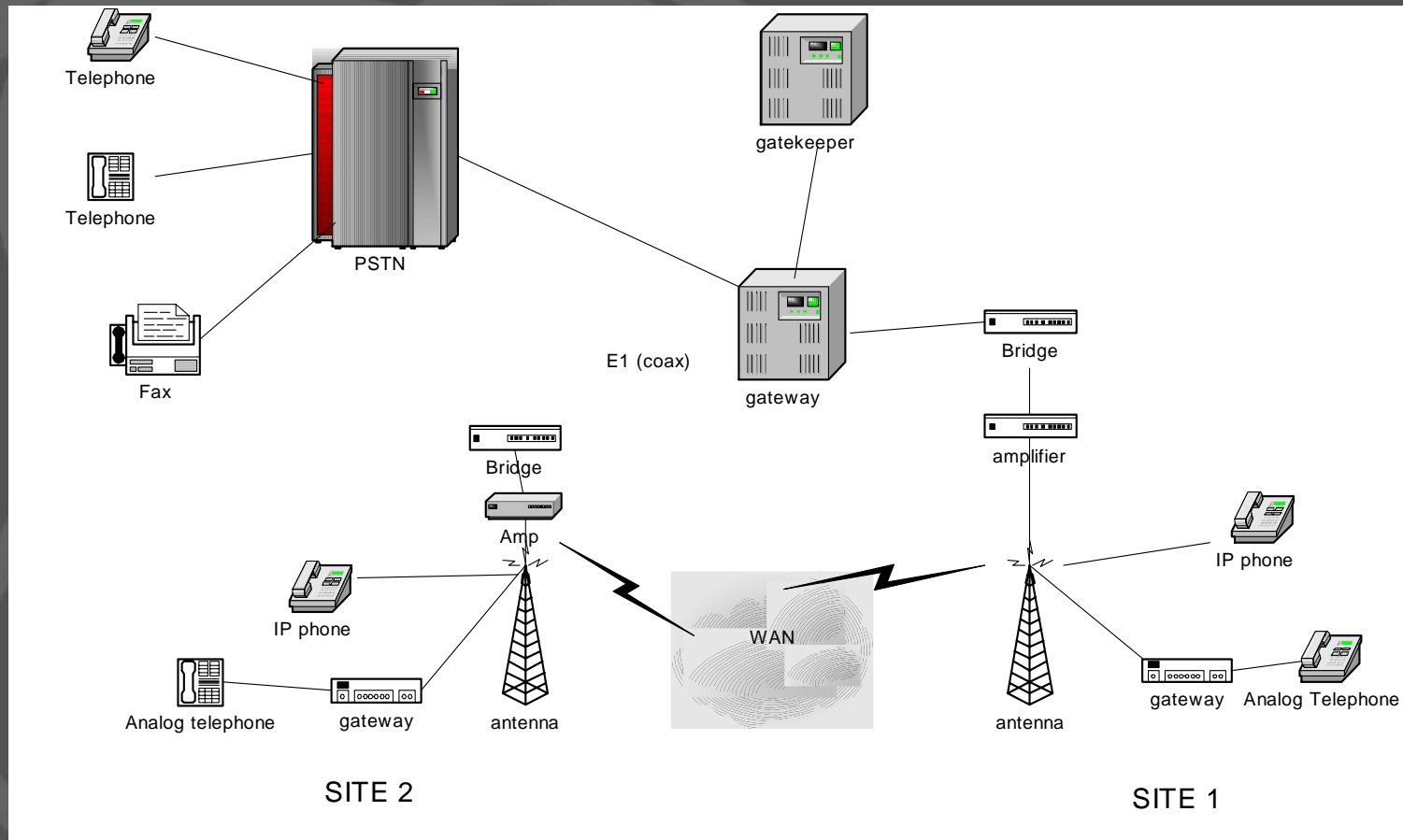
Scope of Pilot Project

- Implement 2 networks in geographic different locations covering 72 households in 14 villages. Preference to be given to basic health units (BHU) schools and municipal offices.

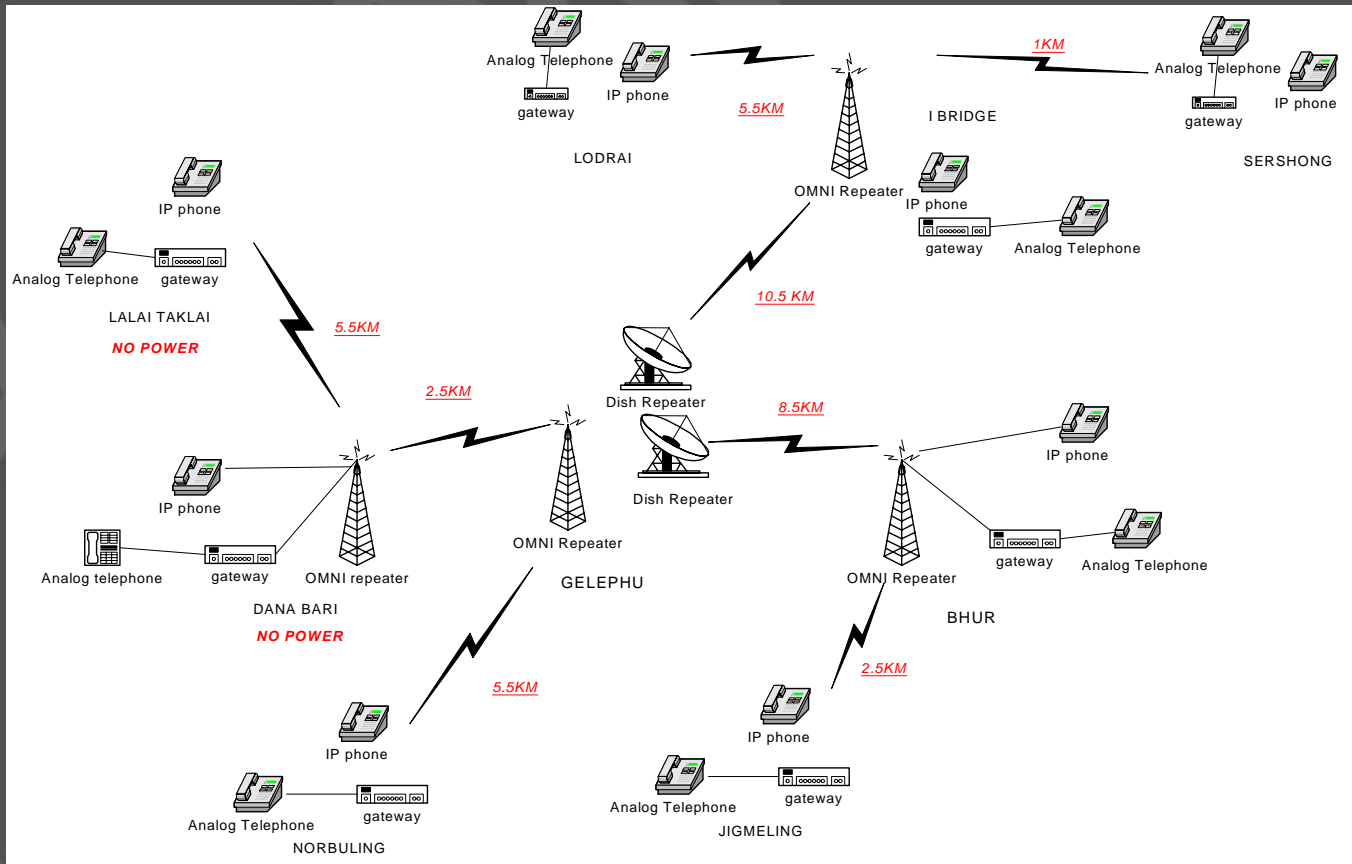
Objectives of Pilot project

- To show that a wireless IP network is appropriate for the last mile delivery of universal service.
- Reliability of the available equipment
- System flexibility and capacities.
- Installation and testing methods. Ease of installation and testing
- Provided bandwidth is adequate for the expected rural calling patterns
- Delays caused by the wireless network are negligible.
- battery backup power system is reliable, efficient and cost effective.
- The customers receive quality service.

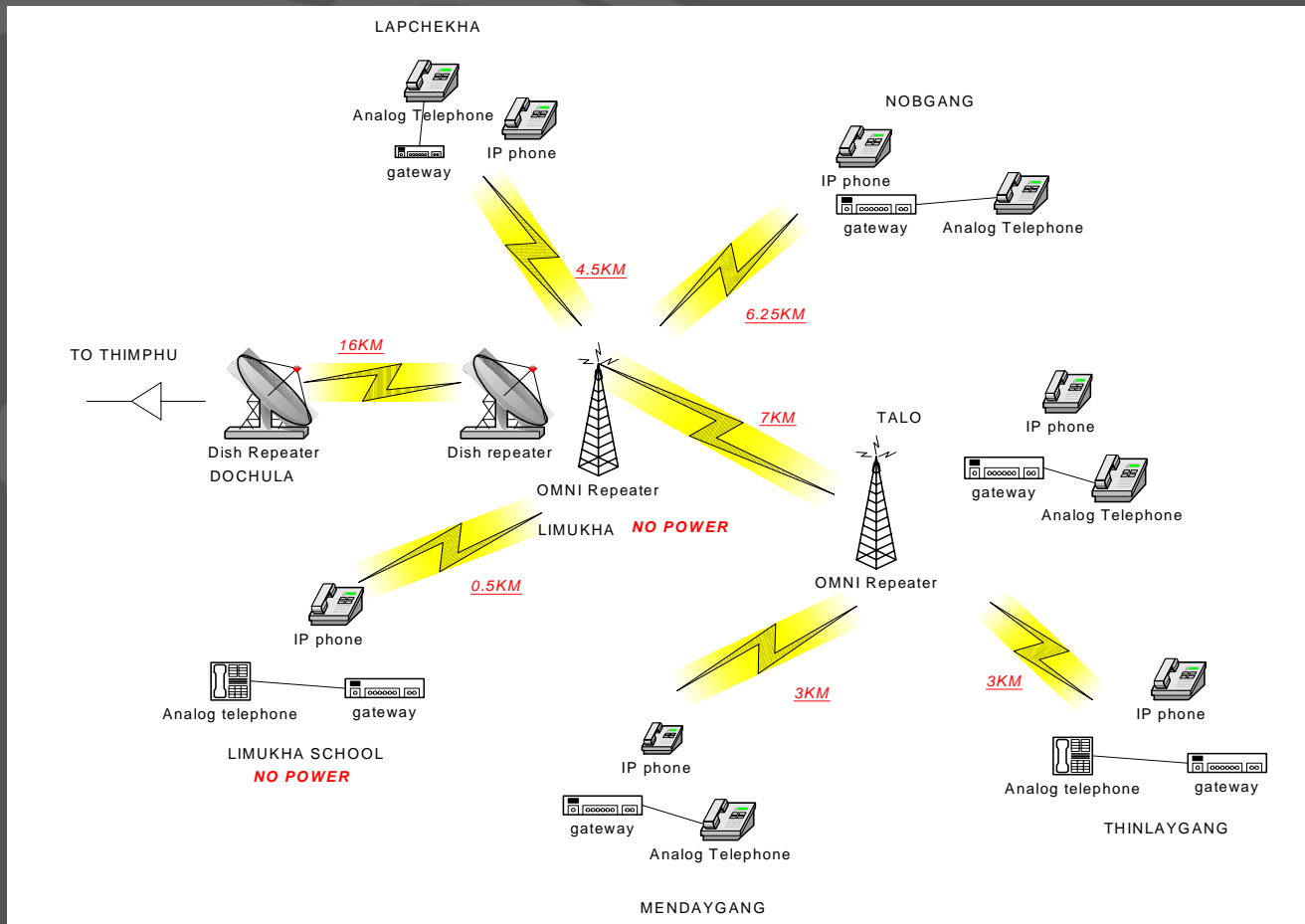
Network schematic



Gelephu Network



Limukha Network



Typical outdoor repeater site



Indoor repeater site



Reuse existing towers



Locally assembled repeater boxes



Save costs on shelters



Customer antennas



Customer premise equipment (with commercial power supply)



Customer premise equipment (with solar power supply)



Status

- The network at Limukha (west) was commissioned in June and customers were billed starting July 2002. Besides occasional complaints, we have reason to assume that the project has been a success in this region.
- The network at Gelephu (south) faced innumerable problems thought to be environmentally caused by the lightning and excessive rain. The network at Gelephu has now been functioning since the 11th November 2002.

Recommendations

- CPE power consumption could be lower
- Stable and regularized power supply is needed
- Grounding of equipment is essential
- Redundancy of Core equipment
- Training of staff
- Too many license fees (Calls processing, network management, billing minutes)
- Spectrum interference should be considered

Conclusion

- The cost effectiveness, reasonable quality, fast and easy installation, extreme flexibility and scalability make it a likely candidate for rural communications. The very low power consumption for the repeaters (0.25 A at 12 VDC) and reasonable power consumption of the terminal equipment (1.76 Amp, 12VDC for 4 port and 2.31 Amps, 12VDC for 8 port) is another comparative advantage.
- The system seems functional and workable though fine tuning is necessary on an individual line basis.
- Though being a pioneer has its disadvantages, consolation can be taken from the fact that the world is moving towards IP and hence the technology will only get better and cheaper.

Thank you

