A comparative analysis of wired and wireless systems and their effectiveness in bridging the digital divide in developing countries

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1. Introduction

Network design engineers in developing countries are challenged to select the best system that suits the needs of operators at an economical cost.

- Important issues to consider:
  - Performance,
  - availability,
  - capacity,
  - coverage,
  - bandwidth,
  - QOS and
  - Cost per line
  - ARPU

2. Present scenario I

2.1 In urban & sub - urban areas in Kenya:

- Very dense populations
- High traffic, High calling rates
- Fixed lines are not readily available
- Frequent breakdowns of cables
- Long MTTR
- Poor and obsolete cable infrastructure
- Majority use mobile phones
- Internet services are very poor
  - (low speed, frequent breakdowns)

2. Present Scenario II

2.2 Rural areas in Kenya:

- Sparsely populated villages and communes
- Long distances between service areas
- No telephones
- Poor road infrastructure
- Difficult terrain (rivers, forests, hills, swamps)
- No commercial power supply
- Majority cannot afford mobile phones
- No Internet

3. Possible wireless solutions

The following broadband wireless systems are useful in providing last mile access and trunking in rural and sub-urban areas:

- SDH Radio,
- WiFi,
- WiMax,
- Hyper LAN,
- VSAT,
- CDMA 450 and CDMA2000,
- WCDMA/UMTS,
- Free Space Optics (FSO).

4. Why broadband wireless

- High demand for broadband services (Bandwidth) in excess of 2 Mbps
- Readily available mass market for :
  - (Voice, SMS, Internet, Leased line, PVNs ..)
- Can be rapidly rolled out across hills, valleys, swamps
- Ease of maintenance
- Mature field proven technologies
- High transmission speeds 54mbps, 74 mbps..
- Low Capex per line
- High ARPU
- Multiple services on same network: voice, data, Email, Facsimile, Voice mail, SMS

4.1 Comparison : Which broadband technology I

Before choosing the technology compare the following:

(a) **Technical parameters:**

» System capacity
» Bandwidth and number of channels
» Spectral efficiency (bits per Hz)
» Maximum traffic per BTS
» Data throughput under load
» Range/Coverage per BTS
» Modulation scheme used
» Signal to Interference Ratio
» Security over the air interface
» Power source and nominal power rating
» Performance test results in the field and QOS

4.2 Comparison : Which broadband technology II

- Economic factors to consider:
  - Manufactured to which standards? ITU-R or proprietary
  - Cost per line
  - Cost of Operating Software upgrade
  - Average Return Per User
  - Mean Time Before Failure (MTBF)
  - Mean Time To Repair (MTTR) by vendor
  - Warranty by vendor
  - Is system upgrade possible both hardware and software
  - Operation and maintenance contracts

4.3.1 Comparison Matrix 1

- Comparison of wired systems:
  - DSL
  - Coaxial Cable
  - Optical fiber with WDM/DWDM

4.3.2 Comparison matrix 2

- Wireless systems:
  - SDH Radio
  - WiFi
  - WiMax
  - HyperLAN
  - Satellite (VSAT)
  - Free Space Optics (FSO)
  - CDMA 450/2000
  - GSM,
  - UMTS

5. Way forward and conclusion

- Technological study & analysis of wireless systems vital before implementation
- Economic analysis and feasibility study necessary
- Training of technical personnel important
- Broadband wireless systems can bridge the digital divide in rural and sub urban areas in developing countries