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Application of Radio Communication Networks for National Development kenyan experience.





venetrearn is a nigh juality digital leased ine service capable of integrating a wide ange of applications within a single line. This means overall eduction in data ransmission costs while maintaining high levels of security

JARED BARAZA Telkom Kenya



Telkom's Jambonet Service offers high speed Data connections to the internet backbone...Click for more



Contents:

- Challenges
- How to overcome challenges
- Example of a successful project
- Way forward
- Conclusion & Recommendations



Challenges to Operators/Entities

Low GDP and income Scattered population distribution Harsh terrain High cost of infrastructure (Equipment, Civil works, access fees, frequency fees, duty) Lack of skilled technicians Radio frequency issues (Regulation, Licensing, Standards)



Successful Example of Integration

Kenya Education Network (KENET) Objectives:

- Provide last mile connection for Kenyan universities to Internet backbone
- Enable Universities to communicate with each other in order to share knowledge, research and educational resources
- promote distant education
- Introduce Internet culture within the university community on an open platform
 Provide the required bandwidth



IMPLEMENTATION TEAM:

Kenya Government: Bilateral The Regulator: Radio frequency matters Secretariat: Coordination, logistics etc USAID: Funding & monitoring Telkom Kenya: Project Management & Engineering The Universities: Users/beneficiaries Others: Local communities near university Contractors: Installation services









Implementation Methodology

Open Multi-stakeholder project:

- stakeholders bound by a memorandum of understanding (MOU)
- strict guidelines and procedures followed
- Strict project management & monitoring
- highest quality control & systems tests.
- maintenance and installation staff trained on the job.
- Continuous monitoring (sustainability)



TECHNOLOGIES USED:

- Digital Microwave radio operating on 7/13 GHz PDH Radio for backhaul to Telkom internet & PSTN backbone
- Optical fiber for linking radio site to computer laboratories/servers
- Copper with xDSL modems
- LAN/WAN networks within the universities
 - Each University was provided free access to Internet for one year



Challenges during implementation

- Congested RF bands in 7 GHz
- RF Interference from other operators
- Tough terrain
 - (rivers, tall trees, hills, lakes, swamps)
- Propagation problems
 - diffractions, reflections, blocked LOS
- Lack of power supply,
 - blackouts, brownouts
- Damage of equipment,
 - transients, lightning
- Difficulty to integrate equipment
- Incompatibility of equipment
 - different standards
- Site acquisition



Results

Connected so far:

- 6 Universities using radio
- Over 20 Universities & colleges using optical fiber & DSL
- Other colleges will be connected in future when <u>funds</u> are available
 - Major traffic on KENET: Internet

Results:

- Each University connected with broadband
- Over 3,000 students on Internet daily (internet culture)
- The network also used by Telkom for voice traffic
- Happy students and professors



LESSONS LEARNED

- Teamwork and collaboration is very important
- Detailed RF planning is vital
- Open platform for hardware & software
- Capacity building is necessary
- Develop local content
- home grown solutions are the best
- Integrated solution voice, data, IP
- Spectrum management is vital
- RF planning tools are necessary
 - Digital maps, planning software, Test equipment
- EMC protection must be implemented



Conclusion & Recommendations:

- Wireless provides a solution for bridging the digital divide
- Cheap but reliable wireless solutions can assist in bridging digital divide in developing countries
- Regulation in ISM Band (2.4 and 5.8GHz) to avoid interference ? ITU to advice members
- local digital content is a top priority
- own initiatives from communities in developing countries
- collaboration with regional & international partners
- Capacity building in ICT is vital
- ICT can drive GDP & DFI in developing countries



Nairobi Area KENET





Kisumu Area Kenet





Maseno University Network





Eldoret area KENET





A "Link" with two Terminals





IDU - General Overview





ICB - IDU Control Board

- Power PC + Risc processor
- Digital modem
- fast A\D, IF TX and IF RX,
- 4 MB RAM
- 4 MB Flash
- 16kb EEPROM.
- pSOS operating system real-time, multitasking fully embedded operating system for powerPC and Pentium.





IPB - IDU Front Panel Board

 IPB contains Power supply and drivers (UART, LEDs, LCD,Key Pad LAN).





IDU PCBs (IPB and ICB)





10/100 ETH Plug-In –LED status

100 Mbps \ Full Duplex connection



10 Mbps \ Half Duplex connection

d.7/03G.703





ODU Connectors

Cooling Elements

 Cooling elements keep the inside temperature **not** more than 10 degrees centigrade above environment temperature.



ODU - Outdoor Unit



Supports scalable data rate from 3 Mbps to 54Mbps.
Small, compact, light weight and aesthetic – easily blends into the local environment.
Flexible ODU/antenna combination is available in 7GHz, 13GHz, 15GHz, 18GHz, 23GHz, 26 GHz and 38 GHz, with ETSI and FCC approved versions. ODU can be installed either as direct mount (as shown) or separately, using a Waveguide.

•ODU can be disconnected from the antenna (to be replaced), without effecting the antenna alignment



LCD - Config Wizard Menu

 Auto PIN detection will add-remove options according to PIN. With ETH10/100 PIN, menu will have some different options to configure.









Multipath inputs and calculation

C. Fade Margine 11,78 dB		
DFM 31,8974		
Left terminal	Threshold BER for DEM check	Right terminal
Elevation [m] [feet]		Elevation [m] [feet]
Centerline [m] [feet]	Longitude region Other region	Centerline [m] [feet]
Latitude	Surface type over large bodies of water 💌	Latitude
deg 65 ▼ 31 ▼ 26 ▼ north ▼	Refractivity gradient precentage	deg 65 ▼ 55 ▼ 59 ▼ north ▼





