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Application of WiFi to supplement fixed and mobile services

Presenter: Jared Baraza, Telkom Kenya, Nairobi

Contents:

- WiFi overview
- Benefits of WiFi
- WiFi applications
- Conclusions

Overview:

- Communication networks in Africa face the following challenges:
  - Lack of last mile access and availability to the consumer
  - Low bandwidths on the copper based networks
  - Poor quality and grade of service
  - High cost of opex and capex costs to the operators
- WiFi is a wireless system (Wireless Fidelity) that is used to solve the above network challenges.
  - WiFi uses low cost embedded computer that run on Linux, Windows XP and Macintosh to deliver high bandwidth, broadband and multimedia applications.
  - WiFi uses Spread spectrum and OFDM modulation techniques to deliver long-range transmission capabilities over the air interface with inbuilt data security and authentication protocols.
  - WiFi systems are therefore suitable for backhaul, Internet, corporate data networks, multimedia messaging, Voice over IP and other bandwidth hungry applications.
  - WiFi is the solution for new entrants in the Internet, Messaging and video streaming business as well as PSTN and mobile operators who want to expand the customer base at a low cost.

The Optimistic View

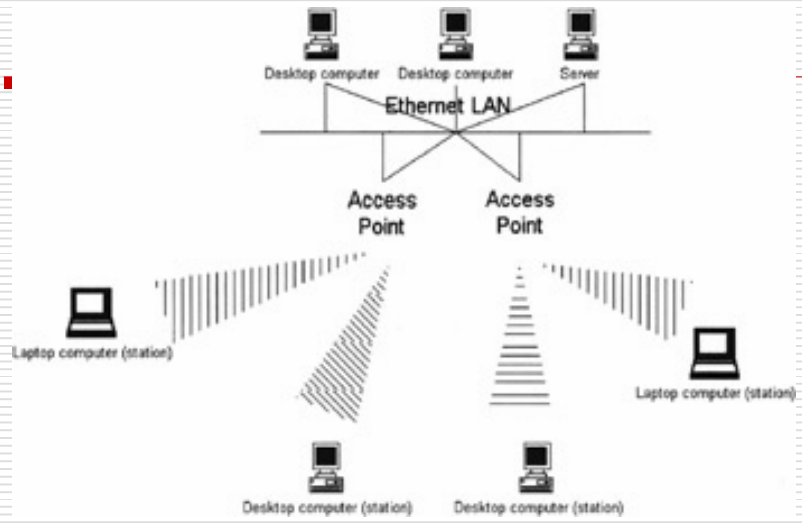
- This is not about the race to Gigabit
  - This is about: Access to Knowledge for Everyone
- **Innovation in Wireless**
  - Innovation is Driven by need
  - Prediction: As the need increases, innovation will come from new places

Components of a WiFi system

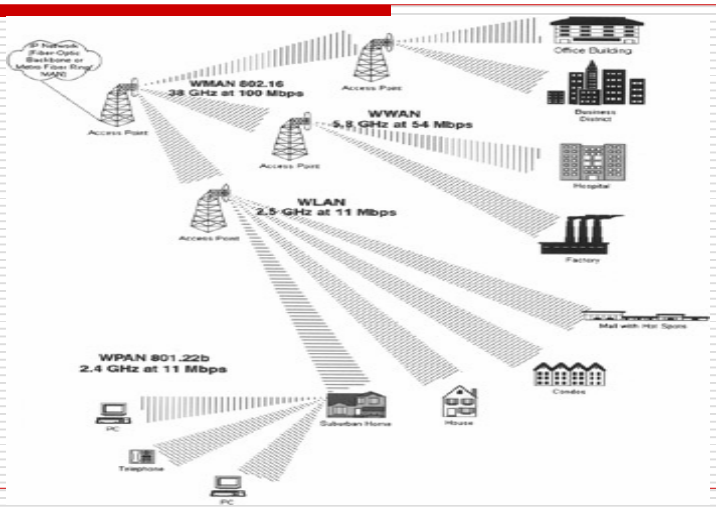
- WiFi systems comprises of the following;
  - Embedded computer radio transmitters
  - Parabolic and omni antennas
  - Desktop or laptop computers
  - USB cables
  - Open source software; Linux, Windows XP
  - RF cables and connectors
  - Power supply

A complete 5.8 GHz, WiFi Repeater station costs about US$ 2000 installed and running.

WiFi network



Wide Area network with WiFi



WiFi Repeater

WiFi repeater

WiFi Access Point

WiFi Access Point

Access Point

Access Point

Access Point

WiFi Radio opened

- Radio

USB

Inside a WiFi AP

Issues to consider before implementing a WiFi system:

- The position of the regulator on usage of ISM bands in the country
- Availability of frequencies in the 2.4 and 5.8 GHz
- Propagation tests to avoid interference
- Effects on radio wave propagation due to buildings, hills, forests, rain, fog etc
- Allowed power limits as per FCC, ITU regulations on EIRP transmitted from an Antenna
- Free space losses:
- **FSL=32.4 + 20* log (d/km) + 20* log (f/MHz) in dB**

Cost of a WiFi system

Access Point	US$62-130
Pigtail	US$30
Coax	US$90-130
Sectoral Antenna	US$500-800
Omni Antenna	US$150-240
Total Investment	**US$330-1100**

Variants of WiFi:

- **Protocols:**
  - **802.11a 5.8 GHz1/2/5/11 mbps DSSS**
  - **802.11b 2.4 GHz5.5/11 mbps DSSS**
  - **802.11g 2.4 GHz54 mbps OFDM**

WiFi over the air security:

- Security of the signal on the WiFi air interface is guaranteed by the following
  - Use of high level encryption
  - Use of firewalls
  - Host based firewall (inbuilt in Linux, windows XP)
  - Personal firewall inbuilt in the access Point
  - Use of SSID
  - Anti spy ware applications
  - Use of OFDMA/Spread spectrum security

Benefits of WiFi systems

- WiFi uses Direct Sequence Spread Spectrum (DSSS) and Orthogonal Frequency Division Multiplexing (OFDM) technologies to provide high bandwidths, high data throughputs, over the air security. The other benefits include:
- No license fee for the ISM bands in 2.4 and 5.8 GHz
- Uses open source software, Linux and Windows XP
- Has a wide range of signal coverage up to 50 Kilometers depending on terrain factors and gain of Antennas
- Can be rapidly deployed in a few hours
- Uses Low cost embedded computer, off shelf antennas and open source software
- Low power consumption
- Field proven and mature 3G technology

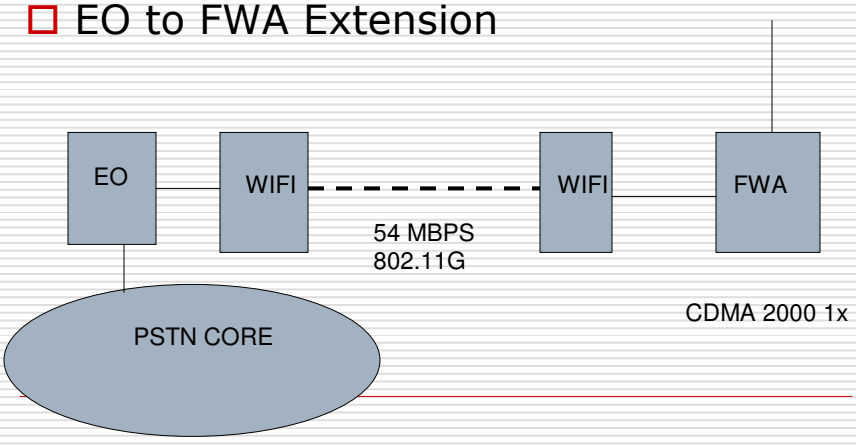
Applications of WiFi

Fixed Line extension

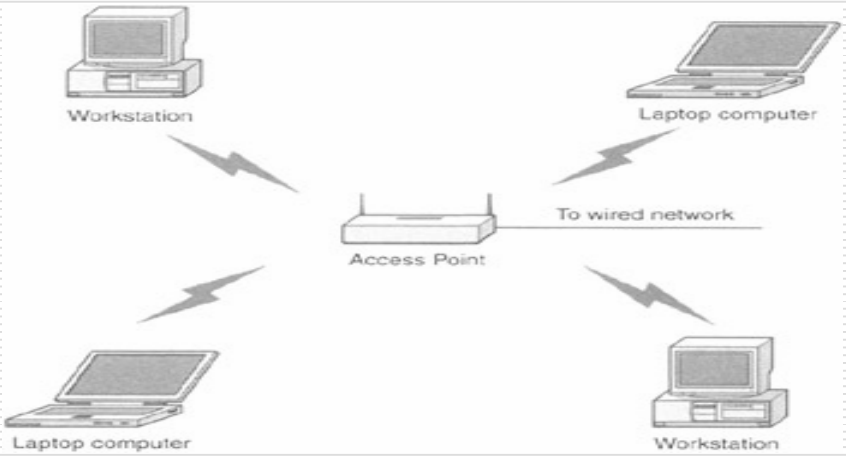
- Fixed operators can use WiFi systems to extend the access network to reach more consumers in sub urban and rural areas.
- Using WiFi systems as a backhaul to connect the end office and Remote Subscriber Units (RSUs)
- Backhaul between the End office and residential estates, buildings and Universities

WiFi for FWA extension

- EO to FWA Extension

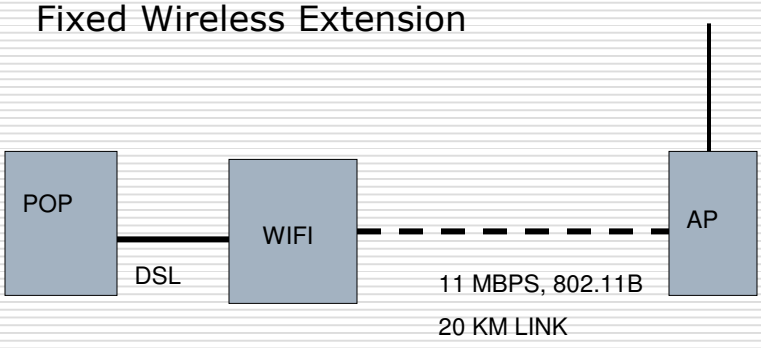


WiFi everywhere

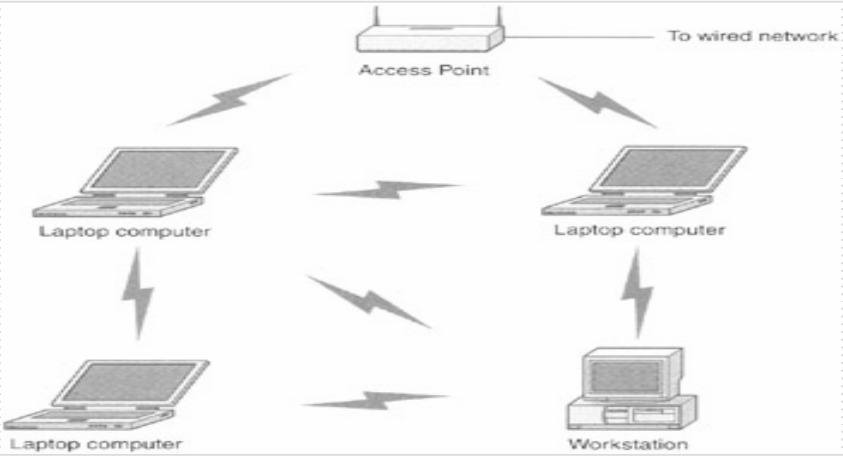


WiFi –Internet extension

Fixed Wireless Extension



WiFi Internet hotspot



Complete radio kit

WiFi for ISPs

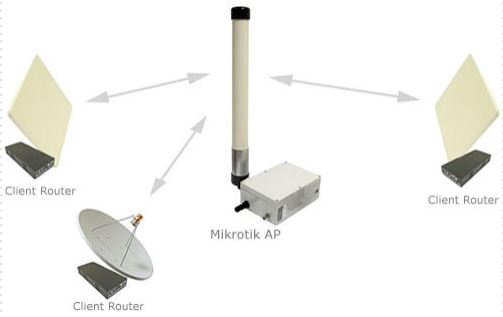
- ISPs can use WiFi as a distribution network between the POP and the clients instead of using the costly copper and DSL or fiber networks.
  - An Access Pint set up at the center of a residential estate; village, University, Airport or small town can deliver Internet and VoIP traffic to each client from the Internet Point of Presence at a low entry cost.
  - The high cost of installation of DSL and optical fiber can be avoided.
  - WiFi is the solution for mass rollout of broadband internet access that is available for ISPs in Africa.
  - A WiFi Repeater and Access Point can be set up in less than an hour.
  - Any client with a Laptop computer and an SSID can access the Internet without a radius of up to 50 kilometers line of sight to the AP at no additional telecom costs associated with DSL and copper networks.

WiFi for Internet

- The network can be set up in two modes:
  - Adhoc or peer to peer mode where customers communicate with each other directly independent of the access point (Independent basic service set-IBSS) network
  - Infrastructure mode whereby clients communicate via the Access Point (Basic Service Set-BSS) network mode.

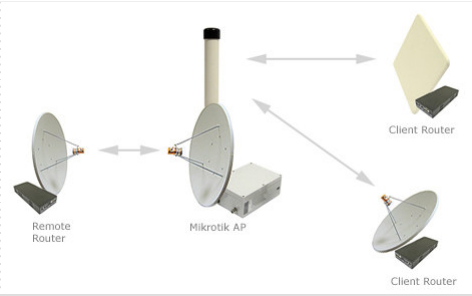
Point to multipoint WiFi

- Access Point



WiFi as backbone

- Backbone link

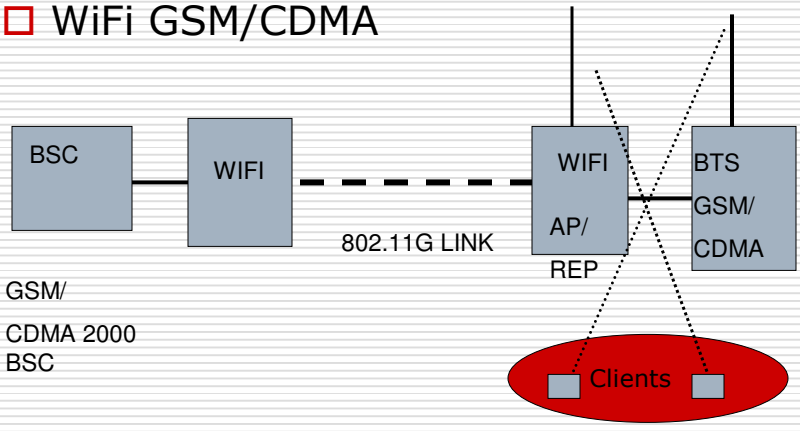


WiFi and GSM/CDMA Mobile extension

- WiFi systems can be used by GSM and CDMA Cellular operators to expand their networks in two ways
- As a backhaul between the BSCs and BTS stations. The WiFi systems at 2.4 GHz can cover long distances whereas the 5.8 GHz systems can be used for short distances up to 10 kilometers
- As an access Point at the BSC or BTS to cater for Internet customers by offering them an Access Point to the Internet. Both 2.5 GHz and 5.8 GHz Access Points and Repeaters can be used by cellular operators to offer Internet services from their existing base stations in rural areas.

WiFi for GSM/CDMA extension

- WiFi GSM/CDMA



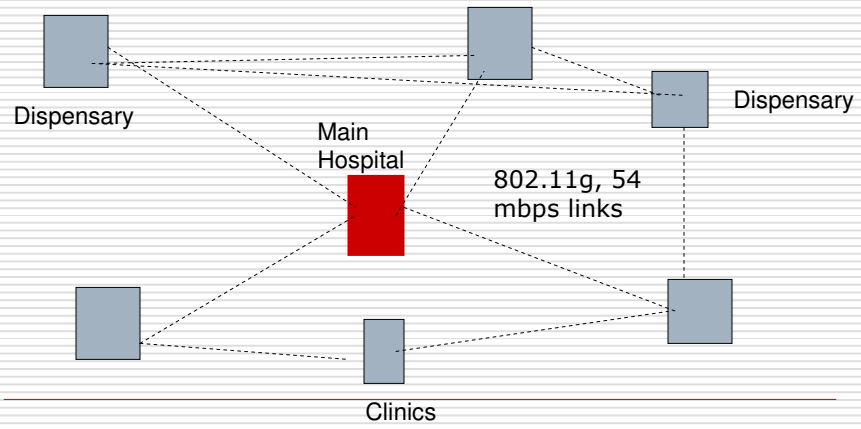
WiFi and FWA clients

Other WiFi applications

- E1 Extension
- Virtual Private Networks
- Distant Education, for connection of university campuses to the central server in the main campus networks
- Telemedicine for connection of remote clinics to the central hospital
- Government networks for connecting divisional offices to a central administrative center in rural areas for voice, Internet and data communication
- Local access to Communities and clients from an Access Point "HOT SPOT" at the following;
  - Airports
  - Hotels and Resorts
  - University campus
  - Malls
  - Rural Areas
  - Fanfare

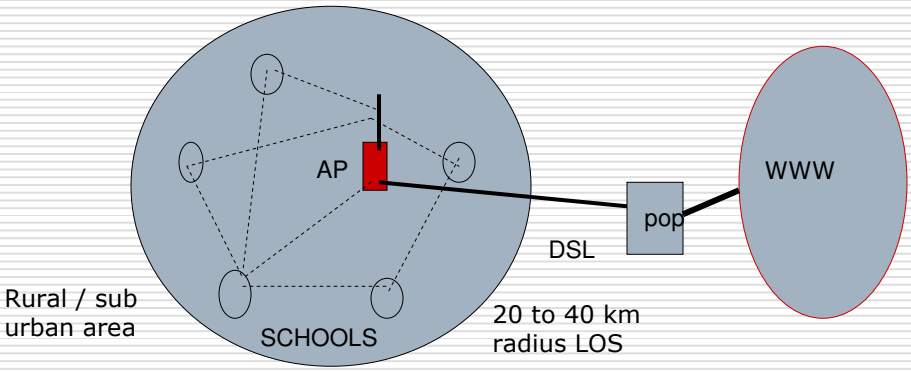
Wifi for Telemedicine

- Central hospital to remote clinics

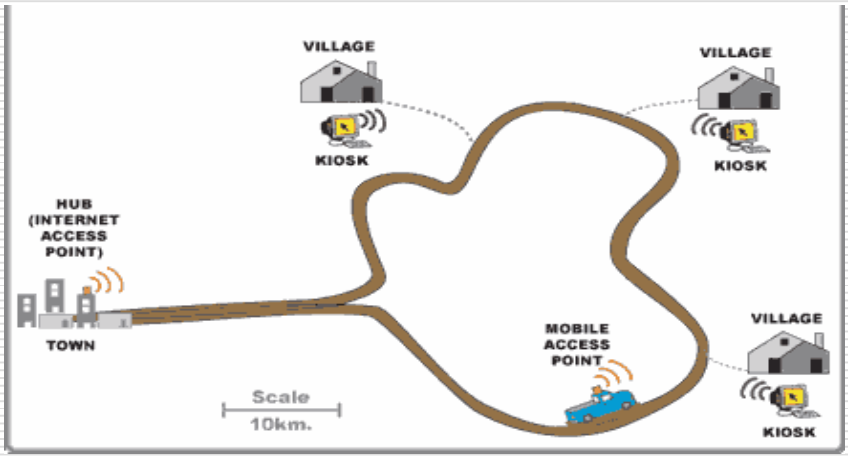


WiFi for distant education

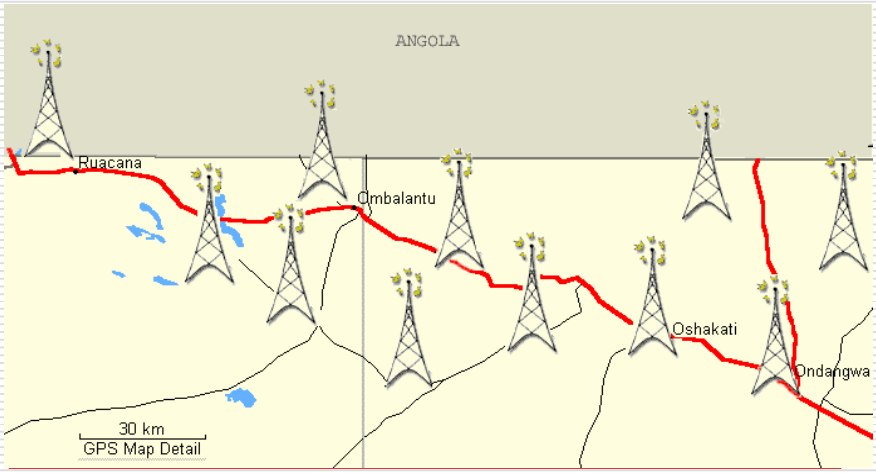
- Internet for schools & Voice over IP



Internet for villages with WiFi



Angola wireless network



Conclusions

- WiFi is useful for the transition from 2G to 3G because it offers fixed and mobile operators in Africa a cheap solution to roll out 3G networks
  - Low cost
  - Available Off the shelf
  - No license fees
  - Field proven mature technology
  - Rapid deployment
  - One solution for voice, data, IP, VoIP, Mobile data, SMS, and other multimedia applications
  - Easy to integrate with pre-IMT 2000 and 3G systems

Way Forward

- WiFi systems are useful for providing connectivity in rural and sub-urban areas where there is lack of access for Internet and data.
- WiFi networks can be rapidly deployed in Africa
- WiFi systems are cheap compared to traditional digital radio systems
- WiFi systems use license free bandwidths in the 2.4 and 5.8 Ghz for high speed data communication for communities, schools, health care, research and scientific applications
- WiFi systems can bridge the missing digital link for the user and the service provider
- The regulators should not stop communities and scientists from using WiFi to communicate where there is no other means of communication
- Operators could consider using WiFi for network deployments

End

- Thank you for attention.
- Email: ochiengjerry@yaho.com