

# DakNet



## *A Road to* Universal Broadband Connectivity

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June 5, 2003

# Overview

- I. Background On Rural Communications
- II. DakNet Concept & Applications
- III. DakNet-Bhoomi Pilot Implementation
- IV. The Road to Universal Broadband Connectivity
- V. Considerations & Questions

# The Digital Divide

- The goal is clear:  
*Universal Connectivity*
- But how do we get there?
- Need technology roadmap that is:
  - Socially appropriate
  - Economically motivating
  - Financially staged
  - Technologically scalable

# Part I

Background On  
Rural  
Communications

# The Wireless Revolution

- Wireless = leapfrogging opportunities
- But what kind of wireless?
  - Radio links (1-100Mhz)
  - Cellular/ WLL
  - Satellite/VSAT
  - WiFi LAN/WAN
- *Insight:* Same factors driving WiFi revolution in developed world can drive a revolution in developing world:
  - Low cost for users and providers
  - Easy of setup, use and maintenance
  - Bandwidth and scalability
  - Spectrum delicensing

# Vision

- Local entrepreneurs within developing countries will use WiFi to:
  - Overcome infrastructure cost barriers
  - Innovate and experiment with applications and content
  - Stimulate the development dynamic for rural first mile communities
  - Grow the infrastructure according to first mile needs and demands, scaling up to universal broadband connectivity

# The Rural ICT Market

- Latent demand for information and communication services
- The needs of the “end-users” come first = the first mile
- But need low-risk seed infrastructure to see what is demanded
  - User adoption takes time
  - Service adoption also takes time

# Asynchronous Is Sufficient

- ICTs introduced as shared resource
- But this has drawbacks for real-time infrastructures:
  - High level of adoption required to achieve cost recovery
  - “Who am I going to call?” problem
  - Shared communications infrastructure tends to be asynchronous

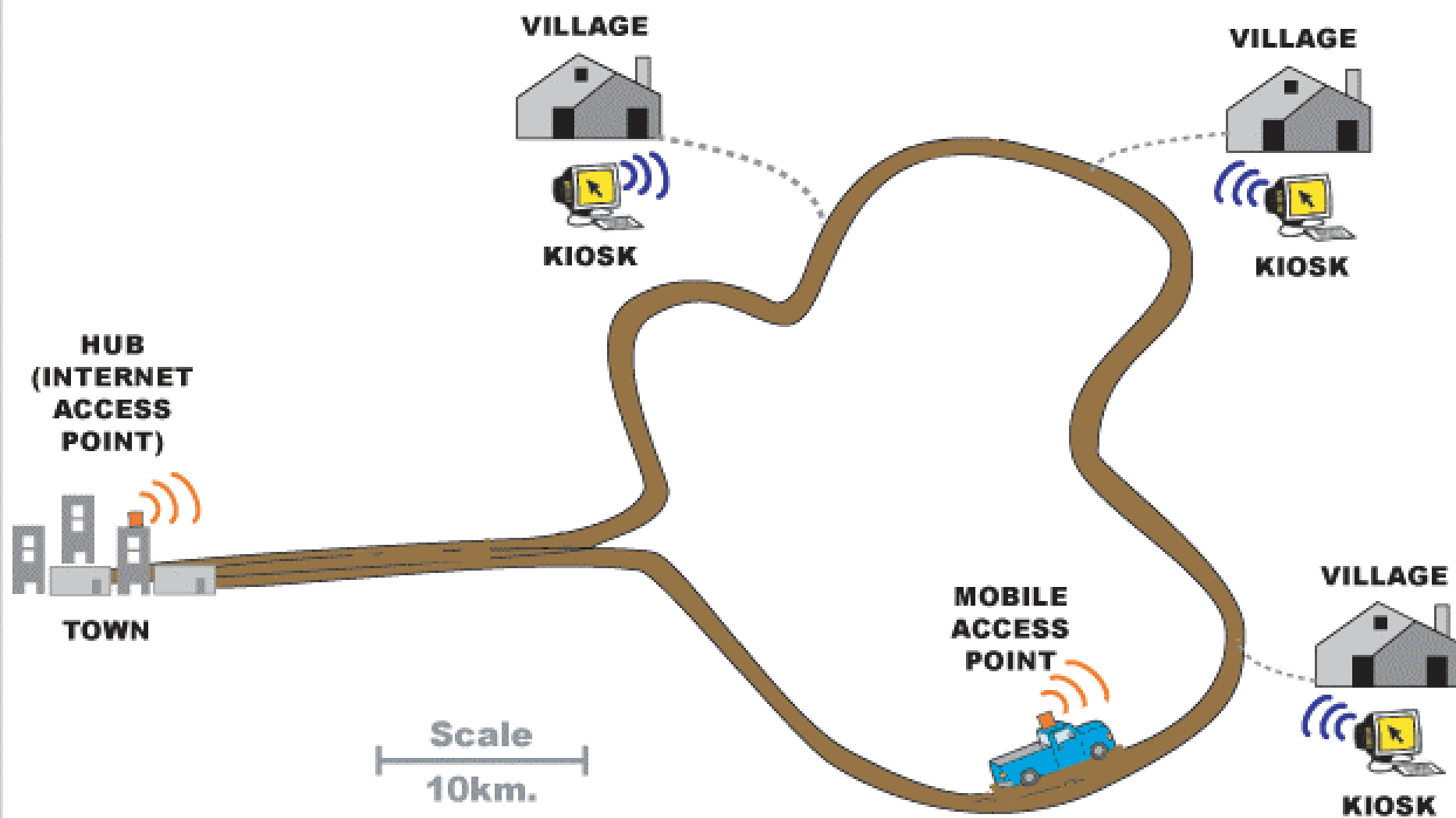


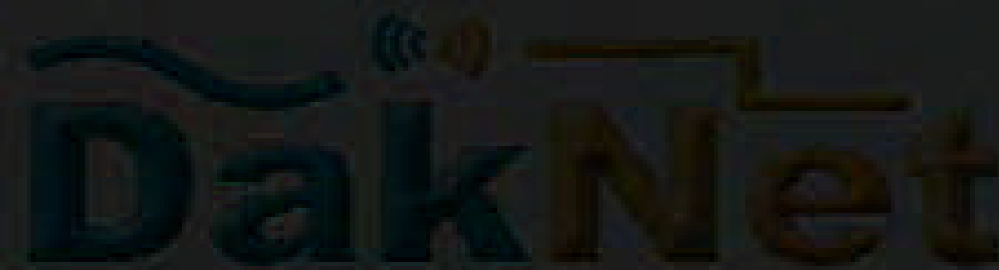
Part II

DakNet



## Network Architecture





*Store-and-Forward  
Wireless Networking  
for Rural Connectivity*

Technology Demonstration Video  
Tikowali Village, India  
March 2002

# Some Applications

- Text-messaging/  
email
  - eGovernance
  - eLearning
  - Telemedicine
- Audio/video  
messaging
  - Communication for  
semi-literates
- Non-real time  
Internet searching  
and browsing
- FTP mechanism for  
Village websites
- VMOIP & WiFi  
Phones

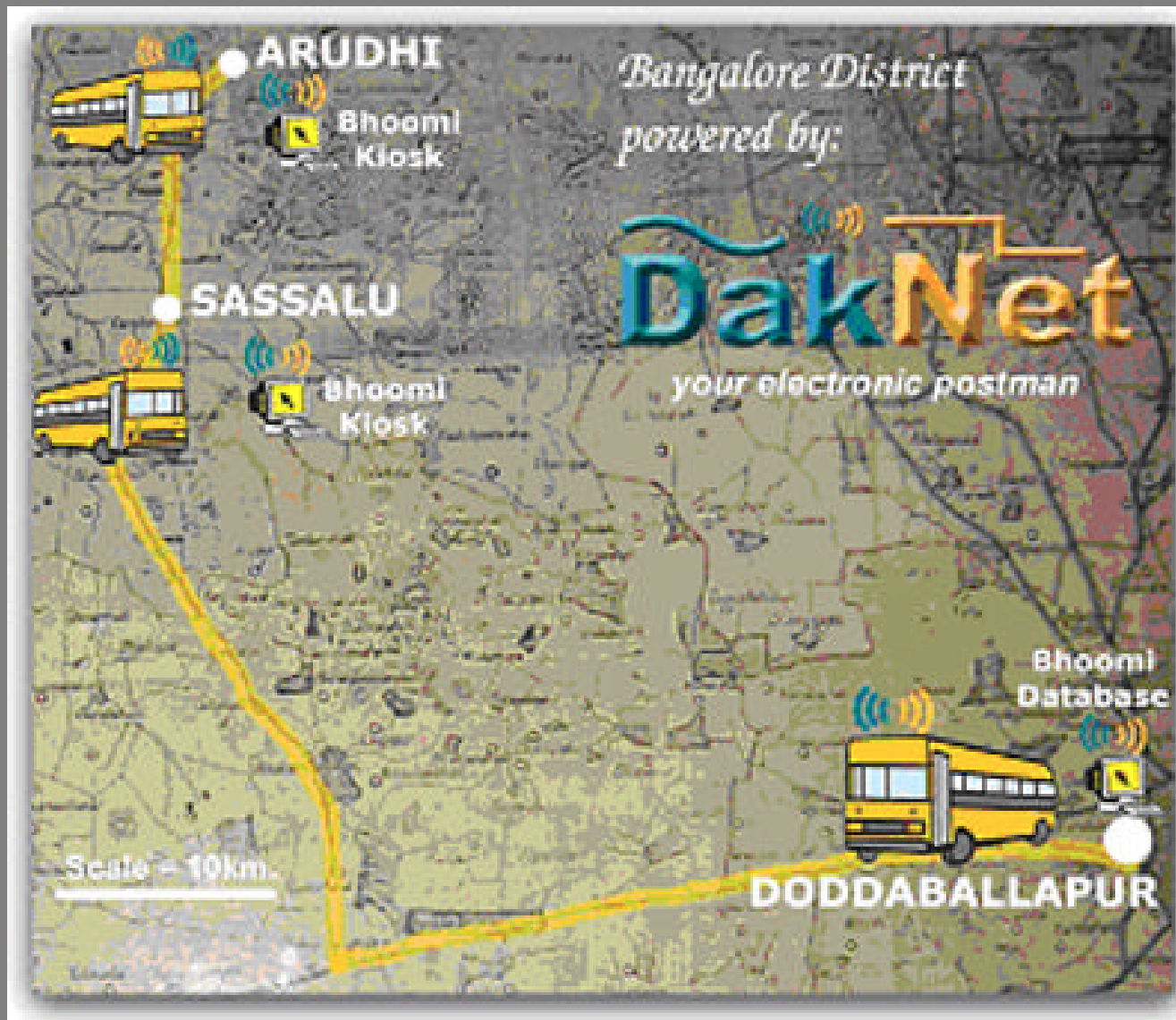
# Part III

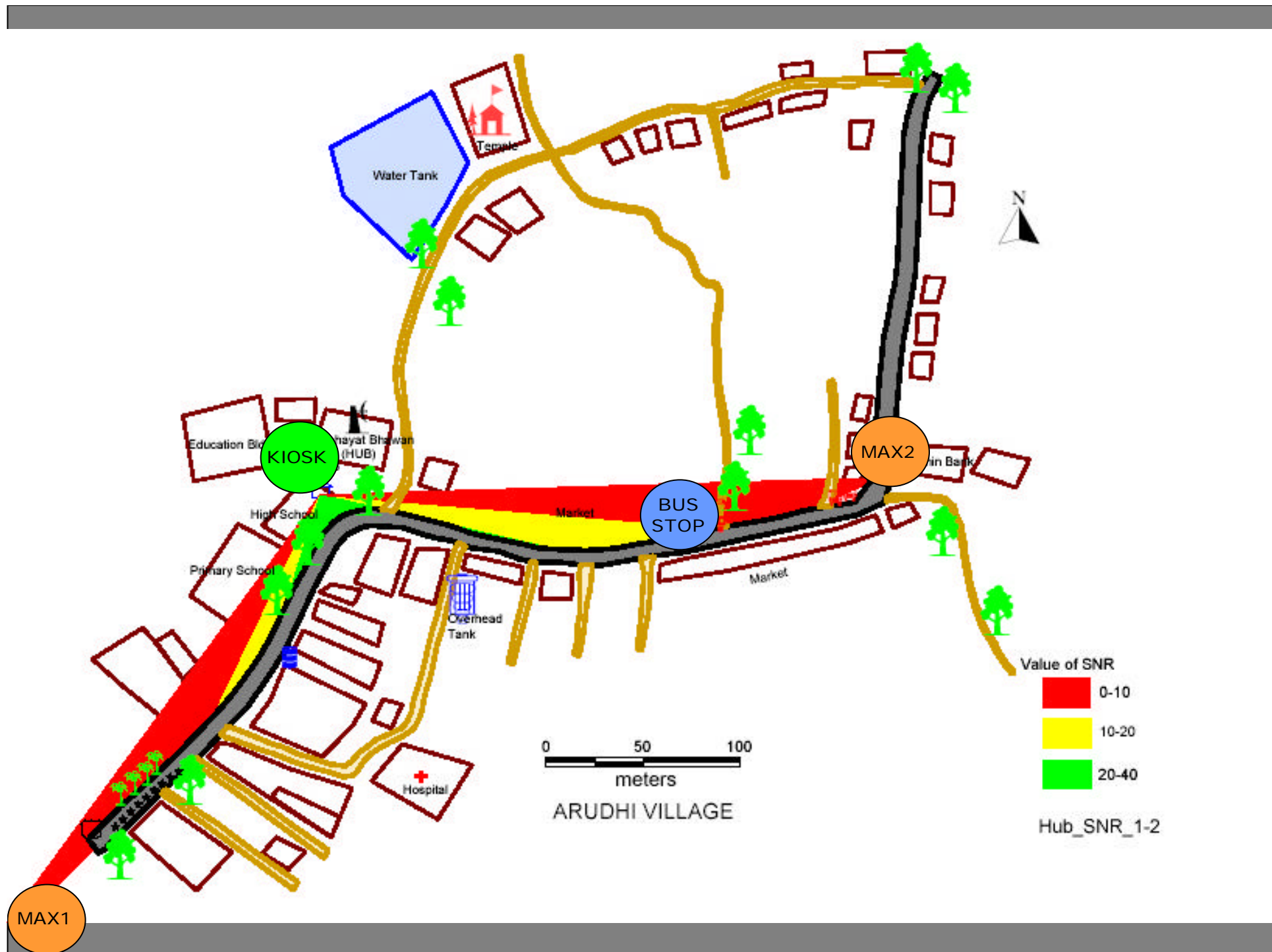
DakNet-Bhoomi  
Pilot  
Implementation

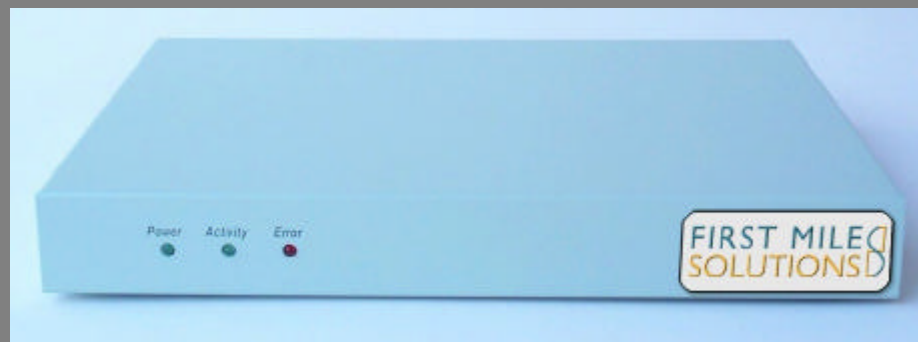
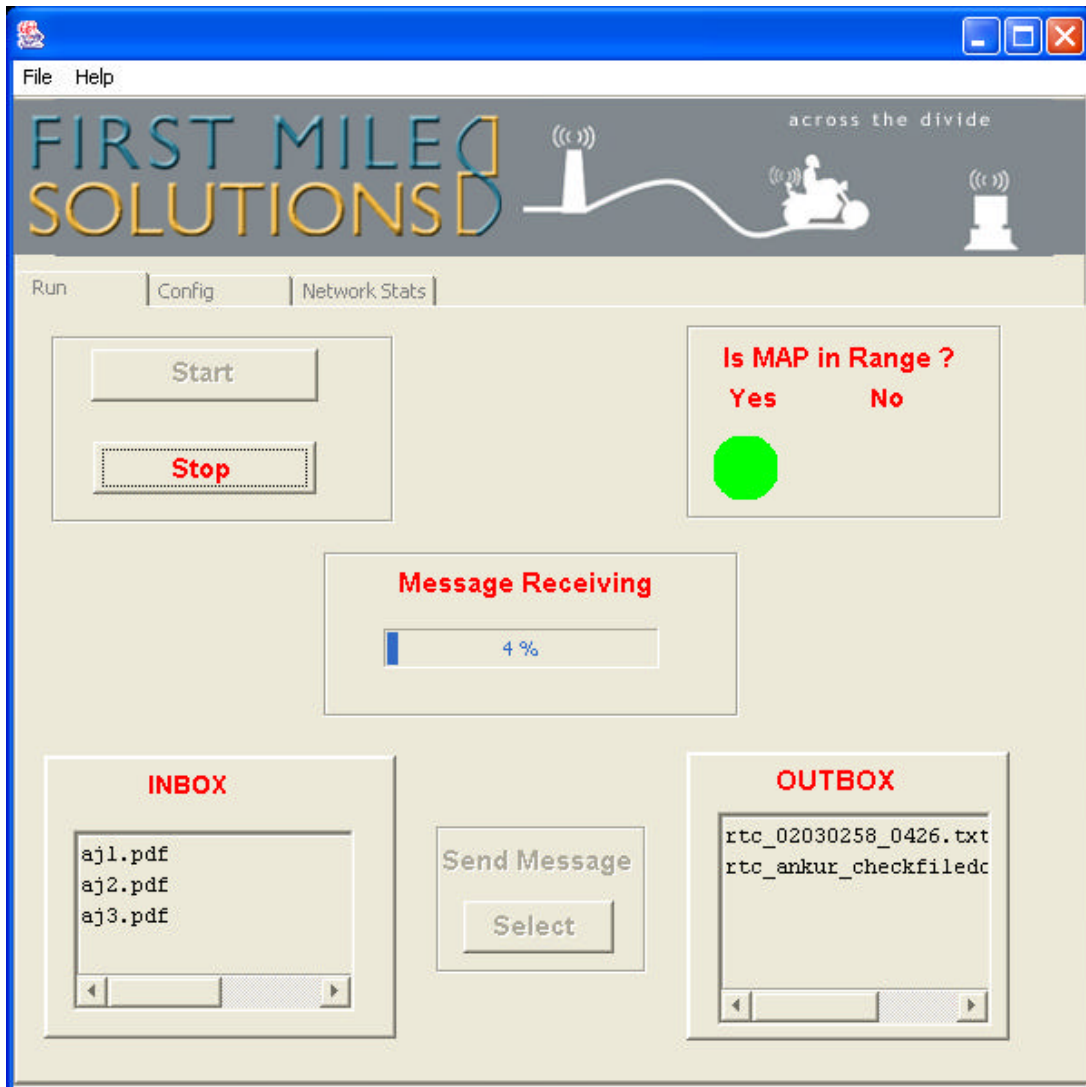
# Bhoomi



- First National eGovernance Initiative in India
- Computerization of all land records in state of Karnataka -- Manual land records illegal
- Some 500,000 land record transactions/month
- Seeking means of decentralizing its database using wireless technology







# DakNet-Bhoomi Pilot

*Rough Cut*

Rural Karnataka, India

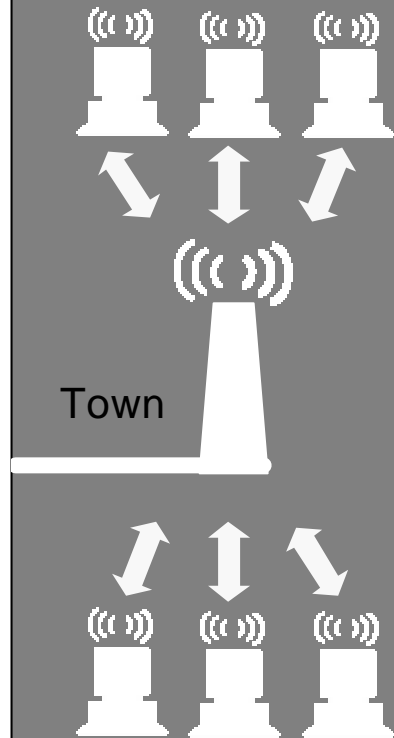
# Pilot Test Parameters & Performance

- Integrated and implemented within one month
- Total CAPEX for DakNet equipment under \$200/village
- Average data transfer per “session” = 21MB uni-directionally
- Average “goodput” with resume function was about 2.3Mb/s
- Maximum range varied from 200m to 1.5km
- Dedicated access points address power constraints

# Part IV

## The Road To Universal Broadband Connectivity

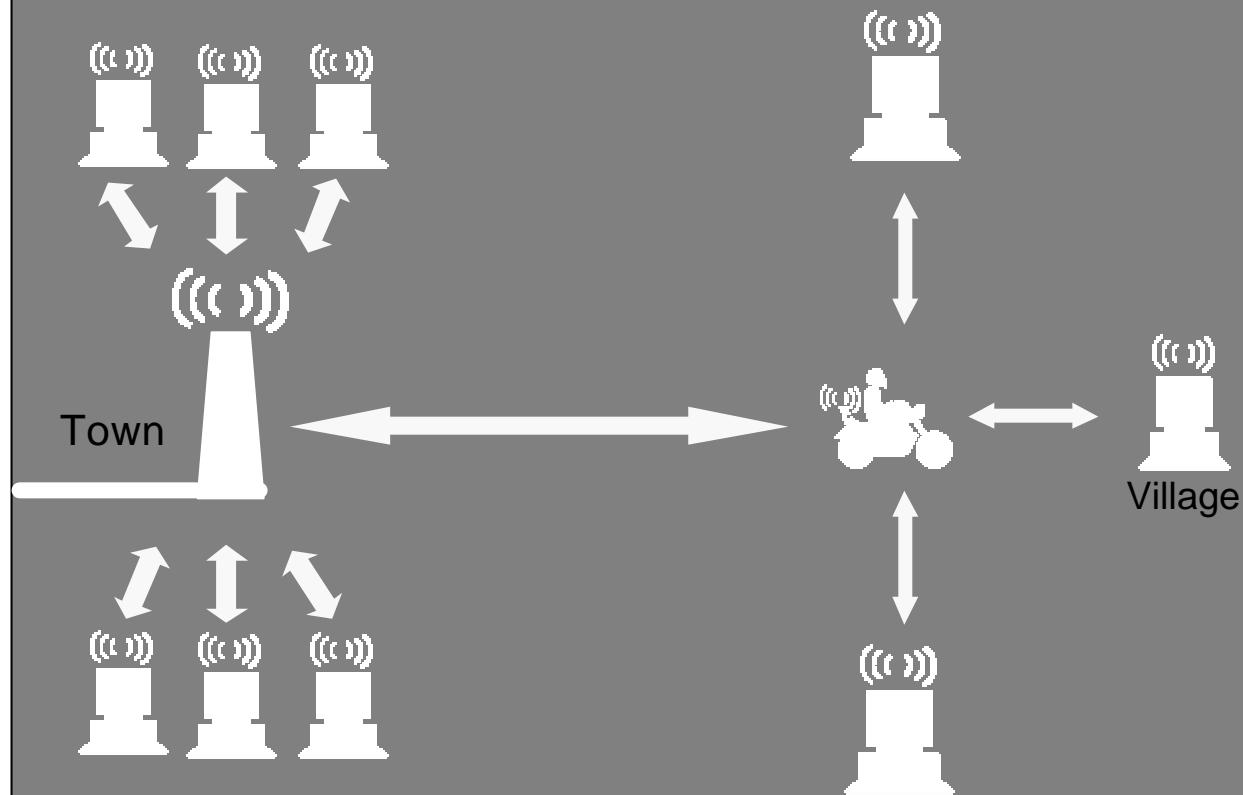
# 1: Semi-Rural WISPs



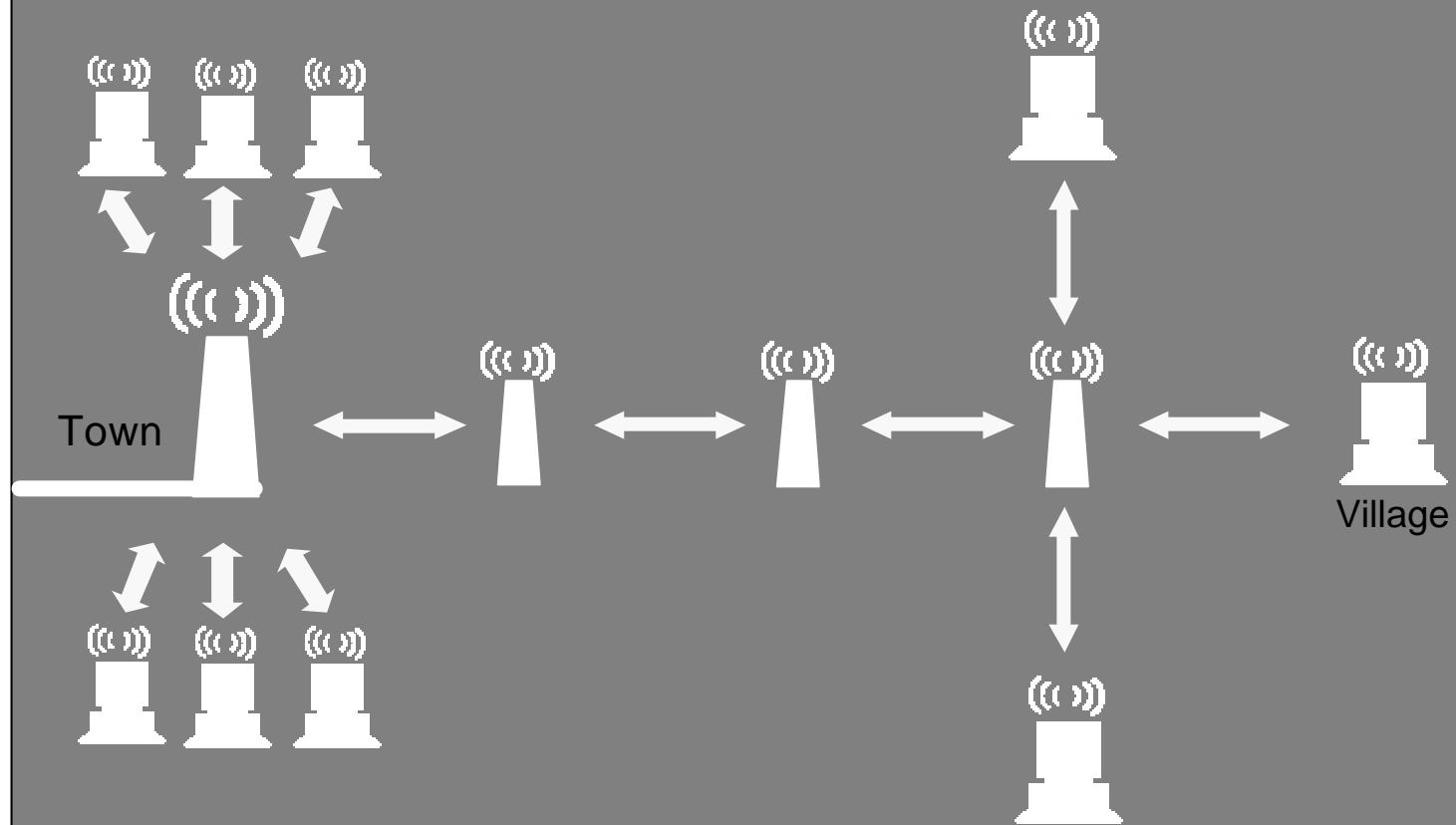
**WiFi “hotspots” for semi-rural communities**

- Enables affordable devices and services
- Stepping stone for surrounding WiFi footprint

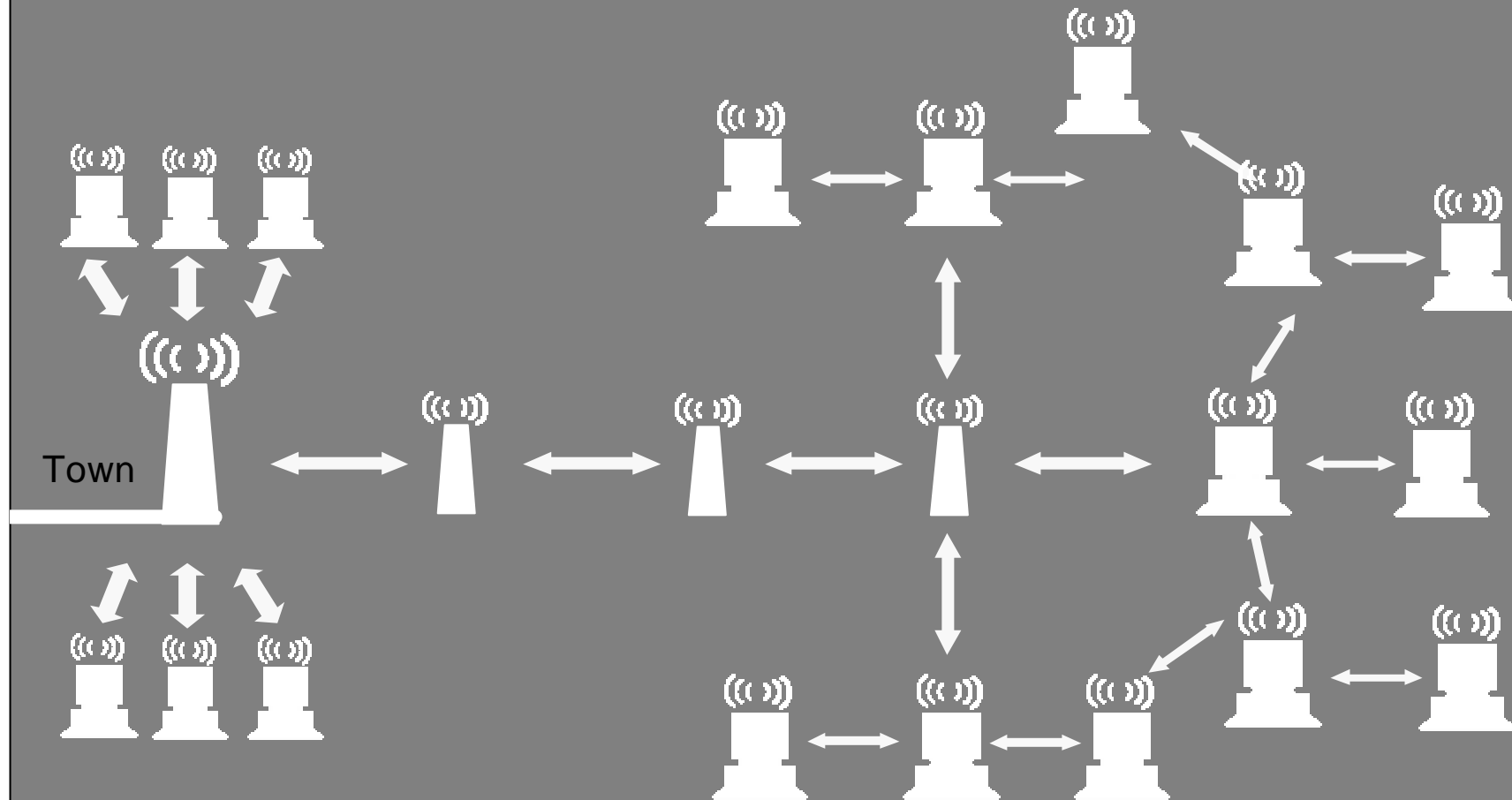
## 2: Store-and-Forward Wireless



# 3: Multi-Hop



# 4: Private Adoption & Meshes



# Considerations & Questions

- Lack of required **talent** within developing countries to develop and implement WiFi solutions
- Access to required **resources** – customs duties
- Need **ugly rugged** hardware for rural environment
- **Licensing** = time and money
- Role of **Voice/VOIP?**
- **Impact** on incumbent telcos?

# Thank You!



[www.firstmilesolutions.com](http://www.firstmilesolutions.com)

Photo: Barry Hemmington

## Applications Layer

Text messaging  
Non-real-time Internet browsing

Audio/Video messaging  
DB synchronization

## Integration Layer

Routing/naming protocol  
Batch Processing

Import/Export Function  
Asynchronous DB emulation

## Transport Layer

Intranet File Transfer  
SMTP Internet Mail Transfer

MAP "Heartbeat"  
Client Web Server

## Network Protocol Layer

TCP/IP  
Ad-Hoc WLAN

MAC Address Restriction  
Wired Equivalent Privacy (WEP) Security

## Operating System Layer

Mobile Access Point running on Linux Debian  
Client software runs on Windows family or Linux

## Physical, Hardware Layer

IEEE 802.11b (11Mbps) wireless LAN cards  
Mobile Access Point: Custom Embedded PC  
Omnidirectional and Directional (terrain-dependent) Amplified Antenna Configuration