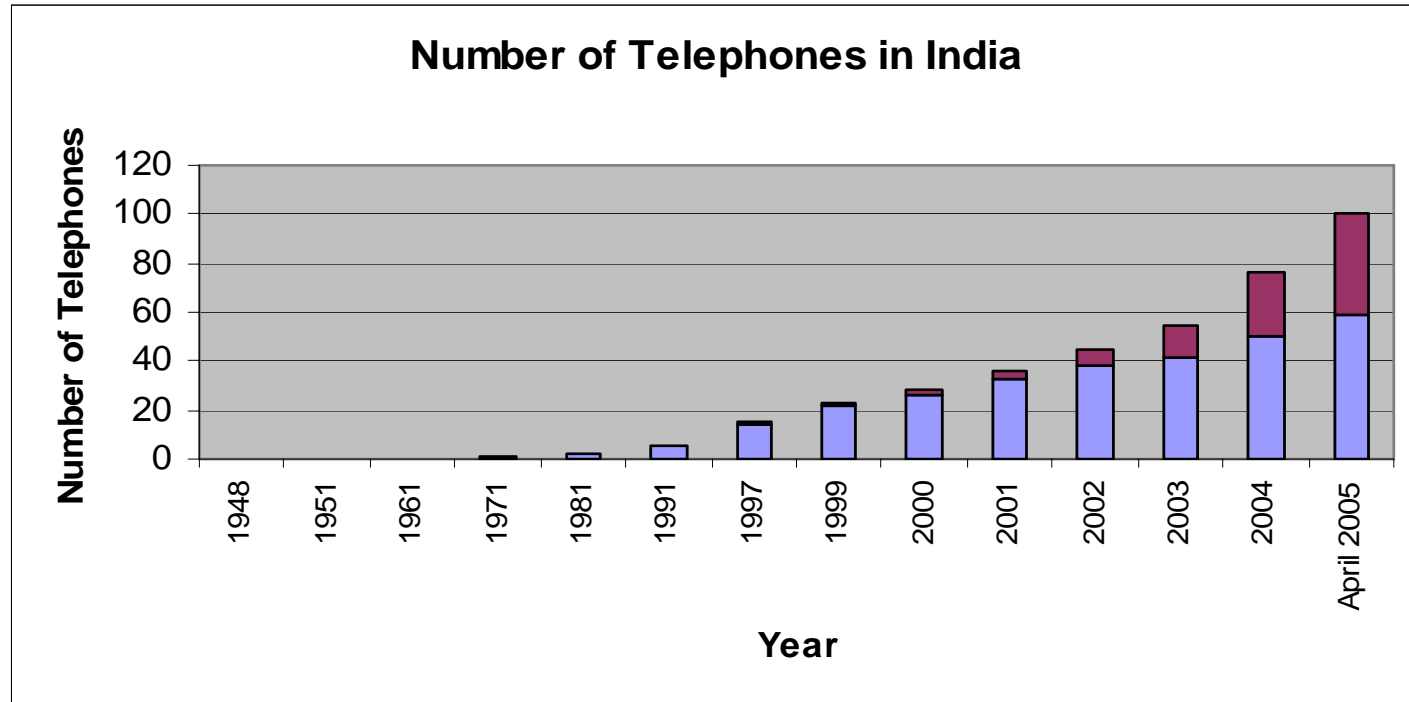


Reaching the Un-reached: **Accelerating India's March**

Ashok Jhunjunwala, IITM, Chennai
ashok@tenet.res.in

Wireless has enabled India reach 1994 dream of crossing 100 million telephone lines in a decade



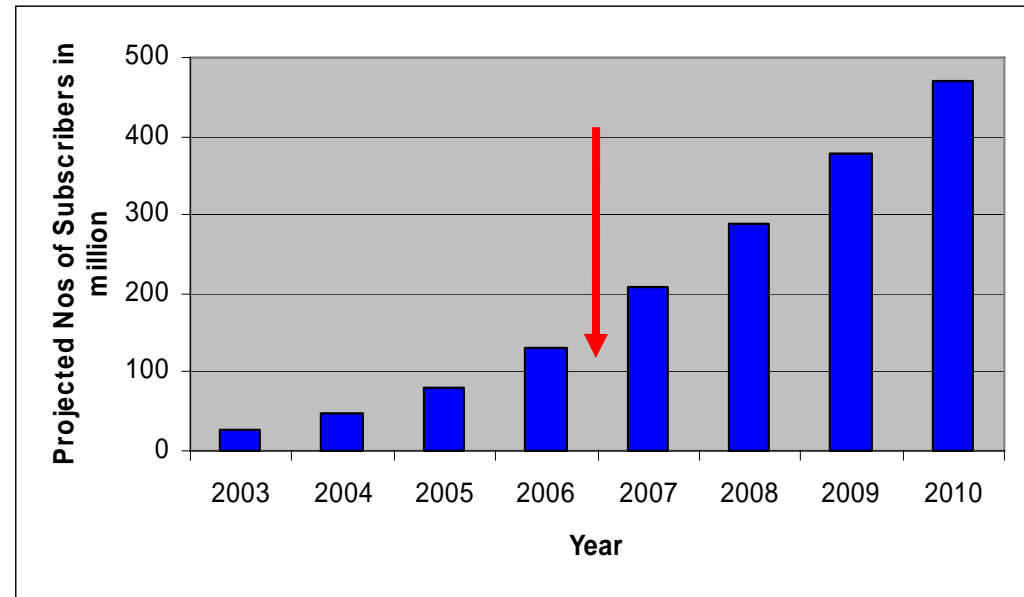
How has this happened?

can the still unreached be reached quickly?

Mobile Market in India boomed

5 million \Rightarrow 50 million \Rightarrow 150 million \Rightarrow 400 million

- with handset price of US\$30 plus
- Infrastructure cost reduces to enable
 - service at 1.5 cents per minute
 - and ARPU of \$ 7 per month



- Need a different price point for the next 300 million rural subscribers
 - Service at 0.5 cents per minute
 - ARPU of US\$ 2 per month



Similarly Broadband Market

- India has less than 1 million Broadband Connection
 - Broadband will boom in India
 - when Infrastructure Capex falls below \$100
 - Tariff falls to US\$ 6 per month: has happened
 - PC / terminal price falls to US\$150 onwards
 - Enabling **US\$ 15 per month TCO**
 - Market size in India can be 50 million in next four years
 - Incumbents can use DSL
 - New Carriers need **Broadband Wireless**

Broadband Wireless competing with low end DSL will ideally require

- Wireless technology with
 - 9 bps per Hz per cell
 - 1.5 to 3 Mbps peak rate for a subscriber
 - Average rate of 200+ kbps (UL+DL) for each sub in 10 MHz spectrum
 - US\$ 50 per sub for BS (assuming 300 subscribers for each of three sector)
 - US\$ 125 per subscriber unit
 - Mobility (bit rates can be a bit lower for mobiles)

Today's Wireless Technologies (3 sector)

■ Today

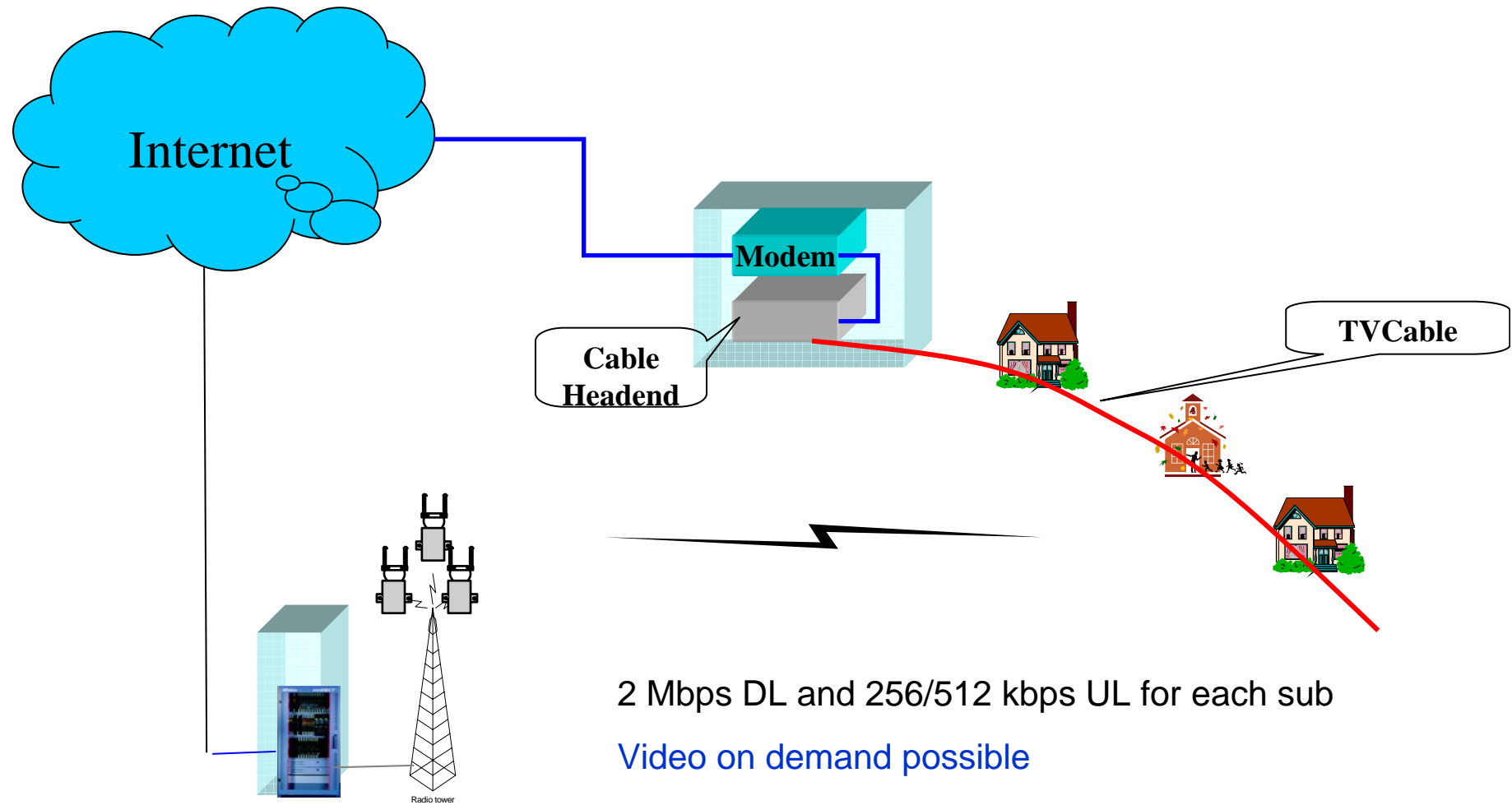
- UMTS/ EVDO: 1.8 bps per Hz mobility
- 802.16D: 1.8 bps per Hz LoS
- Flash OFDM: 4 bps per Hz mobility
- iBurst: 4 bps per Hz mobility only single sector/cell
- BB corDECT: 10 bps per Hz LoS six sector per cell

■ 2006 end

- 802.16E (WiMax): 4 bps per Hz mobility

Cable Wireless (patent pending):

Down Stream on Cable Upstream on Wireless
shares infrastructure with BB corDECT



Broadband expansion will however be limited

- Till we get the right Access Device
 - Today's PC Cost about US\$ 350 with SW

- Thin clients have been around
 - 4% market penetration
 - But interest increasing

Hitachi to replace PCs with thin clients Cites data security concerns

by Paul Kallender
23 May, 2005

<http://www.computerworld.com/securitytopics/security/story/0,10801,101938,00.html>

Concerns about data security are making Hitachi Ltd., one of Japan's biggest electronics companies, replace more of its employees' PCs with thin clients, the company said today. Over the next two years, the company will roll out 16,000 thin clients internally, according to Kazuo Furukawa, CEO of Information and telecommunication systems at Hitachi. Thin clients are computers that can access networks but don't contain hard disks. "Security is becoming an extremely severe problem, and passwords are no longer enough," he said.

The decision to replace more PCs with thin clients follows a trial with 2,000 of the company's first-generation Flora Se210 thin clients that started this February, Furukawa said.

Authorized users identify and authenticate themselves with the thin client using a Universal Serial Bus (USB) device that acts as a key. Access to the company server through the client is password-protected, Hitachi said. The company is now considering replacing all of its Japan-based employees' notebook and desktop PCs with thin clients, Furukawa said.

Novatium NetPC enabling Broadband

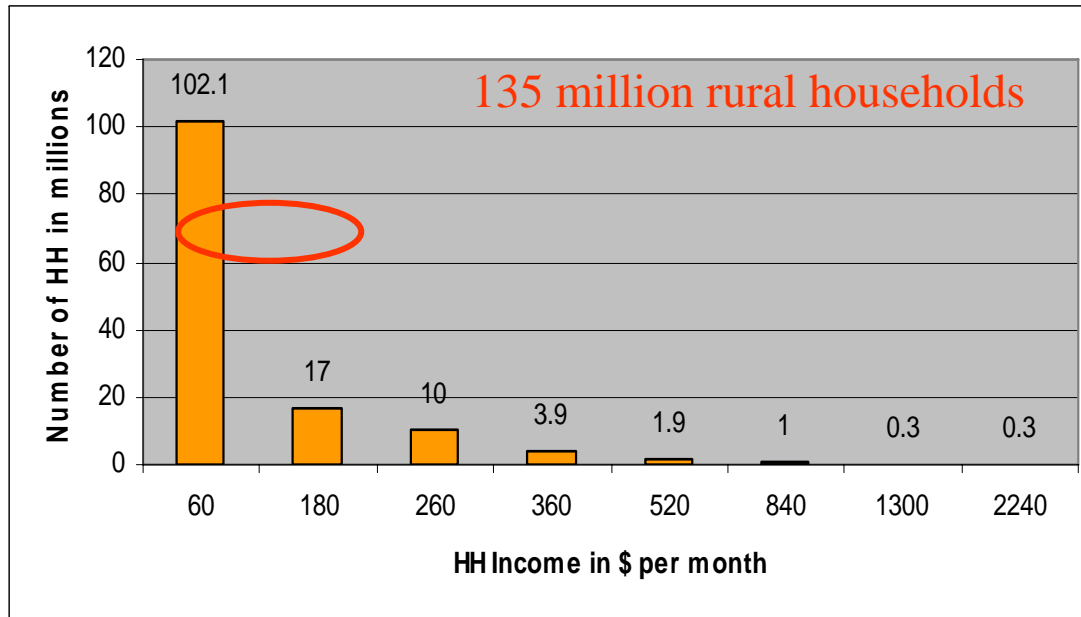
- NetPC (Multimedia Network PC)
 - Connected to a Server on LAN or Broadband
 - Connected to a PC Server
 - No virus, no back-up required, no up-gradadtion every four years
 - Management at server
 - Software costs shared

 - Target price: US\$ 80 plus monitor
 - Works with Windows, Solaris, Unix and Linux Servers



Rural India has 700 million people

- in 600,000+ villages
(about 1000 people per village with per-capita income of US\$0.50 per day)



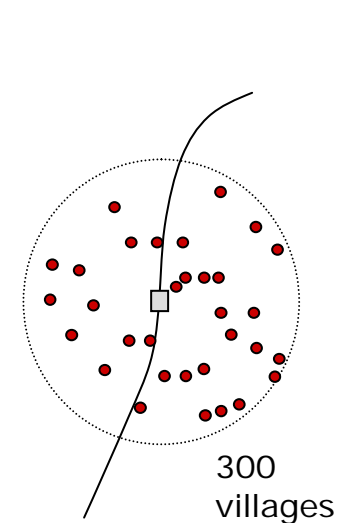
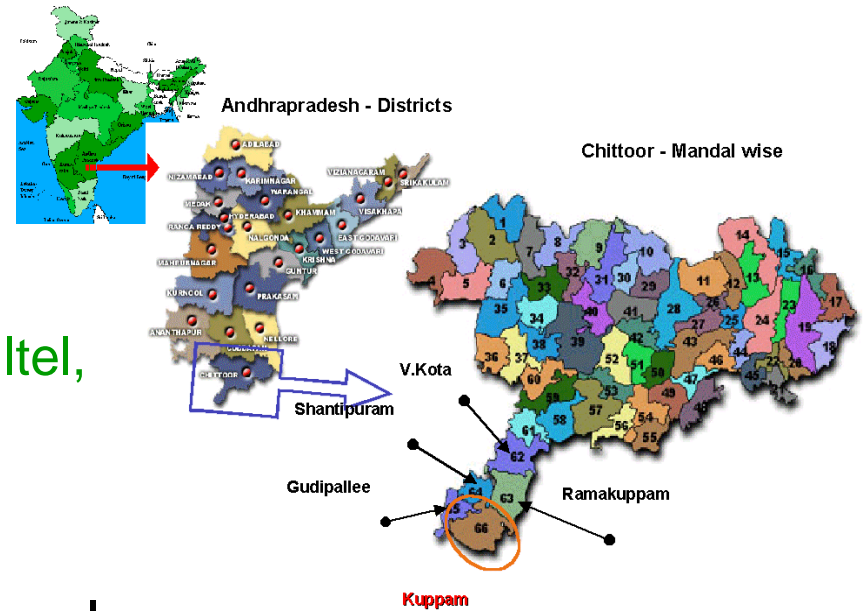
- In addition to telephony, Internet plays a great role to bring in Education, Health & Micro-enterprises
- To scale to 600K villages
 - Technologies
 - Sustainable Business Model
 - Organisation which thinks and acts Rural

Backbone Connectivity

- BSNL, Tata, Relaince, Bharati, Railtel, others have fibre to each Taluka

■ Lease Bandwidth to make a Rural backbone network (Intranet)

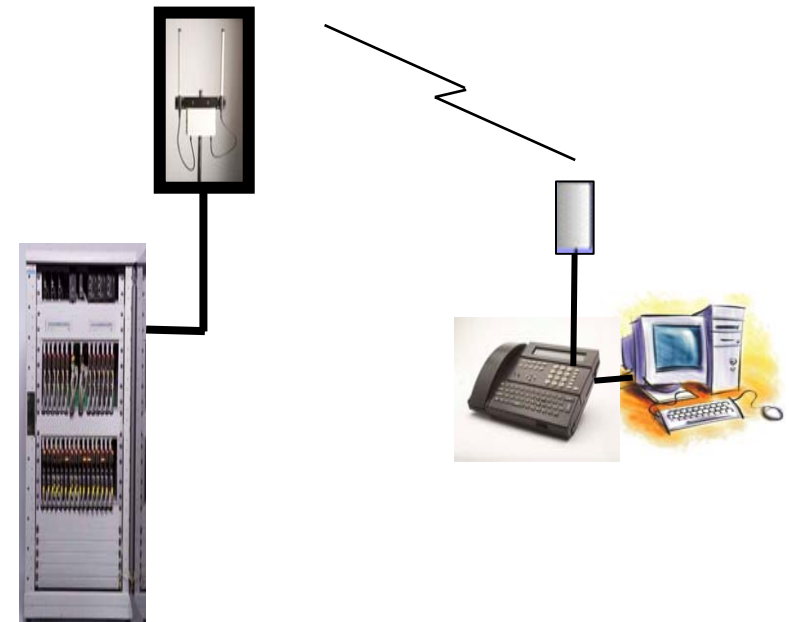
- National / International bulk BW at City
 - Rural (video Conf) BW on intra-net, Cache servers
 - Serve 300 villages around each fibre point



Wireless Technologies

- Wireless technologies are continuously evolving
 - costs come down and bit rates go on increasing year after year
 - GSM / CDMA : Mobility, Voice, SMS, low-bit rate Internet
 - BB-corDECT: Fixed, Voice, Broadband Internet
 - WiMax, Flash-OFDMA, iBurst: Mobility, Voice, Broadband Internet

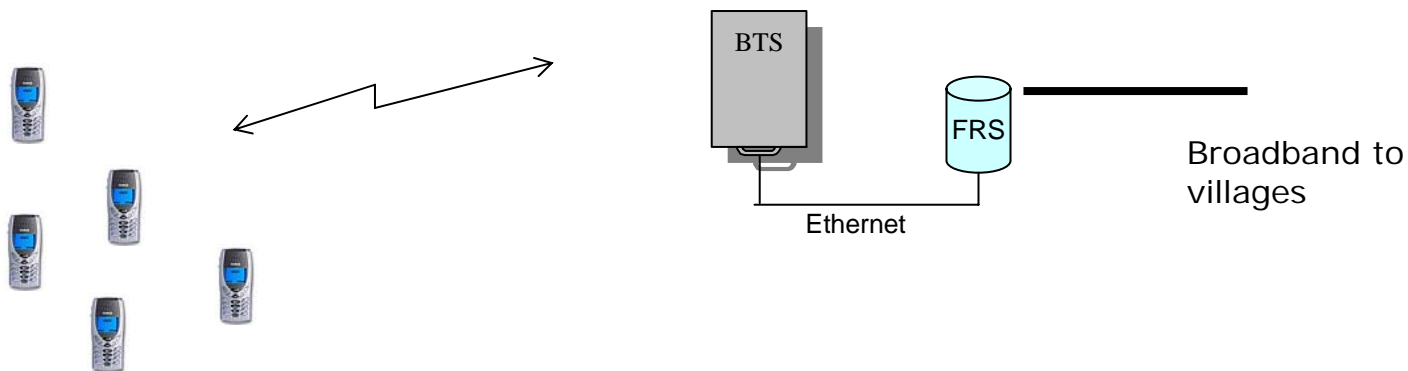
US\$ 200 per line deployed
Exchange and tower in town
Works at 55° C
Power requirement: 1 KW



GSM/ CDMA for Rural connectivity

■ Rural GSM Base Station in each village

- Enables differential tariff for phones registered in the village and making calls from the village
- Enables Rural affordability to not affect urban ARPU



Rural Wireless Access – Costs Vs Benefits

- Other costs for wireless from County / Taluka HQ to each village
 - LOS Tower cost: US\$ 25K
 - Can be substantial for three hundred village coverage unless multiple services are deployed
 - Spectrum costs

- So how does one make this economically viable?
 - Aggregate demand
 - Requires innovative business approach
 - Develop applications and services

Business Model:

- Entrepreneur-driven operator assisted telephone booths introduced in 1987
 - 950,000 such PCOs covering every street
 - generate 25 % of total telecom income serving 300 million people

- Lesson for Rural India:
 - To serve Rural people with incomes less than \$ 1/day, aggregate demand at every village and let Entrepreneurs drive it
 - No one should have to walk more than 500 m to access services
 - Provide **as many services** as possible

Aid/ Grant does not scale
Successful **Enterprises can scale** to all villages



Innovative approach

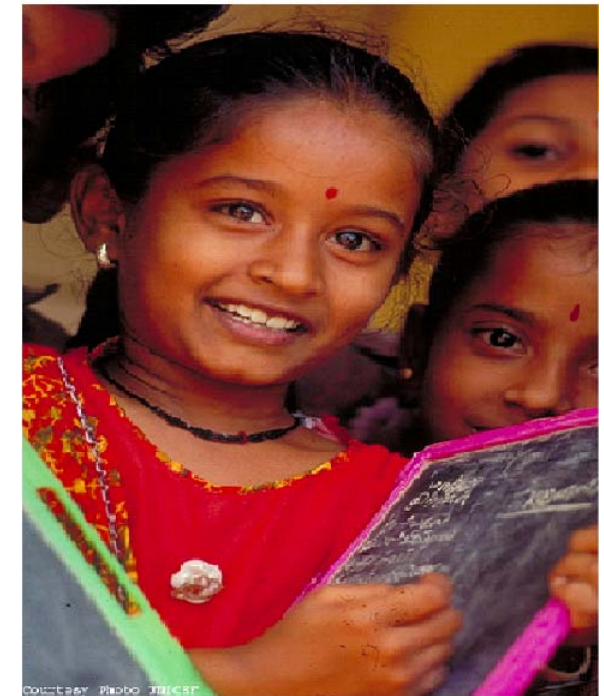
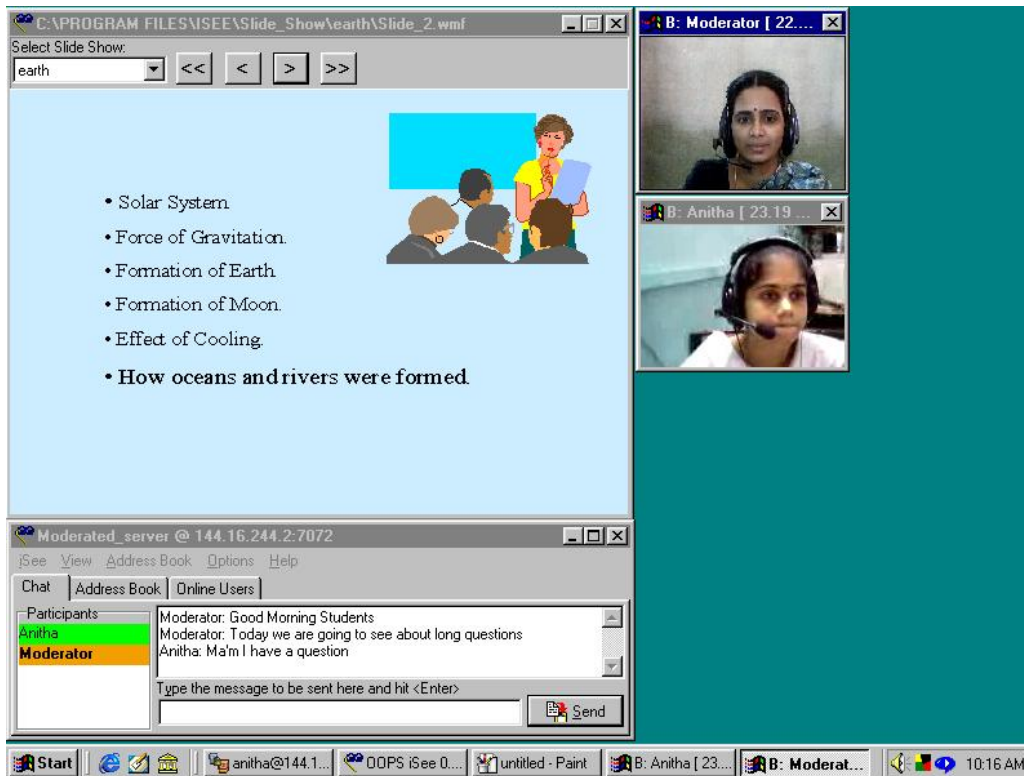
■ n-Logue : A Rural Service Provider

- aggregate demand into a kiosk
 - and get an entrepreneur to drive it
 - **ITC e-choupal and Drishtee** following similar models
-
- US\$ 1200 per Kiosk providing telephone, Internet, multimedia PC with web-camera, printer and power back-up for PC
 - plus Indian language software, video conferencing software, training and maintenance
 - set up by a village entrepreneur on the lines of urban PCOs
 - provides telephone, stand-alone Computer and Internet services
 - needs US\$ 80 per month to break even



Building Services is the Key

- End to End Services using ICT
 - Basic Services (email, browsing, games, DTP, astrology, matrimonial, photography)
 - Communication Services (VoIP, Mobile)
 - Education
 - Micro-franchise
 - ITeS
 - Telemedicine
 - Agriculture
 - Financial Services
 - Jobs
 - Buying and Selling
 - E-governance
 - Micro-enterprise
 - Online Games



Using multi-party video-conferencing tool by OOPS

Education: Good Progress

Outsourced Production enabled by Internet

■ Embroidery for Life

- Women embroiderers trained by designer entrepreneur in villages
- An emerging business model for entrepreneur and kiosk operator



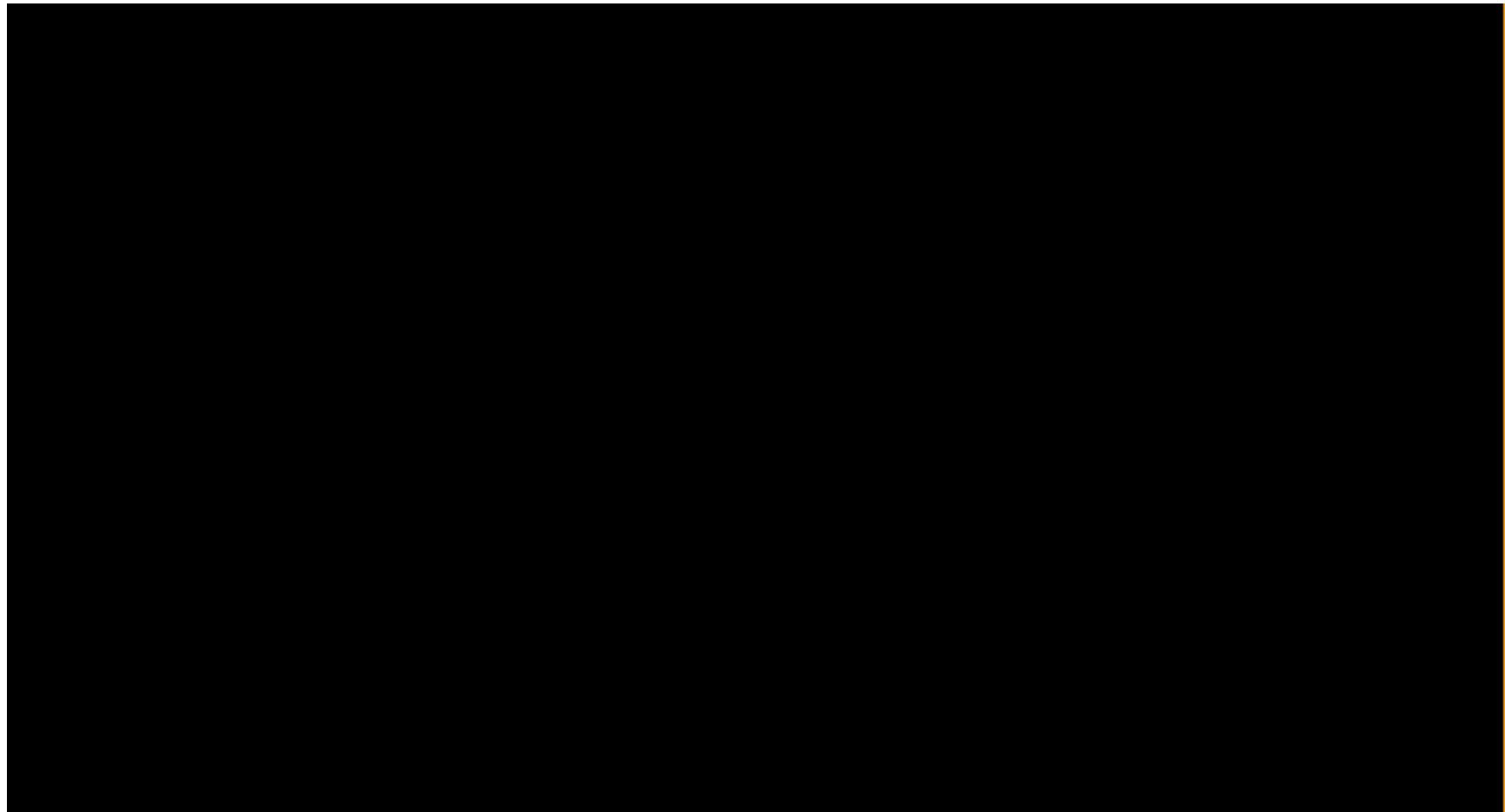
■ Bags for Life

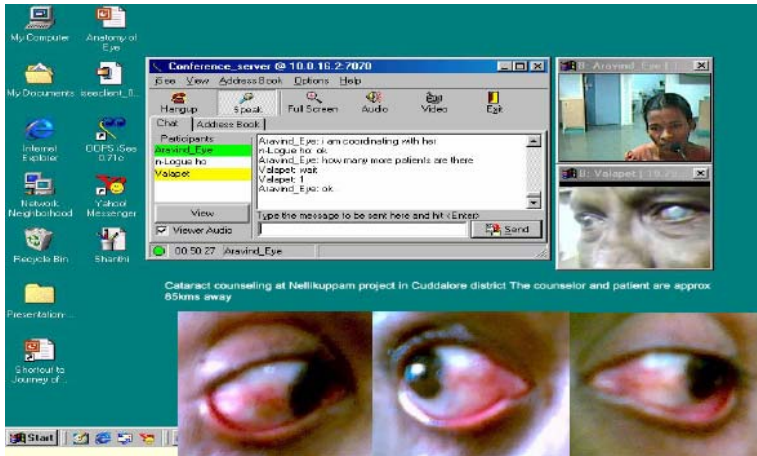
- Training in handmade paper bag, organizing production, quality control
- Quality products for the domestic and export market



IT enabled Services:

Job work performed at the kiosk





Remote Eye Care with Aravind Hospitals



Vet care with Veterinary college

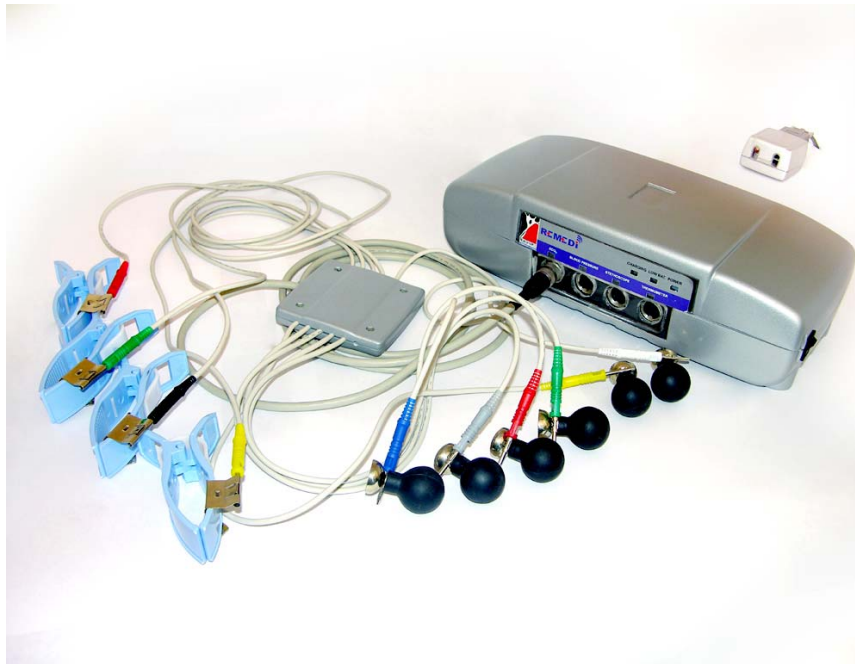


Telemedicine

2+

Started with video based eye care, contacting doctor and Vet doctor

ReMeDi™ Tele-medicine solution

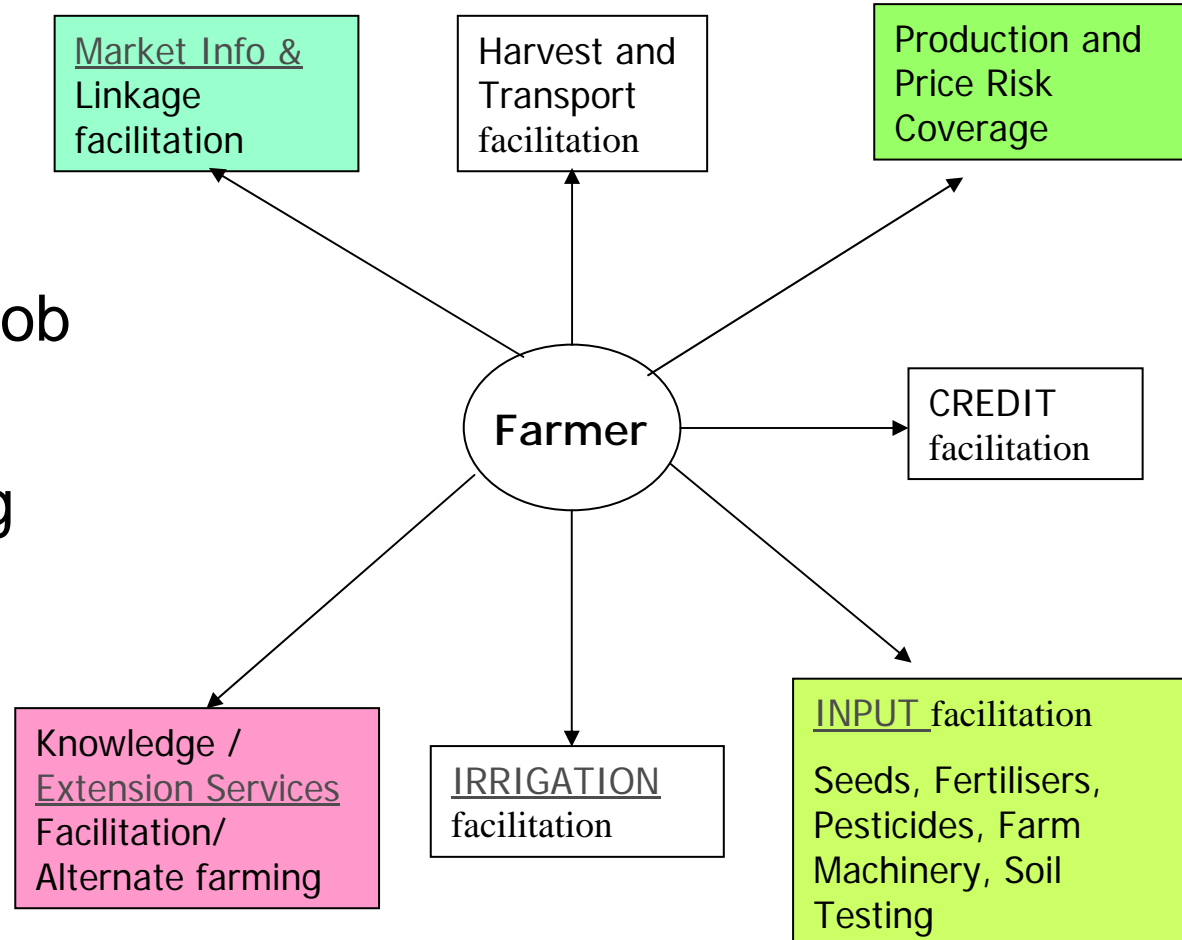
A screenshot of the 'Tele Diagnostic Kit-Version 0.9' software interface. The window has a menu bar with 'Settings', 'Connect', 'Record', 'Help', 'Tools', and 'Audio'. The interface is divided into several panels:

- Patient Details:** Fields for ID (2), First Name (Rajan), Last Name (M), Age (24), and Sex (Male selected). Buttons for 'Send' and 'Create' are present.
- Measurements:** A table with columns 'Case ID' and 'For'.
- Stethoscope:** A panel with a 'Close' button.
- Blood Pressure:** A vertical scale from 50.0 to 225.0. A 'Current Pressure' indicator is green. Below the scale are buttons for 'Systolic' (101), 'Diastolic' (76), and 'Pulse' (96).
- ElectroCardioGram:** Two ECG waveforms are displayed on a grid. The top one is labeled 'LEAD I'. Below the waveforms are buttons for 'Print', 'Close', and 'EnableFilter'. The scale is 'Vert 0.1mm/mV, Horiz 25mm/Sec'.
- Control:** A panel with buttons for 'Stethoscope', 'Blood Pressure', 'Electrocardiogram', and 'Thermometer', each with 'Start', 'Stop', and 'Close' sub-buttons. There are also 'Delegate', 'Grabback', 'Result', and 'Get Result' buttons.
- Temperature (Deg F):** A panel showing a value of 97.6 with a color-coded bar below it.
- symptoms:** A panel with tabs for 'Symptoms', 'Diagnosis', and 'Prescription'. A 'Send' button is at the bottom.
- Video Feeds:** Two video windows are visible. The left one is labeled 'B: Doctor | 48.38 Kbps / 4.41 fps' and shows a man in a white shirt. The right one is labeled 'B: Patient | 54.29 Kbps / 3.43 fps' and shows a man in a plaid shirt.

The Windows taskbar at the bottom shows the Start button, several application icons, and the system tray with the time 6:27 PM.

Agriculture

- ITC doing great job
- Others struggling



Micro-weather prediction

- Collect weather data at each village
 - Temperature, humidity, pressure, wind speed, wind direction and rainfall
 - Can one use micro-weather prediction systems?
 - Use village data for weather insurance

- TeNeT & Neurosynaptic develops
 - Weather Monitoring Kit : US\$ 200
 - Remote Measurement of each of these parameters at each village multiple times a day and recoding at some central server
 - Prototype ready



Huge potential Impact on crop insurance, micro weather models, prediction, disaster management

Financial Services

- Can kiosks be mini-banks?
 - Can they facilitate agricultural loans?
 - Can money transfer from cities/ urban areas be facilitated?
- Can kiosks facilitate micro-finance?
 - Can the interest rate be significantly brought down?
- Can kiosks carry out credit-rating of rural people?

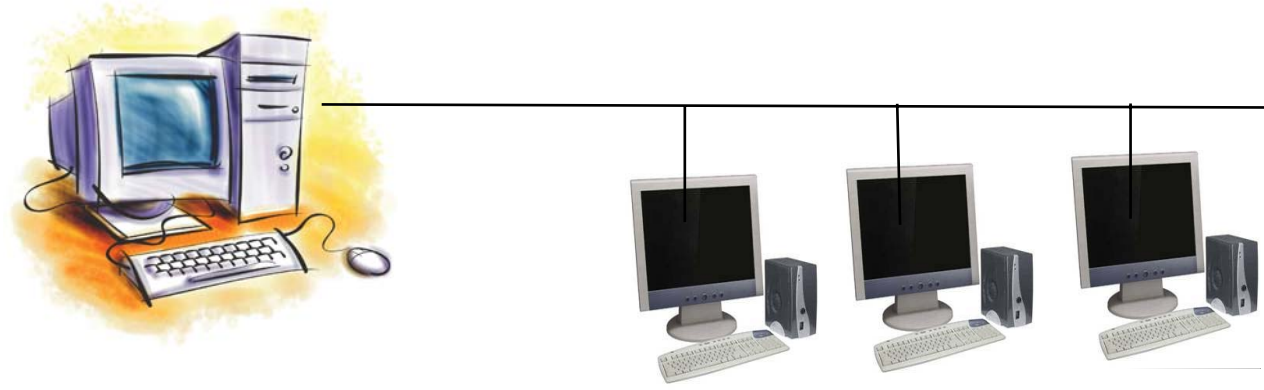
- What about Insurance?

Vortex *Gramateller* initiative with ICICI, reducing the cost of ATM to 1/15th



As kiosks want a second computer

- Introducing NetPC (Multimedia Network PC)
 - Connected to the Kiosk PC Server on LAN
 - No virus, no back-up required
 - Functions identical to a PC
 - Target price: US\$ 80 plus monitor



Services Status

- Infrastructure 3+
- Capacity Building 2+
- End to End Services using ICT
 - Basic Services (email, browsing, games, DTP, astrology, matrimonial, photography) 4
 - Communication Services (VoIP, Mobile) 3
 - Education 3+
 - Micro-franchise 2+
 - ITeS 2+
 - Telemedicine 2+
 - Agriculture 2-
 - Financial Services 2-
 - Jobs 0
 - Buying and Selling 1-
 - E-governance 1+
 - Micro-enterprise 0+
 - Online Games 0

- How do we drive each of these to 4+ in the next two years?
- How many companies does each require?
- What about community oriented services?

To Sum Up

- Internet technologies can impact lives provided there is a big enough Vision
 - 50 million Broadband Connections by 2010
 - Dream of Doubling per capita Rural GDP



- Lots of Innovations required
- Agriculture Support key to Rural Wealth
- Power Supply will be key bottleneck
 - Entrepreneur sets up (20-50KVA) back-up power plant and distribute in the village