

# Towards 50 million Broadband in India

## **How should we progress?**

---

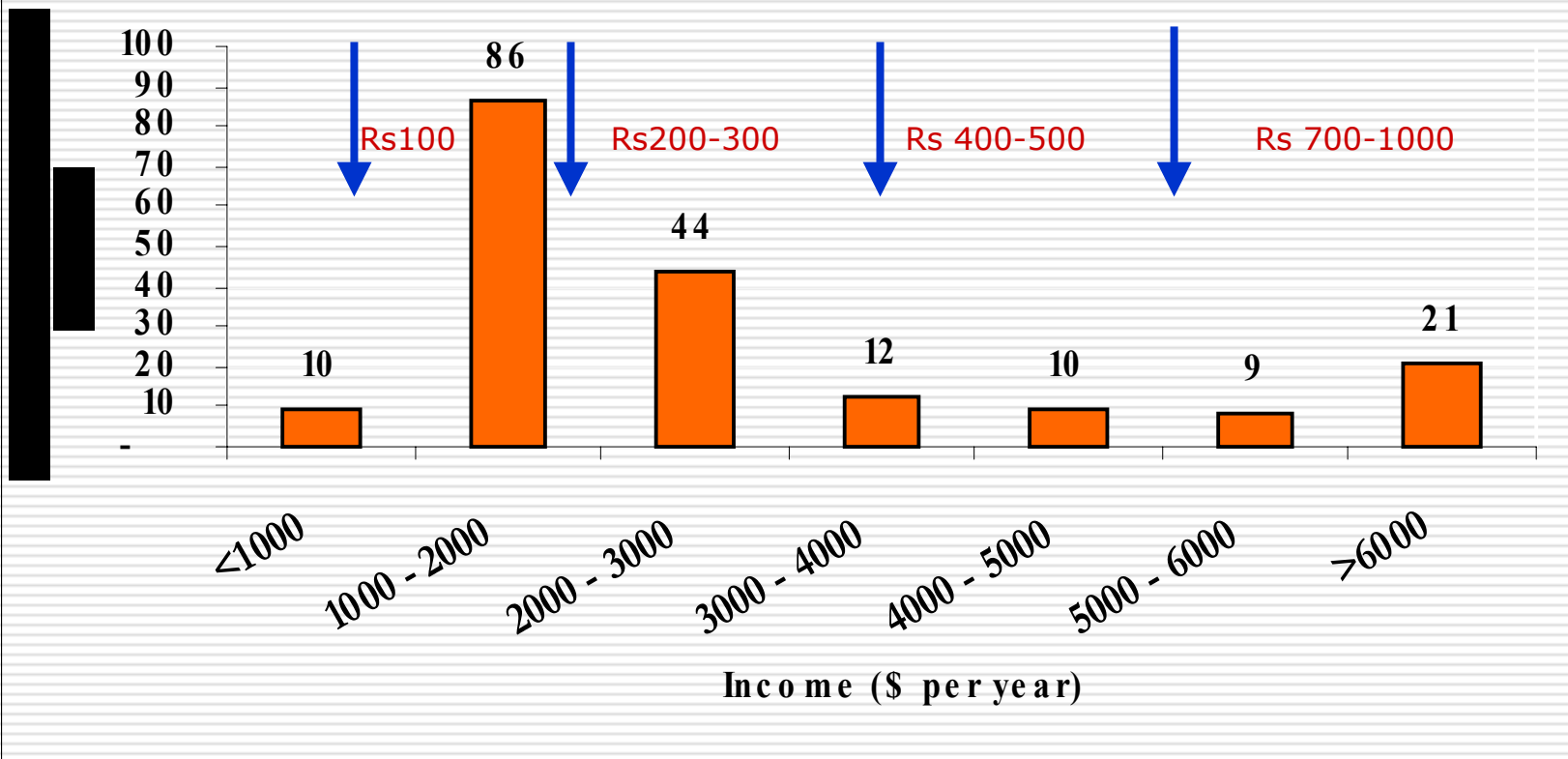
ashok jhunjhunwala, TeNeT Group, IIT Madras  
ashok@tenet.res.in

# Internet is Power

---

- Internet is not just a means of communications, but is Power
  - is a big enabler
  
  - Internet in India has grown
    - but slowly
    - is expensive
    - Internet based Services (Education, Commerce and Entertainment)
      - virtually non-existent
  
- What does India require?

## Income distribution among households

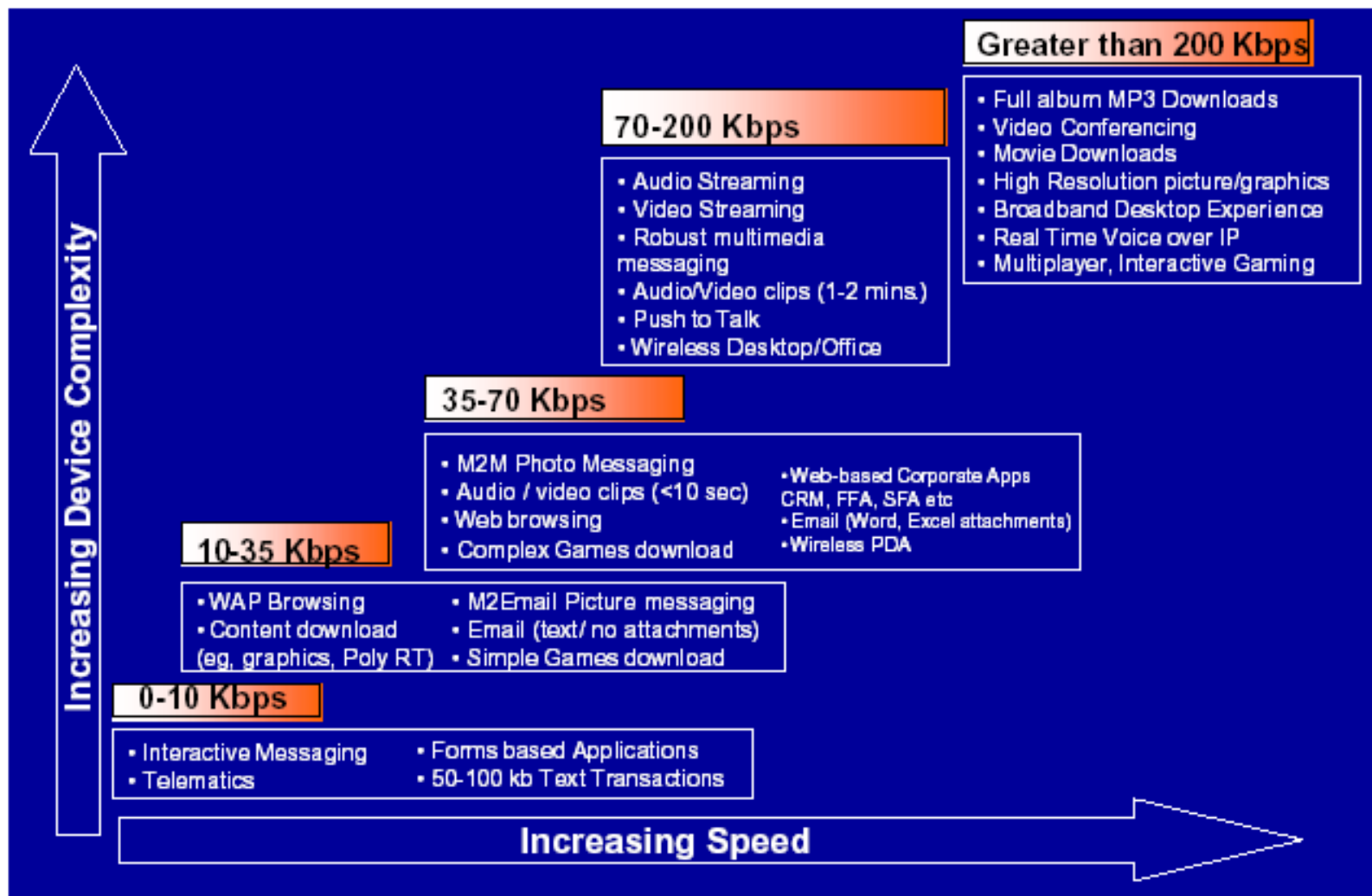


# What would we like at homes/ small offices?

---

- Low bit-rate connection for messaging at Rs 100 (\$2) pm
  
  - 64 kbps (*dedicated*) *Always On connection* at Rs 200 (\$4) pm
    - will enable email, browsing and some education/commerce
  
  - 200 kbps (*dedicated*) *Always On connection* at Rs 400 (\$8) pm
    - will enable video-conferencing, some entertainment
  
  - 2 Mbps (*dedicated*) *Always On connection* at Rs 700 (\$14) pm
    - will enable video on demand, entertainment
  
  - Can we get there? and what about the **terminals**?
-

# Mapping of Services to Preferred Speeds



Mapping of Wireless Data Services to Preferred Speeds



- Solar System
- Force of Gravitation.
- Formation of Earth
- Formation of Moon.
- Effect of Cooling.
- **How oceans and rivers were formed.**



See View Address Book Options Help

Chat | Address Book | Online Users

Participants

- Anitha
- Moderator**

Moderator: Good Morning Students  
 Moderator: Today we are going to see about long questions  
 Anitha: Ma'm I have a question

Type the message to be sent here and hit <Enter>

Send

# Bottlenecks: Progress over last year

---

- International Network
  - Rs 100,000 per month per Mbps (one way to/from USA)
    - if one uses a 100 kbps connection to continuously pull traffic from a US based server, the international network alone will cost Rs 10K per month !!
    - Some cost reduction: Much more to come
    - NIXI is established: Yet to fully function
      - Create Indian Content and host it in India
      - Mirror / host International sites in India
      - reduce International traffic fraction from 85% to 25% in three years
  
- Backbone Network cost in India
  - Rs 20,000 per month per Mbps (one way, farthest distance)
  - TRAI recommended drastic cuts; huge fibre build-ups : Much more to happen
  
- Access Network: connecting from PoP to home/office
  - The challenge continues

# Bottlenecks: Progress over last year

---

- The Access Device / PC: Rs 20 – 30K is too expensive
  - New Access Devices coming up
  - TV based / monitor based / Thin Client
  
- Content: Entertainment, Education, Services, Transaction
  - No major progress in last one year
  
- Affordability: Rs 1000 for Broadband too expensive
  - Total Cost of Ownership needs to be affordable

# For home/office connectivity Access is the primary bottleneck

---

- Access Choices:
  - Dial-up Internet: too costly and too little
  - Mobile: too costly and far too little
- DSL on Copper: available only with incumbent (BSNL/MTNL)
- Coaxial Cable: Can we overcome Quality?
- Wireless: Can we provide enough bandwidth?
- Fibre to the home/curb: build may take time (with Last METERS of copper or wireless)

# Digital Subscriber Loop on Copper

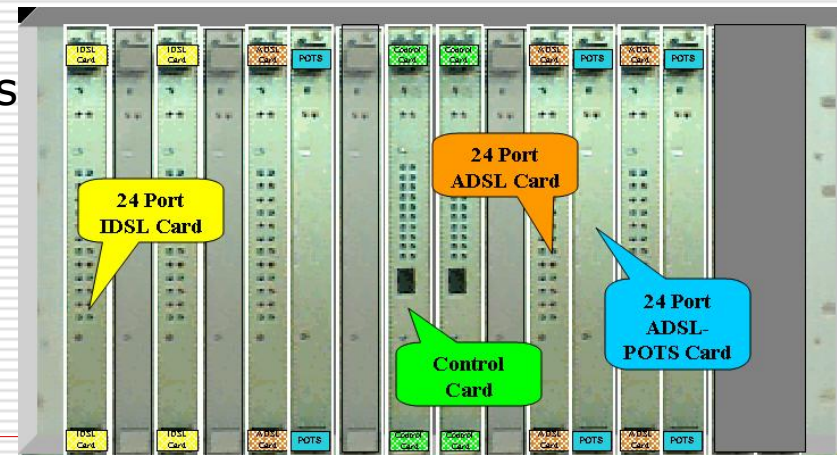
---

- What is technologically possible today?
  - ADSL: 6 Mbps downlink and 512 kbps uplink for 4 Kms cu
  - ADSL2+, VDSL: 30 Mbps downlink and 1 Mbps uplink for 700 m
  
- But who has copper links to homes/offices?
  - Only BSNL/MTNL
- What are the lengths of such copper loop
  - mostly 3-4 Kms; 5% may be 700 m (connected using DLCs)
- What is the quality of such copper?
  - Poor, except when 700 m copper links with DLCs are used
  
- Dishnet/Bharati are putting their own cables in a limited way

# BSNL provides DSL service in 95 cities using DIAS



- Always ON Internet connection at 128 kbps on not so good quality copper lines in about 500 exchanges (95 towns)
- Banyan also offers **ADSL/ADSL2/VDSL solution** for better quality copper lines



120 Line System  
(2-Wire)

# Internet on Coaxial Cable

---

- Widely used in USA
  - 10 to 40 Mbps broadcast in forward direction and 512 kbps to 1 Mbps shared uplink
  
- Coaxial provides TV to 60 million Indian homes
  - at carrier charge of **Rs 80 per month** (in contrast to charge of \$ 20+ per month in most developing countries)
    - how is this possible?
      - Choice of cable, connectors, amplifiers and deployment and maintenance methodology are all designed to provide TV services at Rs 80 per month
    - Most attempts in India towards **conversion** of the coaxial plant for two-way Internet communication has been a failure

# Wireless: The happening Area

can it solve access problem to homes/ small offices?

---

- 2.5 G Mobile: 3G-1x/GSM/GPRS
  - can deliver 100 kbps shared connection to all subs in a sector
  - may deliver 1 Mbps shared connection in future (3G)
    - still at best comparable to 56 kbps dial-up; uses huge spectrum; will be costly --- can compete with dial-up

Network and device	Highest speed we experienced: download	Highest speed we experienced: upload	Vendor-rated average speed <sup>1</sup>	Maximum possible speed
<b>EDGE:</b> Nokia 6620 cell phone	82 kbps	32 kbps	100 to 130 kbps	384 kbps
<b>UMTS:</b> Motorola A845 cell phone and Novatel Merlin U520 PC Card	291 kbps (phone), <sup>2</sup> 320 kbps (card)	54 kbps	220 to 320 kbps	2 mbps

Computerworld:  
<http://www.corante.com/unwired/>

# Will 3.5G (HSDPA / HDR) work?

- Sector throughput 0.75 bits/sector/Hz

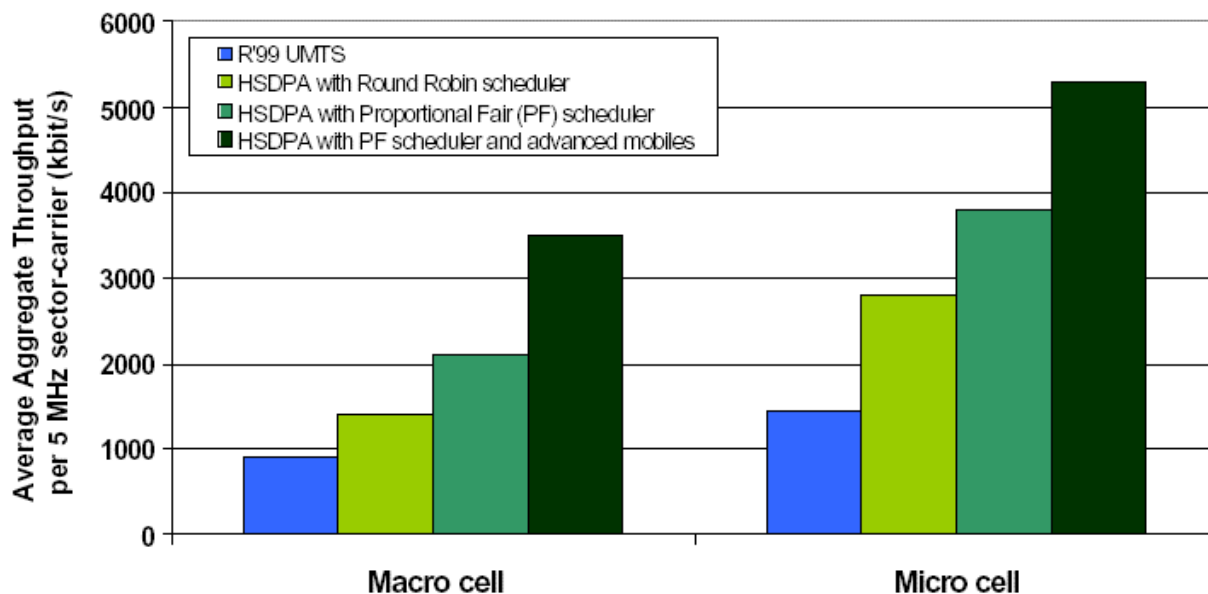


Figure 5. Capacity Improvement of HSDPA

# HDR

- 3-sector cell throughput with IS-856 Rev 0:
  - 3.1 Mbps with 1 Rx antenna (pedestrian)
  - 4.1 Mbps with 2 Rx antennas (pedestrian)
  - 2.1 Mbps with 1 Rx antenna (vehicular)
  - 3.1 Mbps with 2 Rx antennas (vehicular)
- 3-sector cell throughput with IS-856 Rev A:
  - 4.5 Mbps with 2 Rx antennas with equalizer (mix of pedestrian and vehicular)

- Average aggregate throughput through simulation in 1.25 MHz Carrier in forward direction
  - Sector thruptut 0.8 bits/Hz with one RX antenna
  - 1.2 bits/sector/Hz with two Rx antenna

# Is WiMax (802.16) the answer?

---

- OFDM can provide 4 to 5 bits per sec per Hz
    - But what is its reuse ?
      - 1 : 9 (3 sectors, once in three cells)?
        - What can adaptive antennas, DCA, beam forming, power control, adaptive coding, adaptive scheduling, frequency hopping give us?
    - may amount to 500 kbps dedicated connection to each user
      - what price point and when?
    - And what about the infrastructure costs? Unlikely to work with existing infrastructure
- 4G wireless / MIMO
    - promises more: when, how much and at what cost

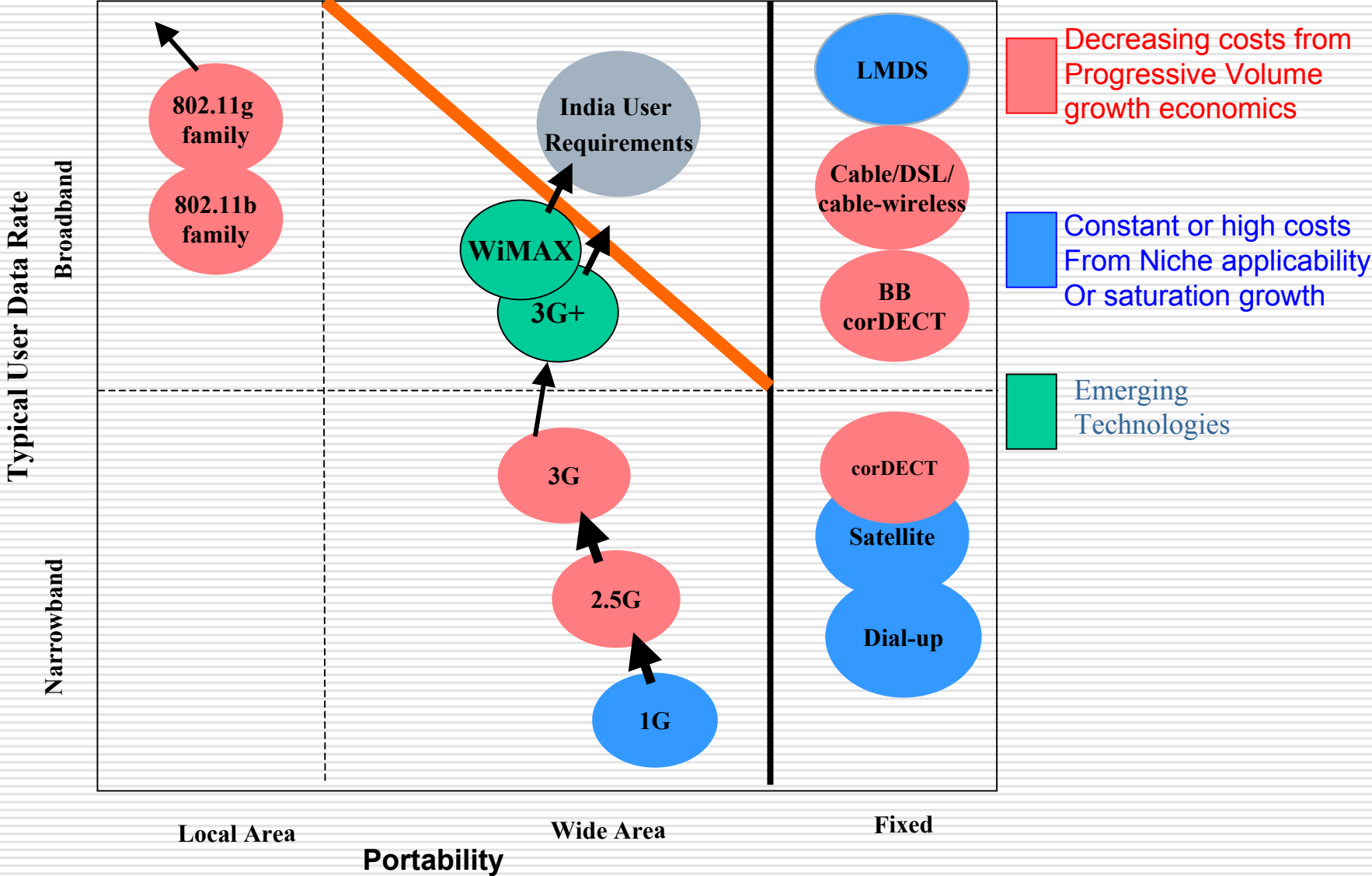
# Wireless Technologies (continued)

---

- BB corDECT WiLL: provides **Always On 100 /200 kbps** dedicated connectivity
  - Ideal for 200 / 64 kbps (*dedicated*) *Always On connection* at Rs 400/ 200 per month
  - Always on low-bit rate(32 kbps) connection at Rs 100 pm

- 802.11 Wireless LAN
  - ideal LAN for office, homes, public places (100 meters hotspots)
    - but required fibre/DSL connection to base station
- PMP Systems (proprietary) providing 64kbps to 2Mbps connection
  - companies like SIFY provides 64 kbps at Rs 20K per month
  - shared connection to multiple users in a building

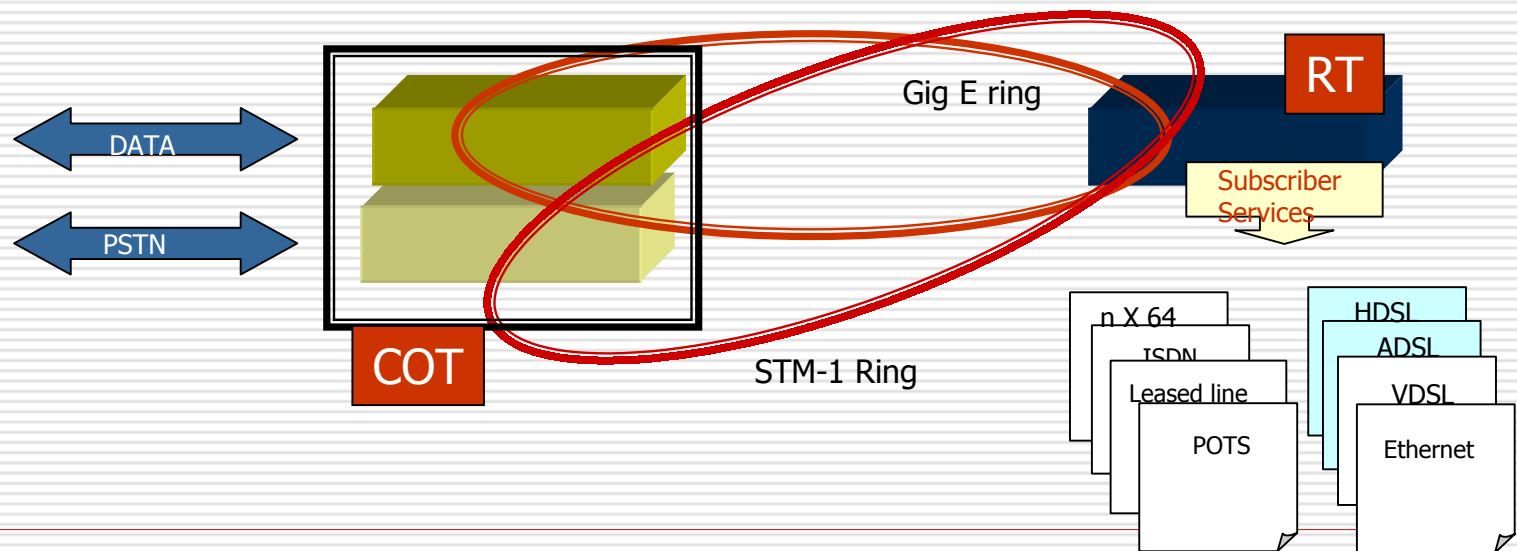
# Comparison of Alternatives



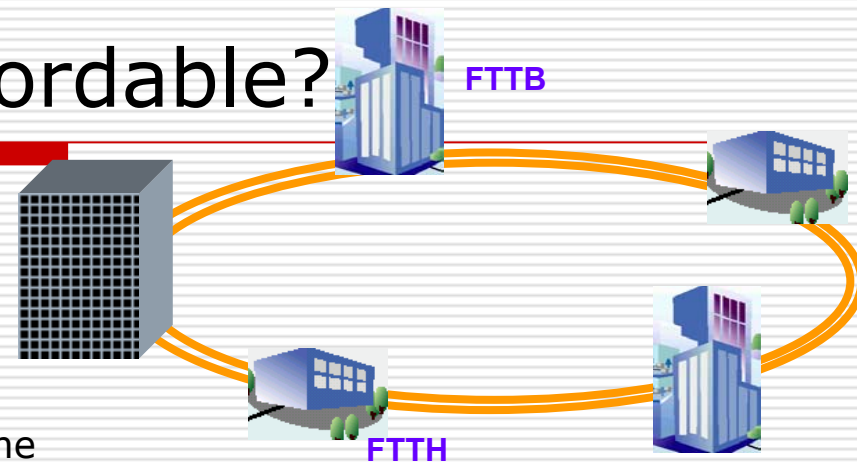
# Fibre Access Network

finally beating the bandwidth game

- Fibre to the Building / Curb
  - last **Meters** on copper (Ethernet) or wireless (802.11)
    - 100 Mbps to each user possible
    - is being used today by almost all operators
      - BSNL, MTNL, Reliance, Bharati, Tata-Tele, Shyam, HFCL



# But is Fibre Access affordable?



## □ How deep can the Fibre go?

### ■ Key drivers

- Cost of Fibre Termination, Line terminating electronics and power backups
- can one have RT serving only 20 subs?

### ■ Depends on

- Customer Density and Affordability

### ■ For dense urban areas of India, Fibre to the building is the most cost effective solution

- comparable to wireless provided one can get it 1 in 3 homes

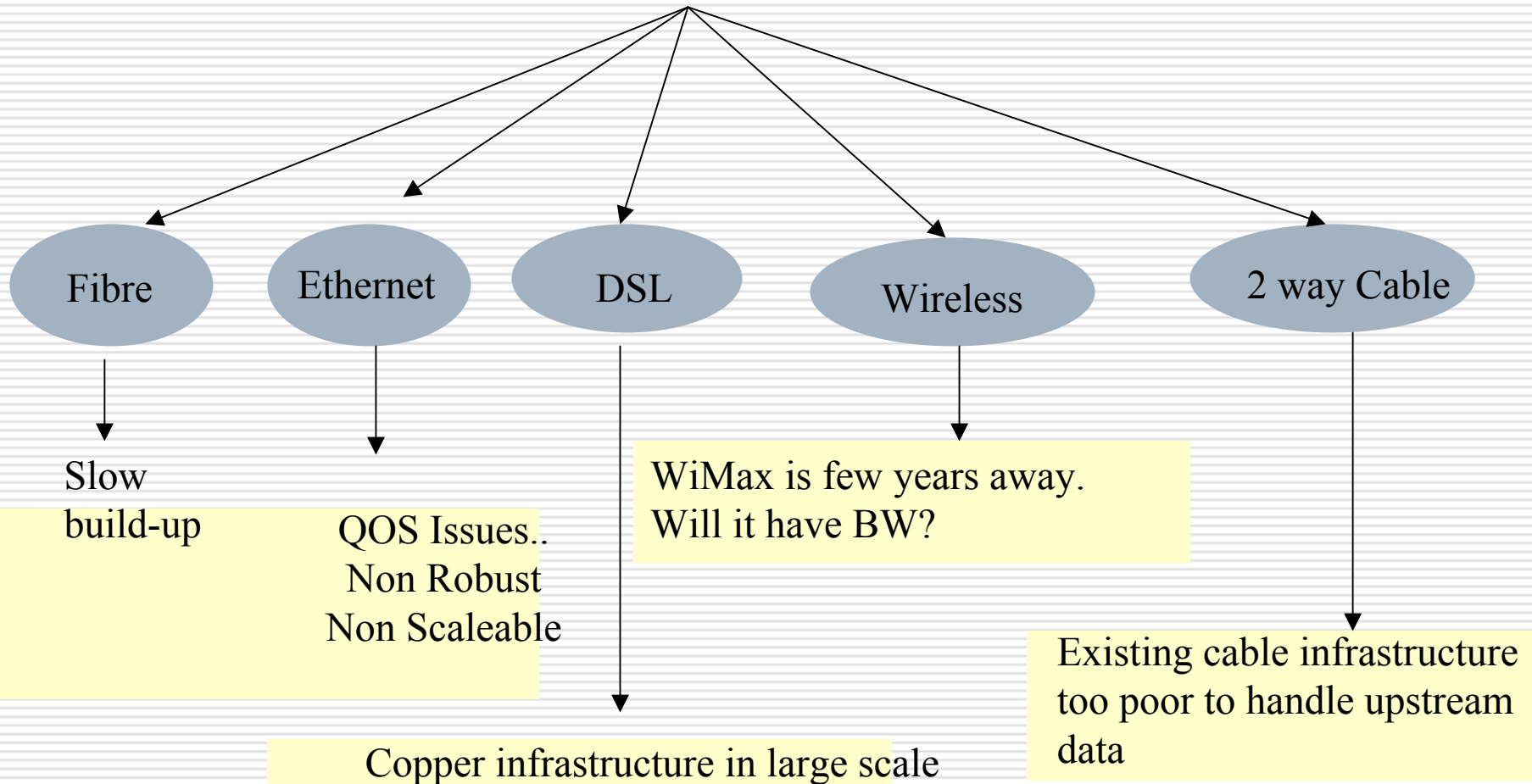
## □ But can one install fast enough?

# Bridging the Last mile on Broadband

---

- Fiber to Home / Copper (Ethernet) in last meters / 802.11 in 100m
  - Slow build-up
  
- DSL
  - [Ideal solution for incumbent \(BSNL/MTNL\)](#)
  - Others do not have Copper?
  
- Wireless
  - Still far away: 802.16 / WiMax is [three years](#) away / will it have BW?
  
- Two way Cable
  - Existing cable infrastructure too poor for this to scale up
  
- Ethernet
  - What Quality ?
  - Non Robust and Non Scaleable
  
- **Non- incumbents require some disruptive Access Technologies**

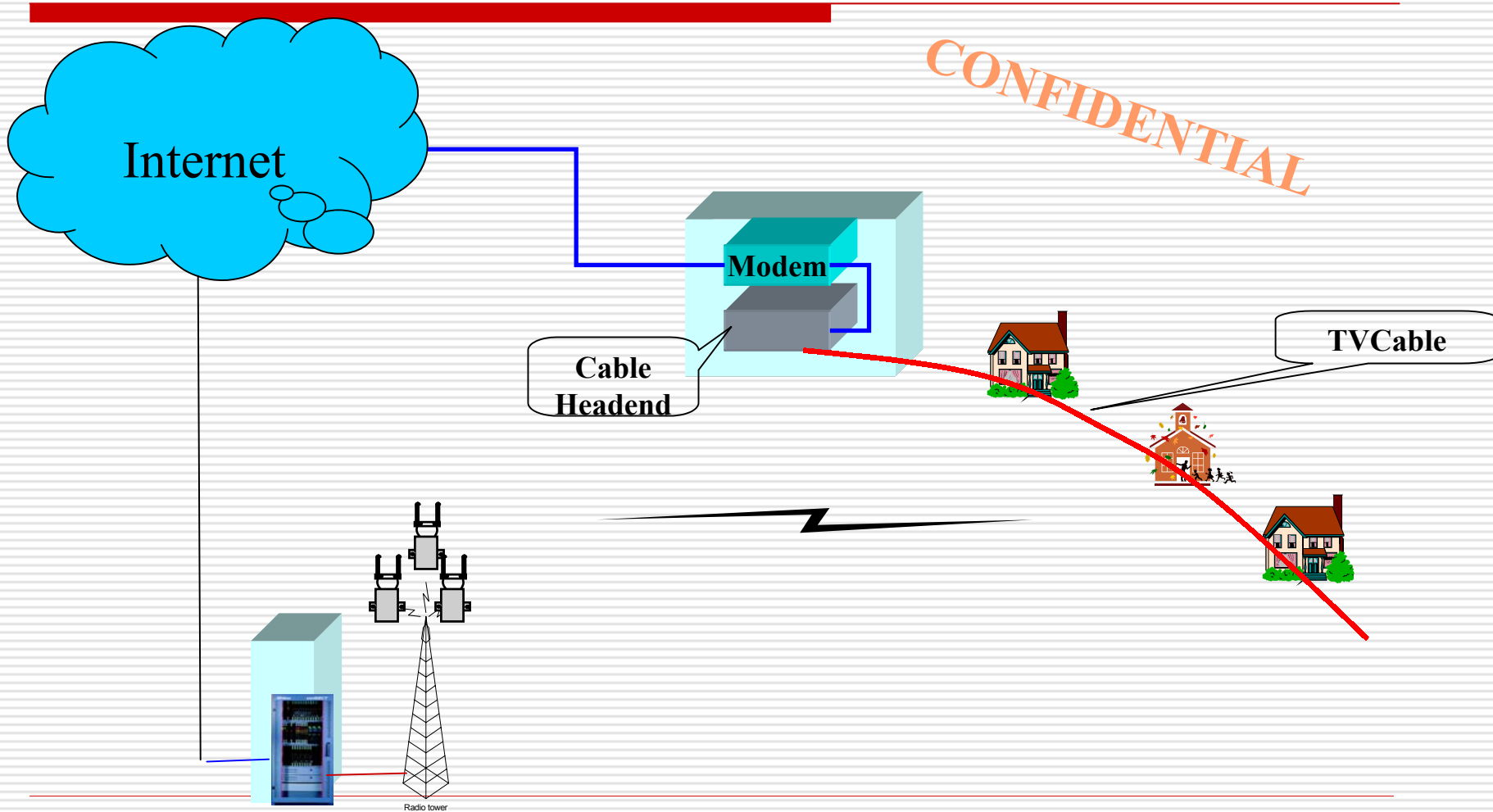
# Broadband Access Solutions



**Non- incumbents require Disruptive Access Technologies**

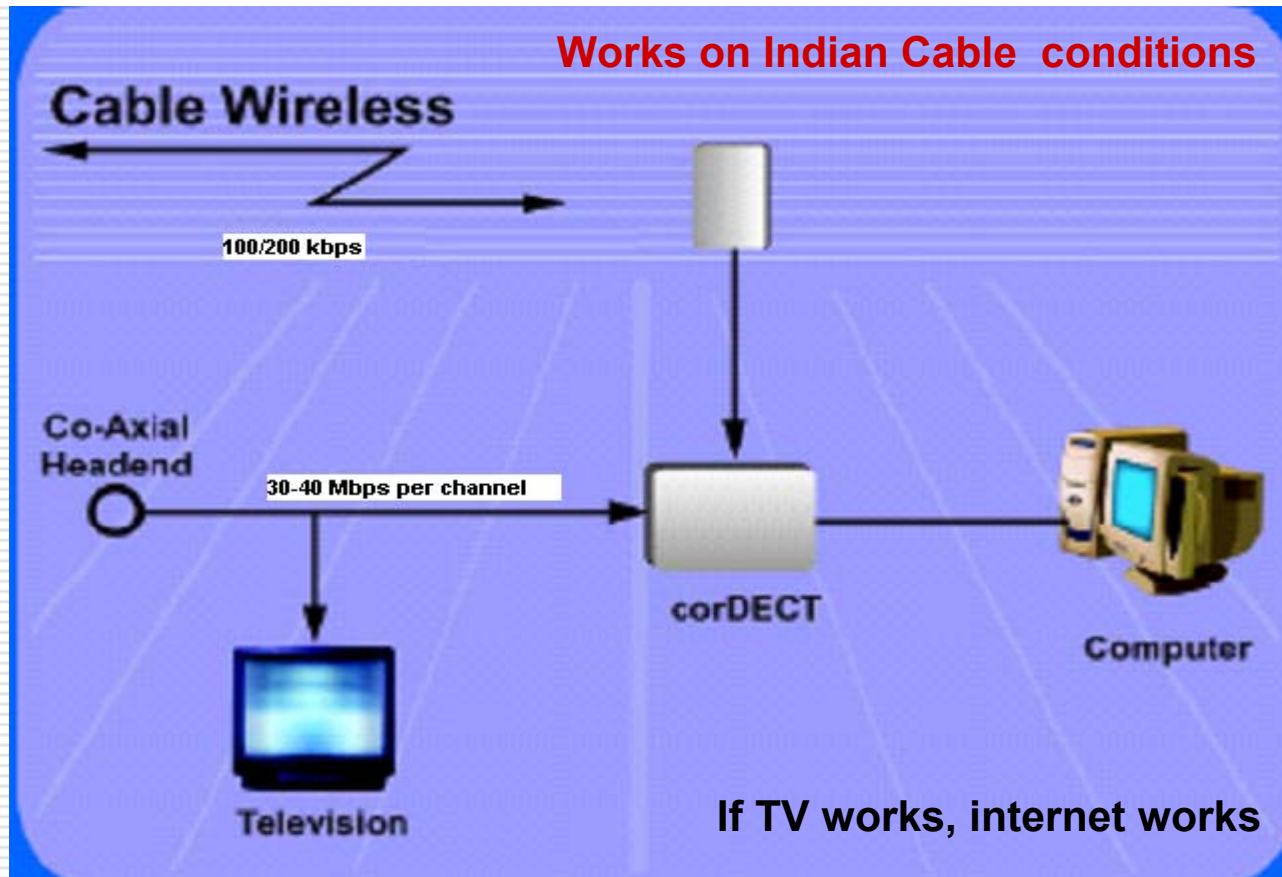
# Cable Wireless :

## Down Stream on Cable Upstream on Wireless



# Cable Wireless

## Downstream on Cable, Upstream on Wireless



An Innovative solution for broadband

# Advantage Cable Wireless

---

- Internet plus circuit switched voice
  - 30/40 Mbps shared downstream, 80/200 Kbps Upstream dedicated per user
    - Triple play enabled (Voice, Internet and Video)
    - Real Broadband services with 3-4 Mbps per subscriber is possible
  
- 'TELCO' Quality of Service
  - All Monitoring and Management on Wireless
    - Automatic feedback on CATV network to ensure QOS
  - Wireless downstream backup, if CATV network interrupted (Lifeline Service)
  
- Reaching the most valuable subscriber early-on
  - 'Explosion' in Addressable Subscriber base
  - Cherry-pick subscribers

# Access Terminals

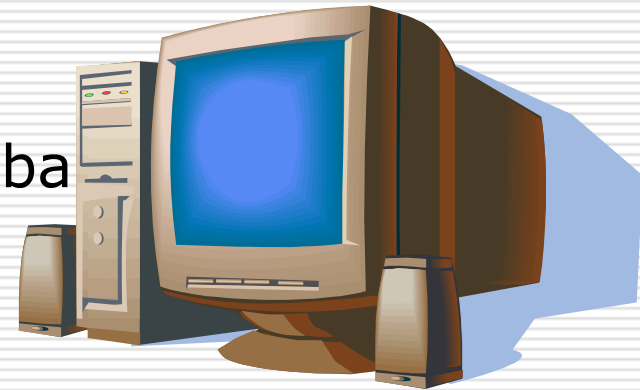
---

- PCs are too expensive for India's homes
  - VIA PC and AMD has brought cost below Rs 15K (\$300)
    - Software costs extra
    - still too high beyond 7 to 10 million homes
  - Need new solutions: Service oriented

# Introducing: Build your own Computer

---

- A low end Linux PC
  - Entry price Rs 7K (US\$150) *devices to reach next 25 million homes*
    - Initially connected to TV, later to new/old monitor
      - video player, audio player, VoIP, Video conferencing, browsing, email, word processing and telnet
  
- Connected to a Server on Broadba
  - All storage at Servers
    - No virus, no back-up required



# Introducing: thin client as Access Device

---

- Thin Access Device
  - Connected to a Server on Broadband
  - Multi-media thin client functions just like a PC
    - All storage at Servers
      - No virus, no back-up required
  - Target price: Rs 4000 plus monitor
  
- For homes and for Mid-size companies



# Introducing: METEL for corDECT

---

- Messaging terminals at **Rs 2K (\$40)**
  - for 50 million homes and small office
  
- email, SMS, information, ticket booking, banking
- smart card, magnetic card optional (another Rs 1K or \$20)
- retail transaction, remote inventory and accounts management



# To Sum Up

---

- To enable India with Internet, we need
  - Always On Access providing differential services at costs between Rs 100 to 700 per month
    - BSNL/MTNL can use DSL
    - new operators have only Fibre Access for 2Mbps Broadband connection
      - Cable wireless is a **new disruptive technology solution for our needs**
  - Terminals widely affordable in India
    - **Novatium Solution needs to be watched**