USE OF WIRELESS BROADBAND FOR RURAL AND REMOTE AREAS –India case study

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Broadband- Status, Policy & Regulation in India And

Use of Wireless Broadband for Rural & Remote areas

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Introduction

Broadband- Broad Definition

- Generally, Broadband describes high speed, high capacity data communication making use of DSL, Cable Modem, Ethernet, Fixed Wireless Access, Optical Fiber, W-LAN, V-SAT etc.
- There is no specific international definition for the Broadband though there is a common understanding that it should be better than ISDN.
- As per Broadband Policy 2004, Broadband in India is defined as:
  - 'Always-On' data connection that is able to support various interactive services including Internet access having the capacity of a minimum download speed of 256 Kbps to an individual subscriber form the Point of Presence of the service provider.

  (The interactive services will exclude any services for which a separate license is specifically required)

Broad ICT Statistics-India
(June 2005)

1) Population- 1.08 billion
2) Fixed Teledensity – 4.4 (47.7 million nos.)
3) Mobile Teledensity- 5.3 (57.4 million nos.)
4) Overall Teledensity- 9.7 (105 million nos.)
5) Internet Connections- 5.8 million (17.5 million users @ 3 users per connection)
6) No. of PCs- 15 million
7) No. of TVs- 100 million
8) No. of Cable TV Connections- 55 million
9) International Connectivity- 360 Gbps/16.7Tbps (Designed)
10) National connectivity- 10 Gbps (6.7 Lakh Kms)
11) Broadband Connection (>=256 Kbps) – 0.4 million
12) International Gateways by ISPs- 25 (Including 5 on Submarine cables)

OVERALL ICT PENETRATION IN INDIA STILL LAGS BEHIND

Key internet and broadband indicators
End of year 2003

Parameters	Korea	Malaysia	China	India	India Jun'05
Internet connections per 100 persons	26	12	2.5	0.4	0.57
Broadband connections per 100 persons	25	0.4	1.4	0.02	0.04
Ratio of High speed to Internet Connections	0.96	0.33	0.56	0.05	0.1
Ratio of Internet connection to PCs	0.3	0.8	0.9	0.5	0.4
Charges per 256 kbps ($ per month)	0.60	20	7.5	40	12
GDP (US$ Per capita) month (US$)	10,000	4,000	965	465	480

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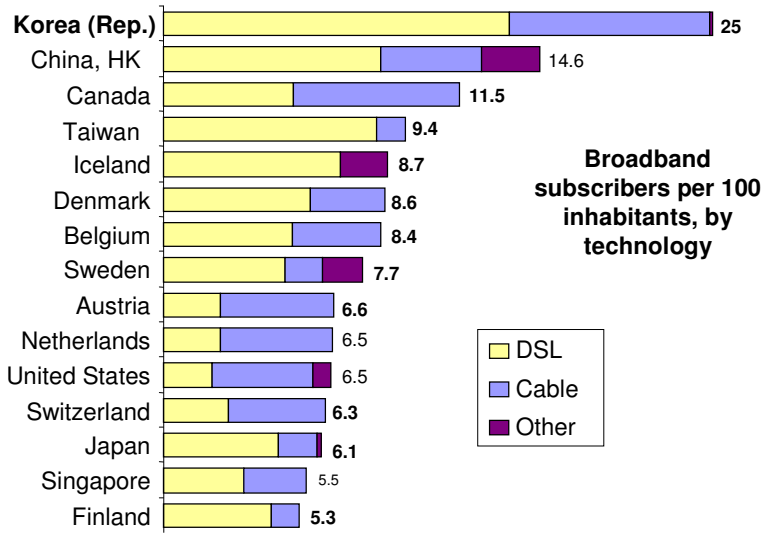
Targets for Internet & Broadband Penetration (Broadband Policy 2004)

Year	Internet Subscribers (in million)	Broadband Subscribers (in million)
2004 (existing Dec'04)	5.5	0.05
2005	6.0	3.0
2007	18.0	9.0
2010	40.0	20.0

International Scenario - Penetration



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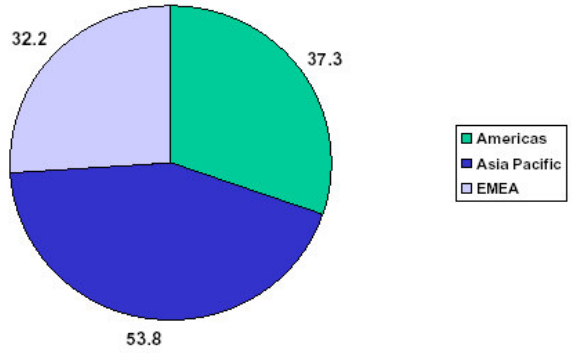
Broadband -Regional distribution

Asia-Pacific leads



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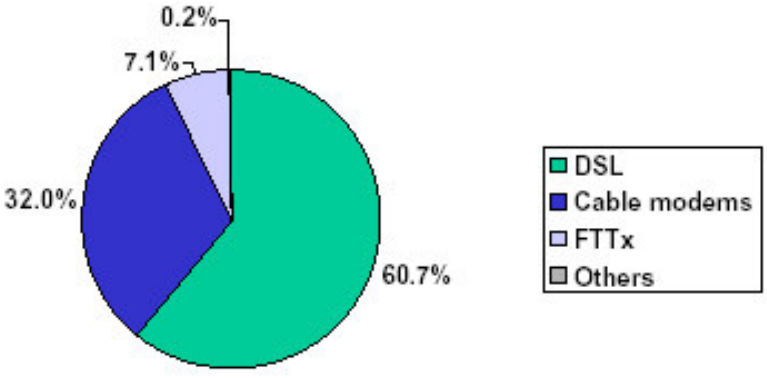
Broadband – Technology wise deployment



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Broadband Policy India2004

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BROADBAND CONNECTIVITY
ESTIMATED GROWTH
TECHNOLOGY OPTIONS FOR BROADBAND SERVICES
- •Various Access Technologies
  - ➢Optical Fibre Technologies
  - ➢Digital Subscriber Lines (DSL) on copper loop
  - ➢Cable TV Network
  - ➢Satellite Media
  - ➢Terrestrial Wireless
  - ➢Future Technologies
- •Quality of Service (QoS)
- •Simplification of SACFA / WPC Clearance

OTHER ISSUES
- •Bandwidth Availability
- •National Internet Exchange of India (NIXI)
- •Role of Other Agencies
- •Fiscal Issues

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Roadblocks for Broadband

1. Price

- Price for broadband access @ Rs. 500 ($12) per month – still unaffordable to masses

2. Access to the customer

- Lack of access to the incumbent's copper loop for DSL by competitors
- Low quality of cable TV infrastructure and lack of industry organization
- High costs for DTH and VSAT access
- Bottlenecks preventing wireless solutions from spreading
- Cumbersome processes for Right Of Way (ROW)

3. Cost of connectivity

- Lack of effective competition in the "within city"/ last mile access networks
- High costs of international bandwidth
- Ineffective implementation of National Internet Exchange of India (NIXI)

4. Fiscal policies

- High taxes and duties, and lack of fiscal incentives for faster growth

5. Content and applications

- Lack of locally relevant content and absence of "change agent" to drive growth

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Govt's Role in Promoting Broadband

- Creating the right policy environment by removing entry barriers.
- Creating National Backbone infrastructure.
- Establishing Internet Exchange in the country.
- Permitting Unlimited Competition for Broadband.
- Encouraging International players to setup Gateways in the country.
- Funding community investment in Broadband in uneconomic remote rural areas.
- Leveraging Govts. own demand and setting example by being on-line leader.
- Extending special tax concessions for equipments & access devices used for Broadband.

Enabling Regulation for Broadband

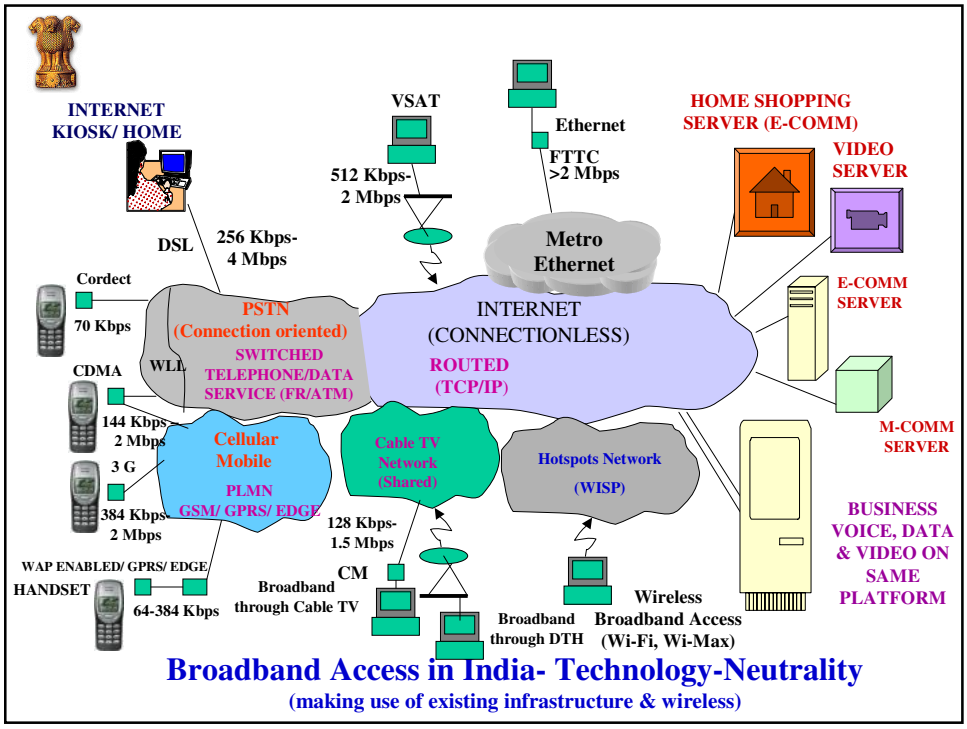
- Promoting facility-based competition by lowering market entry barriers.
- Permitting infrastructure sharing among different service providers for optimum utilization and cost reduction.
- Allowing captive infrastructure of utility companies to be used for public Broadband service.
- Reducing the bottleneck in last-mile access by facilitating deployment of alternative technologies like Cable TV network, Wireless, Power Line etc.
- Reducing the cost of bandwidth for domestic and international Internet connectivity.
- De-Licensing of Radio Spectrum used for Broadband services.
- Permitting broadcast infrastructure like DTH to be used for Broadband access.

Liberalized Licensing and Regulation for Broadband Services

- Same as Internet Service Providers' (ISP) License.
- The most liberal licensing regime.
- Unlimited competition (180 ISPs operational, 388 Licenses signed).
- No entry fee.
- No license (revenue share) fee. Annual Fee of Re. 1 only
- No contribution to Universal Service Fund (USF).
- Permitted to have own international gateway through sub-marine optical fiber cable or satellite.
- FDI limit (100% for non-gateway service provider, 74% for International gateway service provider).
- Permitted to make use of BSO's Dialup Network, Cable TV's Network, own Copper, Fiber, Radio for last-mile connectivity.
- 2.4 Ghz (ISM) band de-licensed for indoor as well as outdoor usage for broadband access (5.1 to 5.3 and 5.7 to 5.8 GHz delicensed for indoor & in-campus usage).
- High speed WLL permitted for BSOs.
- A liberal V-SAT licensing policy (upto 2Mbps).
- Permission to use DTH setup for Receive-Only Internet.

Broadband Policy- Technology Neutrality

- **Service Providers can choose any technology**
  - Over existing infrastructure
    - ✓DSL/ ADSL over Copper loop
    - ✓Cable Modem over Cable TV network
    - ✓Power Line Broadband Access
  - Over new Cable Infrastructure
    - ✓Fiber To The Curb (FTTC)
    - ✓Fiber To The Home (FTTH)
    - ✓Hybrid Fiber Coaxial (HFC)
    - ✓Metro Ethernet over Fiber
  - Over Wireless Infrastructure
    - ✓Fixed Wireless Broadband Access (FWBA) (WiMax 802.16x)
    - ✓Wireless LAN (Wi-Fi) (802.11a/ b/ g)
    - ✓Satellite (V-SAT, DTH)
    - ✓High speed WLL (GPRS, EDGE, CDMA, CorDect)
    - ✓3G Cellular Mobile System (WCDMA, EVDO, IMT2000)
    - ✓B3G Technologies (802.16e, WiBRO, Mobi-Fi)



Broadband Access in India- Technology-Neutrality

(making use of existing infrastructure & wireless)

Enabling Faster Growth of Broadband

1. Evolution of Alternate Last Mile Technologies
2. Mobile Technology Developments
3. Broadband using DTH for Receive-only Access
4. V-SAT for Broadband Access
5. Facilitating Radio Spectrum for Broadband Access
6. Fiscal measures to reduce the cost of access devices, infrastructure and service
7. Reduction in the cost of connectivity
8. Quality of Service for Broadband
9. National Internet Exchange of India (NIXI)

1. Evolution of Alternate Last Mile Technologies

- Use of Coaxial Cable for Telecom Services (Cable TV Network for Broadband and telephony local loop).
- Use of DSL technology on traditional Copper Loops (DIY, Franchising, Shared unbundling, Bit stream access).
- Wireless Access Service for Fixed and Mobile communication.
- VSAT-based Access in remote areas.
- DTH based one-way Broadband Access.
- Emergence of Metro Ethernet Networks

Technology Alternatives for Wireline Broadband

1. Evolution of Wireline Technologies

i) Use of Digital Subscriber Loop (DSL) technology on traditional Copper Loops (DIY, Franchising, Shared unbundling, Bit stream access)

- Asymmetric DSL (ADSL) – 1 Mbps upstream/ 8 Mbps downstream, 3 Km
- ADSL (G.Lite) – Splitter free, 512 Kbps upstream/ 1.5 Mbps downstream, 5.4 km
- Symmetrical DSL – 1.5 Mbps, 3 Km
- Single pair High-speed DSL (SHDSL) – 2.3 Mbps symmetric, 3 Km
- ADSL 2, ADSL 2 plus – 8/16 Mbps, 1.5 Km
- Very high Data Rate DSL (VDSL) – 52 Mbps, 1.5 Km

ii) Cable TV Networks can play a significant role in providing broadband

- Broadband over cable TV accounts for 74% of total connections in US, and 55% in Canada
- 55 million cable homes in India, but infrastructure can not support bi-directional communication and requires upgrade
- Regulatory environment, via an ISP license, allows this with some MSO's and operators already doing so
- For advances to occur, better organization of the industry needed to be executed
- Cable operators will need to adopt innovative business models to compete in converged environment
  - Possible to provide upgraded entertainment services such as interactive digital TV, pay-per-view, video on demand and time-shifted TV
  - Benefits operators with significantly higher ARPU and better customer retention
  - To start with Cable TV network which is uni-directional can be used for downloading, the uplink to be conventional narrow band like dialup/ ISDN/ RADIO
- Operators need training to create awareness about utility of their networks and understanding of the investments required, returns possible, and technical aspects

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iii) Fibre Optic Cable Technologies

- Fiber To The Curb (FTTC) – by existing operators
- Fiber To The Home (FTTH) – Fibre in last mile to deliver converged services
- Hybrid Fiber Coaxial (HFC) – by Cable TV operators
- Metro Ethernet (Fibre based) – extending the range of LAN
- GPON (Gigabit - Passive Optical Network) – triple play over TDM
- (No limitation of distance or throughput speeds)

iv) Broadband over Powerline (BPL) Technologies

- Use of existing domestic power connections for sending data
- Throughput in the range of 1 MHz (4 – 6 Mbps)
- Ideal for rural areas where telecom / cable TV infrastructure may not be there

v) Metro Ethernet Networks

- Use of Ethernet beyond LAN
- Use of high-speed access using hybrid fiber/ copper based Ethernet technology

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2. Mobile Technology Developments

- **GPRS, EDGE, CDMA-1X, CorDect, 802.11 (WLAN, Wi-Fi), PTT, Bluetooth-Already Available.**
- **UWB, 3G, B3G, 802.11n, 802.16 (WiMAX), OFDM, 802.20(WWAN, Mobi-Fi, MBWA)- Emerging out.**
- **Personnel Area Network (PAN) associated with body/ clothing-Becoming a possibility.**
- **Software Defined Radios (SDR) – Multi-Functional, Multiservice, Multiprotocol, Multiband, Multimode (Universal) Radios.**

Broadband Wireless Access (BWA) Technologies

Technology	*Max Throughput*	*Frequency Bands*	*Typical Range*	*Application*
WiFi (802.11x)	54 Mbps/ 11 Mbps	2.4 G, 5.1 G	100-400 mtrs	WLAN
WiMax (802.16x)	70 Mbps	700 MHz, 2.3 G, 2.5 G, 3.5 G, 5 G	Up to 50 Kms	WWAN
Mobi-Fi (802.20)`	40 Mbps	2.4, 3.5, 5.5 G	8-10 Kms	Mobile Broadband
CorDect	70 Kbps	1900 MHz	10-15 Kms	WWAN
WCDMA/ 3G	2.0 Mbps	1900-2100 MHz	Unlimited (Cellular)	Mobile Broadband
EV-DO,HSPDA	2.4 Mbps (shared)	450,,900,1800 MHz	Unlimited (Cellular)	Mobile Broadband
EDGE	230 Kbps	900,1800 MHz	Unlimited (Cellular)	Mobile Internet
GPRS	58 Kbps	900,1800 MHz	Unlimited (Cellular)	Mobile Internet
CDMA (2000-1X)	144 Kbps (shared)	450,,900,1800 MHz	Unlimited (Cellular)	Mobile Internet
FSO	100 Mbps to few Gbps	Light Wave	Few Kms	CAN
Microwave radio (MMDS/ LMDS)	Few Mbps	3.5 G – 31 G	50 Kms +	MAN
VSAT	20 Mbps	4 G – 11 G	Unlimited	GAN (Remote Area)
Wireless USB 2.0	480 Mbps	2.4 G	10 mtrs	PAN
Bluetooth(802.15.1	3 Mbps	2.4 G	1-10 mtrs	PAN
Infrared	16 Mbps	Light Wave	1-5 meter	PAN
ZigBee/ UWB	200Kbps/400-500Gbps	2.5G-5.8G	1-100 mtrs	PAN
RFID	Few Kbps	2.4 G,900Mhz	Few Inches	Contact-less Detection

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Technology Comparison – BWA (3G and beyond)

	UMTS (3G)	HSDPA	EVDO (3G)	802.16 a/d	802.16e	802.20
Bandwidth	5 MHz	5 MHz	1.25 MHz	1.25-20 MHz	1.25-20	1.25-5 MHz
Typical Spectrum	1.9-2.1 GHz	1.9-2.1 GHz	450-1900 MHz	2.3-5.8 GHz	2.3-5.8 GHz	Various
Downlink Peak Rate	0.4 bps/Hz	2.9 bps/Hz	2.5 bps/Hz	3.2 bps/Hz	3.2 bps/Hz	2.4-3.6 bps/Hz
Uplink Peak Rate	0.4 bps/Hz	0.4 bps/Hz	1.4 bps/Hz	2.4 bps/Hz	2.4 bps/Hz	1.2 bps/Hz
Ave DL Thr put	0.1 bps/Hz	0.7 bps/Hz	0.9 bps/Hz	0.53 bps/Hz	0.75 bps/Hz	0.78 bps/Hz
Ave UL Thr put	0.1 bps/Hz	0.1 bps/Hz	0.32 bps/Hz	NA	NA	0.35 bps/Hz
Flat IP Support	No	No	No	Yes	Yes	Yes
Mobility	Full	Full	Full	Fixed	Limited	Full

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3. Satellite based DTH Services offer alternate for the Broadband via Receive Only Internet Service (ROIS)

- **Deployment of DTH for TV has begun, but internet access through this was not permitted**
- **While internet data is downloaded from the satellite, the uplink connection to the ISP is through another channel**
  - **Since DTH (or receive-only VSAT) dish is only receiving, should not require SACFA clearance or NOCC fee for uplink monitoring**
- **New technology permits DTH to be used for bi-directional internet access, though costs are high because of required hardware**

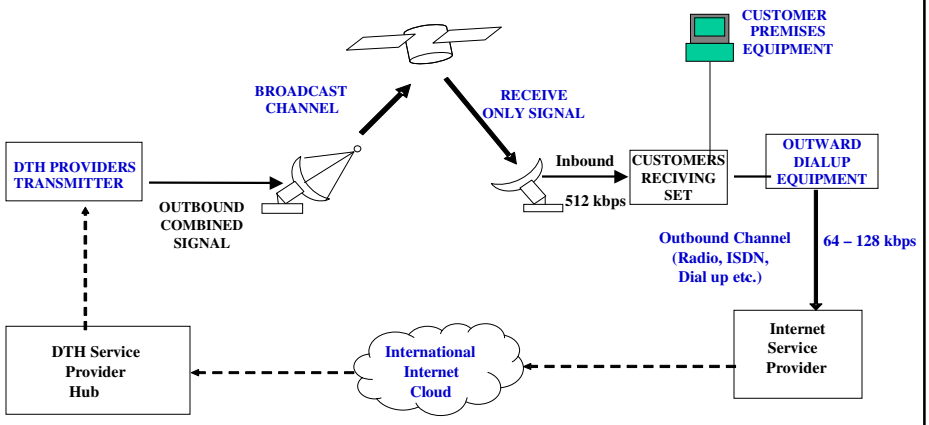
- **Broadband Policy 2004**

a. DTH provider with ISP license allowed to offer Receive Only internet services

b. ISP licenses permitted to allow customers for downloading data through DTH

c. DTH providers permitted to provide both way Internet service after obtaining VSAT and ISP license

Broadband using DTH for Receive-only Internet



Speed of outbound channel is generally between 10 to 20% of inbound channel

VSAT has the potential for significant impact on Broadband Penetration if artificial cost drivers are removed

- Advantages of VSAT for remote geographies, high reliability, multi-casting and disaster recovery applications are well-known
- VSAT operators face increased costs due to special regulations & restrictions because of its CUG category
- Policy makers have some concerns that can be addressed in changing current rules
- To bridge last mile, VSAT license could be permitted to be used as access media for Broadband

- **Broadband Policy 2004**

a. Open Sky policy for VSAT to be pursued by DOT

b. Minimum dish size of 1 m for KU-band permitted

c. Throughput restricted upto 2 Mbps

d. VSAT service providers permitted to provide Internet services by obtaining ISP license

4. Fixed Wireless Access- Great potential to be a dominant access technology

Unlicensed bands

– 802.11x (Wi-Fi) technologies are widely used international standards. Wi-Max has substantial future potential

- 5.1 and 5.7 GHz bands (802.11a, Wi-Max) equally important as 2.4 GHz (802.11b/g, Wi-Max)

Alternative spectrum

– IMT 2000 bands have been keenly contested world over for 3G

- Need to encourage alternative technologies in less congested bands

– Spectrum allocation for fixed use should be unlinked from mobile

- Certain fixed technologies, e.g., CorDECT, considered WLL and spectrum allocation counted against allocation for mobile services

- Broadband Policy 2004

a. 2.40 – 2.48 GHz spectrum De-licensed for outdoor usage with power restrictions (4W).

b. 5.15–5.35 & 5.7–5.8 GHz spectrum De-licensed for indoor usage for low power (200 mW) systems.

c. 5.25 – 5.35 GHz will be De-licensed for outdoor usage in consultation with DOS.

d. 1880 – 1900 MHz spectrum delinked from access providers allocation and available to ISPs.

e. Alternate spectrum for broadband services to be identified

5. Facilitating Radio Spectrum for Broadband Access

- ISM Spectrum (2.4 to 2.48 GHz, Wi-Fi) de-licensed for in-campus WLAN using any technology.
- De-licensing of this for outdoor usage has also been notified with 4W EIRP.
- De-licensing of 5.1 to 5.3 and 5.7 to 5.8 GHz spectrum for indoor & in-campus usage has been notified.
- Earmarking of 20 MHz (1880 to 1900 MHz) for wireless TDD access systems by ISPs (delinking from WLL).
- Time-bound frequency allocation, site clearance & frequency licenses through automation of Spectrum Management System and by setting predetermined standards for WPC.(E-application for SACFA clearance)

6. Fiscal measures to reduce the cost of access devices, infrastructure and broadband service

Recommendations

a. Allow 100% depreciation of PC's and broadband CPE's in first year
b. Give tax benefit for donated PC's
c. Remove anti-dumping duty on import of recycled PC's
d. Reduce and rationalize import duties
e. Put local manufacturing on equal footing with imported finished goods
f. Exempt web hosting from income tax
g. Exempt ISP's from service tax
h. Personal broadband allowance

Broadband Policy 2004

a. High priority to indigenous manufacture of Broadband related equipments
b. Package to bring down the cost of broadband services at affordable level to be worked out in consultation with Ministry of Finance and other related departments.

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7. Reduction in the cost of connectivity

- Cost of connectivity (international & domestic) forms a significant part of Opex for Broadband services.
- Tariff for international bandwidth was forborne and left to the market forces. It was considered to be on the higher side in comparison to international benchmarks.
- Govt. has reduced the license fees for Infrastructure Provider category II from 15% to 6% of AGR and bank guarantee from Rs. 100 crore to Rs. 5 crore.
- Revised tariff orders reducing the ceiling price for international bandwidth (IPLC) by 35% for E1 and by 70% for DS3 and STM1 capacity to be effective from 1.5.2005 have already been issued (sub-judice at present).
- The revised tariff orders reducing the ceiling tariff for domestic leased circuits (DLC) by an extent of 3% for E1 market price and 70% for DS3/ STM1 market price, effective from 1.5.2005 have been issued by TRAI.

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8. Quality of Service for Broadband

•As per TRAI Act, 1997, TRAI has to prescribe QoS parameters.

•Government recognises that QoS parameters are extremely important and have an impact on investment and roll-out decisions of operators.

•TRAI is requested to prescribe QoS parameters for provisioning of broadband service using various access technologies at an early date.

•Work has already started in this direction.

•Govt. has already directed the service providers, not to market a service as Broadband unless it has a download speed of > 256 Kbps.

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Broadband Services

- High speed Internet access – Still the killer application for Broadband in India
- Video-On Demand, Interactive TV, IPTV, PPV, Time Shifted TV, Videoconferencing (Multimedia over Broadband)
- Triple Play (data, voice, video) – One stop solution
- IP-VPN (low cost connectivity)
- VOIP (permitted only for telecom companies)
- Interactive Gaming (future killer application)
- 4 e's (e-Governance, e-Learning, e-Health, e-Commerce)

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Broadband Tariff

1. Regulation:

- Tariff for Internet/ Broadband forborne by TRAI due to unlimited competition
- Determined by market forces (180 players)

2. Type of Tariffs

(i) Flat Rate Unlimited (fixed Rs./ month for unlimited usage)

(ii) Flat Rate Usage based

- ✓ Time based (per hour)
- ✓ Data download based (per Mbps)

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Customer Options

	SP-1	SP-2	SP-3
Speed	256 Kbps	256/ 512 Kbps	256 Kbps
Security Deposit	Triband- Rs. 1300 with Landline Rs. 5300 partly refundable	Rs. 1000	None, since connection through cable
Installation Charges	Rs. 500	Rs. 1000-3000	Rs. 2500
Equipment cost	Rental Rs. 95/month	Included in installation charge	None
Basic Package	•Rental of Rs. 590 for 500 MB for a month. •Lapses if unused. •Additional usage Rs. 1.20 per Mb. Free from 12 am – 8 am	•Rental of Rs. 375 for 500 MB for a month. •Lapses if unused. •Additional usage at Rs. 1.25 per MB.	•Rental of Rs. 400 for 400 MB for a month. •Lapses if unused. •Need to renew package.
Additional IP address	Rs. 2000	Rs. 2000	NA
Dialup domestic and international roaming	NA	Yes	NA

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Roadmap - Current Plans for Broadband

•Govt. has issued Broadband Policy 2004 based on TRAI's recommendations on 'Accelerating Growth of Internet & Broadband Penetration in the country.

• ISPs are teaming up with Cable TV operators to provide Broadband to the homes using HFC technologies and also making use of radio links for high speed last mile access.

• New entrants in Basic Service are using advanced technologies like 'Fiber to the Curb', High Speed WLL, DSL etc. to enable Broadband access in the last mile. Some of the service providers have started offering PC alongwith the Broadband connection under rental / installment schemes.

• Incumbent operators BSNL & MTNL which have a subscriber base of around 40 million over copper loop are appointing franchisees to offer broadband services by offering existing copper network and co-location facilities to the third parties on mutually agreed revenue share basis. Aim to provide 1.5 million connections by the end of 2005 and a total of 7 million Broadband connections in further years. They have also launched broadband services @ Rs. 500 per month throughout the country.

• Public places like Airports, Railway stations, modern business centres, star hotels, cyber cafes, Malls have started having deployment of Hot Spots (Wi-Fi) in unlicensed 2.4 Ghz band (already 300 hotspots in the country). More expected now after outdoor de-licensing of 2.4 GHz band.

Conclusions

1. Government has issued Broadband policy 2004 to accelerate the growth of Broadband services in the country on regulator's recommendations including setting up ambitious targets.
2. Alternate access technologies specially wireless access to play significant role for Broadband penetration in India, breaking the natural monopoly of copper local loop.
3. Cable TV network offers great potential for contributing towards Broadband access.

Conclusions (Contd…)

4. **Wireless based technologies specially WLL, Wi-Fi, Wi-Max, V-SAT, DTH etc. are enabling cost effective and faster broadband deployment & will pick up after enabling notifications are in place.**
5. **Markets to offer innovative applications and leverage cost-effective technologies to make Broadband attractive and affordable.**
6. **In India one of the main hindrance to Broadband deployment has been the cost to consumer which was of the order of US$ 20 per month against the telephony ARPU of US$ 10 per month and Internet ARPU of US$ 5 per month. Now with offerings @ below Rs. 500 per month, it should pick up, but real growth is expected at the tariff of Rs. 250 / month.**

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Rural Access Scenario

Rural telecom access in India is characterized by

- **Low population density – poor commercial viability for service provider**
- **Difficult topological & climatic conditions –high costs of connectivity, spectrum & infrastructure**
- **Scarcity or absence of reliable electric power**

This makes it difficult to provide telecom services of acceptable quality by traditional means & at affordable prices. Also it restricts the fast & economic roll out of services in rural areas

Rural Access Solutions

- **India needs to provide widespread internet access, that can boost.**
  - **Economic growth &.**
  - **Other services/applications.**
- **Wireless solution is must to avoid.**
  - **Overwhelming cost of infrastructure.**
  - **Resources and time required to deploy countrywide fixed-line broadband internet.**
- **Rural access solutions from CDOT addresses these issues through their product design & engineering of rural communications systems.**

Objective

The objective is to improve

- **rural tele-density,**
- **broadband access**
- **facilitating mobility services**

for rural subscribers with low cost of infrastructure & operations.

Features of Rural Wireless Solution

- **Provides integrated voice, multimedia & broadband services**
- **Based on cost effective standard wireless access technologies**
- **Provision for mobility**
- **Provides all IP solutions**
- **Re-utilization of existing infrastructure where available**
- **Frequency re-use for better usage of radio resource**
- **Co-channel interference control**

Applications Envisaged

- **E-governance,**
- **Entertainment,**
- **Tele-medicine,**
- **Video conferencing**
- **Disaster management**
- **Internet Kiosks**
- **Village enterprise development**
- **Tele-marketing**

The following table depicts the goal of telecom services in the country.

Year	No. of phones	Tele-density	No of mobile phones	Rural connecti-vity	Internet connectivity	Broadband connections
2005	100 Mn	10 %	55 Mn	87 %	5.45 Mn	3 Mn
2007	250 Mn	22 %	180-200 Mn	100 %	18 Mn	9 Mn
2010					40 Mn	20 Mn

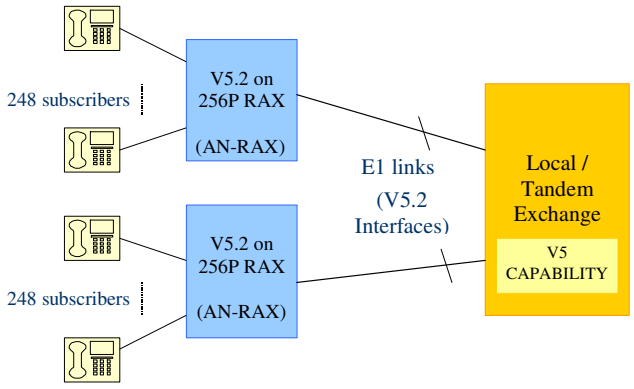
Evolution of Rural Telecom Solutions

- **India has about 600,000 villages 87% of these villages are provided with village public phones (VPT's)**
- **The rural tele-density is still about 2% which is very low compared to more than 27% in urban areas**
- **The rural telephones capacity is about 15 million largely catered by CDOT switches designed for rugged rural conditions**
- **In the last 3 years the rural switches were up-graded to provide ISDN connectivity with 128kbps data rates**
- **As a next step the same switches are provided with add-on units to cater to wireless access using GSM/CDMA technology**
- **Further an upgrade path is envisaged which addresses broad band wireless connectivity, extension of range, provision of direct interface to IP based soft switch**

Rural Wireless Solution

- **The GSM/CDMA access on existing rural switches is supported based on SDR which can be configured for GSM or CDMA base stations.**
- **WiMAX/MILTON is the new broadband wireless technology capable of delivering broadband internet and extending services like internet telephony throughout India without major disruption to other services while deploying the infrastructure.**
- **The last-mile broadband wireless could be achieved through the deployment of wireless LANs (like Wi-Fi), and the LAN traffic could be back hauled to the WiMAX network. This helps in quick provisioning of high-speed connectivity to customers within the base station range.**

Existing rural switch in network



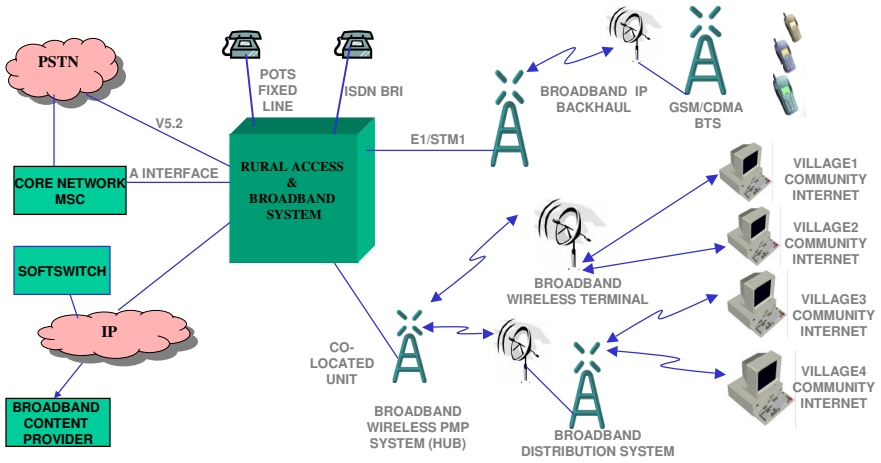
Existing Rural Switch Features

- It is an Access Network Product

More than 30,000 switches are in field.

- It combines the advantage of the proven technology and new network configuration for the rural areas with:
  - Extreme temperatures
  - Non air-conditioning operation
  - Operation in High humidity and salinity
  - Dust prone
  - Low power

Network Architecture For Rural Access and Broadband System



Conclusions

- 70% Indian population is in rural area with low Tele-density
- Village community/enterprise development which contributes to country's GDP growth can be achieved through broad band services
- Faster roll-out and cost effective BW services can be provided using combination of WiMAX and/or Wi-Fi access for both "last mile" and "back haul" connectivity for GSM/CDMA application
- IP migration can be achieved with minimal up-gradations of the current infra-structure
- Broad band solution addresses all the applications required for rural information and communication needs

Thank You

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