

# Brainstorming Broadband

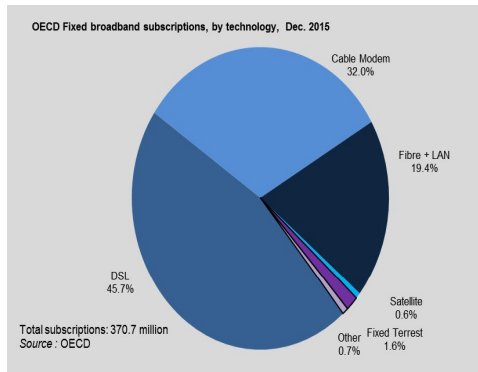
Wireless/Wireline – Financial Viability

TRAI Seminar - New Delhi

Jan 18, 2017

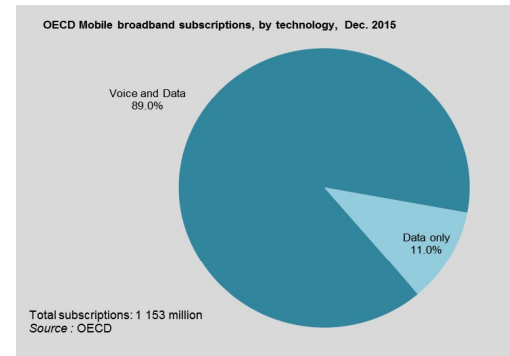
# OECD Fixed vs Wireless

- OECD Fixed Broadband – 2015



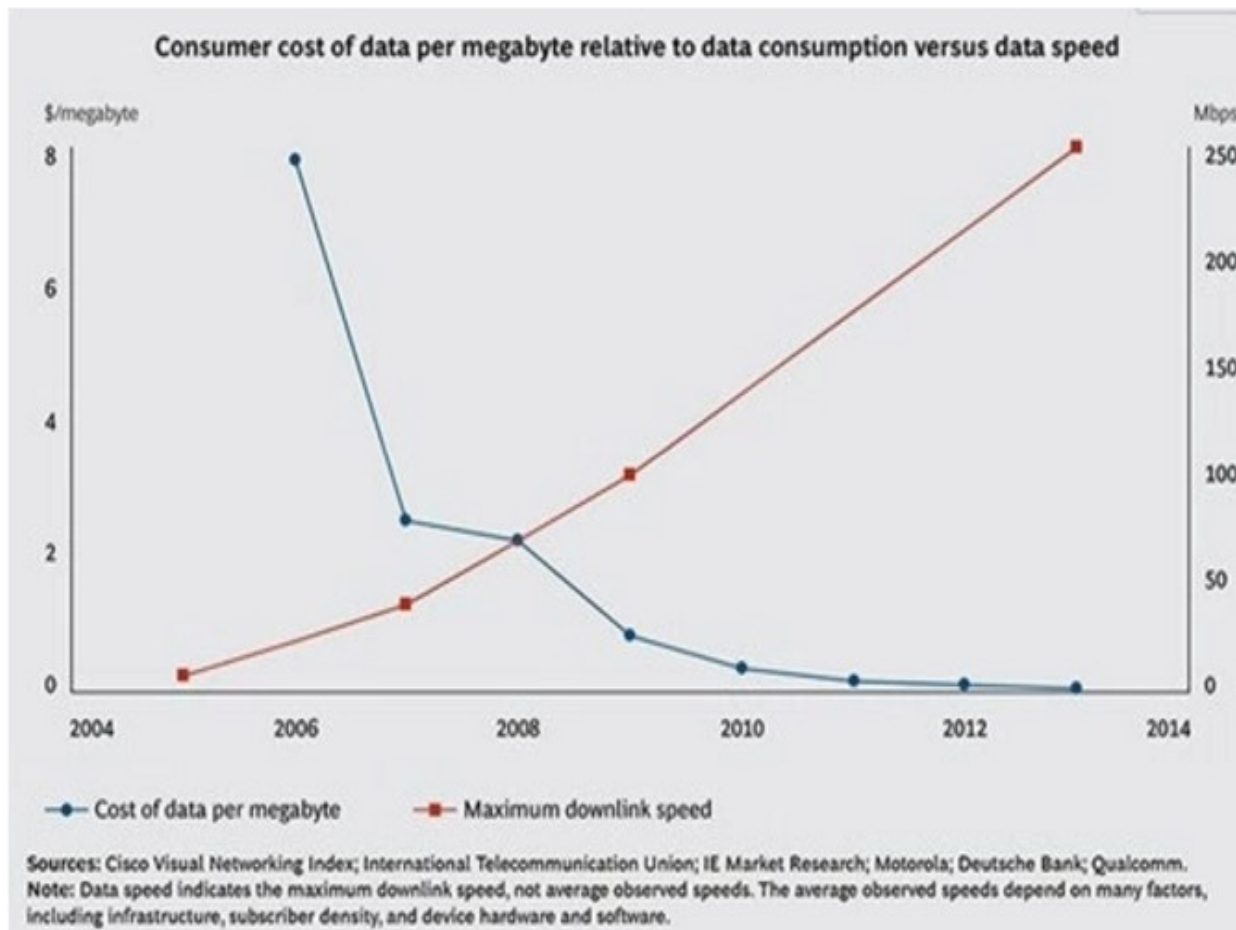
	Total fixed broadband subscriptions
DSL	169,319,398
Cable Modem	118,776,416
Fibre + LAN	71,830,522
Satellite	2,255,836
Fixed Terrest	5,810,587
Other	2,745,676
<b>TOTAL Fixed Broadband</b>	<b>370,738,435</b>

- OECD Mobile Broadband – 2015



	Total mobile broadband subscriptions
Voice and Data	1,026,290,134
Data only	126,531,641
<b>TOTAL Mobile Broadband</b>	<b>1,152,821,775</b>

# Mobile Innovation Lowers Costs and Improves Performance



Source: Jumping from fixed Internet to mobile: India is going wireless

Joshua Bleiberg and Darrell M. West, March 18, 2015:

<https://www.brookings.edu/blog/techtank/2015/03/18/jumping-from-fixed-internet-to-mobile-india-is-going-wireless/>

## Fibre & Wireless Costs

Fibre is indeed most effective for general purpose networks

**...provided:**

- a) There's commercial/financial potential that will sustain the investment;
- b) It is feasible to install at reasonable cost;

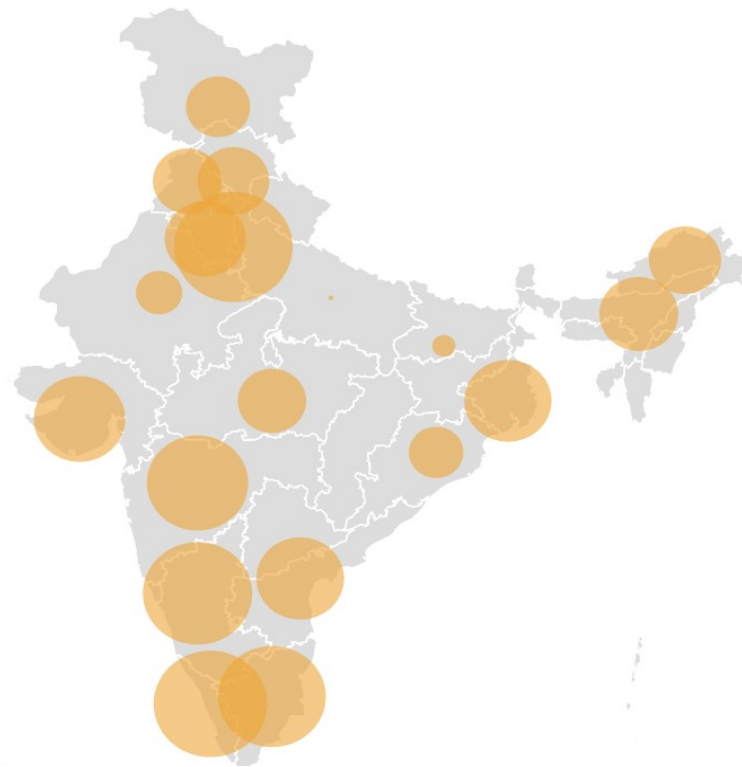
**...excepting:**

- c) Specialised applications, such as high-speed trading... (NYSE – Chicago).
- d) Dispersed users who are not in clusters.

## The Gaps – to be bridged

- 'The India wide web' [on *The Hindu's* web site, by Srinivasan Ramani] showing broadband penetration interactively demonstrates the nature of connectivity needs away from the urban centres and network paths.

### Broadband Penetration



<http://www.thehindu.com/sci-tech/technology/internet/The-India-wide-web/article14588938.ece>

# The Connectivity Needs

At urban centres and along the connecting networks, the cost for laying fibre is reasonable up to a point, excluding ROW, etc.\*

- Away from the clusters and backbones, where about 70% of the people reside, it costs more per user because of the dispersed population, while there may be insufficient remunerative potential.
- Hence the need to augment fibre capacity with less expensive access technologies.
- \*In dense urban areas, it is difficult if not impracticable to lay fibre. Such areas also require wireless access.

# High-Speed Wireless Examples

- Electronic Trading: 60-70-percent of NYSE's daily volume. Large trading companies use dedicated microwave links .
- “A one (1) millisecond advantage in trading applications can be worth \$100 million a year...” Information Week.
- <http://www.stephouse.net/2015/07/compare-fiber-vs-wireless-services/>
- ‘Information Transmission Between Financial Markets in Chicago and New York  
Gregory Laughlin, Anthony Aguirre, and Joseph Grundfest: <https://arxiv.org/pdf/1302.5966.pdf>

A number of wireless technologies have been discussed in India for years. The TRAI has even recommended policies for some of them – (examples - next page)...

## High-Speed Wireless - contd

- 60 GHz (V band) for high-speed short haul (wireless gigabit ~350 m). [Rain attenuation]

- 70/80 GHz (E band) for longer distances (~5 km).

Both can be set up in dense urban environments in place of fibre at much lower cost. [Rain attenuation]

- TV White Space – for the middle mile between fibre or microwave POP (e.g., at Gram Panchayat) to user clusters – 2-7 km away over uneven ground, farther in the plains. Point-to-Point Repeaters can bridge longer distances from the fibre POP. [No rain attenuation]



# WiFi 802.11 ac

802.11 ac – WiFi - 5.8GHz

Self-imposed restriction on capacity:

Theoretically, 8x160MHz channels could be made available.

With 256-QAM,  $\sim 866\text{Mbps} \times 8 = 6,933\text{Mbps}$ ;

India permits only 50MHz. Need:  
80MHz /channel x 2 (or more – to 8 - channels?).

## Cost Comparisons Wireless/Wireline

- Busy hour offered load (BHOL): 444 kbps assumed – 4 Mbps service. Bursts: 10 Mbps; spectrum & ROW charges excluded.

*Wireless Broadband Not a Viable Substitute for Wireline Broadband*

	2x5 MHz Total Tower Sites: 29	2x10 MHz Total Tower Sites: 15	2x15 MHz Total Tower Sites: 10	1x20 MHz Total Tower Sites: 9
Radio Network Equipment	\$4,181,000	\$2,512,000	\$1,918,000	\$1,949,000
Core Network Equipment	\$592,000	\$342,000	\$249,000	\$229,000
Fiber Backhaul	\$2,980,000	\$2,636,000	\$2,631,000	\$2,423,000
<b>Total Investment</b>	<b>\$7,753,000</b>	<b>\$5,490,000</b>	<b>\$4,798,000</b>	<b>\$4,601,000</b>
Capacity Cost	\$470	\$330	\$290	\$280

**Table 5-1: Example Wireless Initial Investment Costs (BHOL=444 kbps)**

	Cost
Outside Plant	\$6,900,000
Electronics	\$1,560,000
<b>Total Investment</b>	<b>\$8,460,000</b>
Capacity Cost	\$ 5

**Table 5-3: Example FTTP Initial Investment Cost**

**Conclusion:**

Both wireless and wireline broadband services play important roles...  
[and users need both] –

[http://www.bbcmag.com/2015mags/May\\_June/BBC\\_May15\\_ComparingWiredandWireless.pdf](http://www.bbcmag.com/2015mags/May_June/BBC_May15_ComparingWiredandWireless.pdf)

www.vantagepnt.com

CIS - Shyam Ponappa

## Cost Comparisons – contd

Wireless/Wireline

Findings - [the assumptions drive these outcomes]

Excluding spectrum costs:

- A network with 2x20 MHz costs about half of one with 2x5 MHz
- 2x5 MHz: 41% > 2x10 MHz
- : 62% > 2x15 MHz
- : 69% > 2x20 MHz
- A fibre network costs <10% more than a 2x5 MHz wireless network.
- A 2x20 MHz wireless network costs a little over half (54%) of a fibre network.

## We Need a Different Approach

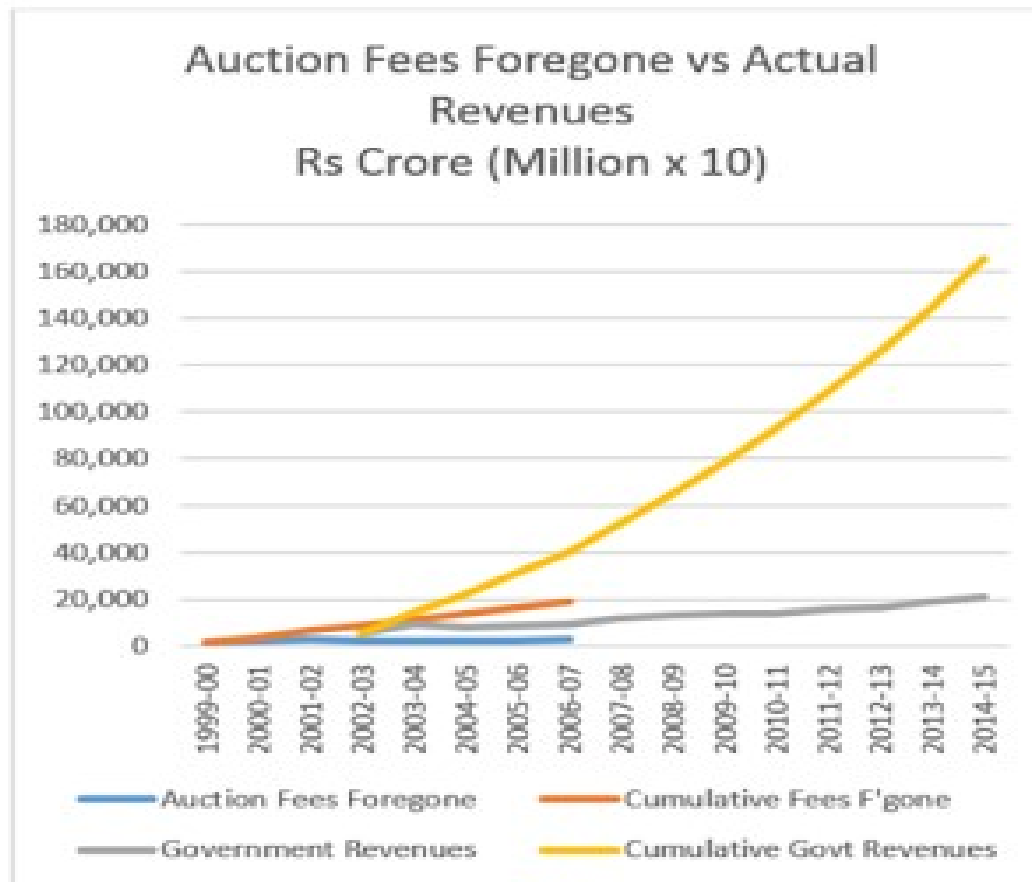
- Because the present approach is unlikely to give broadband connectivity to most households countrywide in a reasonable time (several years).  
[BBNL: 15,614 Gram Panchayats mid-January 2017 out of 250,000 - ~6%]
- Need to work out participatively between:
  - Government
  - Industry (**operators** and **equipment providers**)
  - Users/citizens
  - Keeping judiciary informed, in the loop

What form of solutions will deliver better results?

## Move Away From Deadlock

- Move away from the deadlock of adversarial lowest equilibrium (Nash equilibrium).
- Start with recognising and accepting the facts.
- Consider the evidence before dismissing other points of view.

## Government Collections from Telecom



<http://organizing-india.blogspot.in/2016/04/breakthroughs-needed-for-digital-india.html>

Revenue sharing post setup exceeds up-front charges, and is how, for instance, toll roads are built.

## Phased, Systematic Approach to Design, Implementation

- Use the same approach for building/accessing other infrastructure, such as roads and airports, for digital networks.
- Rationalise policies on spectrum resource use, and in organising the sector through participative pathfinding and problem solving.
- Build national champions in manufacturing to keep costs affordable.  
[e.g., TV White Space, where India could set the standard with its IPR and products, for extending fibre to villages/clusters of rural users.]

Rural Point-to-Multipoint links, where OFC may be infeasible/unviable:  
Block HQs to multiple Gram Panchayats, and GPs to villages around.  
3x – 4x cell tower range, solar power.]

## End-to-End Systems

- Adopt end-to-end design & implementation approach.
  - Objectives & Policies.
    - Coherent, phased objectives in the public interest.
    - Based on fair competition, protecting public interest – but **working with stakeholders** – not as adversaries.
  - Legislation – Formulate primary laws driven by policies, objectives.
    - Secondary laws...
  - Rules, regulations, procedures.
    - Agencies and mechanisms for effective implementation.
  - Implementation.



## Begin With Some Easy Steps – Unfettering Some Wireless Bands With Some Difficult Steps – Policies Facilitating Fibre Deployment

- Begin by dismantling restrictive norms in uncontested areas, e.g.,
  - 60 GHz – unlicensed access as in many countries.
  - 70/80 GHz – light licensing.
  - Microwave radio charges – reduced to nominal (collections as taxes) but with stringent renewable power standards.
  - 802.11 ac: increase spectrum available to 80 MHz, 160 MHz or more.
- While unscrambling disincentives for fibre and cable – through a participative work outs with all stakeholders:
  - Rationalise, align and reduce the burden of ROW, so that more towers are on fibre over time.
  - Set policies to access the Internet through cable TV.

## Do Facilitated, Participative Brainstorming

- Brainstorm on radical solutions:
- Shared networks - to maximise productivity,
  - build out connectivity?
- Private consortiums with Government anchored entities?
  - With common access to shared network + pooled spectrum?
  - Secondary access to unused Government agencies' spectrum?
  - Payment for access to – Privately owned spectrum?
    - Government owned spectrum?

## Conclusion

- Government lead on working out solutions through participative processes, creating policies that enable more deployment and delivery.
- Align and rationalise charges so that they are not onerous.
- Use revenue-sharing principle + tax structure for Government revenues **after** networks are built.
- Explore shared infrastructure and spectrum fully, through separate consortiums with Government participation to secure public interest, with private sector management (Singapore OpenNet model).