Global Content Balancing: Solving the Broadband Penetration Problem in India And Innovations in the Telecommunications World – An India Growth Story

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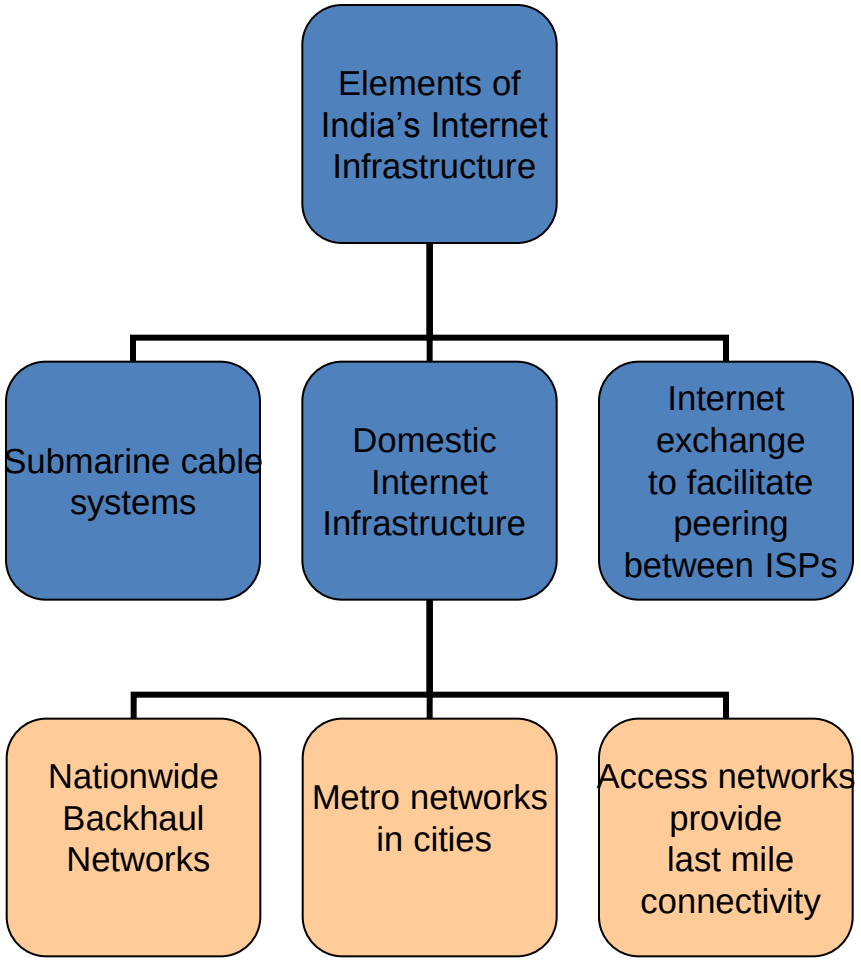
India's Internet Infrastructure

- Submarine cable systems
  - Consists of under sea optical fiber cables that connect cable landing stations located in different countries
- Nationwide, Metro and Access Networks
  - Domestic traffic is transported on nationwide networks of various telecommunication operators
- Internet Exchange
  - ISPs can peer at Internet exchange and route domestic traffic within the country



Why is the Broadband market stagnated?

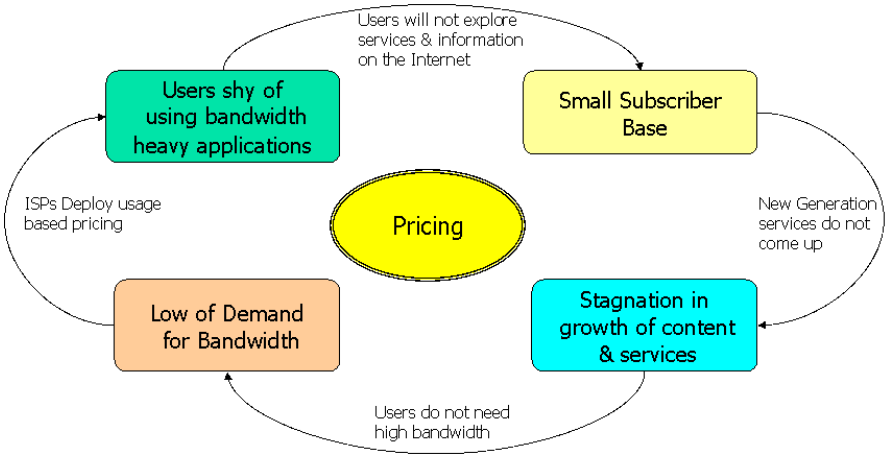
- Cost of Bandwidth
- Pricing model
- Technological failures
- Lack of CAPEX foresights
- Nash deficient business model
- Regulatory implementations

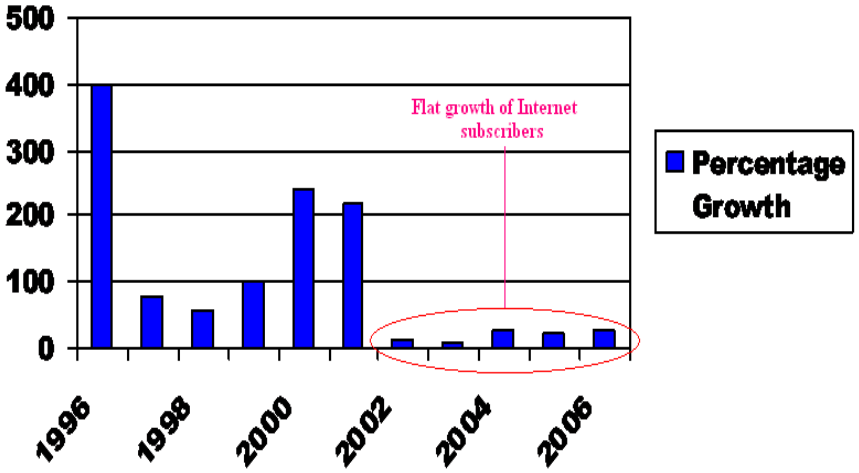
Characterizing Indian Market

Year	Internet Subscribers		Broadband Subscribers	
	Target	Achieved	Target	Achieved
2005	6	**5.55**	3	**0.18**
2007	18	**9.27 till March 07**	9	**2.34 till March 07**

Target fixed in the national broadband policy unachieved

* Number of subscribers in Millions





Broadband penetration %

Particulars	Per user bandwidth	With stat muxing 1:25	With stat muxing 1:50
1.2 billion Indians	250 bits per sec	6.25 kbps	12.5 kbps
300 million middle class	1 kbps	25 kbps	50 kbps
US/Western Europe	20 Mbps	NA	NA
Japan/Korea /China	50 Mbps	100 Mbps (shared)	NA

Need for speed!

Making broadband profitable – Approaches

- Pricing model
- Technology offerings
- Customization
- Content

Our solution to your business needs lies in a combination of all of the above.

It will require some effort to change each of these.

Current problem

Expensive content (OPEX)

Unused Metro (OPEX)

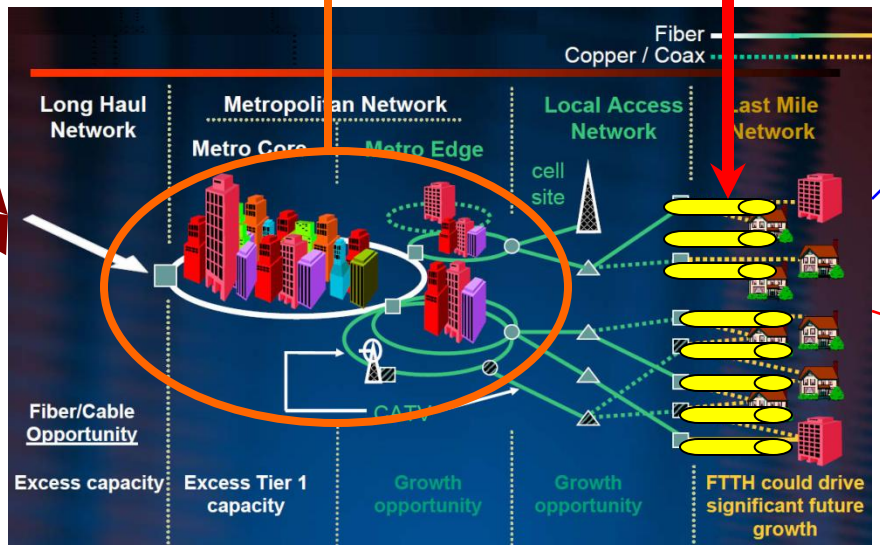
Slow access (CAPEX)

Content 1

Content 2

Content 3

$$$$$
$$$$$



SP network

$$

$$

"No thanks, just browsing."

"No thanks, just browsing."

It is really a business problem!!!

Problem and solution

Expensive content (OPEX)

Content 1

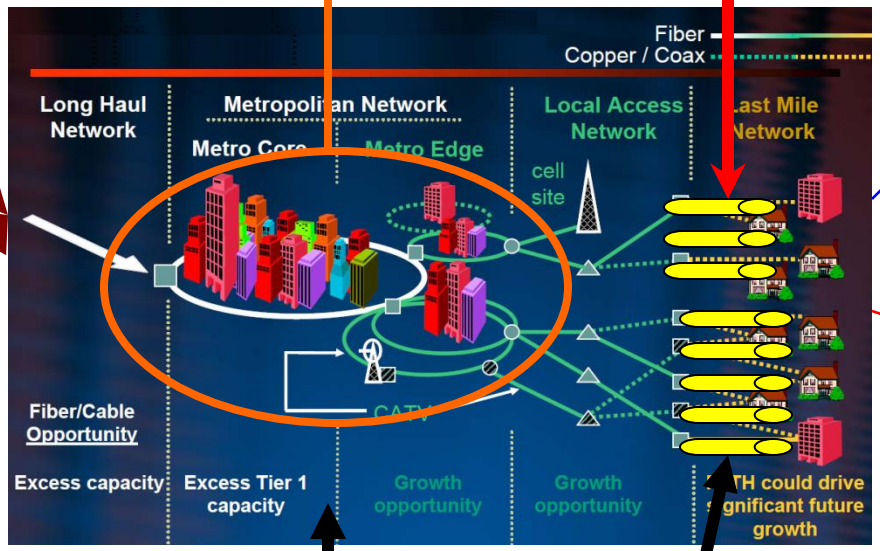
Content 2

Content 3

$$$$$
$$$$$

Unused Metro (OPEX)

In 2 years



In 4 years

SP network

75% content local

Slow access (CAPEX)

High-speed broadband

$$

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"No thanks, just browsing."

"No thanks, just browsing."

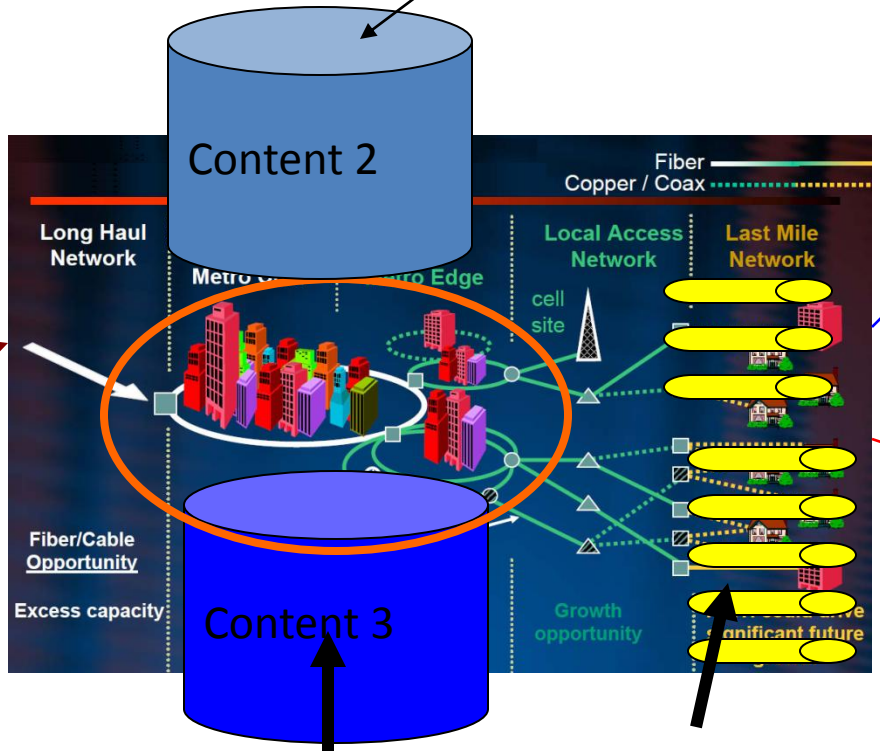
It is really a business problem!!!

Results

In-house data centers used

Low cost of bandwidth

Content 2



"No thanks, just browsing."

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SP netw

In 4 years

75% content local

High-speed broadband

It is really a business problem!!!

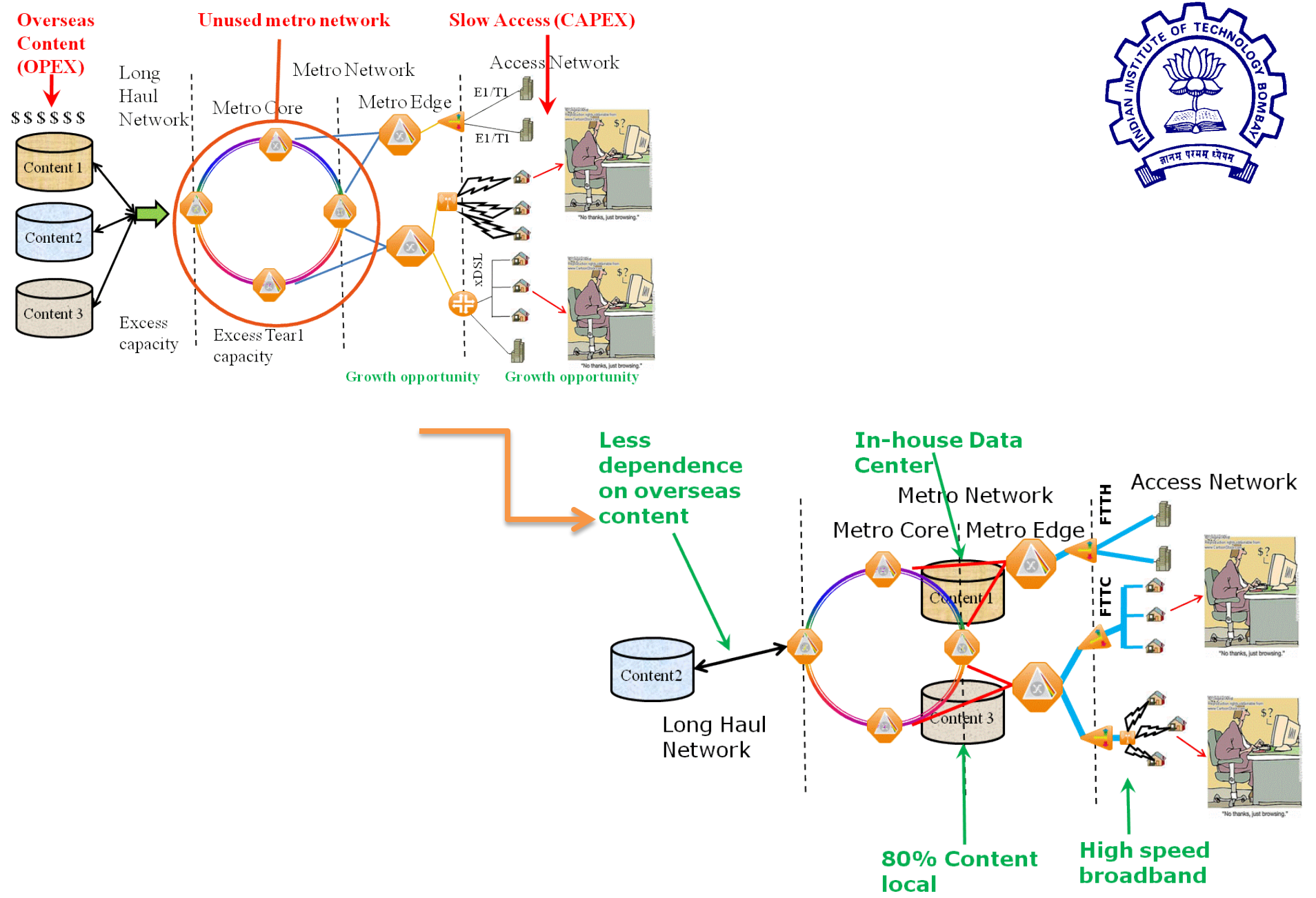
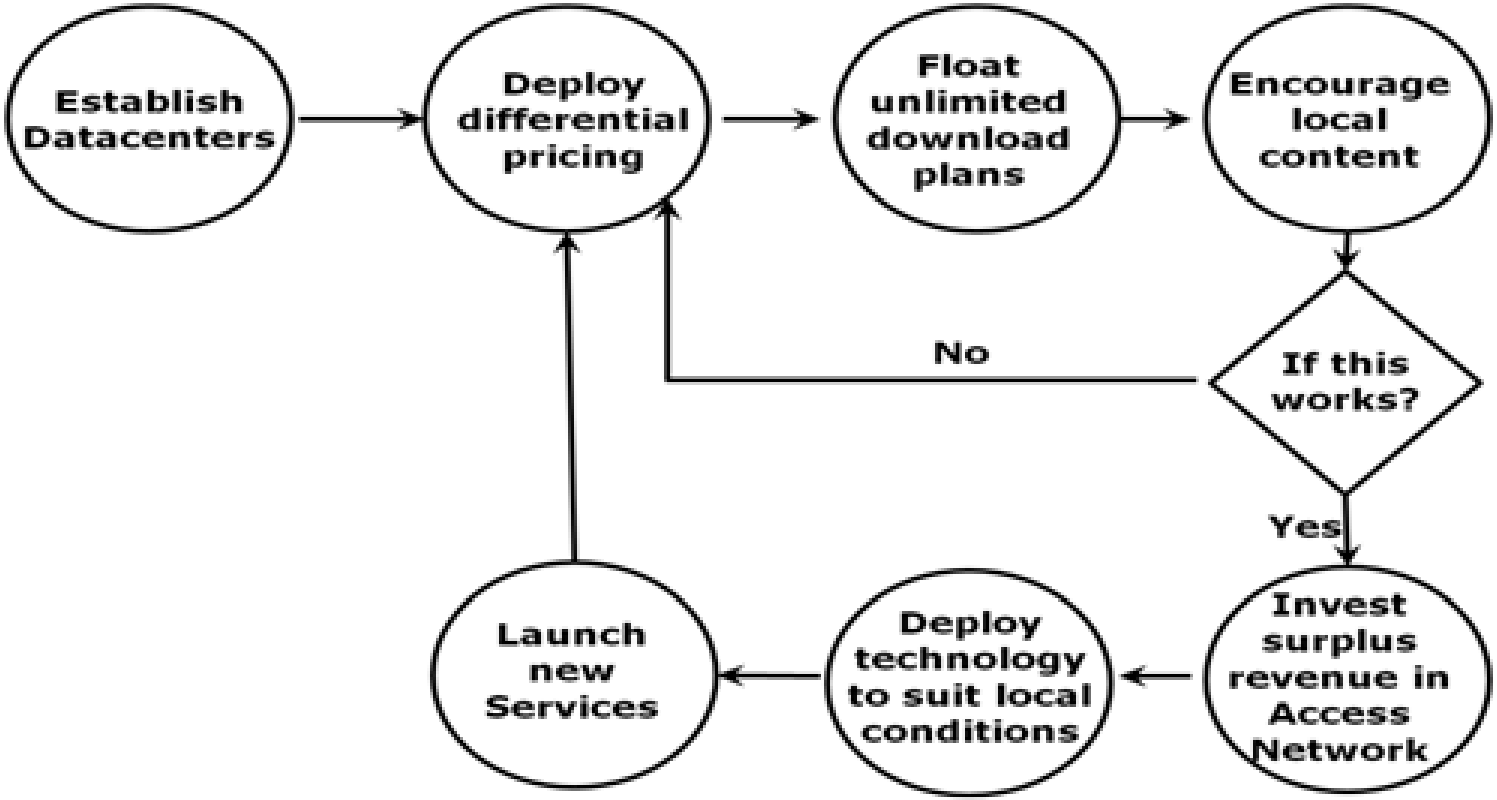
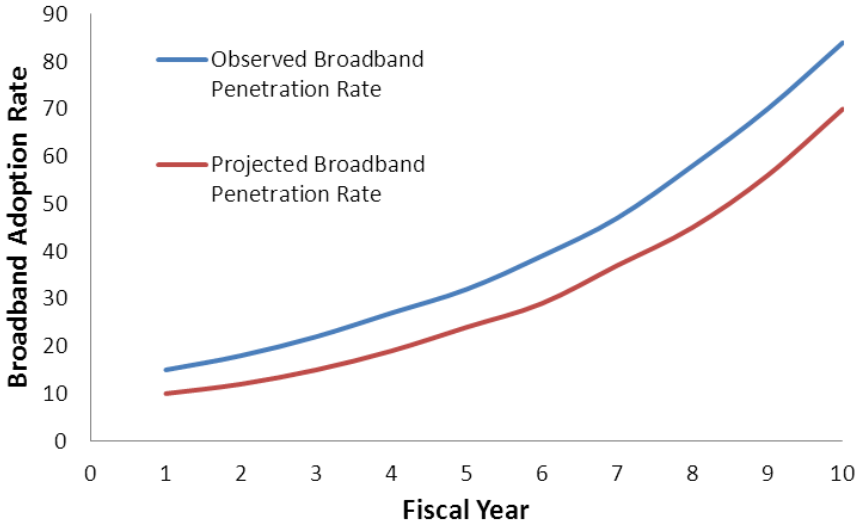


Fig.1. (a) Typical network infrastructure in India (top) and (b) desired network state through our solution (bottom).

Proposed Transition



Justification for the transition



End of Year	Percentage of content migrated to India		
	Optimistic Case	Aggressive Case	Pessimistic Case
First	12	12	6
Second	20	22	13
Third	28	31	19
Four	36	41	26
Five	43	51	33
Six	50	61	40
Seven	59	71	46
Eight	67	80	53
Nine	75	90	60

Projected broadband adoption rate (above) and Projected Content Migration (below).

List of Parameters

Market Size [$M(t)$]	10000000	Rate of interest (Fiber)	2.5%
Cost of OLT	USD500/Unit	Loan period (Fiber)	40 years
Cost of Fiber	USD2000/Km	Rate of interest (Equipment)	2.5%
Fixed Cost of WDM	USD20000/Node	Loan period (Equipment)	15 years
Variable Cost of WDM	USD2000/Gbps	Percentage Download in Total traffic (β)	80% – 80%
Fixed Cost of IP	USD25000/Node	Percentage Overseas Content (α)	80% – 80%
Variable Cost of IP	USD3500	Expenses parameters	
Metro N/W Fiber length	290 Km	Contribution of equipment (C9)	0.12 – 0.07
Cost of International B/W (d_o)	USD0.01/Mb	Contribution of License cost (C10)	0.04 – 0.03
Cost of Domestic B/W (d_i)	USD0.0002/Mb	Contribution of Building & land (C11)	0.03 – 0.05
Cost of DSLM	USD1000/Unit		

Parameters for Proposed Model

Up time Home User (ρ_1)		3480 – 5400 min/month	58 – 90 hrs/month	San Equipment cost	USD 1000/Tb
Up time Enterprise User (ρ_2)		9000 – 9000 min/month	150 – 150 hrs/month	Datacenter OPEX (ϵ)	0.30 – 0.30
Up time Corporate Users (ρ_3)		12000 – 12000 min/month	200 – 200 hrs/month	Home User (f_1)	40% – 60%
Average data transferred (κ)		1.5 Mb/ min		Small Enterprise User (f_2)	50% – 30%
Billing Rate IPTV		USD 5 /Month		Corporate Users (f_3)	10% – 10%
Billing rate Telepresence		USD 20 /Month		Home User IPTV (f_4)	5% – 60%
Percentage Content Migrated to India (γ)	Best Case	12% – 90%		Enterprise User IPTV (f_5)	0 – 0
	Average Case	12% – 75%		IPTV Corporate (f_6)	1% – 6.5%
	Worst Case	6% – 61%		Home User using Telepresence (f_7)	0 – 0 0 – 5%
Reuse Factor (R)		0.50 – 0.50		Enterprise Users using Telepresence (f_8)	0 – 0
Datacenter Hosting charges		USD 20/GB/month		Corporate Users using Telepresence (f_9)	6% – 40%
Traffic to Datacenter charges		USD 20/100 Gbps			

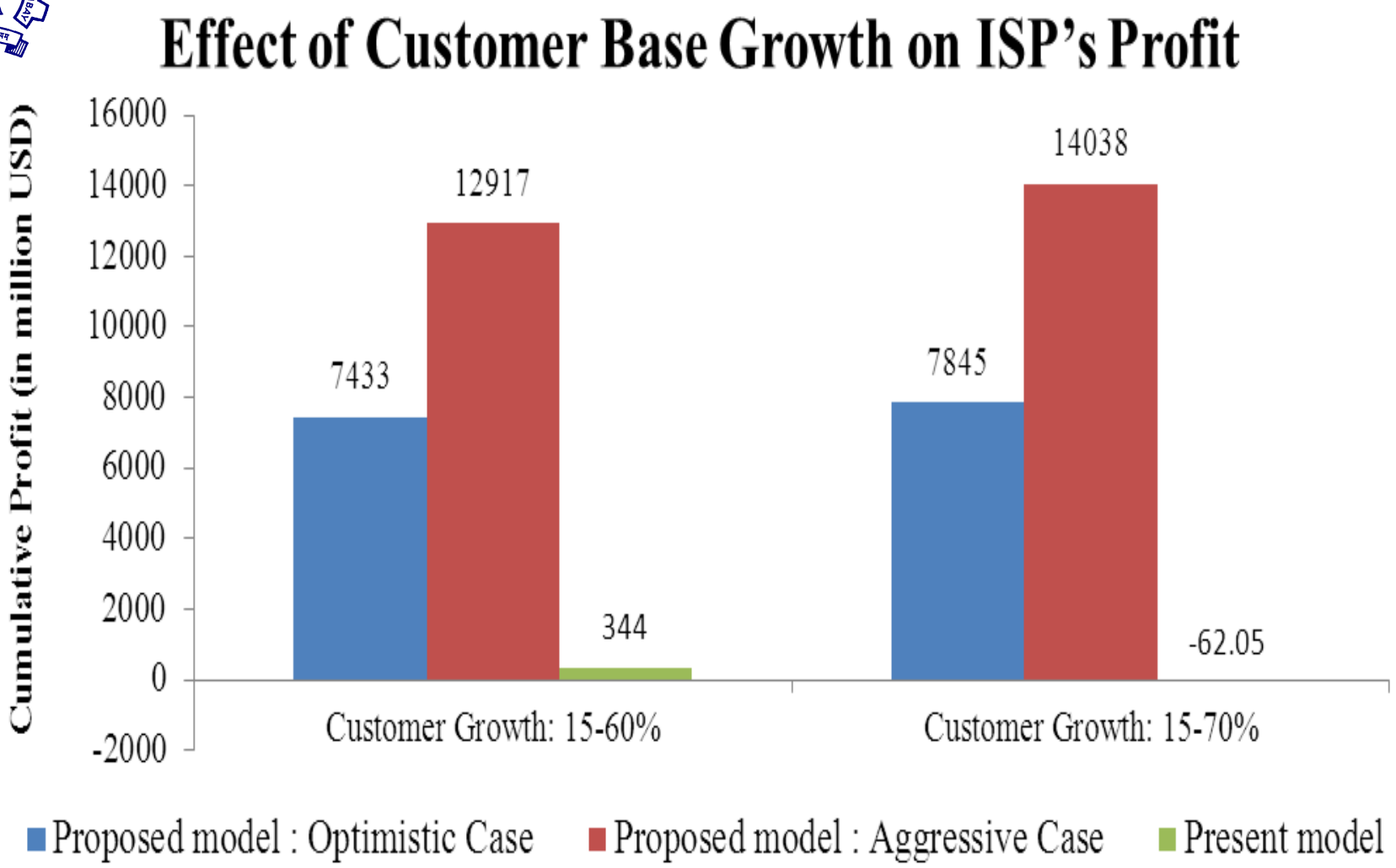


Fig 1: ISP's profit v/s customer base growth

Consolidated data for income and expense

Year	Proposed Model						Present model		
	Optimistic Case – Total Expenses	Optimistic Case – Total Income	Optimistic Case – Profit/Loss	Aggressive Case – Total Expenses	Aggressive Case – Total Income	Aggressive Case – Profit/Loss	Present model Total Expenses	Present model Total Income	Present model Profit/Loss
1	2965.3	1034.62	-1930.68	2965.3	1034.62	-1930.68	1999.67	1712.16	-287.51
2	3153.91	1557.05	-1596.86	3166.26	1557.05	-1609.21	2294.42	2031.79	-262.63
3	3421.92	2089.09	-1332.83	3414.63	2149.68	-1264.95	2639.36	2411.09	-228.27
4	3711.65	2754.66	-956.99	3678.04	2895.6	-782.44	3043.54	2861.19	-182.35
5	4024.03	3584.46	-439.57	3955.73	3830.63	-125.1	3517.71	3395.32	-122.39
6	4359.76	4616.06	256.3	4246.24	4998.63	752.39	4074.6	4029.16	-45.44
7	4719.13	5895.36	1176.23	4547.26	6453.31	1906.05	4729.28	4781.33	52.05
8	5101.9	7478.44	2376.54	4855.25	8260.37	3405.12	5499.65	5673.92	174.27
9	5507.04	9433.74	3926.7	5165.18	10500.1	5334.94	6406.88	6733.13	326.25
10	5478.99	11844.7	6365.73	4919.06	13270.7	8351.61	7476.11	7990.08	513.97
	TotalProfit/Loss		7844.57	**TotalProfit/Loss**		14037.73	**TotalProfit/Loss**		-62.05

Table 2: Consolidated data for income and expense – customer base 15% to 70%

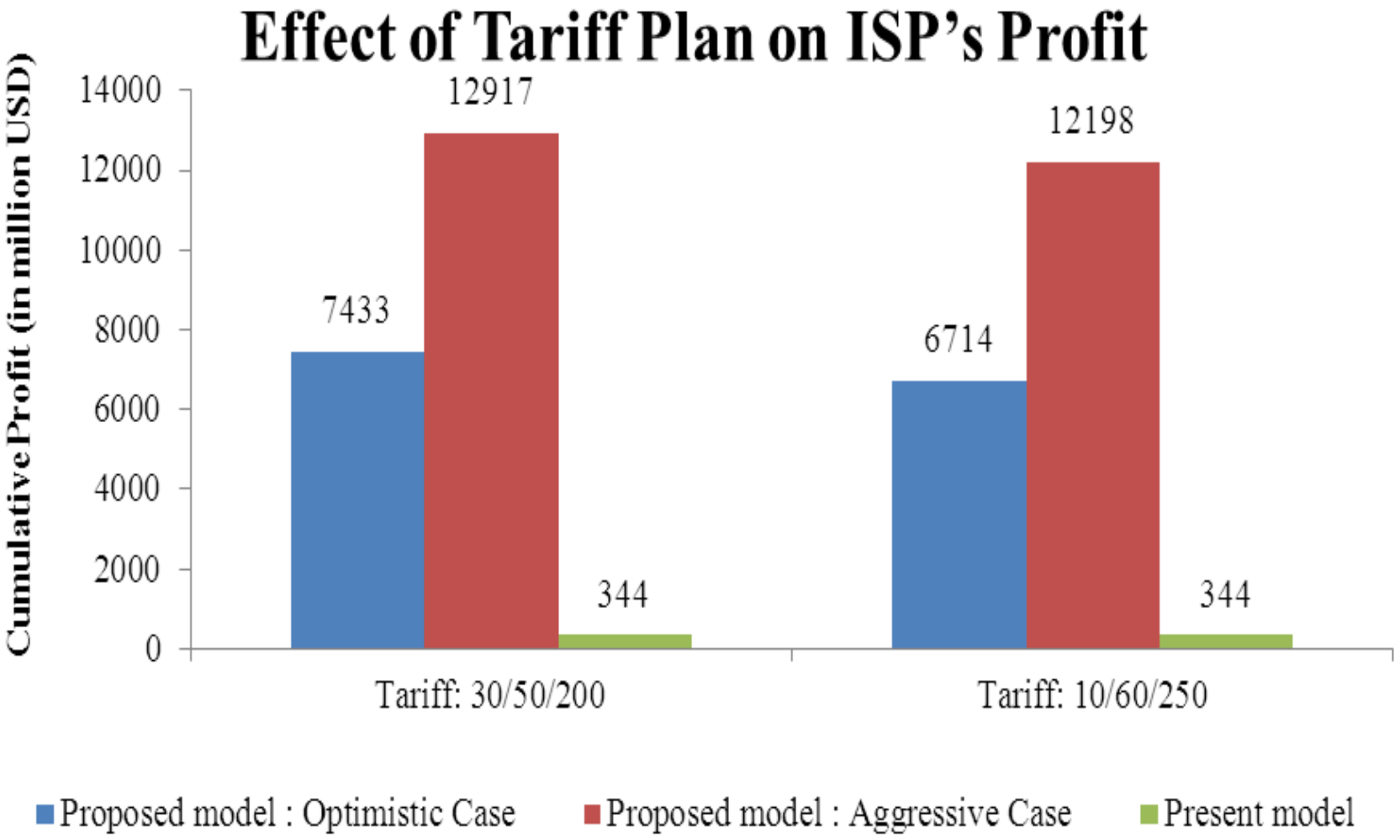


Fig 2: ISP's profit v/s tariff plans

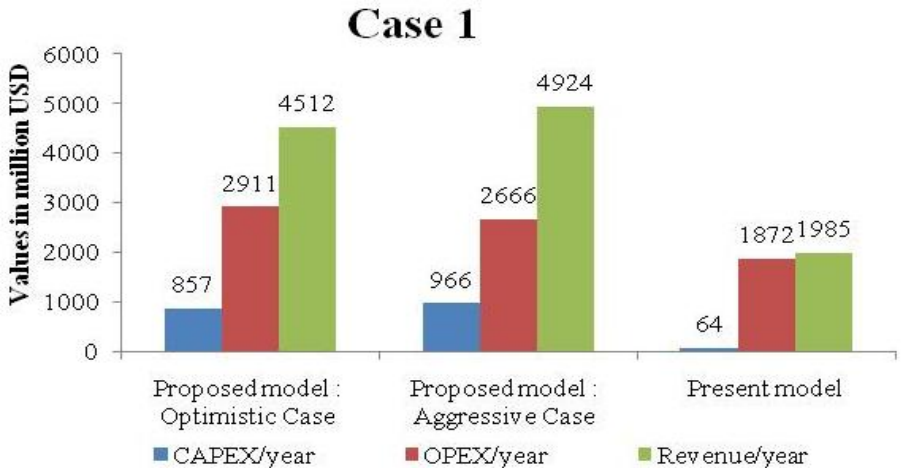


Fig. 3.Average income and expense in Case1

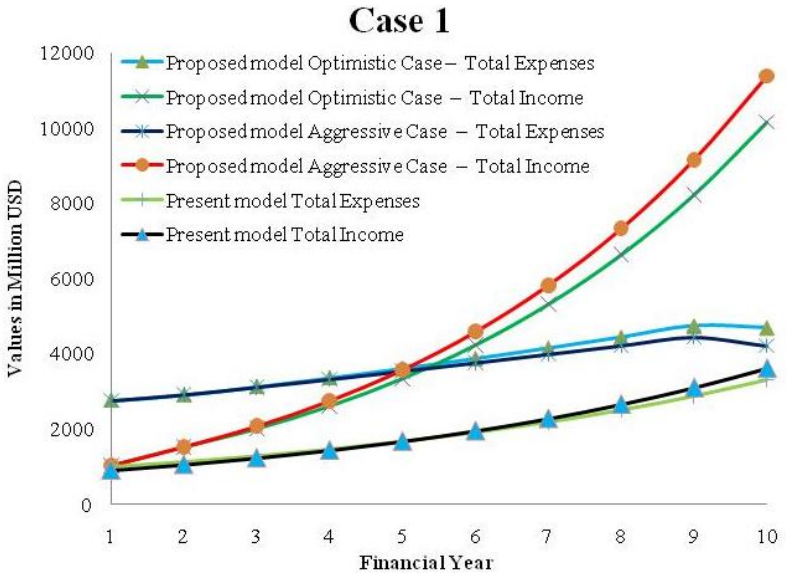
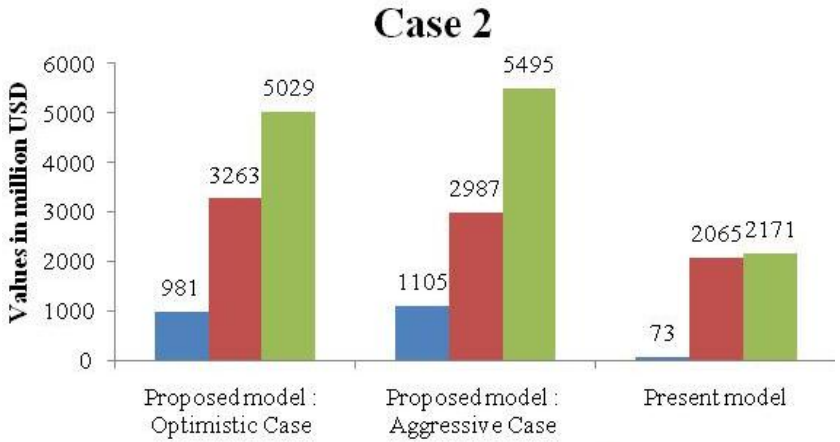


Fig. 4.Cash-flow per fiscal year in Case1

Present Model		Proposed Model	
Billing rate/ Mb Download	USD0.02	Home user Billing rate	USD30 /month
Billing rate per minute plan	USD0.016	Small Enterprise User	USD50 /month
Billing rate Cyber café	USD 100	Corporate Billing rate	USD200 /month
Billing rate Corporate user	USD 100	Cost of ONU	USD185/unit
Customer Base	10 – 40 %	Customer Base	15 – 60 %

Case specification for Case1



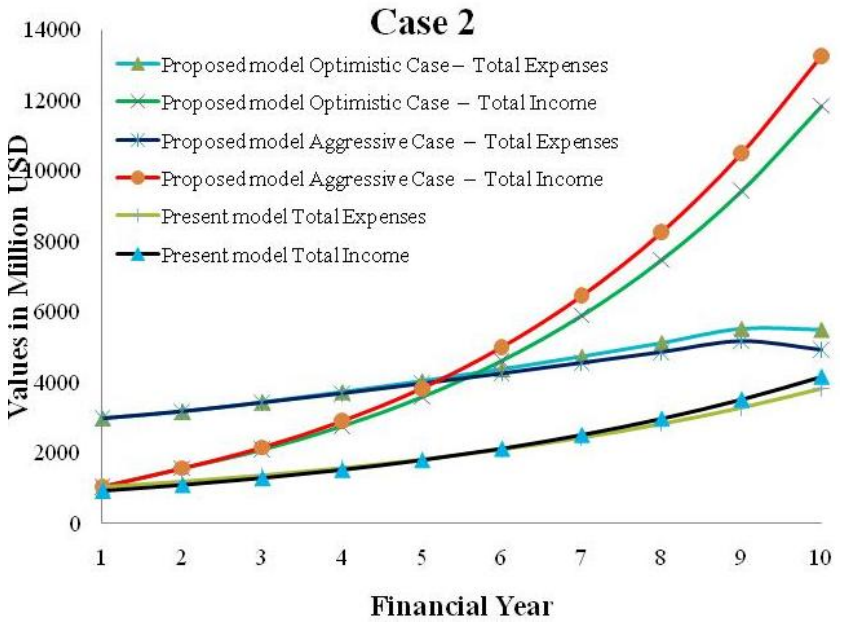


Fig. 5.Average income and expense in Case2 Fig. 6. Cash-flow per fiscal year in Case2

Present Model		**Proposed Model**	
Billing rate/ Mb Download	USD0.02	Home user Billing rate	USD30 /month
Billing rate per minute plan	USD0.016	Small Enterprise User	USD50 /month
Billing rate Cyber café	USD 100	Corporate Billing rate	USD200 /month
Billing rate Corporate user	USD 100	Cost of ONU	USD185/unit
Customer Base	10 – 46 %	Customer Base	15 – 70 %

Case specification for Case 2

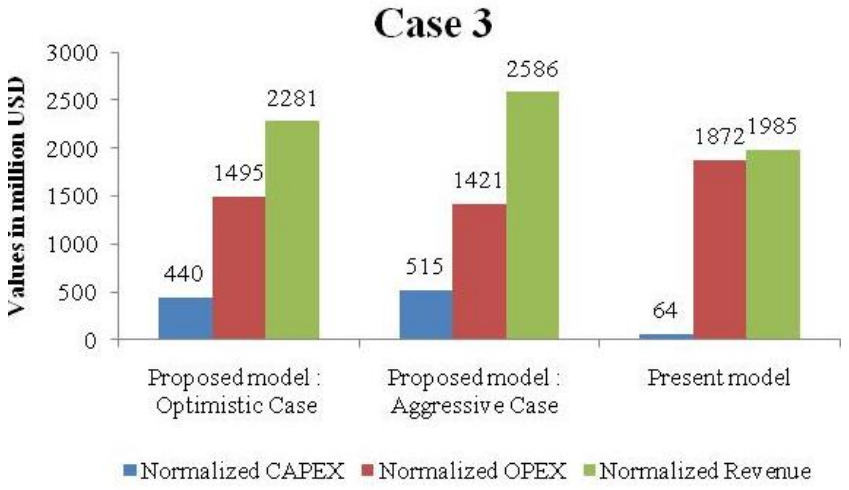


Fig. 7.Average income and expense in Case3

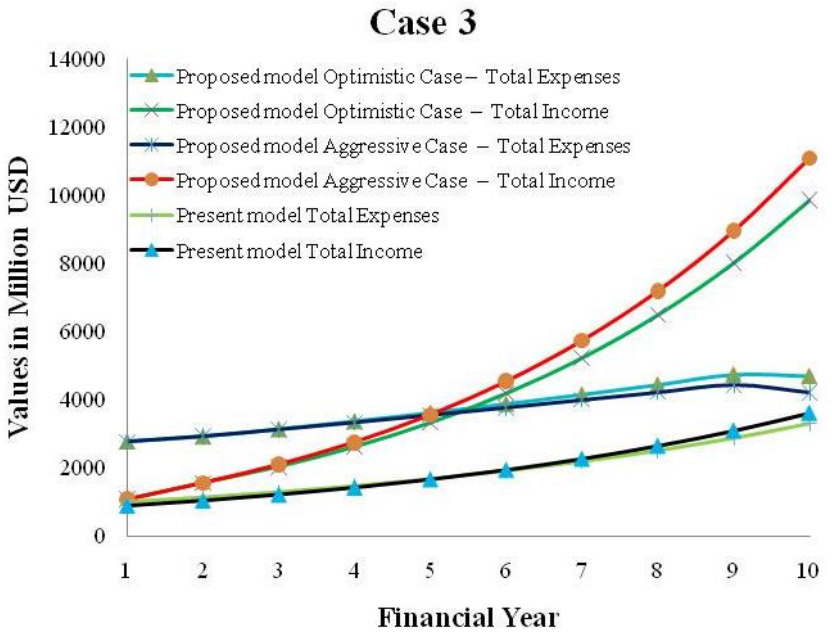


Fig. 8. Cash-flow per fiscal year in Case3

Present Model		**Proposed Model**	
Billing rate/ Mb Download	USD0.02	Home user Billing rate	USD10 /month
Billing rate per minute plan	USD0.016	Small Enterprise User	USD60 /month
Billing rate Cyber café	USD 100	Corporate Billing rate	USD250 /month
Billing rate Corporate user	USD 100	Cost of ONU	USD185/unit
Customer Base	10 – 40%	Customer Base	15 – 60 %

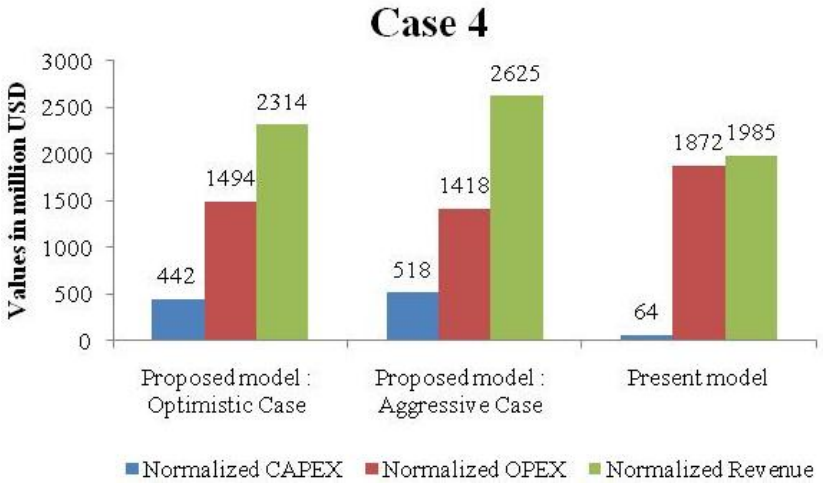


Fig. 9.Average income and expense in Case4

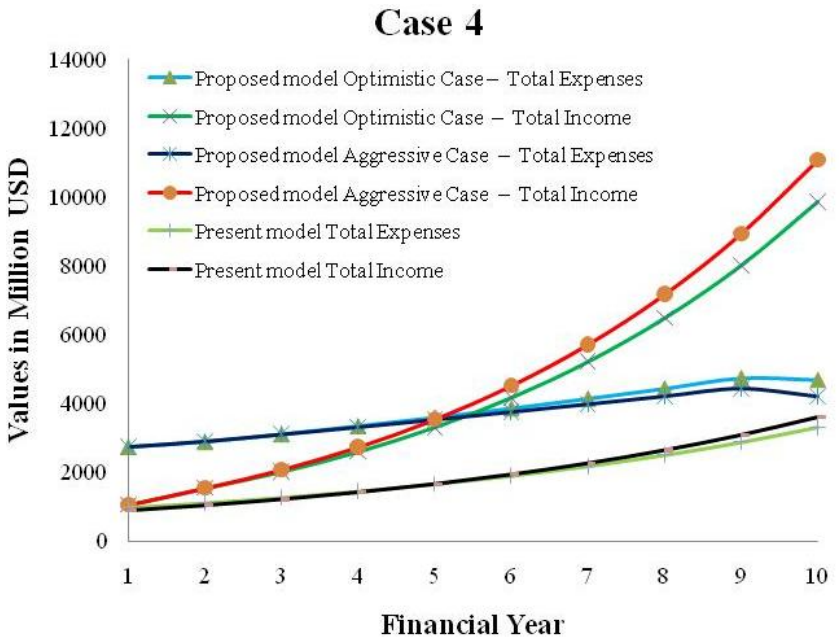
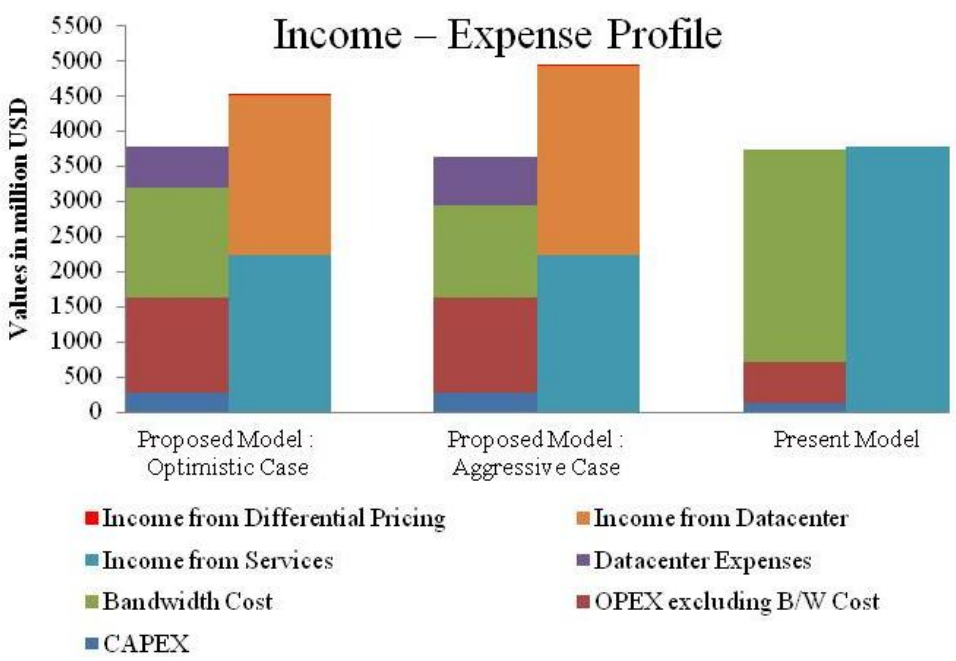
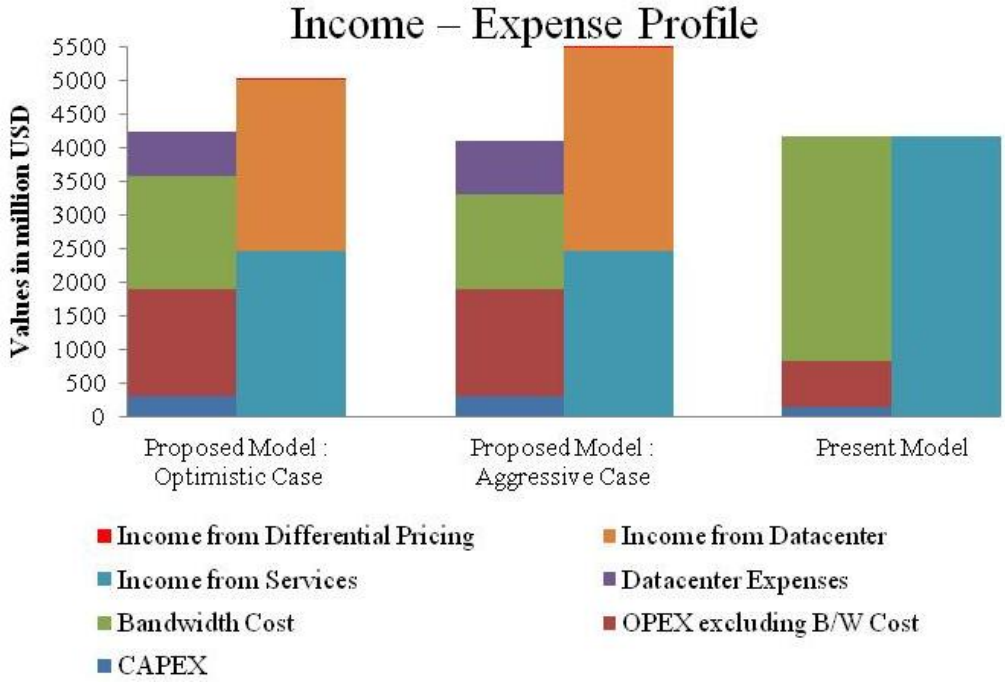


Fig. 10. Cash-flow per fiscal year in Case4

Present Model		**Proposed Model**	
Billing rate/ Mb Download	USD0.02	Home user Billing rate	USD10 /month
Billing rate per minute plan	USD0.016	Small Enterprise User	USD60 /month
Billing rate Cyber café	USD 100	Corporate Billing rate	USD250 /month
Billing rate Corporate user	USD 100	Cost of ONU	USD100/unit
Customer Base	10 – 40 %	Customer Base	15 – 60 %


Income – Expense Profile
Values in million USD
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Proposed Model : Optimistic Case
Proposed Model : Aggressive Case
Present Model
Income from Differential Pricing
Income from Datacenter
Income from Services
Datacenter Expenses
Bandwidth Cost
OPEX excluding B/W Cost
CAPEX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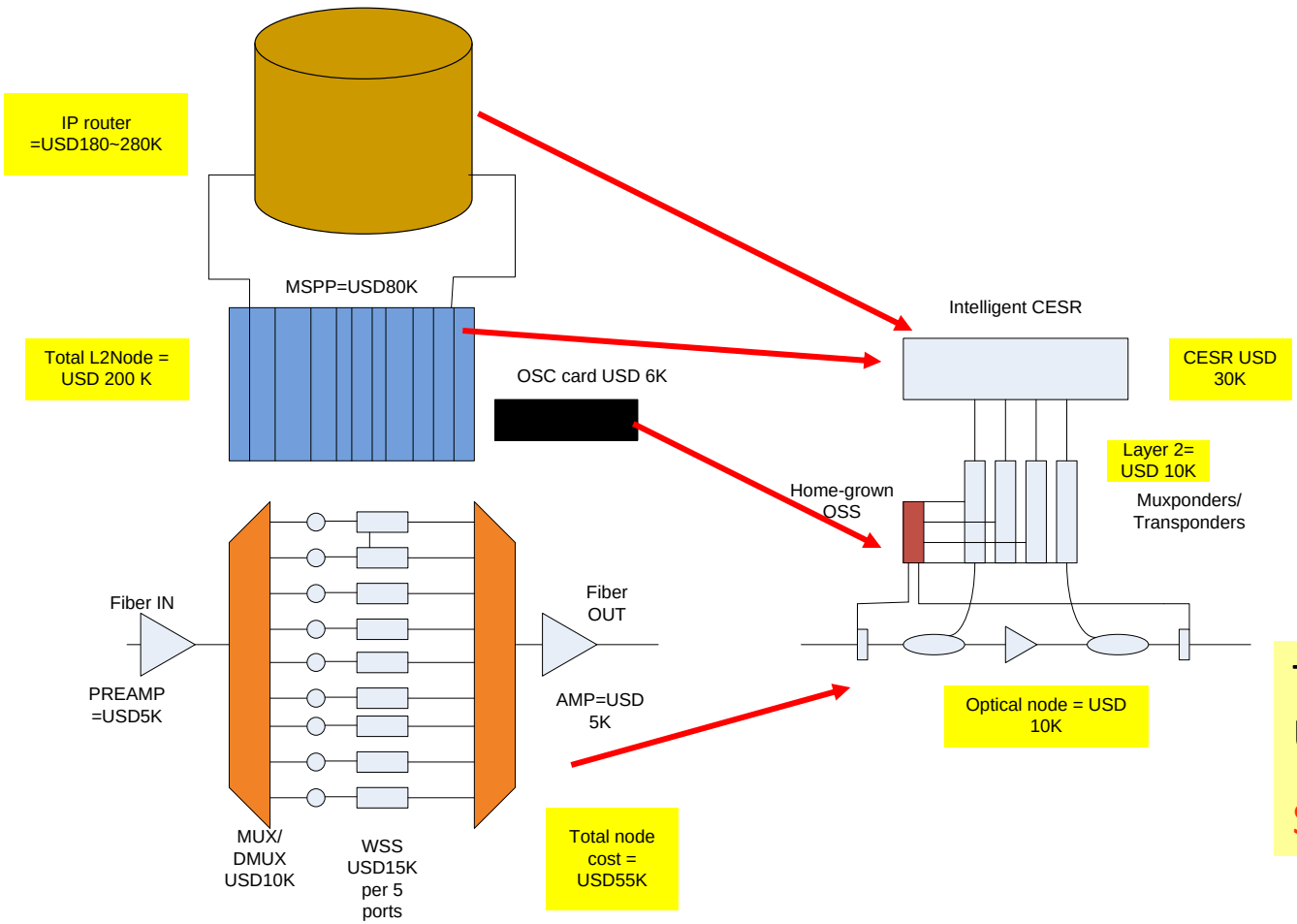
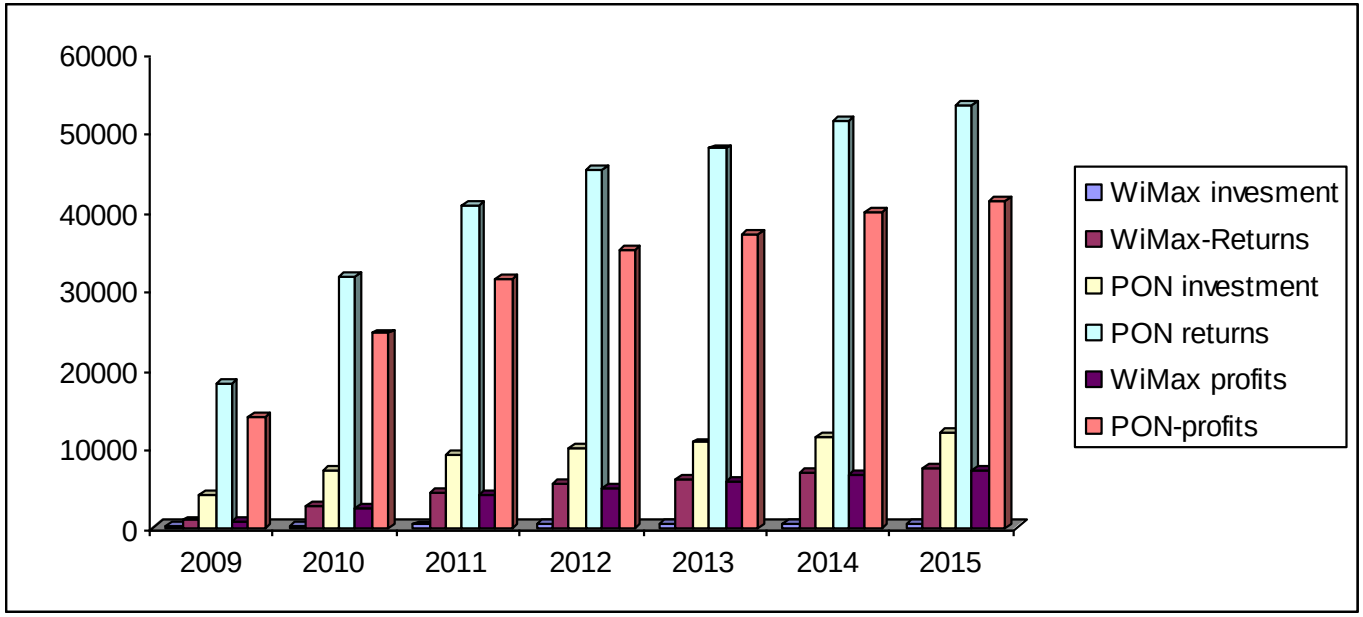
Proposed Model : Optimistic Case
Proposed Model : Aggressive Case
Present Model
Income from Differential Pricing
Income from Datacenter
Income from Services
Datacenter Expenses
Bandwidth Cost
OPEX excluding B/W Cost
CAPEX

Customized equipment for YOUR needs



Total cost savings = USD 420K!!!

Savings: 85.7%!!!

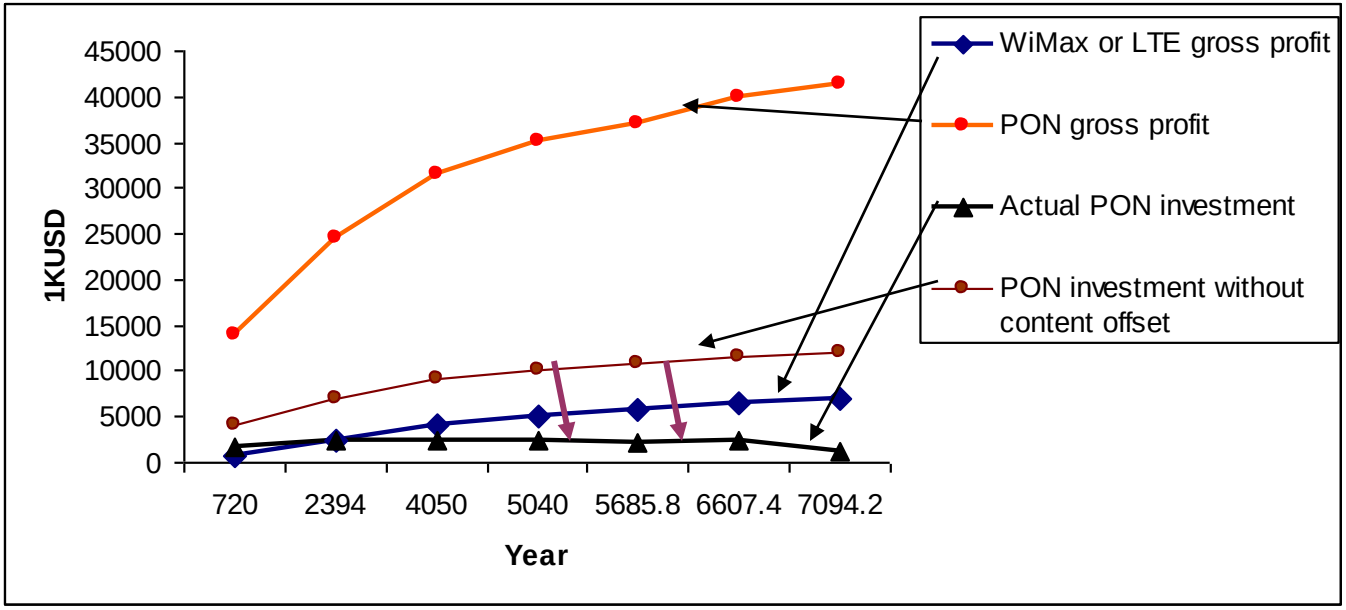


WiMax or LTE

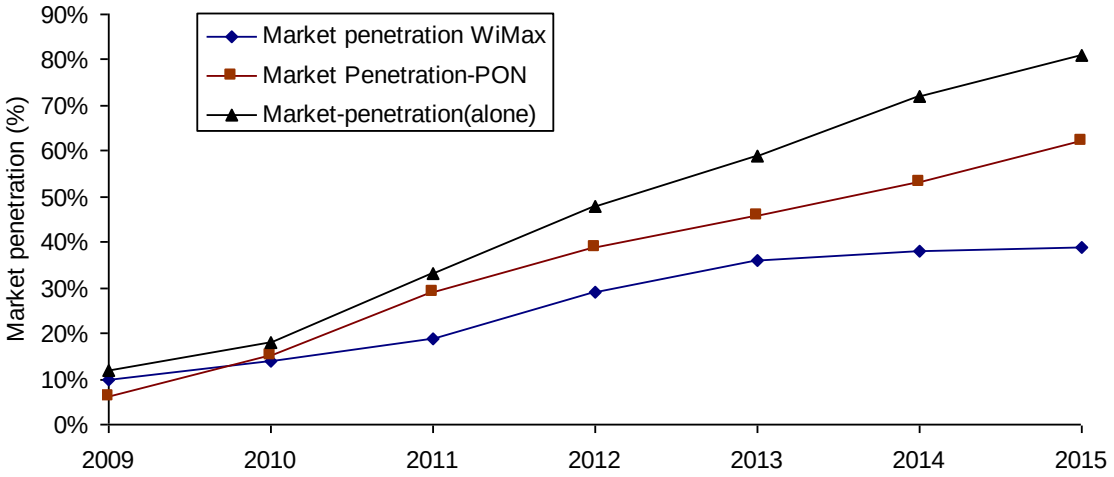
Versus

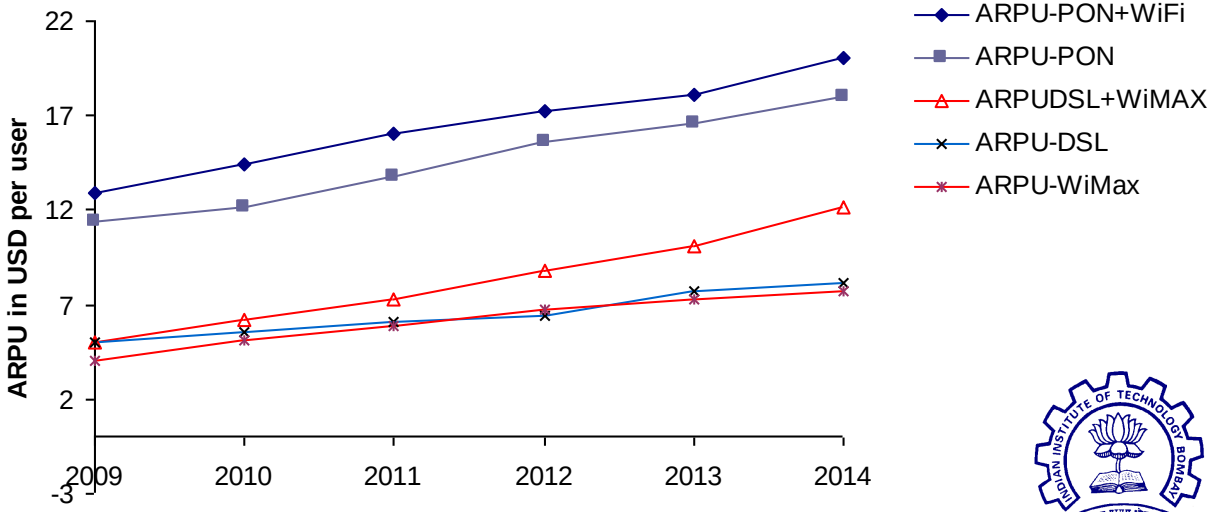
PON

USD 10/30 for PON and WiMax connection



Market penetration – WiMax, PON, with and without competition





Engineering Telecommunications in the Developing World

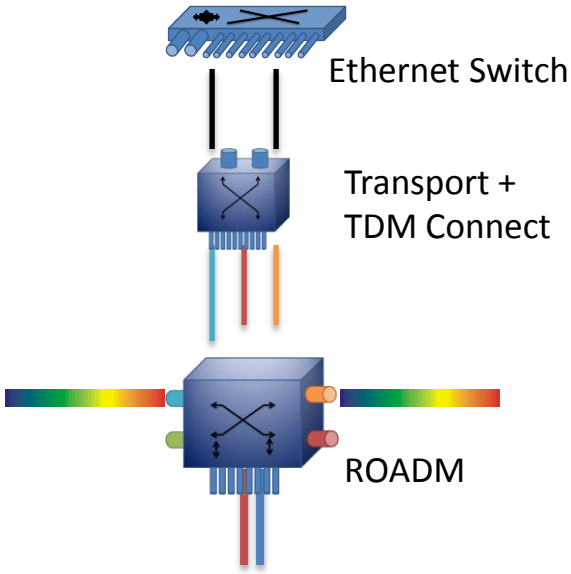
- Green-field networks – is the current protocol stack the right way to go?
- Can we collapse protocols to define a new network hierarchy, yet be backward compatible?
- Ethernet+MPLS in a Carrier class transport seems the way to go.

Protocol collapsing – networks in the developing world

- Networks are smaller, more managed
- Using the experience of the developed world – no learning curve necessary.
- Service centric.
- Adding meaning to labels/tags.
- Managing domains, providing protection and restoration, good OAM&P.
- Creating a new hierarchy.

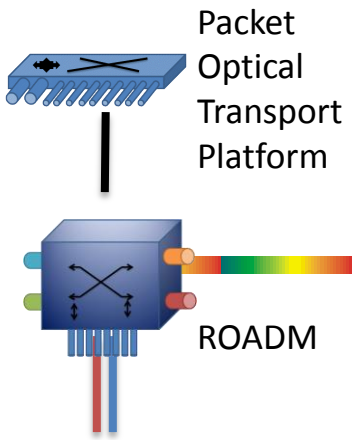
Convergence in the Network.. TODAY

Hierarchical systems



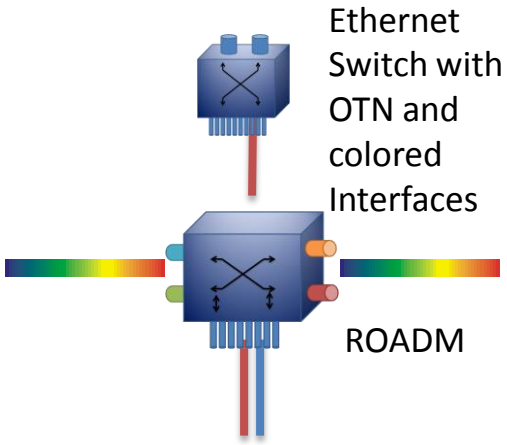
- CAPEX intensive
- Sub-optimal management
- Unoptimized interfaces

POTS with ROADM



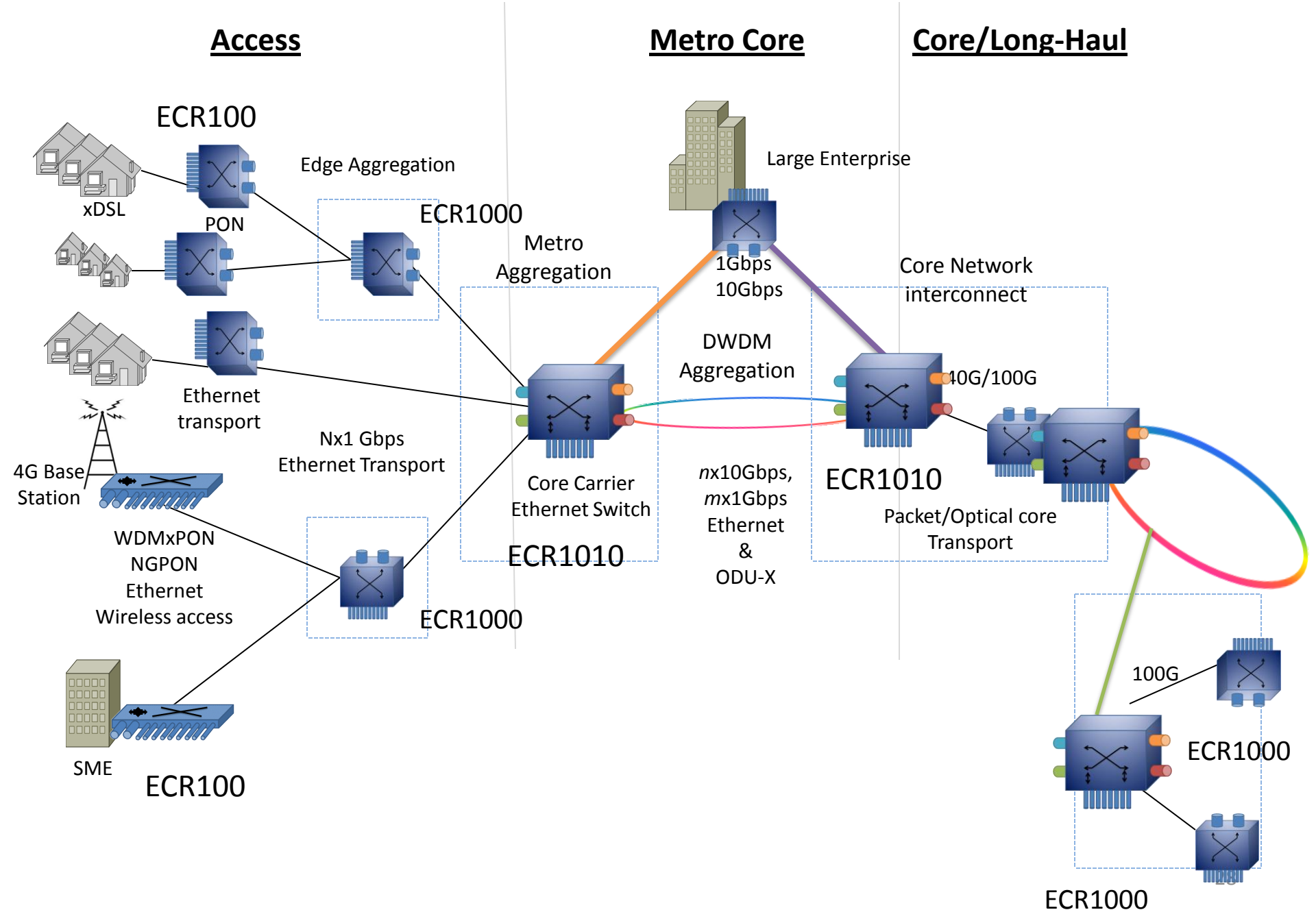
- ODU switching
- Cannot meet dynamic bandwidth needs
- Suboptimal CAPEX

CE, POTS, OTN and ROADM

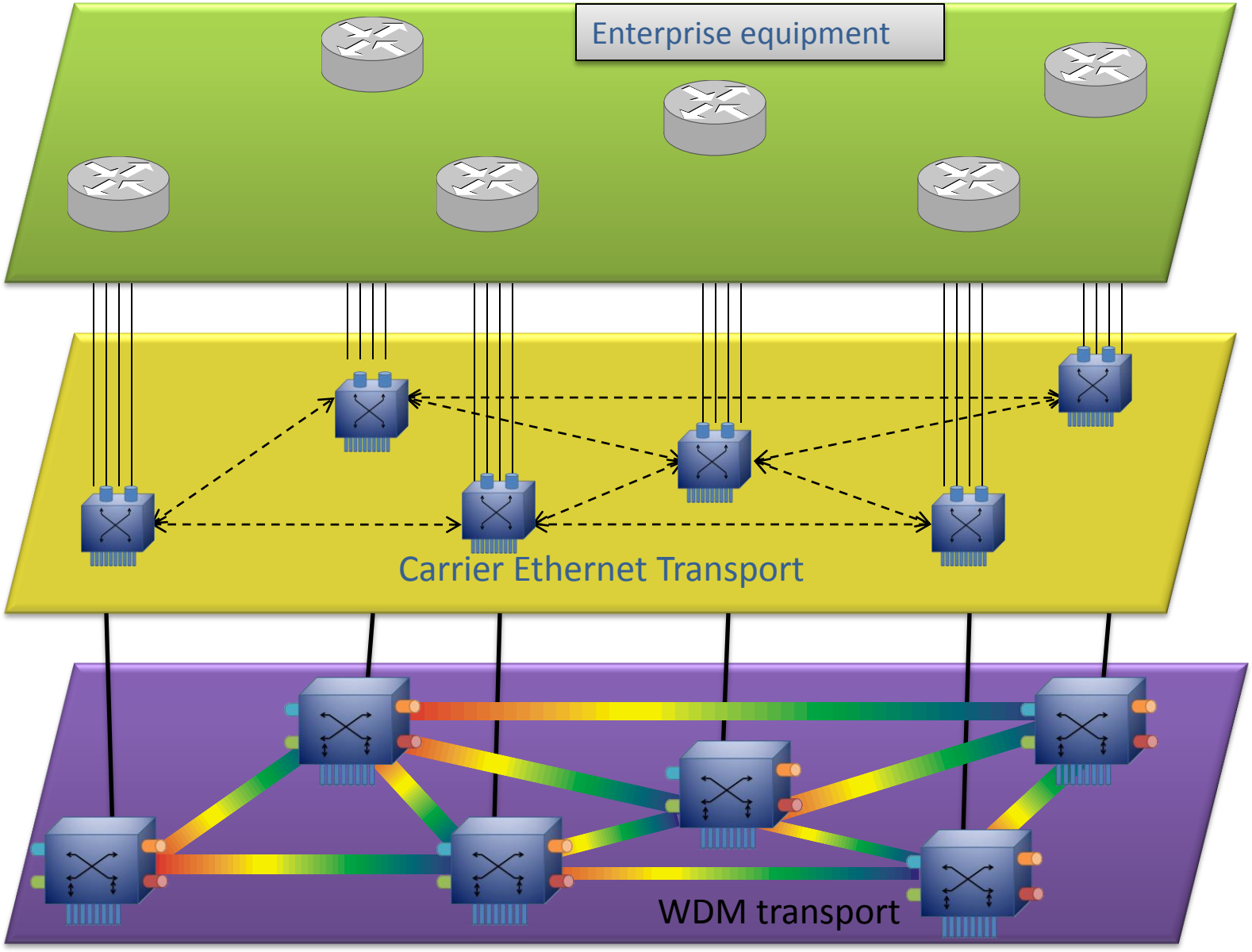


- Optimized for transport
- Cost effect
- Multi-layer optimized
- Management ease
- Multi-granular and dynamic support

Technologies across the Network Spectrum



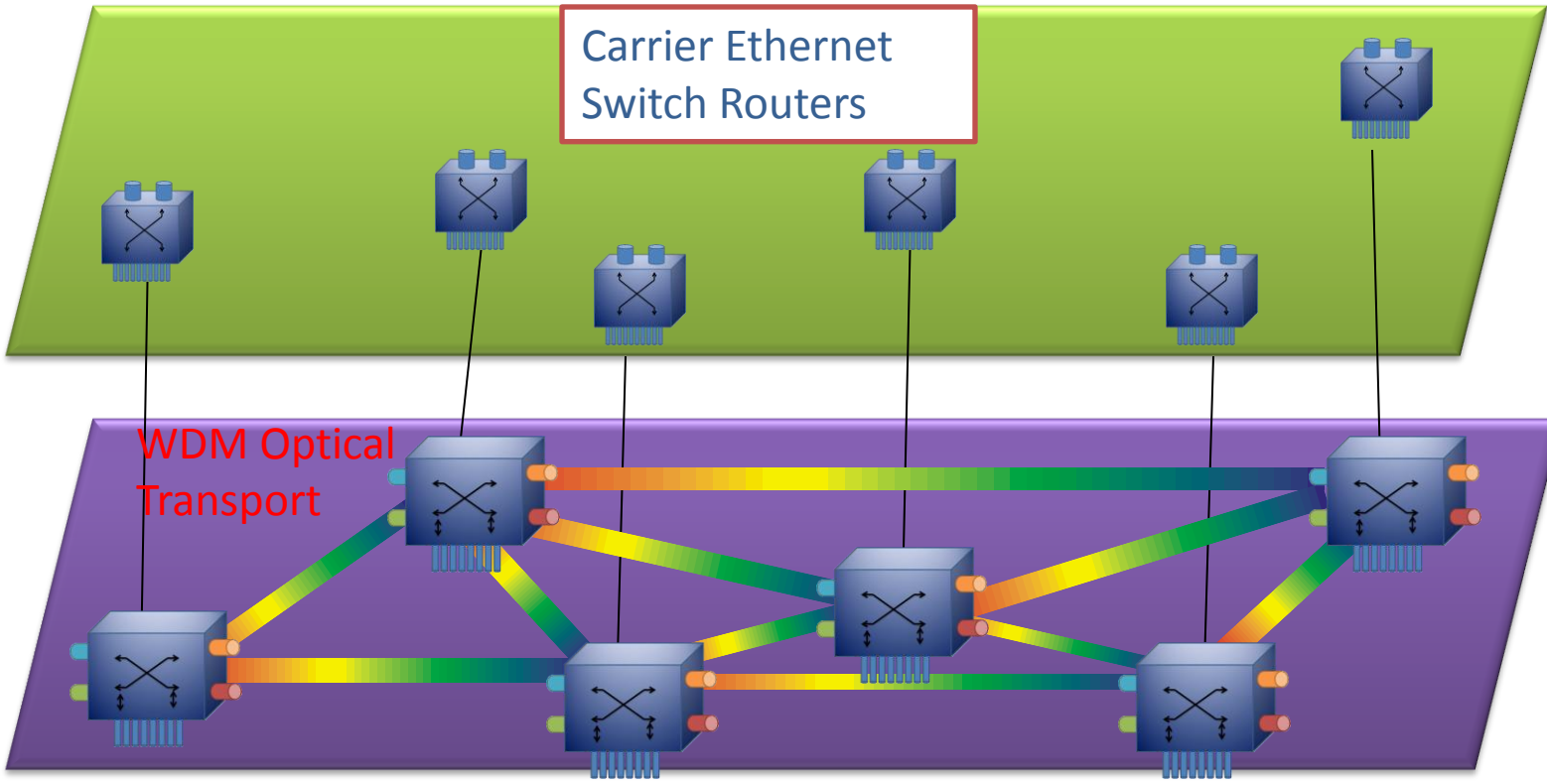
Multi-layer optimization – smart intelligent design can save up to 70% CAPEX and 45% OPEX

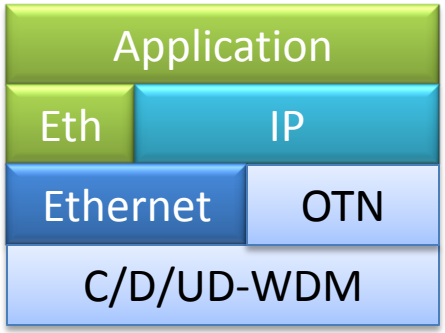


The Rule of the Thumb Mantra for Indian Networks

Note that just CE switches will NOT solve your problem

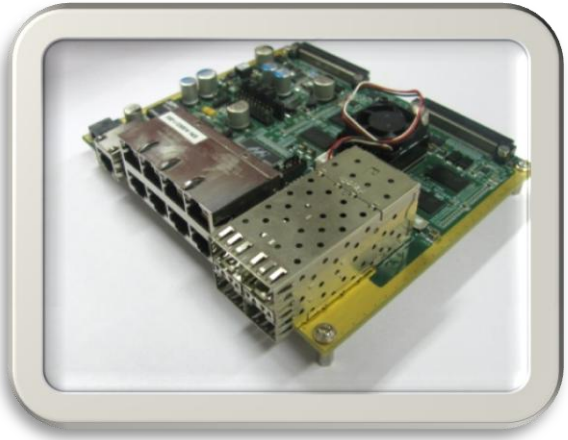
You do need a routing component to the CE switches





The protocol stack – note the absolute absence of MPLS and SDH

Innovations at IIT Bombay



From Innovation to Collaboration

MTNL is proud to be the trusted communications partner to India's leading financial houses, working for them to meet the challenges of growth, scalability and sustainability. We offer a full suite of business communication services across data, voice and managed services. Our solutions are tailored to fit your particular needs.

MTNL, is a state-owned telecom PSU . We have always been challenging the limits of innovation and striving to find new and better ways of doing things.

Our team are committed to helping you succeed. We will stick with you through thick and thin.

We are dedicated to providing the highest quality of Data Centre services.

MTNL Data Center provides a backbone network of various information systems and houses very dense computer systems and interconnected components.

MTNL Data Center functions on an indigenous technology developed by IIT Bombay's Gigabit Networking Laboratory. This indigenous router makes the data-centre fast, reliable, easy to operate with a lower total cost of ownership to the customer.

We would be pleased to answer any questions about how Data centre Services can help your enterprise or business to succeed. Please contact us on **data-center@mtnl.net.in.**

MTNL has been offering innovative communication solutions for decades in the cities of Mumbai and Delhi. MTNL is now offering data-center services, by augmenting its network using a data-center specific technology solution. The technology for architecting the data-center is designed, developed and productized by a team at IIT Bombay. This indigenous technology has many firsts, including being the fastest networking fabric to support any data-center, the lowest energy consumption in the industry, using a novel technology to encompass a multitude of data-center functions and being able to meet the requirements of next generation data-center and cloud computing environments.

MTNL offers next generation data-center services ranging from hosting services (web-hosting, IPTV, video-on-demand), to more complex IT-virtualization services using virtual machines, such as financial computational software, stock-market backup, enterprise IT applications, and remote IT processing. The data-centers located in Mumbai will support connectivity to almost every enterprise and business within the city. The data-centers by themselves would be state-of-the-art housing business critical IT-gear facilitating complete outsourcing of IT services. MTNL offers a plethora of managed and unmanaged services to their customers and businesses.

Focus on Financial Services:

MTNL brings to its customers a special financial package of data-centre services. As part of this package are data-centre plans that are catered to meet the needs of financial customers. We understand the value of time and how time can translate to money. To better optimize your trading software and develop your investment portfolio, MTNL has deployed data-centre plans with the state of the art network within the data-centre as well as deployed special computational servers to make your software efficient. By optimizing the software using data centre support, customers will extract the maximal benefit from virtualization. With response times bounded to within 1 microsecond, the data-centre is able to increase your software performance and create value continuously year-on-year.

Business Offerings:

MTNL offers a broad variety of data-center services to its customers and consumers. These services can be categorized as managed or unmanaged depending on the level of desired complexity and enforcement of Service Level Agreements (SLAs). The data-center itself is designed to be a state-of-the-art facility with compliance to international standards (namely the TIA942 requirements). Data-centers are located at different points within the city to provide fast response, remote backup and are completely redundant in every respect. Salient features of data-centers include:

- World's fastest interconnection fabric developed by top research group at IIT Bombay.
- Excellent connectivity to the outside world connected by India's fastest backbone network.
- Excellent connectivity to customers – using fiber or copper over MTNLs dedicated backbone.
- Managed data-center with redundant electrical, fire, air conditioning, switching, memory and management.
- Multi-level data-backup – for the first time ever.
- Enhanced security available in a proprietary mode.

Infrastructure:

The data-centers conform to industry standards and are built to beat any calamity, natural, manmade, incidental or otherwise:

- **Physical**
  - Secure access
  - Seismic zonal security
  - Fireproof DC room.
  - Remote monitoring, recording of events.
  - Firewalls to the Internet
  - Proprietary security for applications.
  - Waterproof, fireproof DC cage.
- **Cooling**
  - Controlled environment with secondary/redundant cooling.
  - Support of in situ measurement of temperature.
  - Temperature maintained at 22 degrees C and at a humidity of 50%.
- **Multilevel power support**
  - Redundant power supply
  - Battery backup
- **Network support**
  - Sub-1 microsecond switching fabric for very fast turn around.
  - Natural multicast support.
  - Support for 1Gbps and 10Gbps line cards.
  - Support for cloud services.

The following services are offered by the data-center:

- **Managed Services:**
  - Financial Services
  - Virtual Machines for Computational and Financial Software
  - Software as a Service
  - Remote IT processing
  - Remote backup
  - Video on demand
  - Integration with MTNL's cellular network
- **Unmanaged Services**
  - Automatic backup
  - Hosting services
  - IPTV
  - Webhosting
  - Entertainment services