

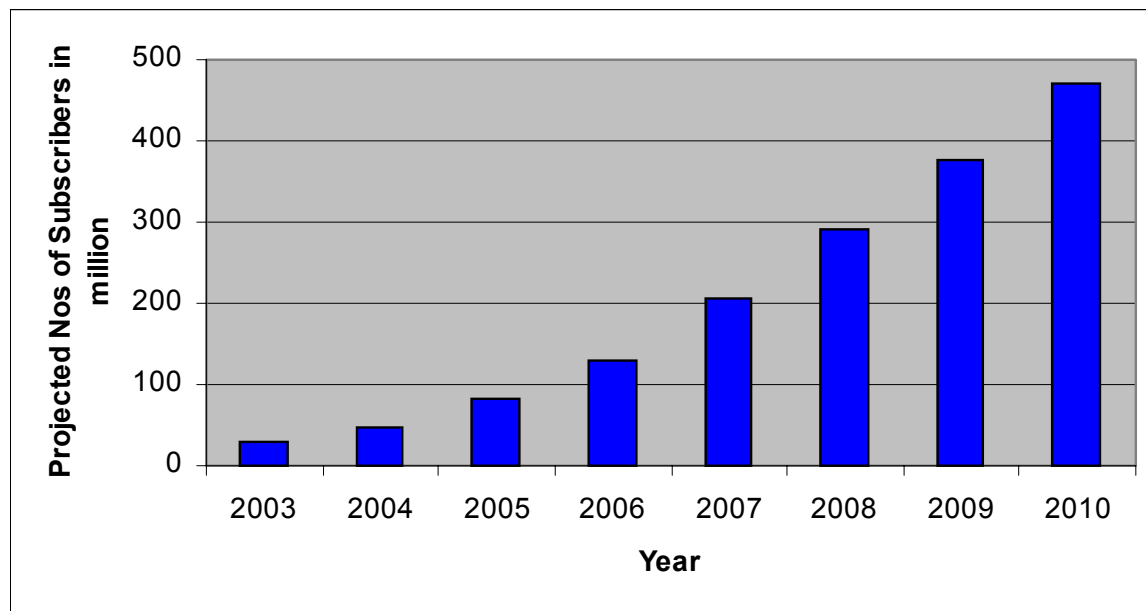


Role of Optical Fibre in India's Telecom Boom

ashok Jhunjhunwala
ashok@tenet.res.in



Indian Telecom Market is booming

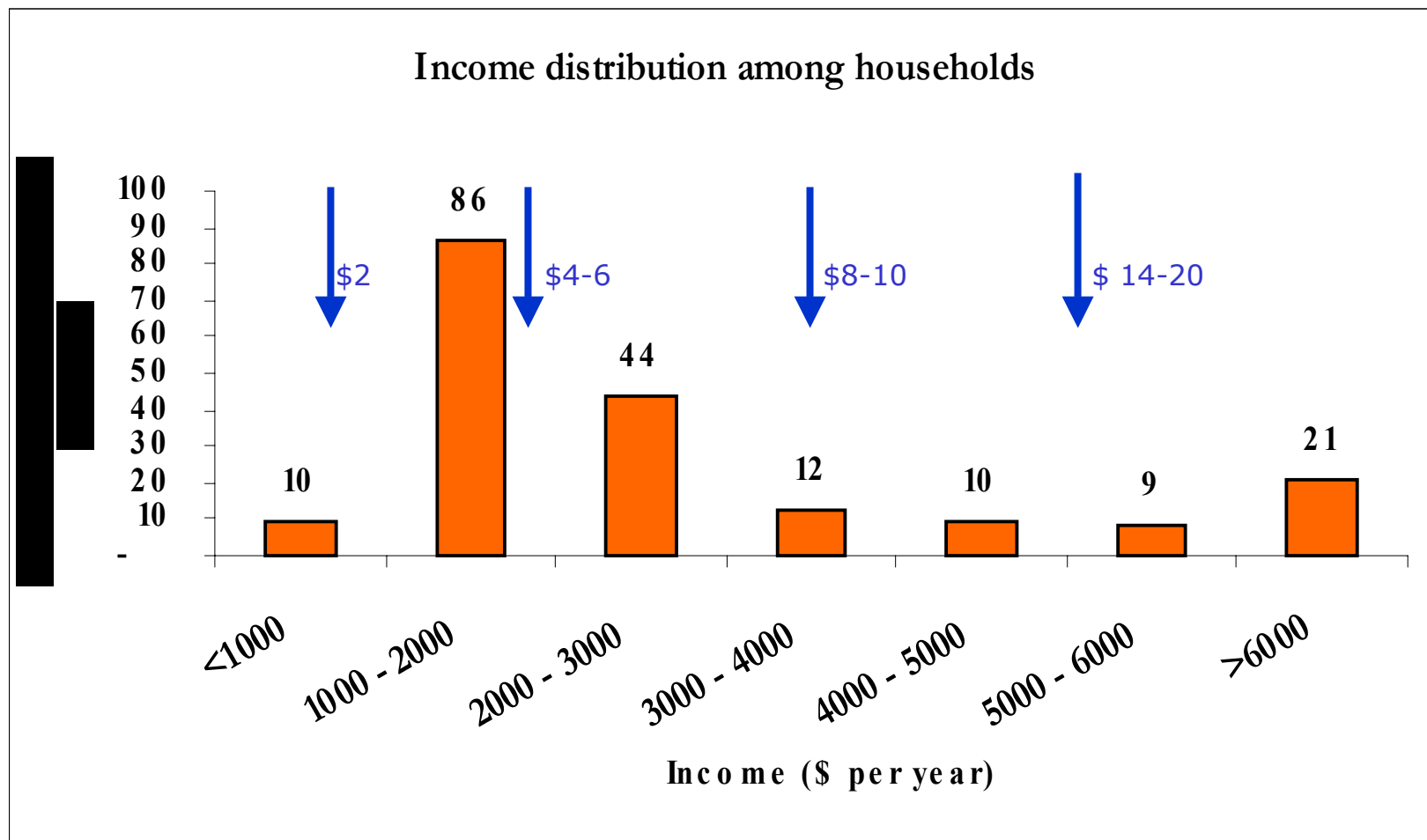


5 million \Rightarrow 50 million \Rightarrow 150 million \Rightarrow 400 million

- Telephones:
 - 1994: 8 million
 - Today: crossing 100 million
 - Adding 2.5 million lines every month
 - **Fastest growing** telecom market in the world
- Broadband
 - Today : 1 million
 - 2010: 50 million



India has a billion plus people





And Indian Market boomed

- Not until Telecom (Mobile) Infrastructure Capex < \$75 per line
 - with handset price of \$50 to \$200 and service at **under 2 cents per minute**
 - **ARPU of about \$ 7**
 - **2+ million subscribers added each month**



- To continue growth
 - Tariff / ARPU needs to drop further
 - 1 cent per min / \$ 2 ARPU
 - To address households with income less than \$100 per month



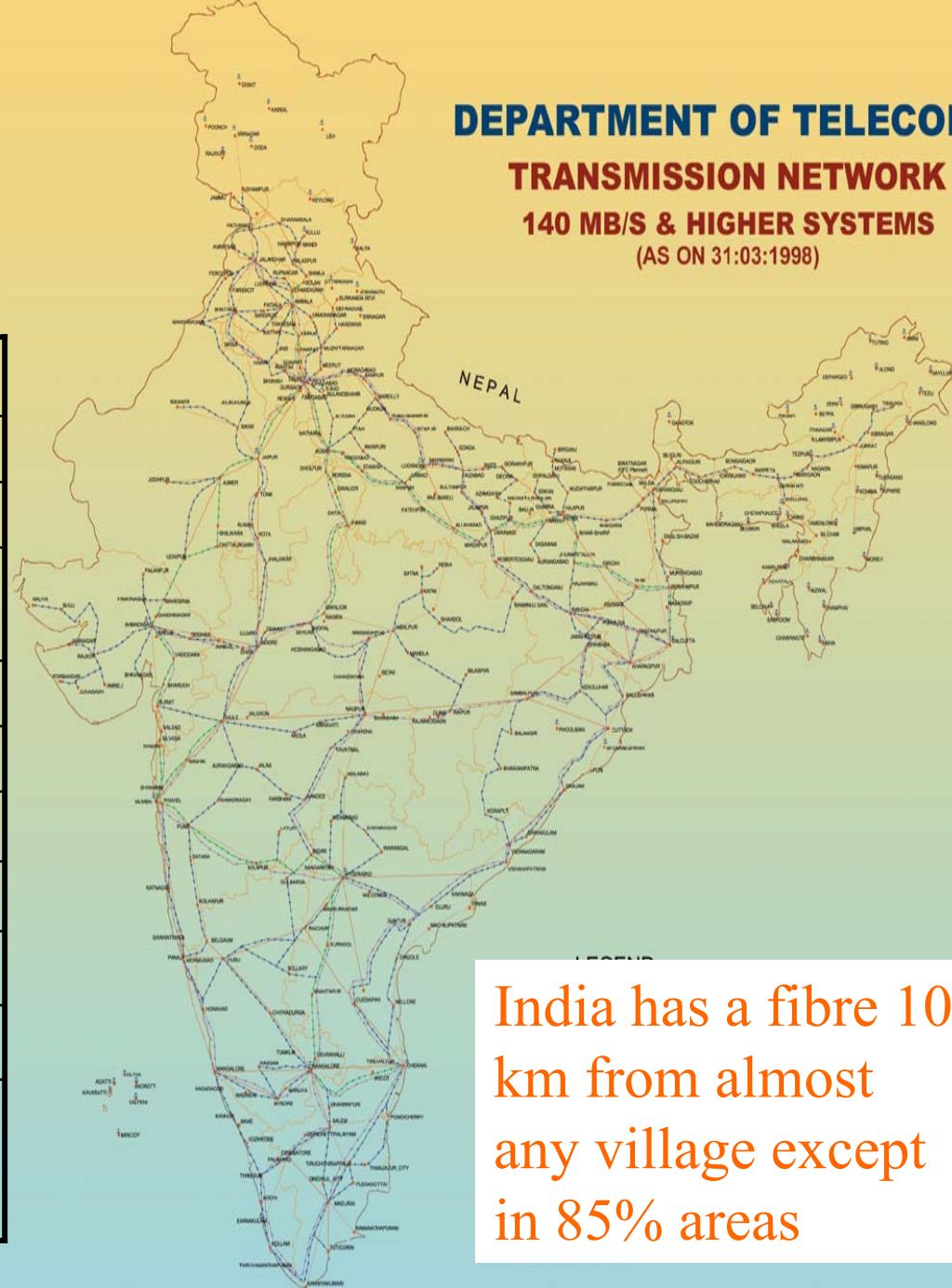
Telecom Network Costs

- **Backbone Network (contributes to 10% of CAPEX)**
 - Fibre & install (50%), WDM & SDH Networks (50% of backbone network)
- Backbone Switches & Routers (contributes to 5-10% of CAPEX)
- **Access Network (contributes to 60 to 65% of CAPEX)**
 - Mobile (50-60%), Fixed Wireless (10-15%) and Fibre Access (25-40% of lines)
- Service Platforms (contributes to 10 to 15% of CAPEX)
 - OMC, Customer Care & Billing, NMS, IN Services and ISP platforms

Backbone Network

Carrier	Route Kms
BSNL	450,000
Reliance	60,000
Tata Tele, VSNL, TPBB	35,000
Bharti	40,000
Railways	60,000
Railtel	40,000
PGCIL	4,000
Shyam Telelink	4,000
MTNL	4,000
Others (HFCL, GAIL, BSES, Cellular operators)	10,000

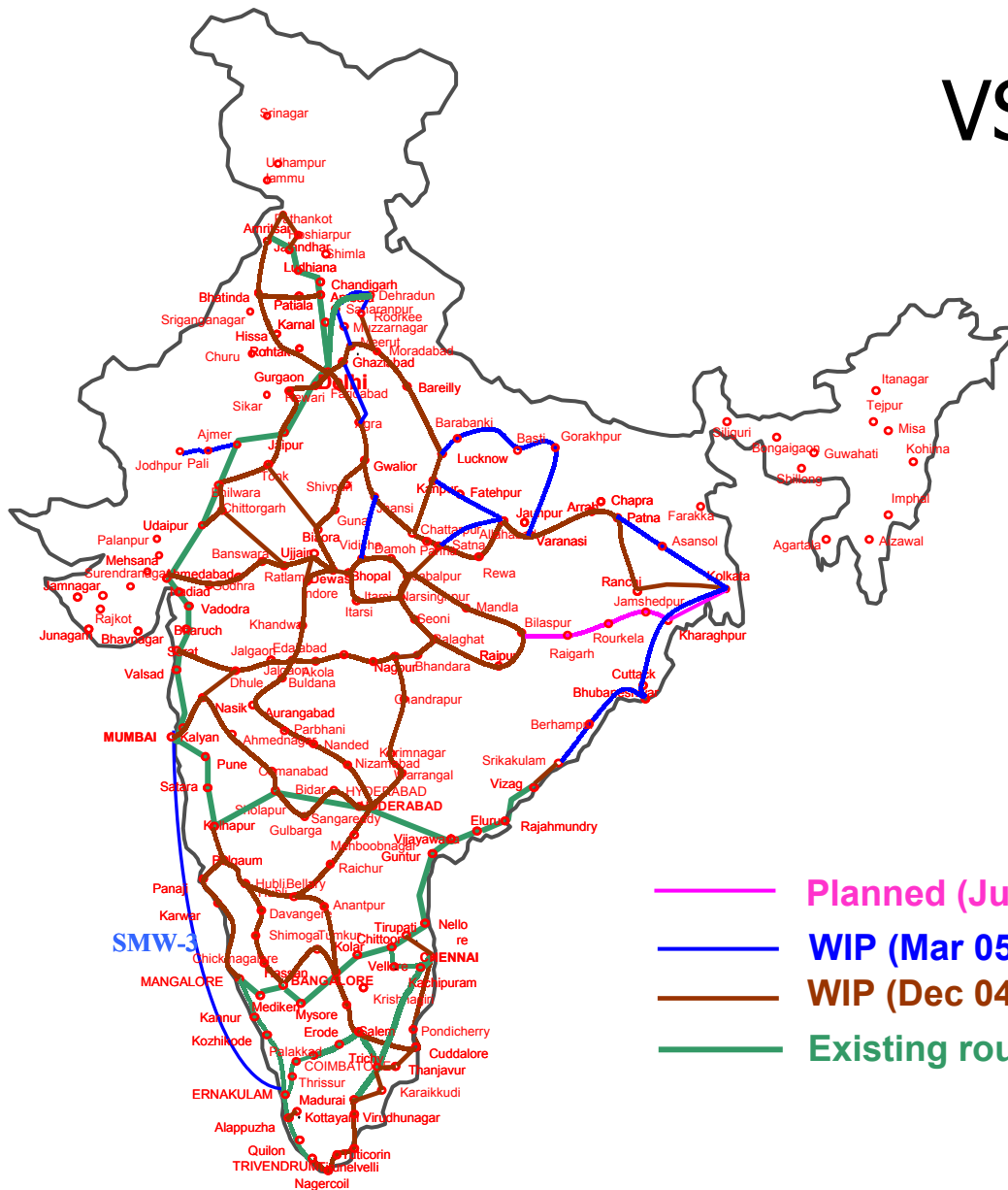
DEPARTMENT OF TELECOM TRANSMISSION NETWORK 140 MB/S & HIGHER SYSTEMS (AS ON 31:03:1998)



India has a fibre 10 km from almost any village except in 85% areas



VSNL/TTSL Network Coverage



- BSNL has fibre going to most taluka (county) headquarters
- Reliance, Bharati and Tata laying fibre feverishly

INDIA

DWDM NETWORK

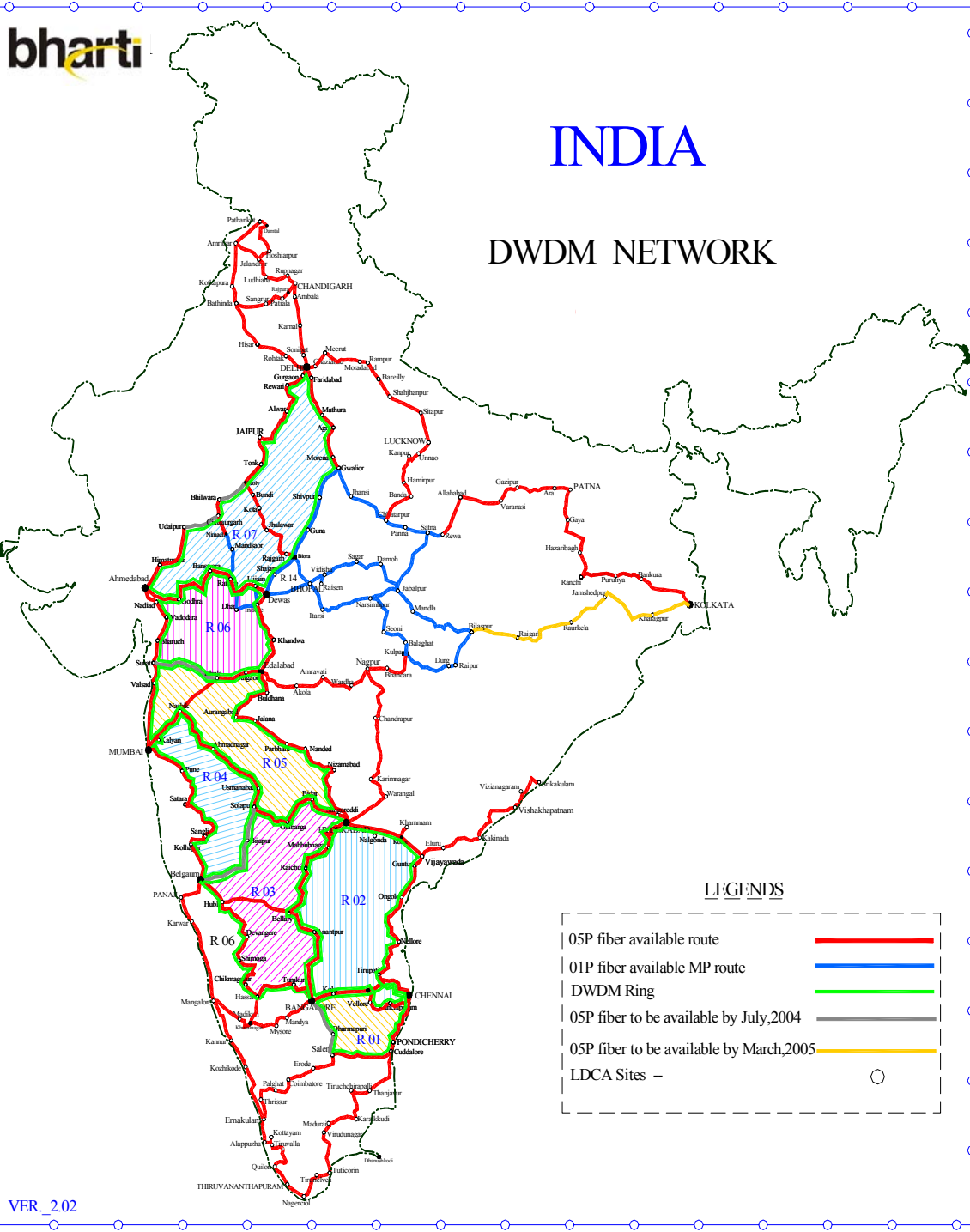
- Technology

- WDM Network

- mostly obtained from Lucent, Alcatel, Nortel
- Huawei, ZTE knocking at doors

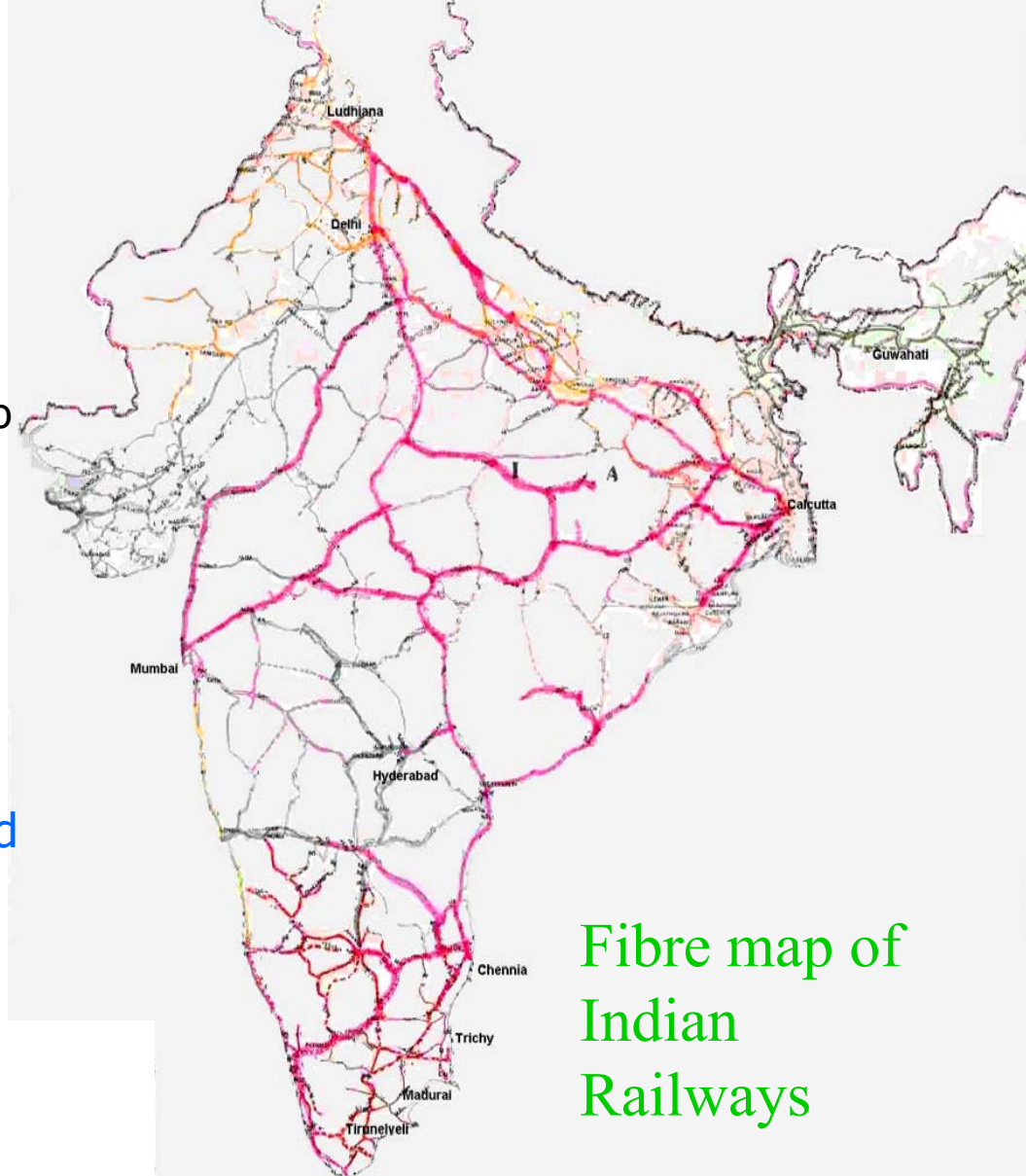
- SDH Network

- Huawei, UTStarcom, ZTE, Tejas Network dominate
- Chinese and Indian cost-effective technologies





- Fibre has already helped in reducing costs
 - Cost of **Backbone Network falling rapidly** primarily due to enormous fibre bandwidth and continuous lowering of costs
- Fibre backbone is being built rapidly in India
 - **20 Km x 20 Km fibre grid** throughout India and
 - **1 Km x 1 Km (or even finer)** grid in urban areas



Fibre map of
Indian
Railways



But while backbone cost reduces

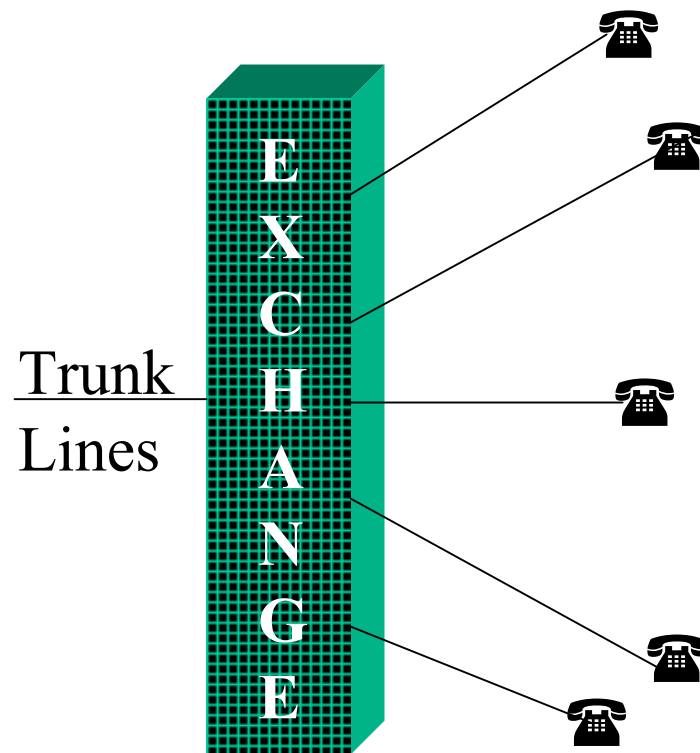
- Increase in Access Costs negates this fall
 - Access costs in urban areas dominates costs
 - Access costs in rural areas much higher
- ⇒ Can Fibre help reduce Access cost?



Evolution

- Early 80's Exchanges

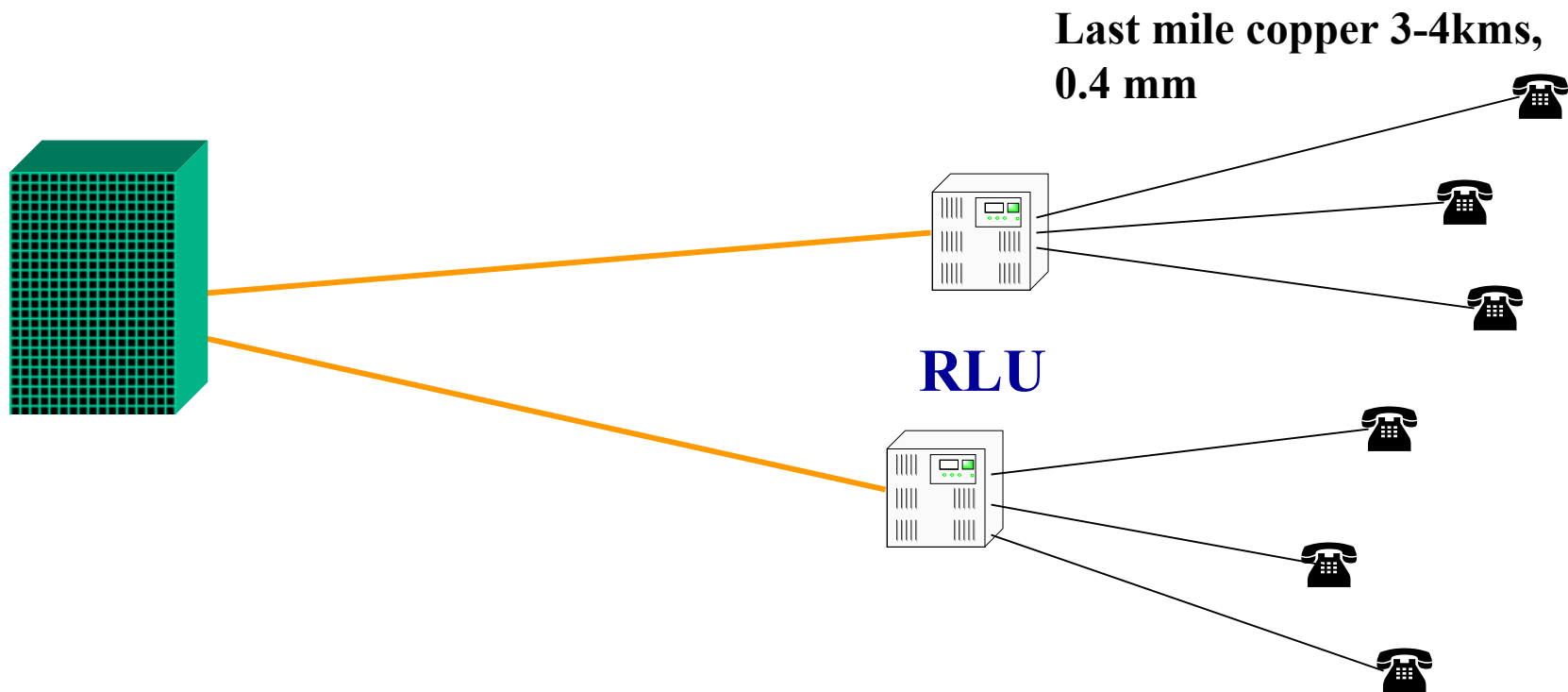
- with long copper...6-8 kms
- Expensive
- Time consuming to deploy
- Difficult to maintain





Evolution

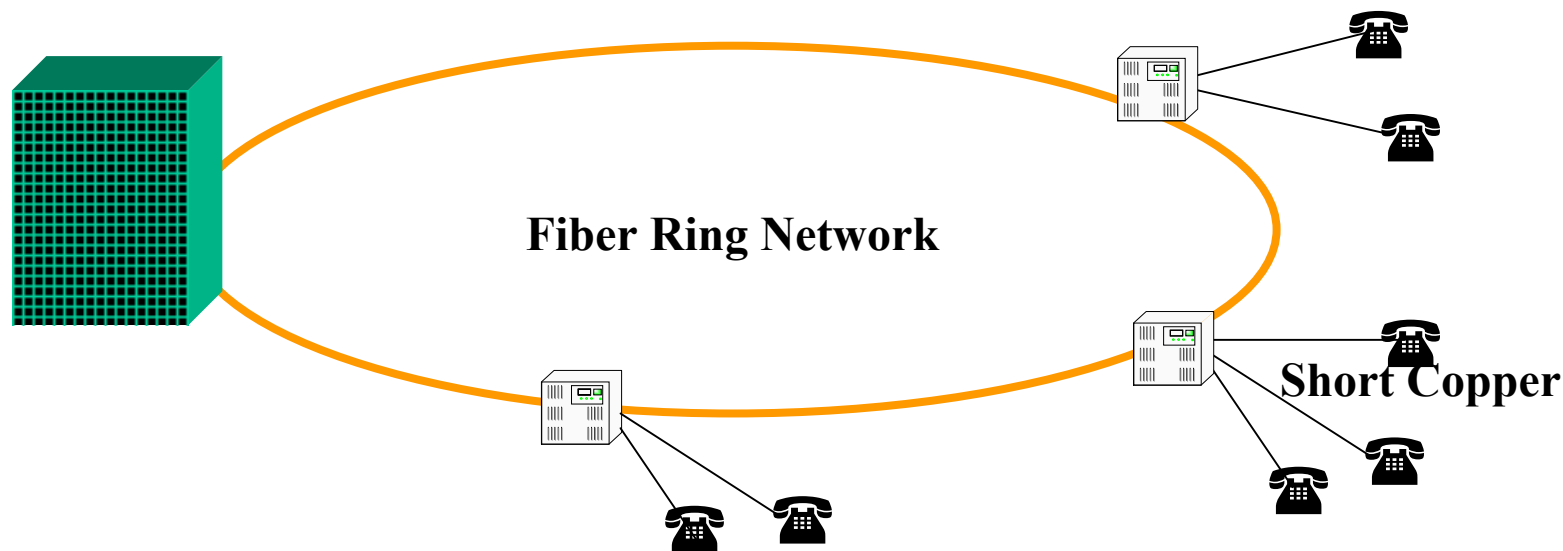
Late 80's RLU





Late 90's DLCs

Evolution



- DLC moves Remote Terminals (RT) to street corners serving 480 to 2000 subscribers
 - Subscribers located within a radius of 500 to 800 m on Copper
 - brings cost down substantially
- Not cost effective for serving fewer subscribers

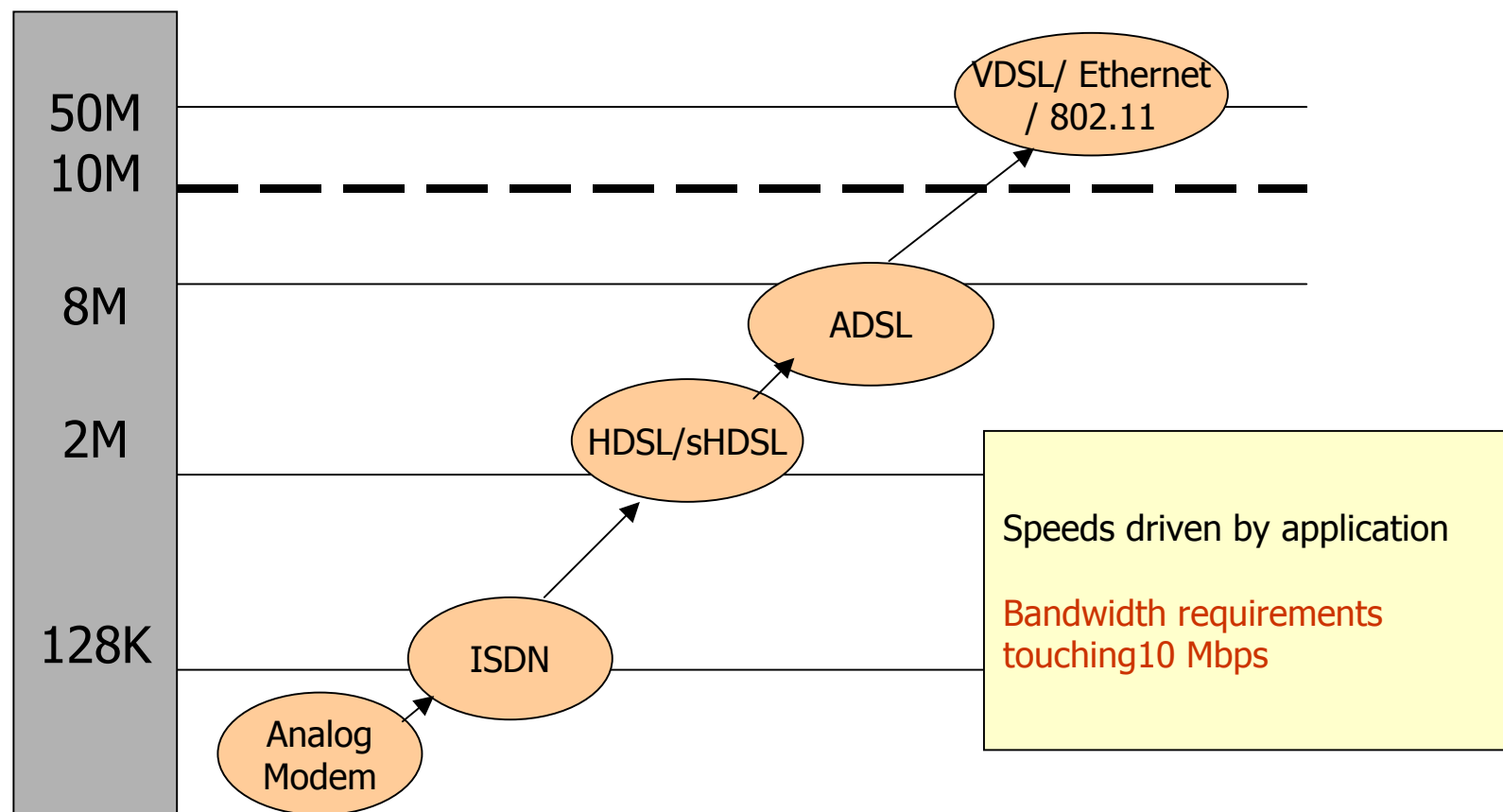


Fiber in the Access

- How deep can the Fiber go?
 - Key drivers
 - Cost of Fiber Termination
 - Line Terminating Electronics
 - Power Backups
 - Depends on
 - Customer Density
 - Affordability

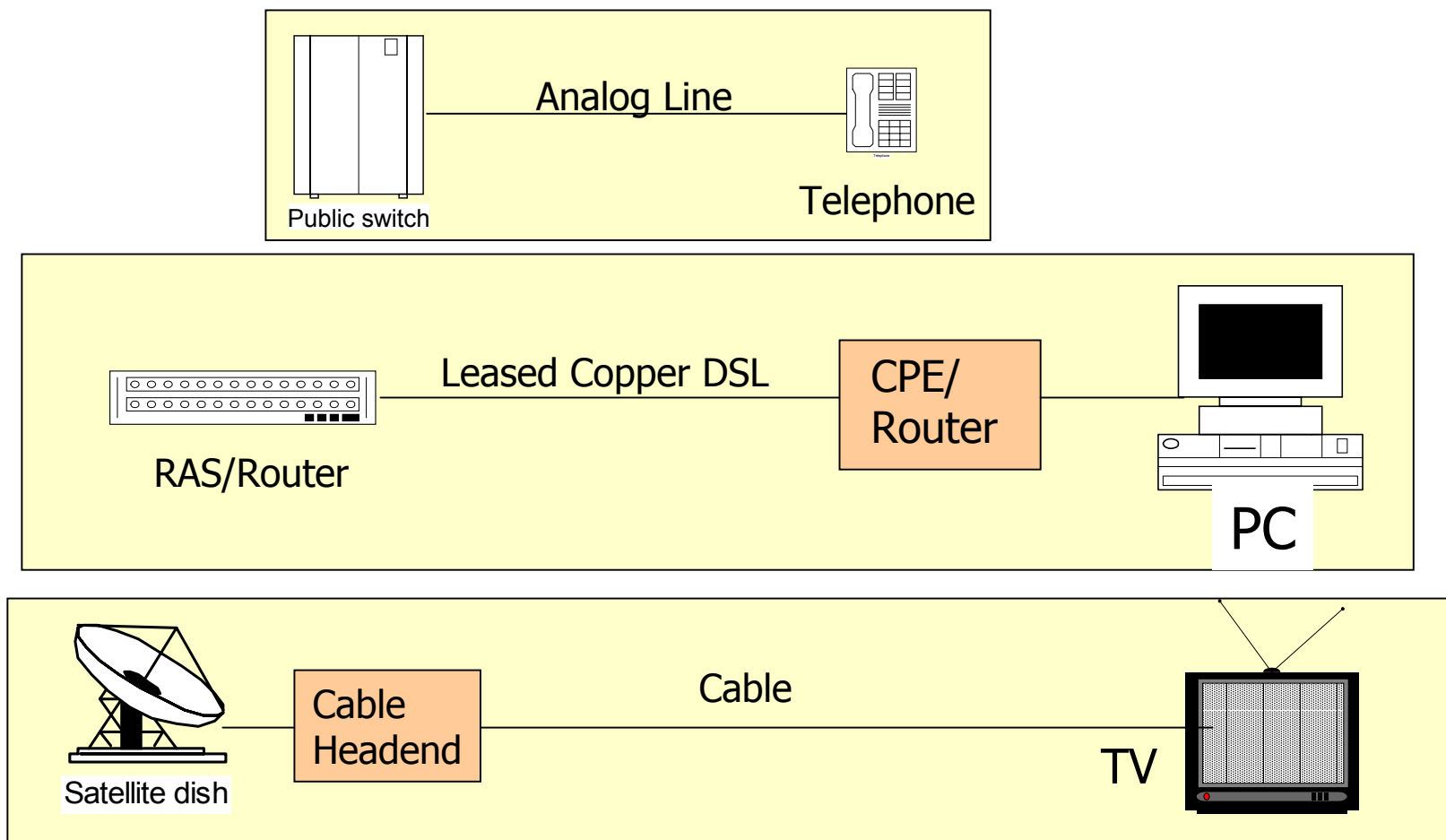


Evolution of Data Access Network on Copper





Separate Networks for Different Services





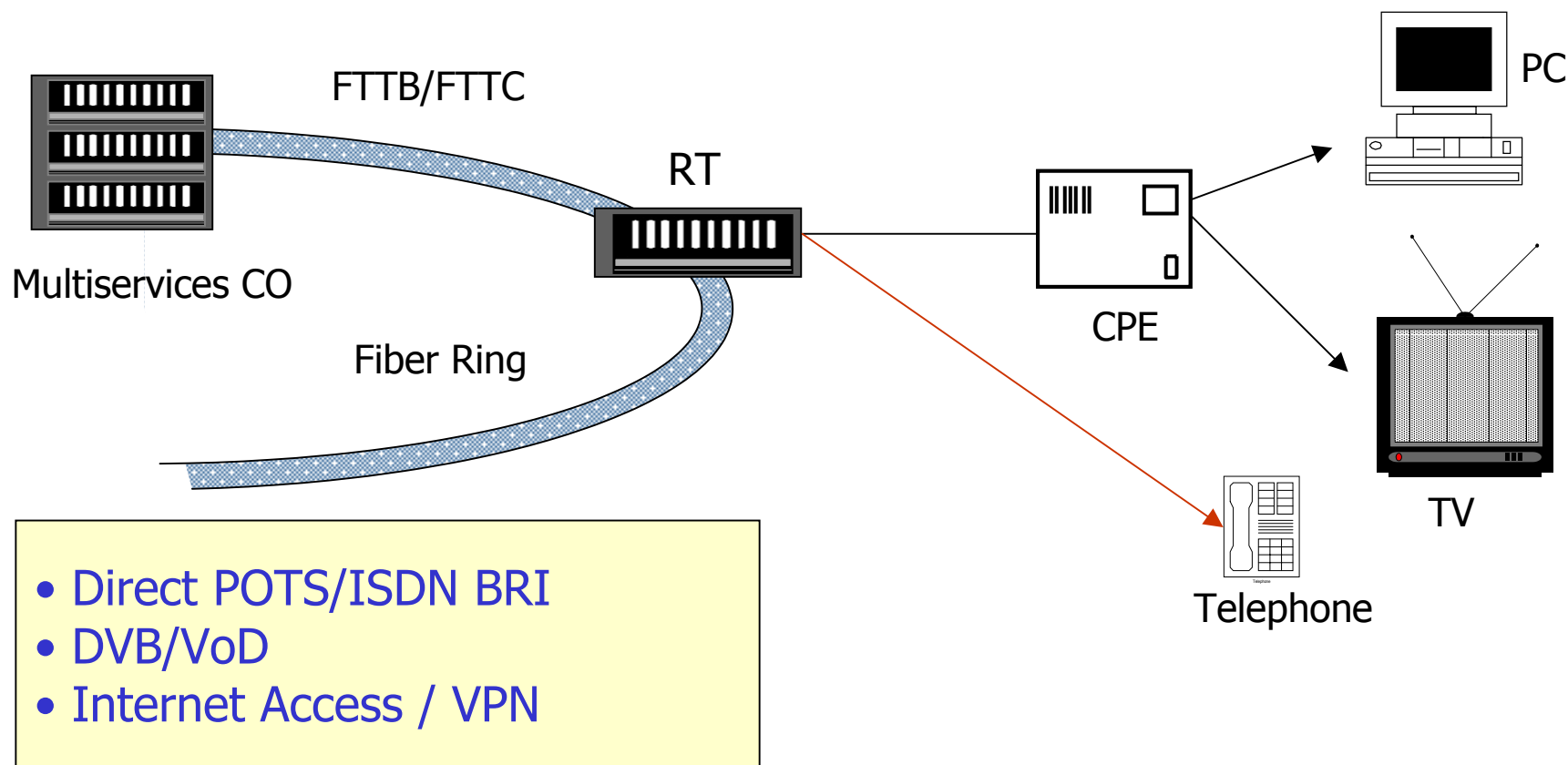
Has Time Come?

- To take **Fibre to the building**
 - to commercial and multi-storied residential buildings
 - reduces copper length and costs
 - **remote terminal must be cost effective** even while serving smaller number of subscribers
- To **integrate** voice, Internet and TV services?

How **few a subscribers** can a fibre remote serve and remain cost effective?

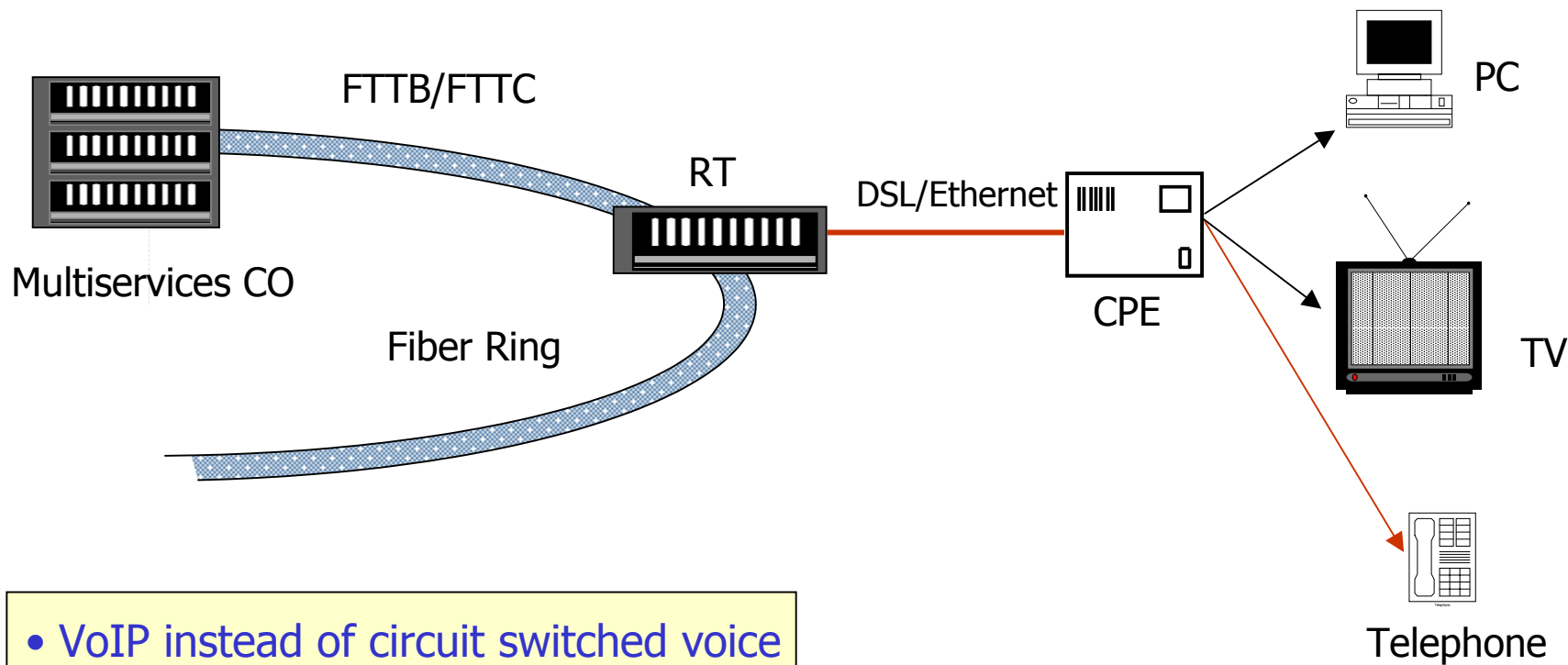


Emerging Integrated Services Network





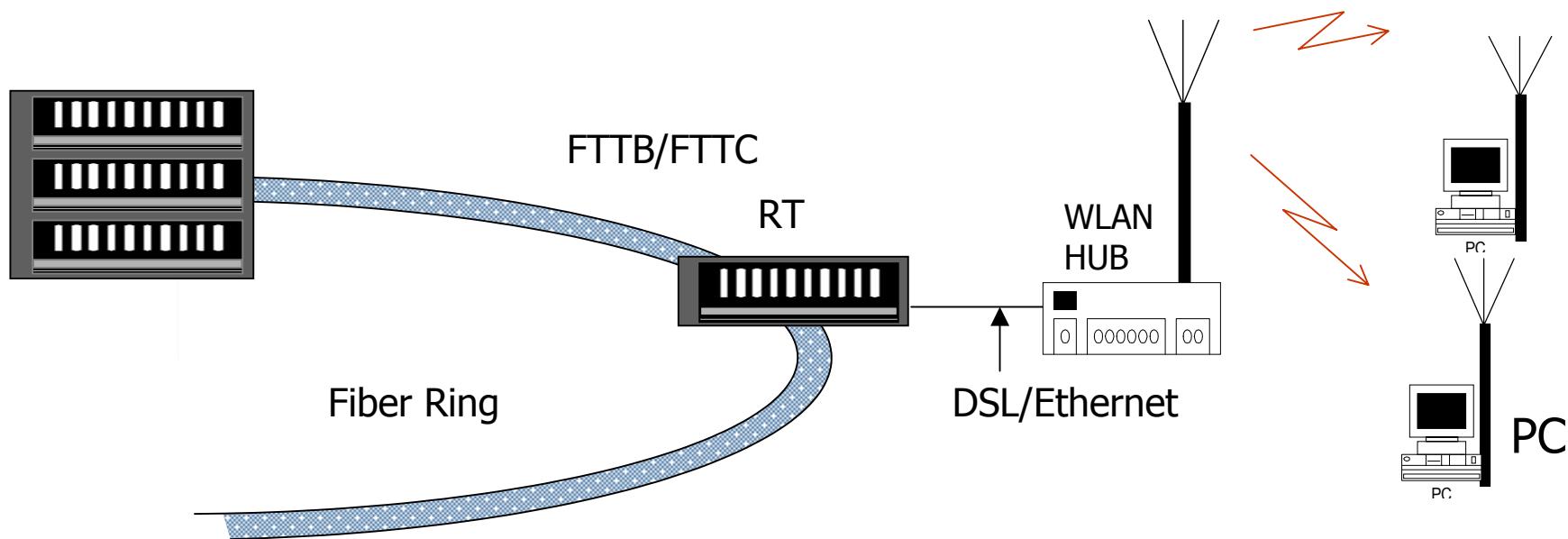
Voice over IP in tomorrow's Network



- VoIP instead of circuit switched voice
- DVB/VoD
- Internet /VPN



Wireless LAN in Last Meters

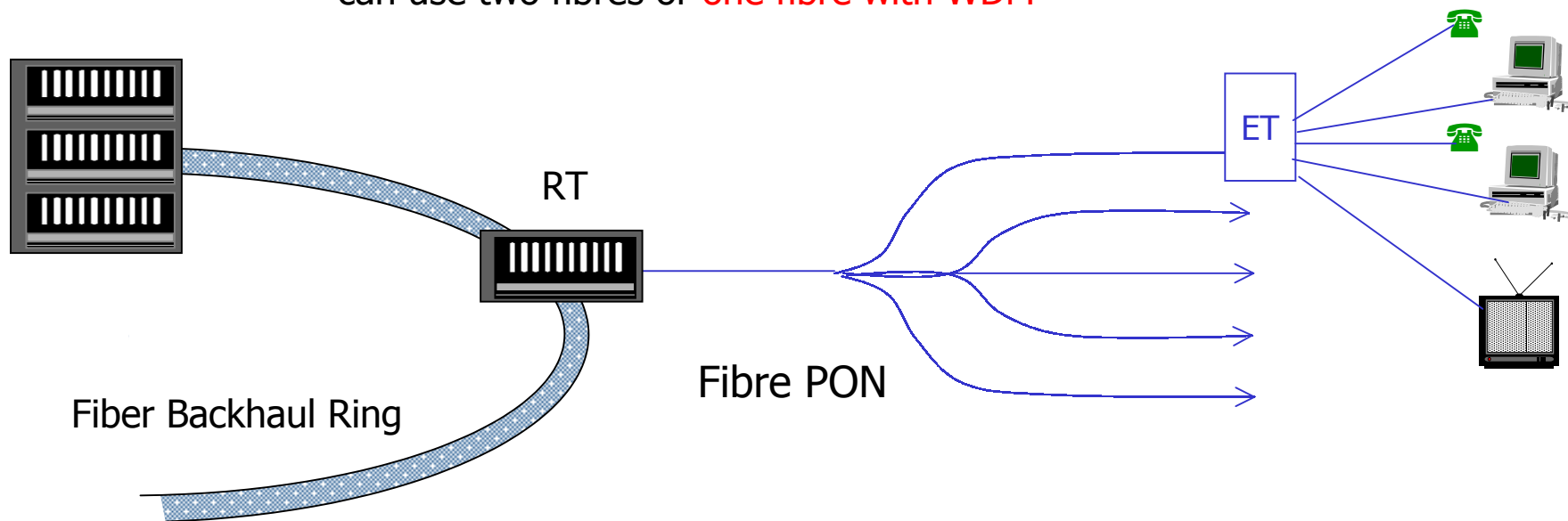


Seamless interface to
Wireless LAN (IEEE802.11)



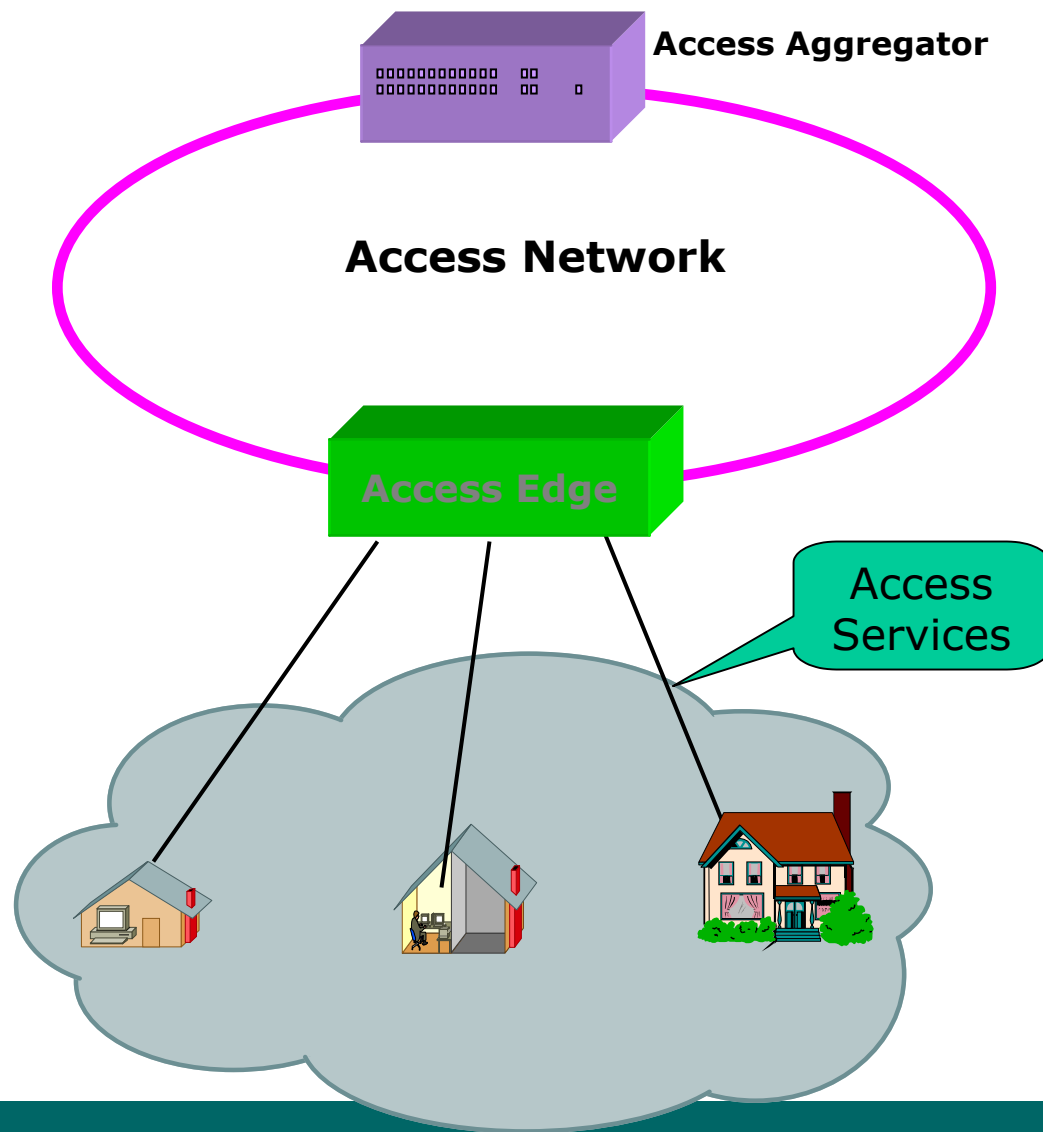
Fibre Passive Optical Network

- can use Fibre PON (100 Mbps Ethernet or STM-1) to connect multiple Enterprise/ Building terminals
 - PON implies ease of addition deletion of node and easier management
 - can also broadcast multiple digitised video stream
 - can use two fibres or **one fibre with WDM**



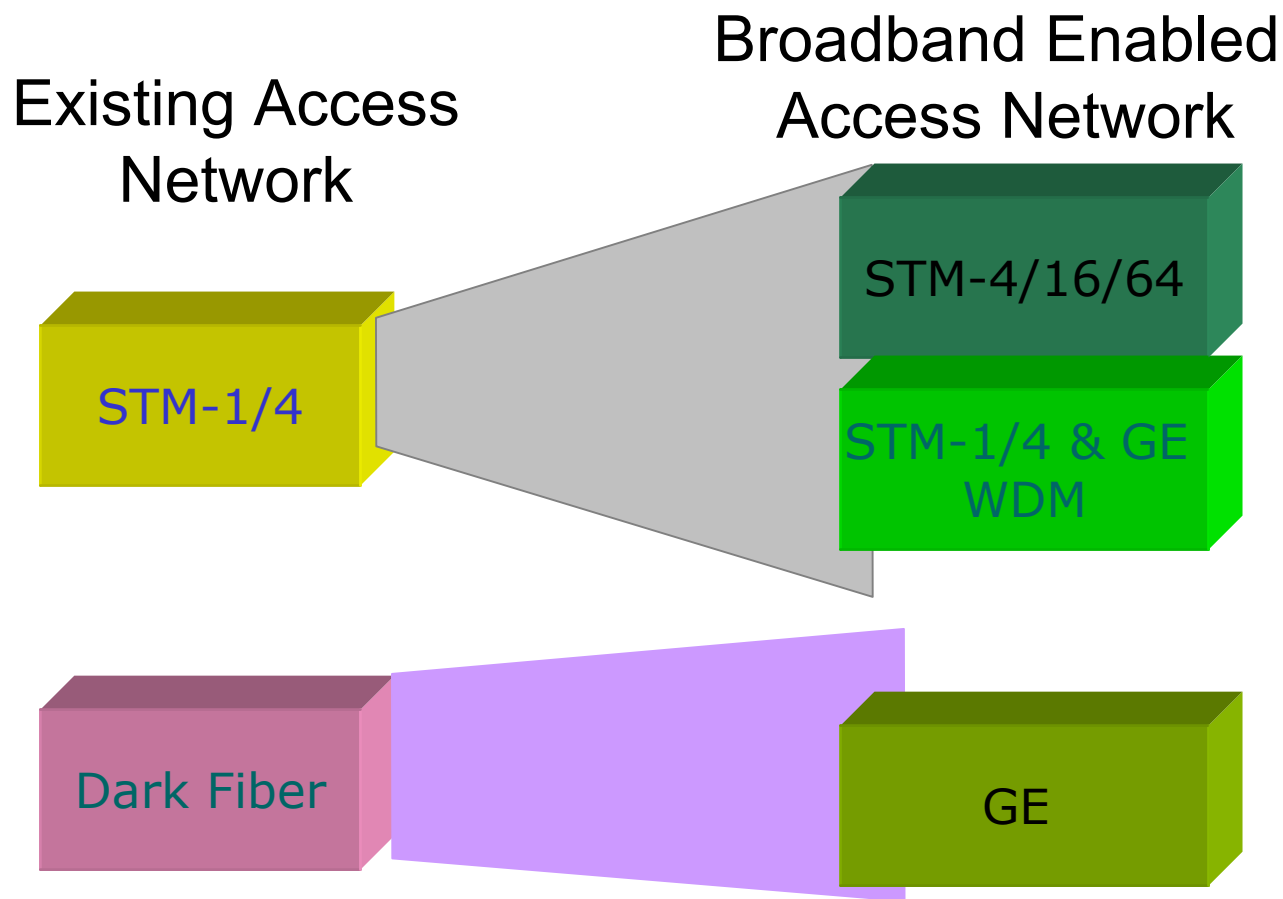


Access Network



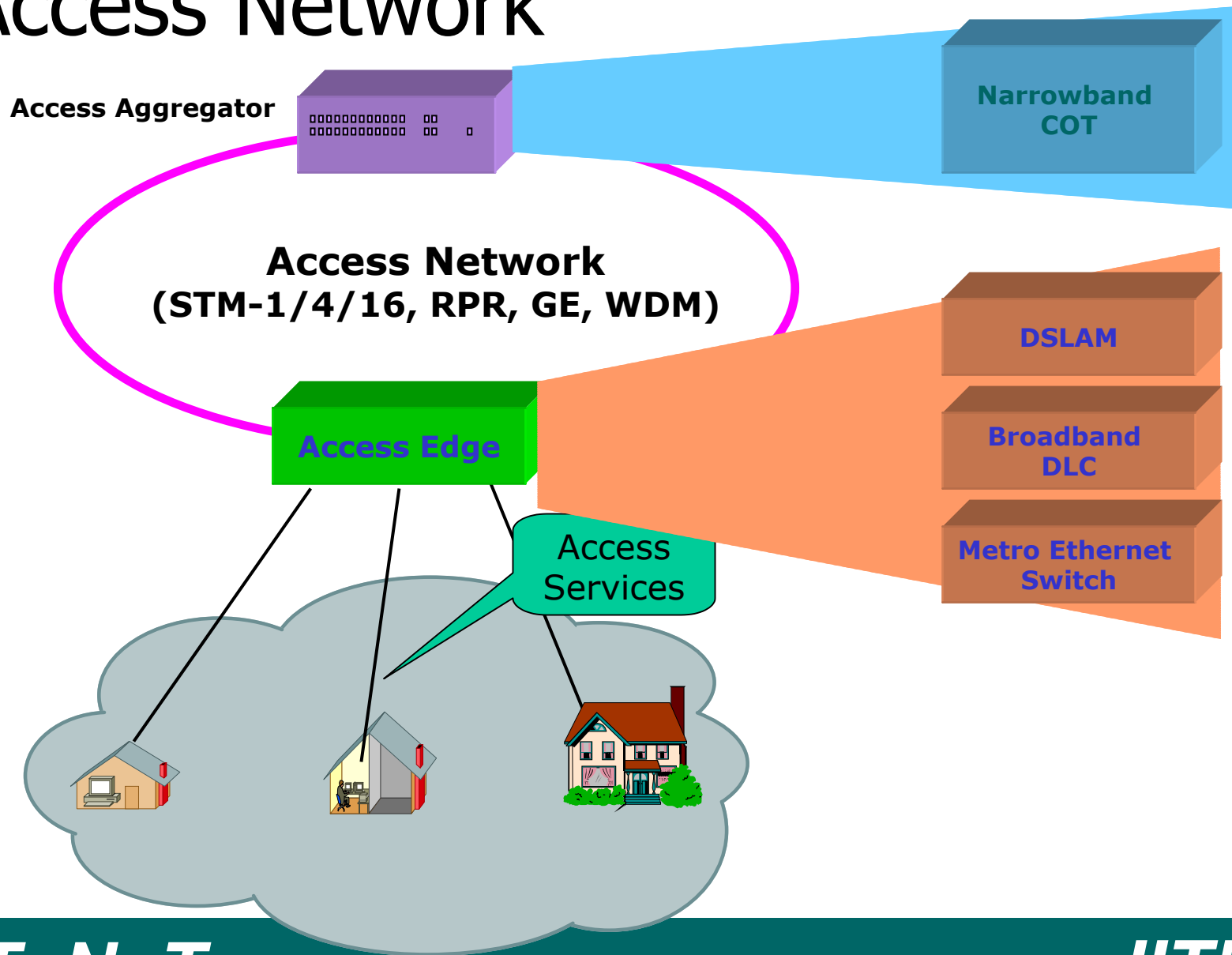


Access Network for Broadband



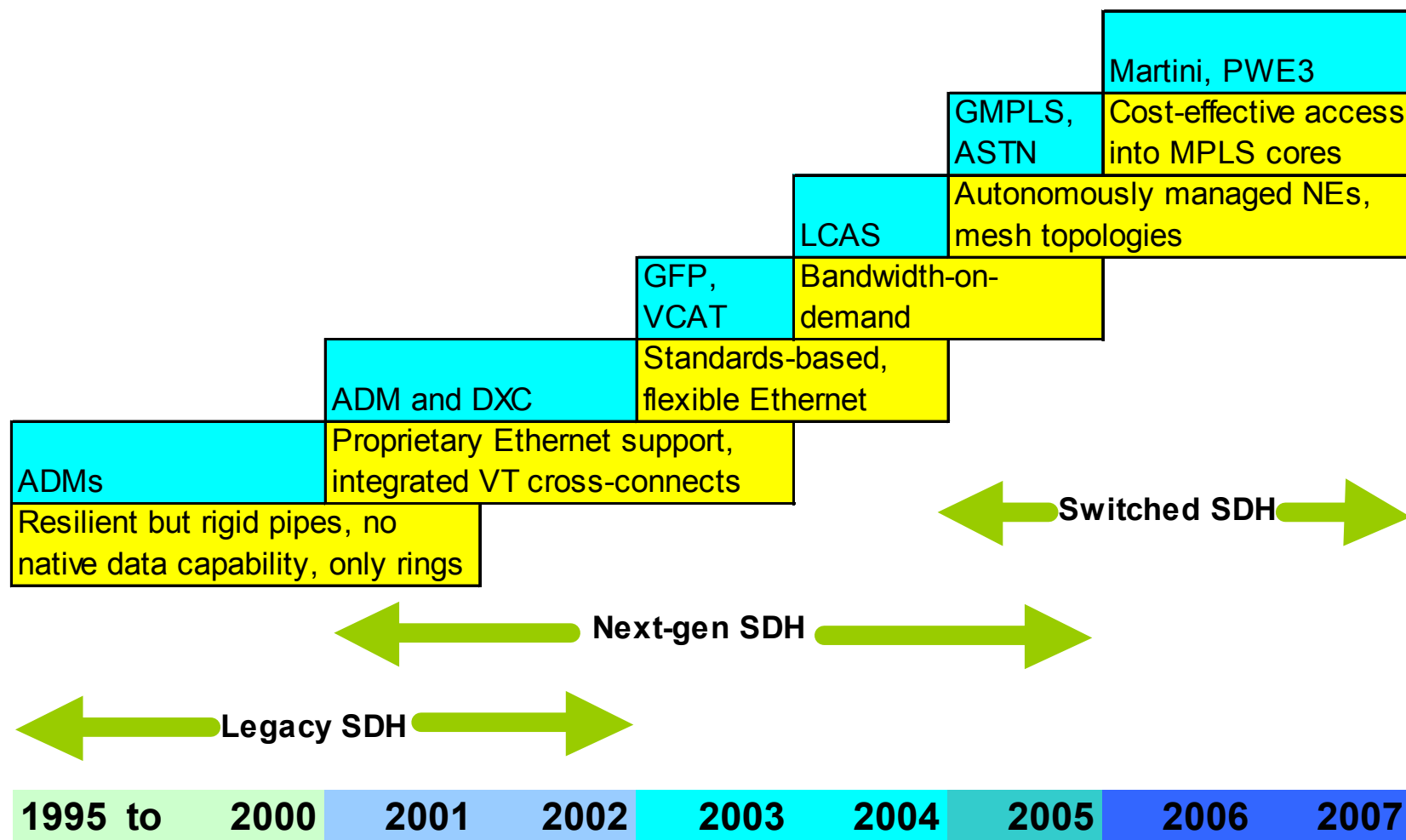


Access Network





Data-Centric Evolution of SONET/SDH





RT-640



RT-256



RT-24

Broadband DLC (BB-DLC)



EMS Management Functions

Broadband Management

System Configuration of Broadband-Switch

- User Provisioning

- Port Configuration

- Switch Protocols Configuration

Fault Management of Broad-Switch

- Port Failure

- Security Violations

- Broadcast, Multicast, unicast Alarms

Accounting Statistics in Broadband-Switch

- Port Level Statistics Collection

- RMON-2 Counters



Time	Node	Card	Entity	Type	Category
Tue Sep 17 11:3...	COT	OWMC	Main Shelf Slot : 11	Card Up	Not Classified
Tue Sep 17 11:3...	COT	OWMC	Main Shelf		
Tue Sep 17 11:3...	COT	OWMC	Main Shelf		

- Sub-network Topology
- Topology view is dynamically updated

Time	Node	Card	Entity	Type	Category
Tue Sep 17 10:2...	COT	OWMC	Main Shelf Slot : 11	Card Up	Not Classified
Tue Sep 17 10:2...	COT	OWMC	Main Shelf Slot : 11	Exp. Shelf#4 : Upside DC-DC Converter ...	Not Classified
Tue Sep 17 10:3...	COT	OWMC	Main Shelf Slot : 11	Main Shelf : Upside DC-DC Converter R...	Not Classified
Tue Sep 17 10:3...	COT	OWMC	Main Shelf Slot : 11	Main Shelf : Upside DC-DC Converter R...	Not Classified
Tue Sep 17 10:3...	COT	OWMC	Main Shelf Slot : 11	Main Shelf : Upside DC-DC Converter R...	Not Classified

- Node shelf view
- Hierarchical access to managed objects
- Fault Information



VICC

Configuration Performance Statistics Maintenance **Fault Management**

E1 #	Status
0	IN SERVICE
1	IN SERVICE
2	IN SERVICE
3	IN SERVICE
4	IN SERVICE
5	OUT OF SERVICE : LOS
6	OUT OF SERVICE : OOF
7	
8	
9	
10	
11	
12	
13	
14	
15	

OK

Fault Management: Port Service status is displayed at an individual basis.

OWMC

Configuration Performance Statistics Maintenance **Fault Management**

Enclosure

Temperature Top 17 deg Centigrade
Middle 18 deg Centigrade
Bottom 18 deg Centigrade

Door Status **Open**

Back Plane Voltages

Input DC Voltage (-48V) 17.5
Backplane Voltage (5V) 19.1
External Ringer Voltage (75V) 25.17

DC-DC Converter

Shelf

Main Upper Present **Functional**
Main Lower Absent

Exp. 1 Absent
Exp. 2 Absent
Exp. 3 Absent
Exp. 4 Absent
Exp. 5 Absent

Battery Status Absent

PSDU Status

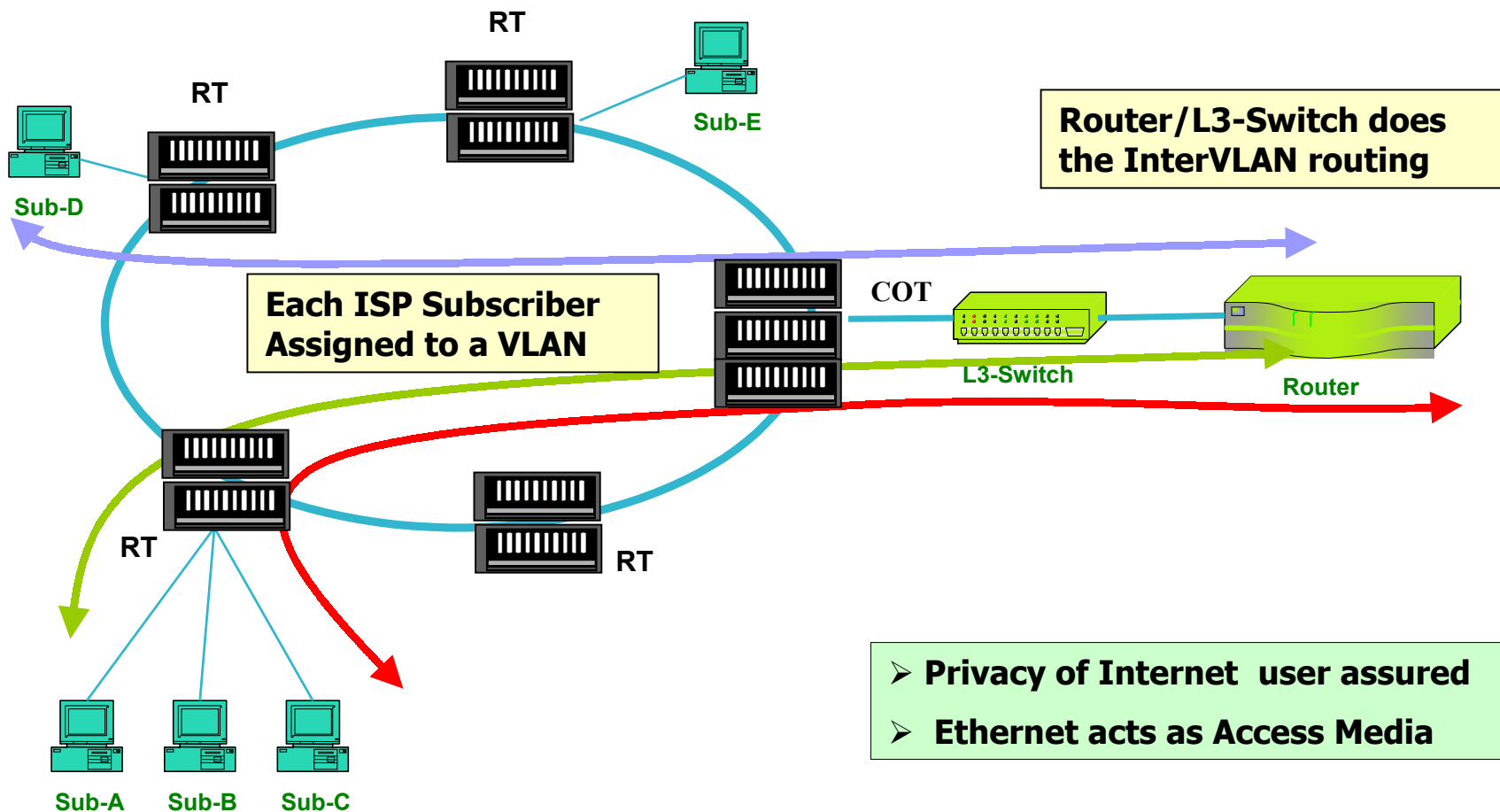
Source	Main Shelf	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5
5 V	Normal	Failure	Failure	Failure	Failure	Failure
75V	Normal	Failure	Failure	Failure	Failure	Failure
VBAT	Normal	Failure	Failure	Failure	Failure	Failure
-48V	Normal	Failure	Failure	Failure	Failure	Failure

OK CANCEL

Fault Management: Enclosure Status: Temperature, Door ,Rectifier

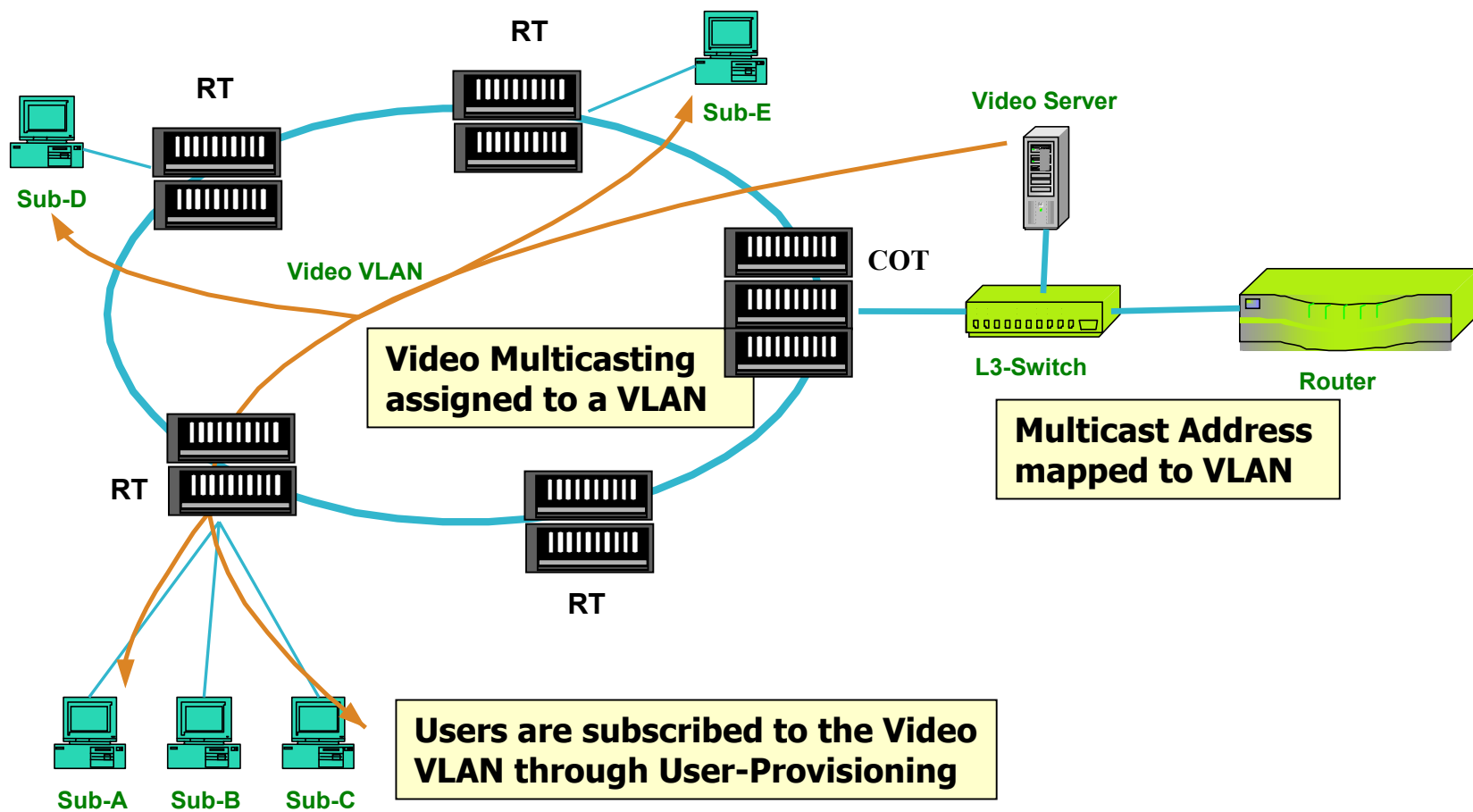


Internet Service (Dedicated VLAN)





Video Streaming over MAN





Business case

- How deep fibre can go in dense urban areas?
 - 200 sq.meter dwelling area, 2 homes per dwelling area, 10,000 homes per sq.km

	Chennai	Madurai	Erode
Dense urban area	10km x10km	3km x 3km	1km x 1km
Dense urban homes	1 Million	90,000	10,000
– Dense urban population	75%	35%	12%
– Market share			
• Ethernet @ Rs 500 pm	35%	35%	35%
• DSL @ Rs 800	15%	15%	15%



Business case

	Ethernet	DSL Access
Fiber grid	100m x 100m	500m x 500m
Last Meter	100m	300-500m
No of lines	20 –24	24 – 48
Cost of fiber per line	Rs 1000	Rs 1000
Electronics/CPE	Rs 4000	Rs 6000
Copper	Rs 1000	Rs 2000
Others	Rs 3000	Rs 3000
Total Capex	Rs 9000	Rs 12000
– Market Share	15%	35%
Revenue per year (video, telephony, Internet)	Rs 6000	Rs9600



Trends in Telecom Equipment

- Networks are using two categories of products
 - “Platform” Products:
 - Core network product: upgraded as network grows; higher price
 - Are competitive differentiators within the overall network solution
 - Usually complex technology: Slow technology change: every 10+ years
 - Example: DWDM equipment, Large optical switches
 - “Point” Products:
 - Access/edge network product: essential building block of overall network solution
 - Price sensitiv;; need variants to address different price/features
 - Fast technology change: every 5 years
 - Example: STM-1/4 SDH equipment, Access Routers
- Today’s Platform products → Point Products in future
 - STM-16 is a Platform Product today, will be Point Product in the next 2 years





Equipment Vendors are re-aligning their Business model

- North America/European vendors re-aligning business models
 - major cuts in R&D: stiff competition from price-driven Chinese vendors
 - Leveraging operator relationships: end-to-end supplier of products and services
- Focusing R&D on Platform Products, while de-funding Point Products
 - Platform products: major competitive advantage through differentiated tech
 - Can not profitably develop next-generation Point products, to address the advances in standards/technology as well as price pressures
- Looking for OEM relationships to for competitive Point Products
 - Lack of competitive Point Products hurts core business
- Only Indian and Chinese companies can continue to invest and develop next-generation of Point Products



Opportunity for India/China

- Develop leading-edge, price-competitive Point Products
 - next-gen SDH/SONET Point Products (STM-1/4/16)
 - Drive strong differentiation through advanced networking software
- Gain major global market share in select Point Product segments
 - Form OEM relationships with multiple, global equipment vendors
 - Focus only on Point Products
 - Not competing with OEM customers who are end-to-end suppliers
 - Win dominant share of the fast-growing Indian telecom market
 - India will be one of the top-3 telecom markets in the next few years



To Sum Up

- Fibre has played a great role in making telecom and Internet affordable in India
 - will continue to play the primary role tomorrow in making the network more affordable
 - Focus will be on
 - Access Network
 - Integrating voice, Internet and TV networks
 - Backbone network

Innovation in Point Products may make larger impact in India
must start investing in WDM, all Optical Network and Optical Switching