Emerging Trends in Broadband Technologies – Next Generation Access (NGA)

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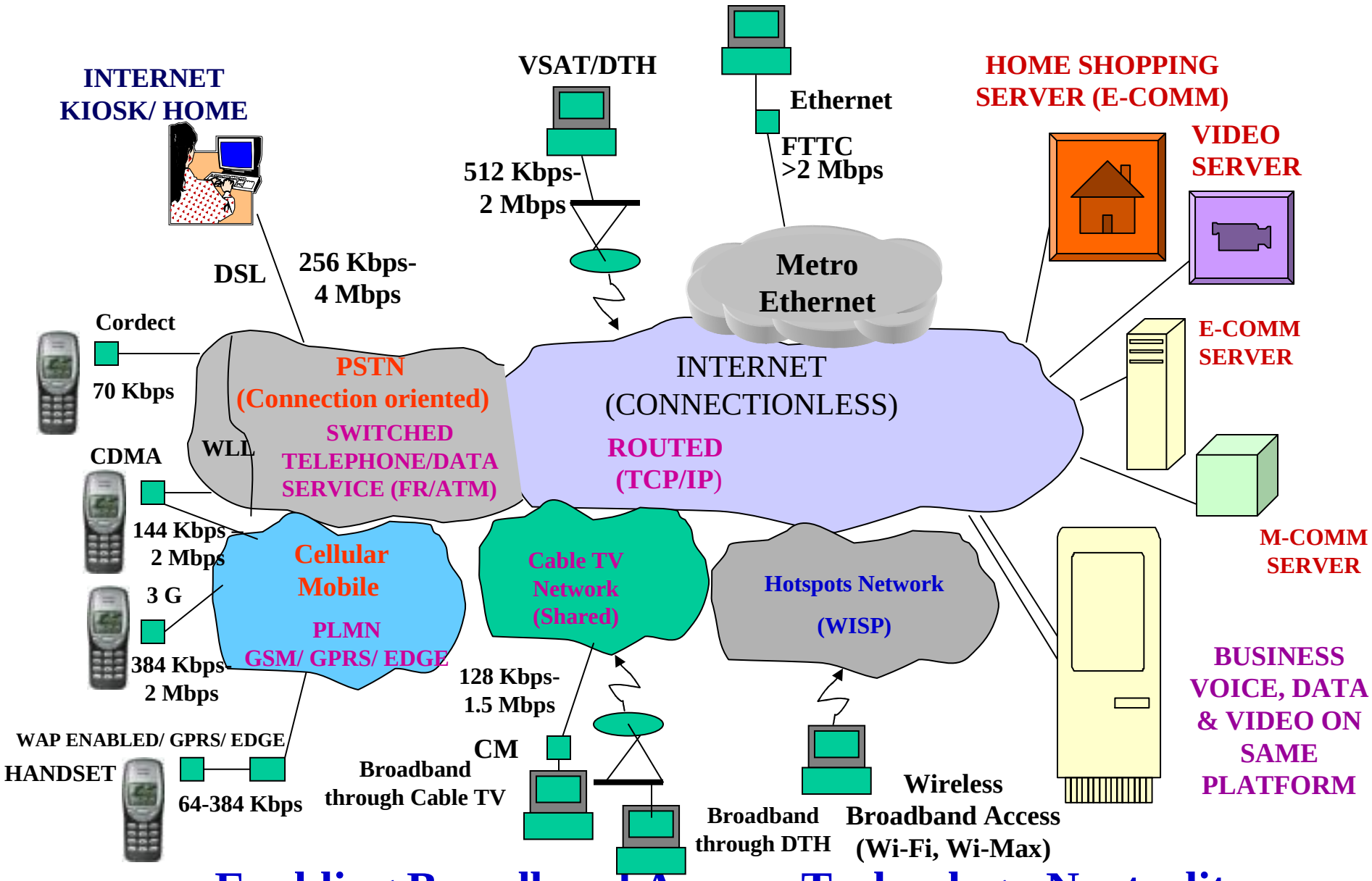
AGENDA

- Emerging Technological Developments – Emergence of Next Generation Access
- Telecom deregulation – Technology-neutrality, Forbearance, Infrastructure sharing, Unified Licensing (4 Pillars of De-regulation).
- Future of NGA - FTTH
- Next Generation Broadband Converged Network – NGBCN).
- Conclusion.

Technology Development Trends

- **Increased speed and density of Integrated Circuits (Moores Law).**
- **Enhanced Transmission capacities on Optic Fibre Networks and Networking Flexibility(Gilders Law).**
- **Distributed and Open Platform-based Communication Software.**
- **Capacity Growth and new Application Services on Wireless.**
- **Emergence of Next-Generation Networks (IP-based).**
- **Ubiquity of networks through RFID & IPv6 (Next Generation Internet).**



Enabling Broadband Access -Technology-Neutrality

(making use of existing infrastructure & wireless)

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.**
- **Wireless Access Service for Fixed and Mobile communication.**
- **VSAT-based Access in remote areas.**
- **Power line based Access (BPL).**
- **Free Space Optics (FSO).**

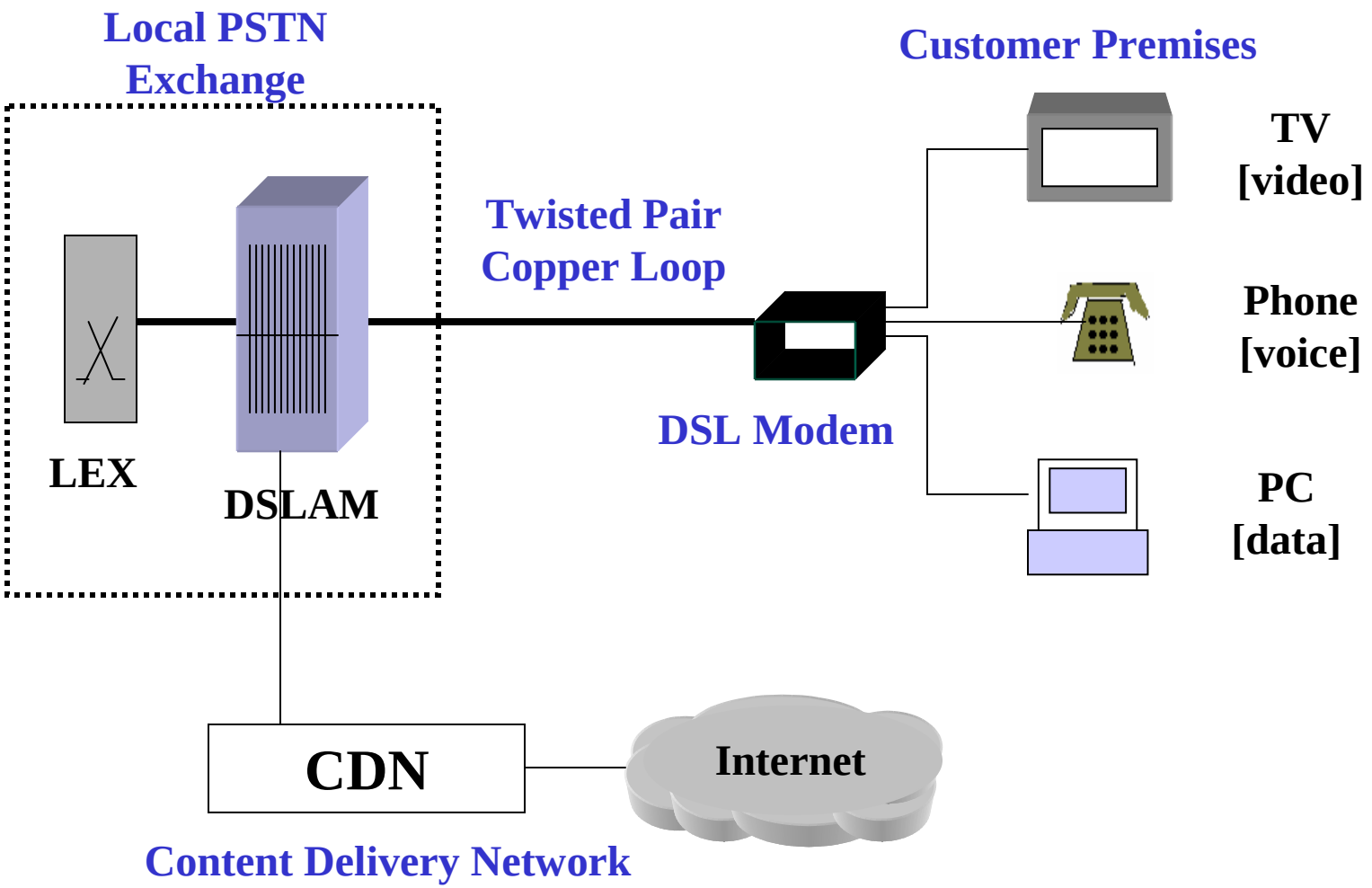
Technology Alternatives for Wireline Broadband

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 – 8/24 Mbps, 1.5 Km**
- **Very high Data Rate DSL (VDSL) – 52 Mbps, 1.5 Km**

Broadband over copper loop (DSL)



2. Cable TV Networks for broadband access

- **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**

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
- –Power over Ethernet (POE)

3. Mobile Technologies Trends

- **GSM, GPRS, CDMA, CorDect, 802.11 (WLAN,Wi-Fi) 802.16(Wimax),PTT,Bluetooth,UWB, 3G- Already Available.**
- **EDGE,,B3G, 802.16e (Mobile WiMAX), OFDM, 802.20 (WWAN,MBWA), All-IP cellular networks- Emerging out.**
- **Human Area Network (HAN) associated with body/ clothing-Becoming a possibility.**
- **Fixed Mobile Convergence(FMC) leading to inter-operability of handsets for any type of access – Quad Mode Multi Band handsets. (WiFi,Wimax, GSM, CDMA)**
- **Software Defined Radios (SDR) – Multi-Functional, Multiservice, Multiprotocol, Multiband, Multimode (Universal) Radios.**
- **Cognitive Radio (CR)**

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	VAN
Bluetooth(802.15.1	3 Mbps	2.4 G	1-10 mtrs	PAN
Infrared	16 Mbps	Light Wave	1-5 meter	BAN
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

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

Trend Towards Convergence – NGN

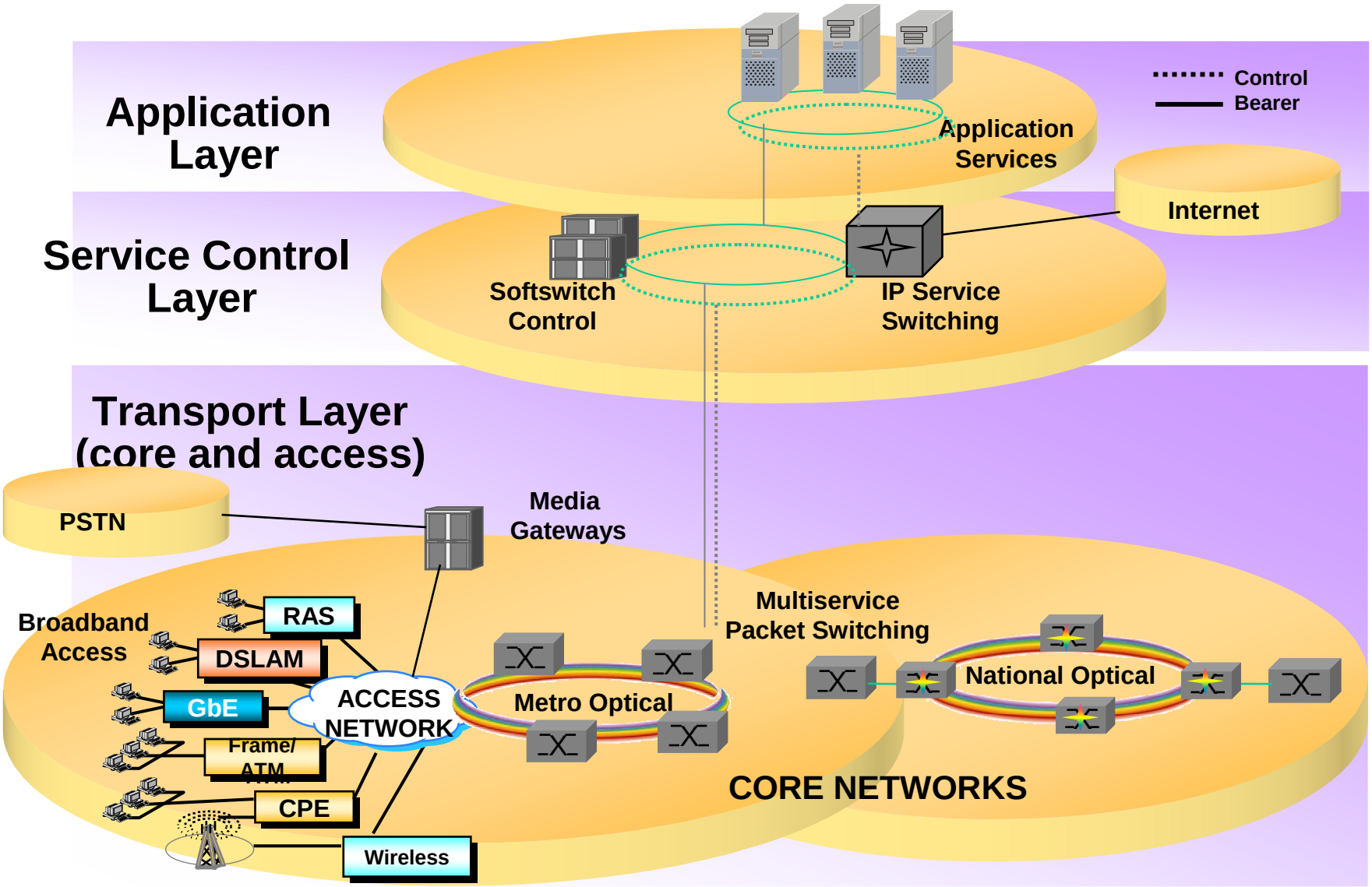
- **Evolving Networks leading to Convergence of Voice, Data & Video services on a common infrastructure resulting into cost saving and performance improvements as well as leading to new avenues for revenue generation.**
- **Convergence of Telecom, Broadcast and Internet leading to Multimedia services.**
- **Evolving NGNs and 21CNs capable of guaranteed QOS and high level of Security, Reliability and Flexibility.**
- **Emergence of single "Information Plug" (Triple-Play).**
- **Customers aspiration – Better, Faster, Cheaper,One Stop Shop, Single Bill.**

What is NGN Ecosystem?

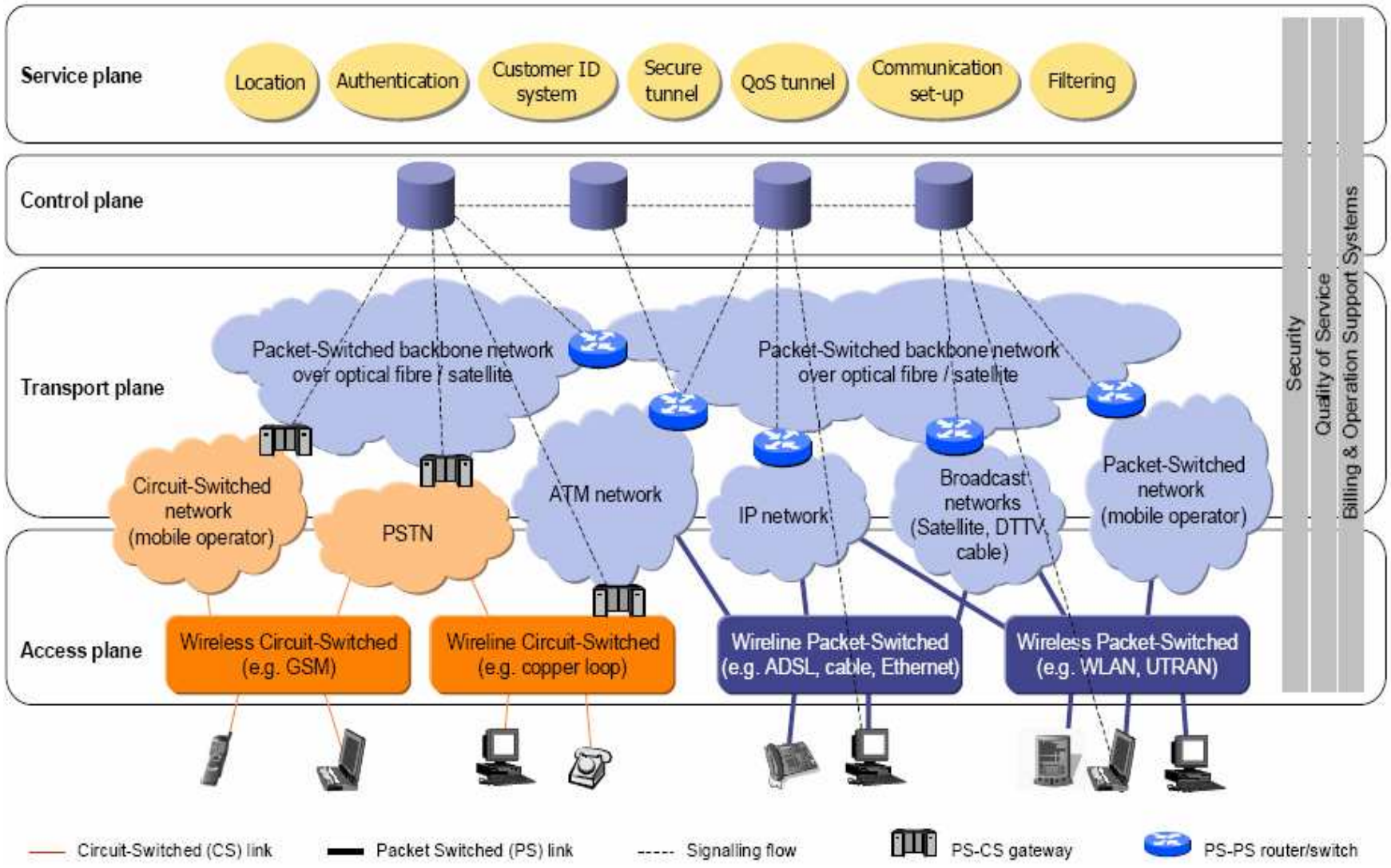
(From Layman's point of view)

- **Next Generation Services – Converged (quad-play-voice, data, video, mobile)**
- **Next Generation Access – High speed (Broadband) IP based connectivity (ADSL,VDSL,Wi-Max,Cable TV, FTTH, BPL)**
- **Next Generation Transport – Carrier Ethernet, IP-MPLS**
- **Next Generation Architecture – Service oriented (SOA), layered (transport, control, application)**
- **Next Generation Mobile – 3G+(B3G)**
- **Next Generation Internet – IPv6**
- **Next Generation Interconnect – Capacity and Quality based**
- **Next Generation Licensing – Unified**
- **Next Generation Regulation - Converged**

NGN – a layered architecture distributing intelligence at every layer



Typical NGN architecture



Emerging Broadband Applications

Voice over IP	**Unified Messaging**	**BB - High Speed Internet**
Primary line	**Content Delivery**	**PC to Phone**
Second line	Games	**Phone to PC**
IP Centrex usage	Downloads (MP3)	**IP VPN (data)**
Voice VPN	Gambling	**BW on-demand**
IP Centrex	**Video on demand**	**QOS on demand**
Basic	TV on demand	**Quad play**
Advanced	Cinema of the future	**Instant messaging presence management**
Multimedia Conferencing	**Long distance bypass**	**MMS on fixed network**
IPTV		**Location Based Services (LBS)**
		FMC (Fixed Mobile Con.)
Distance learning	Internal	**3G & beyond applications**
Distant arraignment	External	
Remote lab	**IP offload**	

Broadband Services Trends

- **High speed Internet access (death of World-Wide-Wait) – Still the killer application for Broadband in India**
- **Video-On Demand, Interactive TV, IPTV, PPV, Time Shifted TV, Videoconferencing (Multimedia over Broadband)**
- **Quad Play (data, voice, video,mobility) – One stop solution**
- **IP-VPN (low cost secured connectivity)**
- **VOIP**
- **Interactive Gaming (future killer application)**
- **4 e's (e-Governance, e-Learning, e-Health, e-Commerce)**

Spectrum Utilization Trends

- **Radio Spectrum availability is key to the success of exploitation of new technology trends.**
- **Being a limited resource, new technological evolution and management techniques required for optimum utilization.**
- **Usage of Multi-Layer, Hierarchical structures based on macro, micro and pico cells, Cell splitting, Synchronous Frequency Hopping,Narrowbanding ,etc.**
- **Use of Adaptive, Intelligent Antenna Array and Scattering.**
- **Enhancing the information carrying capacity of radio spectrum by Multi-level Modulation, Compression, AMR Coding, DTX, DSI ,OFDM, etc. to move towards Shannon's Limit.**

Telecom Deregulation-Enabling Broadband

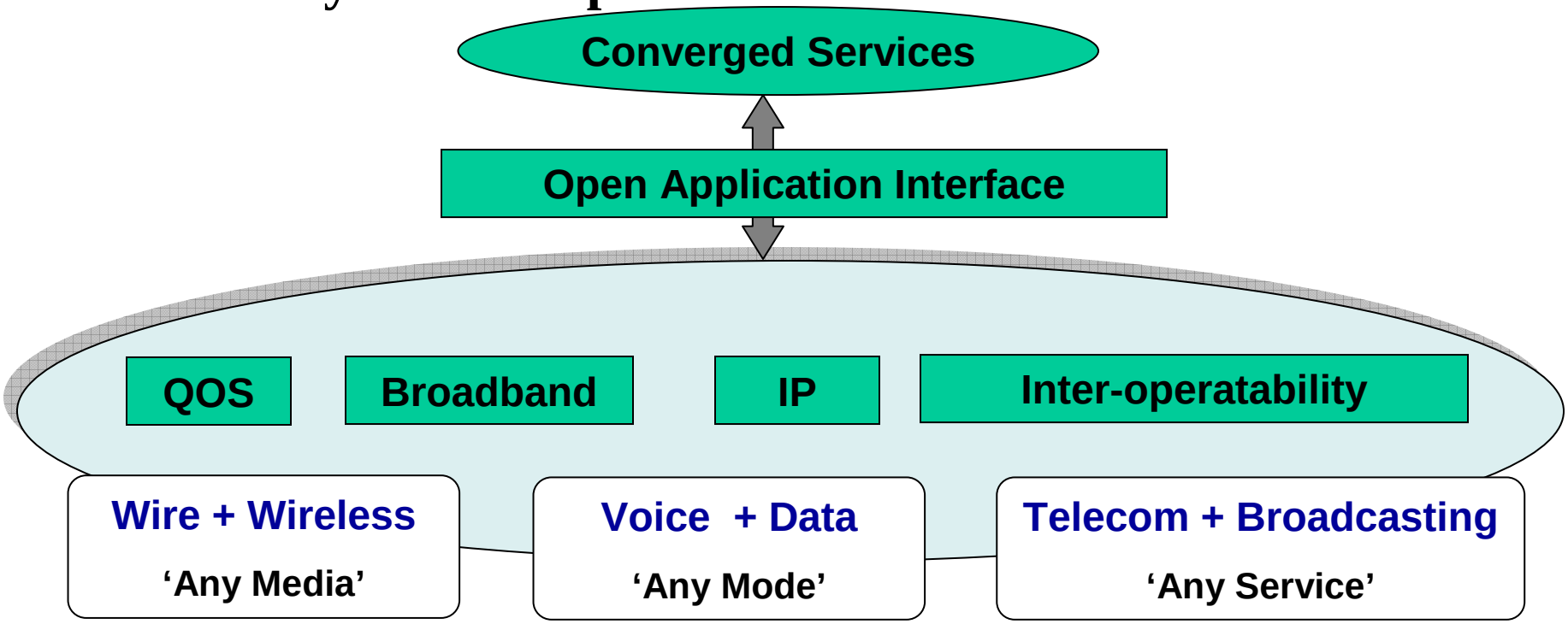
- **Regulatory Regime to be technology-neutral and meet the policy objectives laid down for the country.**
- **Encourage entrepreneurship in regard to development of new application services and also facilitate infrastructure sharing among service providers (co-opetition).**
- **Move towards Unified Licensing/ Authorization Regime to simplify the procedures and removing entry barriers.**
- **Ensure level-playing field and adequate flexibility to operators by forbearance in tariff.**
- **“Hands-off”/ “Light regulation” regime to help tackle the challenges thrown open by the evolving trends in ICT leading to targeted growth in the services and applications.**

Future of NGA – Fiber to the Home (FTTH)

1. Enables superfast broadband applications to customers.
2. Green technology
3. Future proof
4. Enables realtime Convergence, Collaboration and Innovations

14. Next Generation Broadband Converged Network (NG BcN)

“Next generation network(NGN) which provides seamless converged services from Telecom, Internet & Broadcasting infrastructure at any time, anywhere to anywhere, from any device to any device as per the wish of Customer.”



Conclusion-What lies Ahead?

- **Technology**
  - **Usage of Broadband and Wireless will grow exponentialy;**
  - **99% new voice subscribers added to be on wireless;**
  - **VOIP becoming enabling and future- proof option leading to migration to NGA;**
  - **Last mile access issue to vanish by demonopolisation of local loop by alternate technologies and unbundling;**
- **Applications & Services**
  - **Growth of Internet Telephony and Converged services. - Demand for new application services such as IN, Number Portability, e-commerce, e-governance, tele-education, e-health Unified Messaging ,multimedia, LBS,Mobile cash;**
  - **Service control with customers- on demand services**
- **Affordability**
  - **Inexpensive Customer Premises Equipment and affordable tariff for Converged services;**
- **Converged licensing and markets**
  - **Single information plug and bill for multiple converged services(quad-play).**

THANK YOU

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