ITU-D RDF for Americas
NGN and Broadband, Opportunities and Challenges
(Santo Domingo-25 to 27th Nov.,2009)

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 (Coopers Law).**
- **Emergence of Next-Generation Networks (IP-based)- Delivering QOS for Real time services.**
- **Ubiquity of networks through RFID & IPv6 (Next Generation Internet).**

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).**
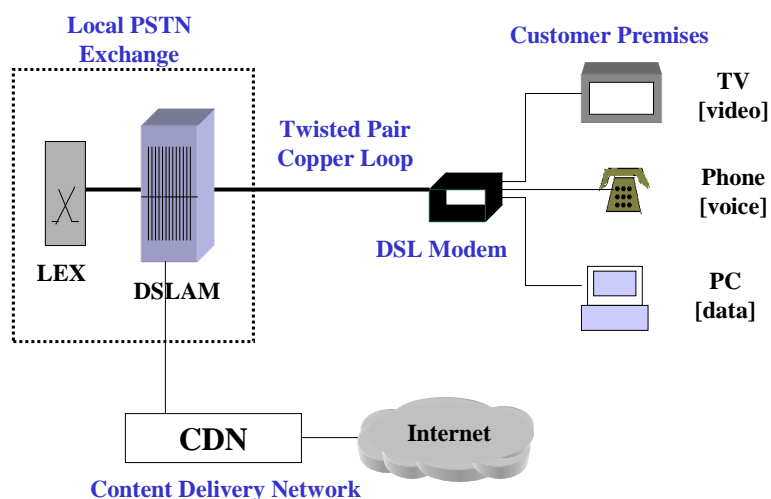- **Free Space Optics (FSO).**

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)

Local PSTN Exchange

Customer Premises

Twisted Pair Copper Loop

DSL Modem

LEX

DSLAM

TV [video]

Phone [voice]

PC [data]

CDN

Internet

Content Delivery Network

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)**
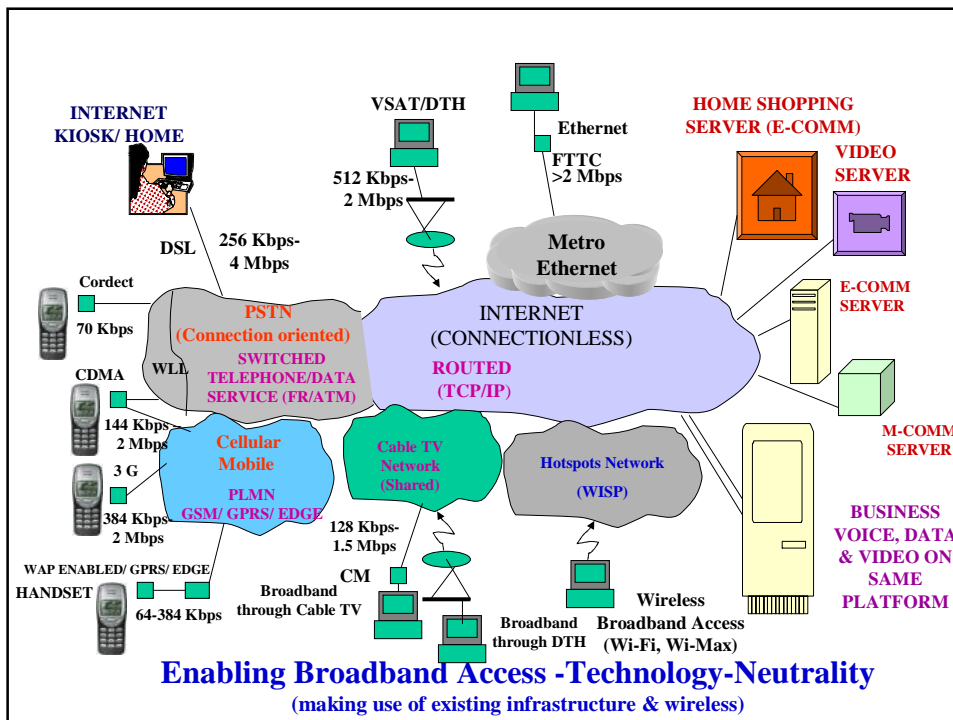
Mobile Technologies Trends

- **GSM, GPRS, CDMA, CorDect, 802.11 (WLAN,Wi-Fi) 802.16d(Fixed Wimax),PTT,Bluetooth,UWB, 3G- Already Available.**
- **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)/Intelligent Radio**

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 (IMT and Advanced)

	UMTS (3G)	HSDPA	EVDO (3G)	802.16 a/d	802.16e	802.16m
Bandwidth	5 MHz	5 MHz	1.25 MHz	1.25-20 MHz	1.25-20	5-20 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	2.4 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	1.2 bps/Hz
Flat IP Support	No	No	No	Yes	Yes	Yes
Mobility	Full	Full	Full	Fixed	Limited	Full

Enabling Broadband Access -Technology-Neutrality
(making use of existing infrastructure & wireless)

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
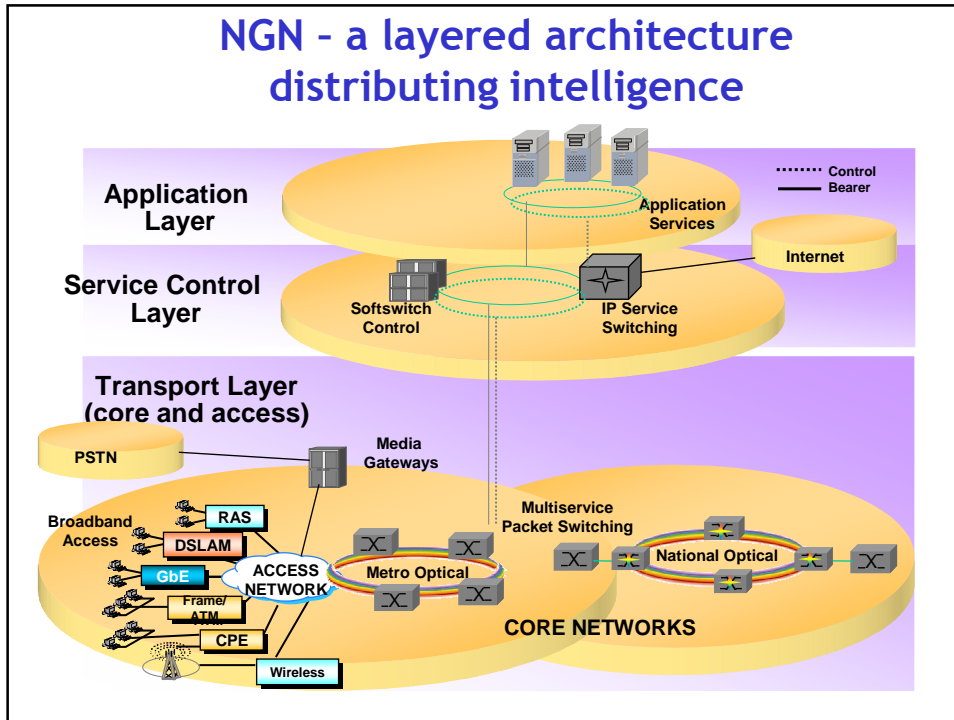
Typical NGN architecture
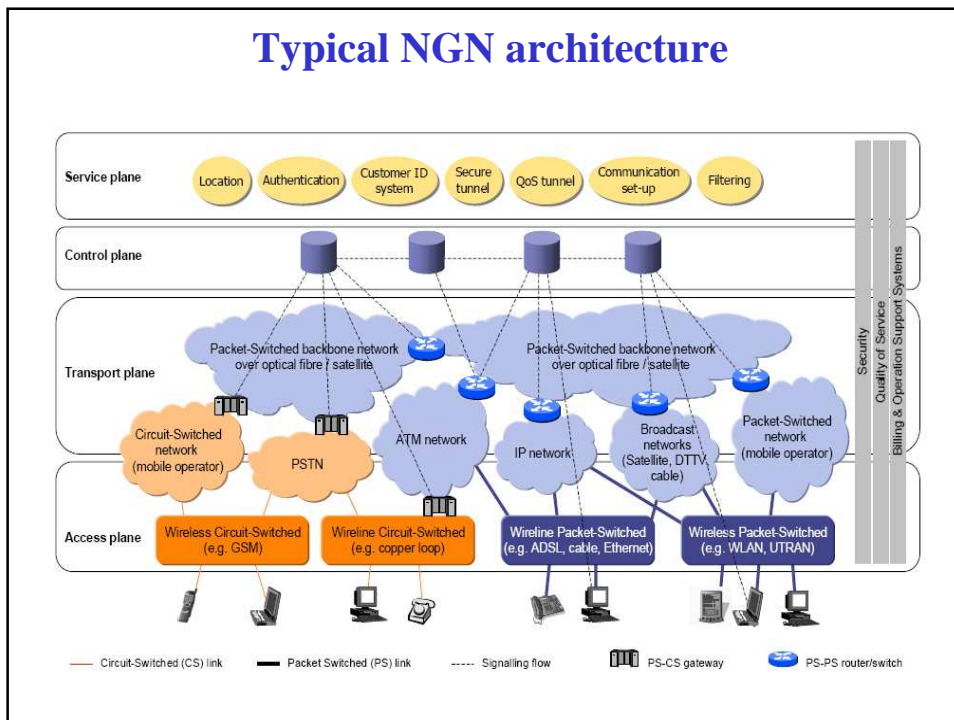
Broadband Services Trends

- **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)**

Emerging Broadband Applications- EOIP

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 IPTV	**Long distance bypass** **Telepresence**	MMS on fixed network Location Based Services (LBS)
		FMC (Fixed Mobile Con.)
Distance learning	Internal	3G & beyond applications
Distant arraignment	External	
Remote lab	IP offload	

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 Micro , Pico and Femto cells, Cell splitting, Synchronous Frequency Hopping, Narrowbanding ,etc.**
- **Use of Adaptive, Intelligent Antenna Array , OFDM and Scattering.**
- **Enhancing the information carrying capacity of radio spectrum by Multi-level Modulation, MIMO, 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.**
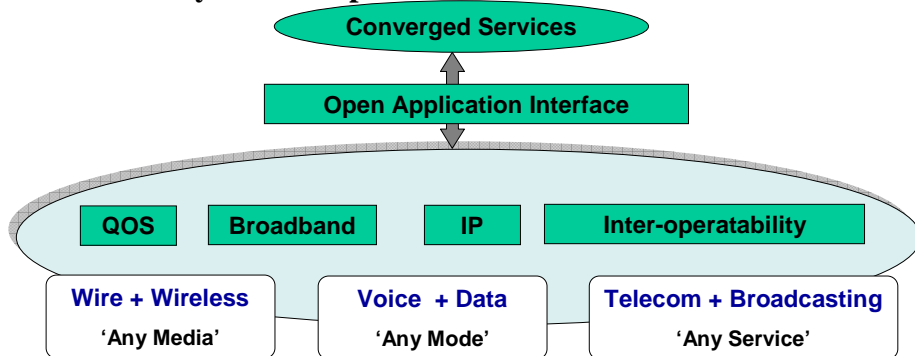
Technologies for Next Generation Access (NGA)

	Now	ADSL2+	FTTC (+VDSL)	FTTP (All homes)
Downstream Headline	8 Mbit/s	24 Mbit/s	40 Mbit/s	100 Mbit/s
Downstream Typical	5 Mbit/s	10 Mbit/s	20 Mbit/s	50 Mbit/s
Upstream Headline	0.8 Mbit/s	0.8 Mbit/s	10 Mbit/s	30 Mbit/s
Upstream Typical	0.4 Mbit/s	0.4 Mbit/s	5 Mbit/s	15 Mbit/s
Cost of Deployment			£200 → £400/line	~£600/line
Regulatory Impact				Regulatory issues to be resolved

Future of Next Generation Access (NGA) – Fiber to the Home (FTTH)

1. Enables Superfast broadband applications to customers.
2. Green technology
3. Future proof
4. Enables real-time High Definition Multimedia, Convergence, Collaboration and Innovations

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."

Converged Services

Open Application Interface

| QOS | Broadband | IP | Inter-operatability |

| Wire + Wireless | Voice + Data | Telecom + Broadcasting |
| 'Any Media' | 'Any Mode' | 'Any Service' |

THANK YOU

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