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Impacts of Information about the Broadband Technology: Research Challenges and Opportunities

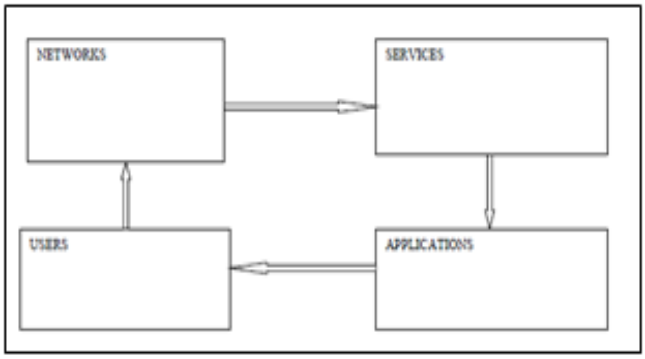
Lekh Raj[1], Sata Nand[2], Manoj Kumar[3], Ravinder Mohan Jindal[4], Leekha Jindal[5]
[1, 2, 3] M. Tech Scholar, Dept. of Computer Science and Application, Ch. Devi Lal University, Sirsa, Haryana, India
[4]Assistant Professor, P.G. Department of Computer Sciences, HMV College, Jalandhar, India
[5]Assistant Professor, P.G. Department of Computer Sciences DAV College, Jalandhar, India

Abstract: The present paper provides the conceptual framework on the Broadband technologies for access networks: digital subscriber line (DSL), hybrid fiber coax (HFC), power line communications (PLC), fiber to the home (FTTH), fiber to the curb (FTTC), fiber to the cabinet (FTTCab), and wireless alternatives such as WiMAX and satellite. The main part of this development and growth has been in the core networks, and the capacity of the access network to delivery broadband services remains as a challenge ("last mile problem"). The access network remains a bottleneck in terms of the bandwidth and service quality it affords the end user. By other side, the access network is much more spread geographically and covers larger areas. Several access technologies can be used in this part of the network, which can be used to resolve the bandwidth bottleneck and the investment problem: xDSL, HFC, FTTx, FWA, WiMAX, PLC, Satellite, etc.

Keywords: DSL, HFC, PLC, FTTH, FTTC. Geographically, Core Network,

I. INTRODUCTION

The requirements for higher access capacities are primarily driven by the increase use of several broadband technology user terminals in the home. The dial-up modem was the primary means of getting online, enabling Internet connection speeds upwards of 56,000 bits per second, or 56 kilobits per second. The number of Internet users, the sophistication of content, and demand for advanced applications increased exponentially in the mid-1990s, highlighting the need for more high-capacity bandwidth to accommodate the rise in network traffic. This demand, along with cheaper network equipment, drove the development and deployment of broadband in the late 1990s. In 1999, broadband was being heralded as an economic and social catalyst, a technology that was poised to "increase our nation's productivity, create jobs and meaningfully improve our educational, social, and health care services."Over the last few years, broadband has replaced the dial-up modem as the primary Internet connection for the vast majority of consumers and businesses because it can deliver robust voice, video, and data services more quickly and reliable. Indeed, only 10 percent of American households still use a dial-up connection while over 55 percent have adopted broadband. Full broadband coverage is highly important for bridging the digital divide. The digital divide expresses the difference in ability for people to communicate and utilize e-based business and services relative to their geographical location, their living standards and their level of education.



II. RESEARCH METHODOLOGY

Why is broadband so momentous

The significance of this technology for the economic health of the country is widely held across the developed world. Hence, the Broadband Stakeholder Group's (BSG, 2001) recommendations to government on the roll-out of the technology to schools were readily received and resulted in a policy to deliver broadband connectivity to all points of learning, with every school having a specified level of connectivity by 2006. The economic imperatives behind the roll-out of broadband technologies in both educational institutions and society as a whole are clearly articulated in the literature. Hugo Parr, Chairman of the OECD ICCP Committee (Organisation for Economic Co-operation and

Development Committee on Information, Communications and Computer Policy), argues that ICT in general is a key driver in economic growth, of which broadband is the most significant current development in our move towards a knowledge economy (cited in OECD, 2003).

- enhancing the learning experience;
- improving co-operation between educational institutions;
- delivering new potentialities, such as delivering real-time satellite images into the classroom;
- improving efficiencies in existing educational provision;
- widening access to education with significant impact on life-long learning.

Broadband technology is proving to be effective in schools, but the impact varies in conjunction with the vision of its user. Provision of high-speed connectivity in itself is not sufficient to ensure the above impacts are achieved. These five areas of impact provide the initial structure for the present discussion of the evidence of the benefits of broadband in education, although it is acknowledged that these five categories are not exhaustive. There is recognition in the literature that for such impacts to occur, the implementation of broadband must be accompanied by a change in user behavior and ultimately changes in teachers' perceptions and uses of the technology and in the pedagogical approaches they bring to the classroom.

III. BROADBAND IN HUMANITY

They describe the concept of the "Wow Moment"; such a moment captures an event as simple as online shopping at the supermarket, which makes the technology real for the user, turning them from sceptics to active users. The importance of behavioral drivers rather than resourcing issues presented in this report is likely to be equally relevant in education. Taking a step back from the educational focus, the report draws on there search of the iSociety (Crabtree and Roberts, 2003) in their analysis of broadband's impact and uptake in British society. Their description of the three stages of broadband adoption, adaptation and absorption provides an appropriate means of evaluating current educational use of the Internet. One of the points that challenges long held views is their finding that the limited response to the uptake of broadband is not an issue of supply, as the technology is available to the majority of the population, but of perceived need on the part of the potential users.

Objectives

Networks:

The networks envisaged in the proposed national strategy or policy must deliver fixed and mobile broadband to end-users via technologies such as cable (i.exDSL), fibre, satellite and networks. A part from the desirable factors of broadband speed and capacity, recent research shows that broadband should be affordable. Under the broad topic of networks, we discuss broadband speed, capacity, technologies and universal access and service.

Broadband Speed:

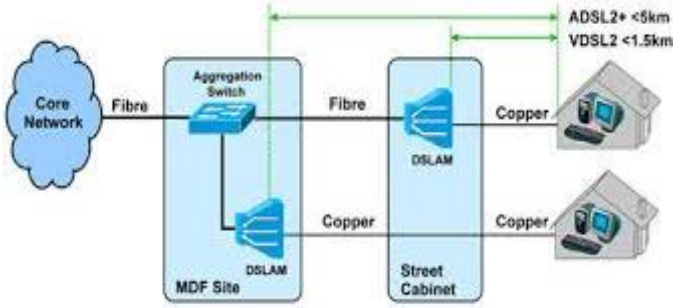
The most commonly used term for describing future networks is "next generation access" or "super-fast internet". As a starting point, developing countries could target a universal availability of 1Mbps downstream broadband service by 2020 or there abouts. A recent study established the need to review the definition of broadband internet. While some developing countries currently define broadband as internet speeds of at least 256Kb/s in either direction (i.e in Kenya), most have no formal definition at all, and service providers have to set their own goals. The issue of advertised against delivered speeds also remains largely unresolved the world over. This is too modest a goal by the standards of the highest performing countries, but is broadly consistent with the near-term goals of a typical developing country's universal access targets. There could be intermediate targets progressively improving on the connection speeds and the proportion of subscriptions, users, households, businesses and institutions clearly defined.

Broadband Capacity:

Capacity could be provided via wired or wireless technologies. Recent research points to the growing adoption of nomadic and wireless technologies such as 3G, Wi-Max and Wi-Fi in comparison to fixed technologies such as DSL and FTTx specially in developing countries. Next generation connectivity could also be defined using capacity to provide anticipated applications, rather than speed measures. For example, South Korea uses the term "ubiquity" to describe its goals. In this case, the term "ubiquity" refers to anytime, anywhere, on the move connectivity; digital multimedia broadcasting and so on. As earlier stated there is already considerable international broadband bandwidth available in some developing countries such as Kenya via the undersea cables namely, SEACOM, EAssy and TEAMS. This places Kenya somewhere in the second quadrant of the Aspen Institute model, at least as far as international bandwidth is concerned. For example, the US broadband plan tasks the Federal Communications Commission (FCC) to make 500 Megahertz of new spectrum available for mobile broadband within 10 years, of which 300 Megahertz should be made available for mobile use within five years. The same broadband plan urges the FCC to enable incentives and mechanisms to repurpose spectrum to more flexible uses, ensure greater transparency of spectrum allocation, and to expand opportunities for innovative spectrum access models by creating new avenues for opportunistic and unlicensed use of spectrum and increasing research into new spectrum technologies.

IV. BROADBAND TECHNOLOGIES

Also, ICT industry regulators need to identify sufficient spectrum to cater for increased demand by mobile broadband service providers. . In this regard, policy considerations are necessary to promote access to 3G/4G enabled devices by way of subsidies or tax exemptions on the initial cost and or on subscriptions. Broadband technologies are evolving very rapidly. For example, Digital Subscriber Line (xDSL), Cable Modems, variations of fibre optic cable (FTTx) and broadband over power line (BPL) are all potential fixed broadband technologies whereas VSAT, Wi-Fi, Wimax, Space optics (FSO), and mobile wireless (3rd and 4th Generation systems) are potential wireless broadband technologies. Each of these technologies has maximum transmission capacity, maximum range, advantages and limitations. Whereas most developed countries relied on fixed broadband technologies such as fibre and digital subscriber line, wireless and nomadic technologies are taking root as key access technologies for broadband in developing countries. For example, find that wireless technologies comprising 3G & beyond, Wi-Fi and Wi-Max are the most critical for broadband access in most developing countries followed by fibre to the home/premise, (FTTx), classes of digital subscriber line, cable modem and satellite (VSAT) access



Universal Access and Service (UAS):

In a number of developed countries, there is a common objective in place to make broadband available on a "universal" scale, thus intrinsically linking the concepts of UAS and universal broadband availability. The universal access and service (UAS) programmes targeted public and private access to basic voice telephone services. As many developed countries achieved "universal" telephone service in many places, these countries re-focused their attention towards affordable broadband access. Recent advances in broadband policy formulation is to have some regulatory measures for the universal service fund administration by an independent body, and inclusion of broadband in universal access funding. Further, as noted by many policies related to education, health, government service provision, infrastructure development, tourism, and so on depend upon broadband and may even include specific plans for the promotion of broadband adoption. Universal access efforts in developing economies may critically depend on mobile broadband. For example, asserts that in Sub-Saharan Africa, subscriptions using wireless broadband are more than eight times those of fixed connections, suggesting the potential for wireless broadband in areas where traditional fixed connections infrastructure is lacking. A detailed plan for inclusion of broadband in UAS is thus critical for any proposed national broadband strategy or policy.

Services:

These services have caused considerable demand in bandwidth estimates bandwidth requirements in excess of 20 Mbps for advanced uses, such as next generation TV and e-learning, on-line gaming and so on. Broadband can be considered in terms of high speed data connectivity over "Next Generation" or IP based networks. This follows the erosion of the distinction between separate voice, data and video services as traditionally offered by telecommunication operators, and the emergency of services such as "triple play" (i.e broadband, video and voice) or "quadruple play"(i.e broadband, video and voice with some form of mobility usually using Wi-Fi). At a glance it may seem impossible to utilize such kind of bandwidths on mobile devices employing 3G and similar technologies which currently have maximum capacities of about 2Mbps. However proponents of mobile broadband argue that up to seventy-five percent of the current services offered via mobile broadband require less than bandwidth capacities of 2 Mbps. Currently, common mobile broadband applications include video based fleet management, location based serves, M-commerce, M-health, M-government and M-governance and so on. Another important dimension of broadband service, latency—the time taken for data to reach from source to destination—is dependent on the end-to-end infrastructure and is not very critical in last mile-technologies except satellite connection, in which latency is inherently large.

Send or Receive Text Messages	92%
Take a Picture	92%
Access the Internet	84%

Send a Photo or Video to Someone	80%
Send or Receive Email	76%
Download an App	69%
Access a Social Networking Site	59%
Get Location-Based Directions	55%
Post a Photo or Video Online	45%
Check Their Bank Balance or Do Online Banking	37%
Access Twitter	15%
Participate in a Video Call or Chat	13%
Use a Geo-Social Service Like Foursquare or Gowalla	12%

Broadband Applications and Content:
According to, applications are function-specific software that deliver content to users, and are becoming the centerpiece of the broadband ecosystem. Applications are increasingly used to deliver media and content to users and to generate appreciable amount of revenue for the operators in comparison with voice services whose income has been declining in the recent past. Identifies three content types as follows:
International content: any information that is served in the same format around the world, regardless of location, and provided by an international developer on an international platform.
Localized content: is created for local users, but provided by an international developer or publisher and customized for local tastes, generally with the input of some locally created material.
Local content: content wholly developed for, and by, the local community, or in other words, content for a local user with relevance to local material that reflects and is obtained from their day-to-day life. Further finds, international entertainment news, local news, breaking news, social networking such as face book, twitter, jobs and dating the most commonly sought after content in East Africa. Find development of local content key in broadband readiness in developing economies.

V. FUTURE APPLICATIONS

This type of application relies on the concept of pervasive computing or "the Internet of Things," a term first coined by Mark Weiser (Mattern and Floerkemeier, 2010; Obaidat and Woungang, 2011). Bandwidth–heavy applications in the near future, much like those available today, will involve transferring high–resolution images and videos to multiple users. Application ideas from the previously mentioned, ongoing project sponsored by Google confirm this trend. One application utilizes live streaming video of government workers' daily activities to increase transparency of local governments. Another proposes remote–controlled housekeeping robots that enable people to clean their living rooms while they are at work (Google Moderator). Pervasive computing refers to the introduction of many embedded and mobile devices that are interconnected to provide improved quality of life through computing technologies. Pervasive computing can relate to any of the application areas described above with particular impact on the future of healthcare and education. The development of wearable sensors within clothing can provide abundant physiological data to help physicians more accurately diagnose and treat chronic diseases. From monitoring general vital signals to motion analysis for stroke rehabilitation and treating Parkinson's disease, these wearable sensors are referred to as *health body area networks* (HBANs) (Delmastro and Conti, 2011). Developers of HBANs seek to limit power and bandwidth consumption of sensors for greater comfort and acceptability.
The power and bandwidth usage are dependent on the type of data collected, the topology of the network over which the data are transmitted, and the actual hardware employed. Bluetooth technology, for example, is utilized for short distance connection from sensors woven into clothing to personal mobile devices such as smart phones that then transmit the

gathered data to central health information data servers for analysis. Bluetooth operates at a maximum speed of one Mbps and represents the largest amount of bandwidth consumption developers realistically want from an HBAN (Chevrollier and Golmie, 2005).

The fundamental requirement for pervasive computing is ample bandwidth for connecting multiple devices simultaneously. Numerous devices communicating with each other and central servers utilizing the Internet requires an abundant supply of bandwidth to ensure the network is robust enough to handle various levels of concurrent traffic. Without ubiquitous broadband, the applications described will not be feasible.

VI. CONCLUSIONS

The services and user experiences in the Norwegian trials showed that the always-on feature changes the usage of the services and leads to new ways of using broadband, such as increased use of music and movie downloading. Availability of broadband access to everybody has become a political goal of high priority and is considered a necessity for the building of the information society. With all the new possibilities and the increased access network capacity users will have different sets of possibilities. It is no longer just to learn how to log on, send an email and find something on the WEB. There will be strong differences between users as a result of ability and interest. The problem of today of providing broadband connections is shifted towards the problem of educating the majority of a population to use the technology both for its own interest and in the building of an eEurope including all of the population. For private users there is traffic all day and surprisingly high traffic loads from midnight until dawn, with some reduction during working hours. Enterprises and schools have a short intense user period during daytime. A small fraction of the private users dominates the traffic volume, and for these users the traffic towards the network exceeds the incoming traffic volume. This type of usage is expected to dominate in the future, and future broadband networks must have capability to offer the individual user a capacity that can be a symmetric on demand in both directions. A breakthrough for capacity demanding eservices will require that the majority of users reach a certain activity level. Additional key elements required are confidence and trust in e-based services by handling security issues seriously, overcoming the language barrier, standardised online payment methods and solving copyright issues.

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