# Communication Support Technologies for e-Learners

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Abstract: Advancements in telecommunication services and networking, have remarkably improved information communication services. The growing need of proper and secure communication is based on using appropriate communication technologies to work effectively and efficiently to meet the objectives of the information users. For some time this has been a great problem. For example, if one element e.g. a cable is supporting high bandwidth but a router limits it. In this paper supportive elements in information communication to enhance the communication performance are discussed. The technologies discussed here are: LAN/WAN, wireless, cabling Ethernet & ATM, iSCSI, IPv6 and outsourcing. These elements have been analysed, keeping in view how safely, efficiently, timely and exchangeable interfaces can be maintained for the sake of e-learners. These issues have been raised in the Indian context.

Keywords: LAN, WAN, iSCSI, wireless technology, Ethernet, ATM, outsourcing, IPv6.

## 1. THE CHALLENGE

Heavy investment is required to procure ICT items – this is the first and biggest challenge. Then the next challenge is to acquire the required items. My focus is to discuss this next critical challenge. Further, they should also ensure its secure storage and delivery. IT has provided great strength to any organization and innovation through IT has been earmarked for developmental work (Talero & Gandette 1995).

In answering this challenge, the emerging issues in support of information communication for integration of massive information across the different types of e-enabled users are discussed.

## 2. THE INDIAN SCENARIO

The Indian population is 1.07 billion in 28 states and 7 UTs. The total literacy rate has grown to 65.04% (65.38% for males and 54.16% for women). The Indian elementary education system is the second largest systems in the world having an intake of 1.49 million children of age 6-14 and 0.12 million schools. For higher learning, there are about 320 state universities and over 15000 colleges. The total number of students in higher educational institutions was about 9228000 in 2005. Keeping this in view, in the fiscal year 2006-07 the education sector received 31.5% more funds than the last fiscal year (Education Times, Lucknow edition 2006).

More than 1000 pilot projects are being run by the government to spread IT among the masses. About $14.55 billion has been spent, with an estimated 40% success rate. Some, like Vidya Vahini, are providing connectivity to government senior secondary schools and Gyan Vahini is upgrading the IT infrastructure in higher learning institutions. The operation knowledge Government IT action plan (www.nic.in) envisages IT for all by 2008, computers & Internet access in all educational institution by 2003, and Government plans to create SMART schools and virtual institutions. Recently in a University communication the University Grants Commission (UGC) decided to establish "A UGC Network" named as UGCNET to provide a seamless, broadband, scalable nationwide inter-university link up to create virtual enhancement of the academic structure. Till now about 183 universities are covered under this net. In another attempt to strengthen the aim to disseminate education EDUSAT, an Indian educational satellite, was launched in 2004 to provide audio and video communication facilities. To increase the PC ratio the Government of India IT task force (Yojna 2000) has envisaged making a ratio of 1 PC per 50 people by the year 2008.

As far as the Internet economy is concerned, it is reported (Manjar, Rao and Ahmad 2001) that $22 billion is floating in India and 184 companies have invested in this economy. Further, 41% of companies have invested in the IT segment. These are some good indications.

## 3. LAN AND WAN

The basic elements for the formation of LANs were previously considered to consist of Network Interface Cards (NIC), hubs, switches and routers. Now integrated motherboards with NICs has reduced the number of element of the LAN. Further, due to a fall in prices and minimizing communication errors, switches are replacing hubs. Routers do not have much market and had a low growth (Pasha 2002) of 3.6% during the 2001-02. Now, the switching element has taken the lead and to a growth level of 28% during the 2001-02. IEEE has set the 802.1Q standard to enable VLAN information across a network and to enables timely delivery of highly delay-sensitive traffic, a signalling network priority on a per frame basis is

required. For this purpose, a method has been provided under the IEEE 802.1P standard (Conver 1999).

## 4. WIRELESS TECHNOLOGY

A survey conducted in India by Express Computer (Wireless Survey 2002) found that a large portion (70%) of Indian companies have not deployed any wireless solutions but 10% are considering implementation. Interestingly, 47% implementation has been achieved for net access and communication purposes and for wireless implementation 48% of companies showed interest. Now WiMAX is emerging due to its superior range and bandwidth which can transfer around 70 Mbps over a distance of 30 miles to thousands of e-enablers from a single base station. For the new emerging ad hoc wireless networks, a routing protocol, termed Associativity Based Routing (ABR) has been augmented (Toh, Delwar and Allen 2002).

## 5. CABLING

Towards enhancement of the capacity of the cables, migration is on the eve of upgrade. For example, upgrading of Cat5 to Cat6 cable enhances capacity from 100 Mbps to 1 Gbps with a speed of 1000 MHz, though this is a costly affair. Fibre is too costly, so structured cabling is the best choice left among cabling solutions (Patra 2002). Cat7 is a recent improvement and is expected to capture 0.4% of the global market by 2006 (Naik 2005). Further, even fibre cabling is expensive but it also works for up to 70 km distance. The future will see a combination of Ethernet and Fibre technologies. DWDM (dense wavelength division multiplexing) is also being considered where a 1.6 terabit per second optical transmission has been noticed.

## 6. ETHERNET AND ATM

Originally providing shared bandwidth of 10 Mbps, Ethernet is now providing 100 Mbps dedicated connections through Fast Ethernet. To meet the 1 Gbps speeds of Ethernet switches, routers are not competent enough to match this speed. That is where ATM switches come into consideration for their deployment under the WANs. By making bursting connections these share resources stochastically under ATM and statistical gain has been achieved which enhances services. A burst-level priority scheme (Naik 2005) is allocated to burst on-the-fly according to their priorities which alleviates the under utilization of the resources.

## 7. ISCSI

To overcome the cost of fibre channel networks (Wireless Survey 2002), iSCSI can be implemented on a Gigabit infrastructure, but iSCSI does not yet meet standards and does not secure communication over a WAN. It can send the data over IP networks as well as over fibre channel over IP (FCIP), and can still run over Ethernet networks but FCIP run with the fibre channel technology (www.iSCSI.com). This can be viewed as an advantage for the future. As iSCSI is changing the networked storage landscape, its market is estimated to jump over $5 billion by 2007 from $216 million in 2003.

## 8. IPV6

IPv6 is a new generation Internet protocol designed by IETF, and now it will be possible to move from about 4.3 billion IPv4 addresses to over 3.4 trillion, trillion, trillion, trillion. Because of features providing an automatic routing and network reconfiguration, IPv6 has shown its advantages over today's IP (Wireless Survey 2002). Currently, its replacement cost is high (www.IP6v.com). This transition would cost around $1 billion per year.

## 9. OUTSOURCING

Outsourcing, another emerging phenomenon has resulted in significantly decreasing expenditures of enterprises and in turn, they gain high growth in marketing. Under this scenario advanced companies are outsourcing the software development jobs to different countries. Carmel (2002) recently pointed out that having human resources in abundance in India, to manage a global software project a virtual team could be developed. He categorized the software exporting nations into 4 tiers as Traditional ( USA, EU, and Japan), 1st tier ( Israel, India, Ireland), 2nd tier (Philippines, Russia, China), 3rd tier (Mexico, Romania, Pakistan, Costa Rica) and 4th tier (South Africa, Jordan, Bangladesh, Cuba). India has large firms and large projects which are the main reason for India's survival for a long period. It is known from discussions that in regard to export India is gaining $6 billion per year in software services. It was reported (Sanghi and Kirpalan 2002) that from 2001 to 2005 the American market would grow by 60%. In 2006 it is expected that $23.4 billion export revenue would grow by 27% annually. India has an opportunity of $100 billion to come (Carralho and Babu 2006).

## 10. DISCUSSION

According to NASSCOM (Express Computer 2003), a rise of 24% in IT spending (hardware, software & imports) in India is seen at about $15.5

billion by 2003. In the software and service sector, export was $22.5 during 2005 and is expected to reach $57 billion by 2009 as India controls 44% of the global offsource outsourcing market for software and back-office services. There are only about 7 million Internet users in India (expected to go up to 35 million), whereas the United States has one-third of the total Internet population. Population connected to the Net has shown a poor growth of 7% (www.bizasia.com). After a decade, the Indian IT services industry has shown consistent annual growth of 50-60% (Yojna 2006).

## 11. CONCLUSION

The upcoming scenario of ICT and other IT endeavours requires proper maintenance of IT infrastructure to meet the demand of providing a guaranteed service level. Therefore the discussed support communication elements should be properly deployed for e-enablers.

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