Delivering eLearning through Fixed Wireless Broadband Access: A Fantastic Opportunity to Bridge the 'Digital Divide'

Lord John Edgecumbe Shazell @ Johan Shazell Abdullah

CEO, Teleconsult International Pte. Ltd., Singapore/
Vice President, Association of Telecommunications Industry of Singapore (ATiS) / Member, Singapore Infocomm Technology Federation (SITF) / Broadband Evangelist
E-mail: tconsult@singnet.com.sg
URL: http://www.tcint.biz or http://eplato.com

Abstract

With the rapid development and advancement of InfoCommunication Technologies (ICT), the ICT industry is now armed with an alternate and pervasive technology choice and real solution to provide visionary, intelligent services like eLearning, eHealth, and the like, to remote areas of countries, economically, with high availability, resiliency, scalability and Quality of Service (QoS). Traditional Telecommunications system solutions and thinking using wireless, either microwave or point to multi-point in the past have been used effectively for Voice/Facsimile, payphone and legacy communications, where fixed cable networks are uneconomical to provide and which from an engineering point of view, will not work due to distance.

However, the big failing of such systems and technologies, was the ability to be able to deliver 'Bandwidth'. Use of these systems and technologies, has satisfied the concept of Universal Service Obligation (USO, by providing basic services, in some cases a single solar powered payphone in a village or a small number of voice connections. Technologies such as Broadcast, Satellite are still viable technologies, to serve the rural communities and will still have a role. However, with the advent of modern Fixed Wireless Broadband Access solutions, there is now a pervasive and vibrant technology and interest from the manufacturers and service providers, to deploy such systems. Economically, this makes a lot of sense.

This paper discusses how eLearning can be delivered over a modern Fixed Wireless Broadband Access system, with some ideas and concepts, how eLearning should be presented, based upon sound teaching techniques and focusing on the Learning process. Use of Fixed Wireless Broadband Access, can be utilized effectively and economically to serve rural areas, and bridge the 'Digital divide', but can also be used to serve peri-urban and urban areas as part of a solution mix of technologies. There is no 'one size fits all' technology solution to meet the needs of the community, across all segments of work and life. Services such as Education in the form of eLearning or Distance Learning, Health Care in the form of eHealth or TeleMedicine and other services to the local Police, Fire, Internal Security, Religious Affairs Departments and the like, can all be provided over a Fixed Wireless Broadband Access Network with the required level of security. The key is simply one word.....'Bandwidth'. In addition to the above, some Fixed Wireless Broadband Access technologies, now also allow provision of legacy services, like POTS

and facsimile, at the same time as providing Broadband access, thus solving basic communications problems.

1. Introduction

1.1 Background

Telecommunications or as it is more now correctly termed, InfoCommunications Technology (ICT), which is a term commonly used due to the convergence of Information Technology (IT) and modern Telecommunications, has long been the catalyst of growth in a country. If a country has a good Telecommunications system, then the economy of the country will grow, in the same way that it is a pre-requisite of a vibrant economy, that the country must have a good road system, airports and sea ports. However, dependant upon the extent and reach of that ICT network i.e whether it extends completely from the urban, into the peri-urban and rural areas, will be dependent upon whether ALL citizens of that country, enjoy the benefits which can be made available to them over the ICT network. In the 'Knowledge-Based Society' and in the larger context of the 'Global Village', it is important that the country is connected to the 'Information Super Highway' and this means that the ICT infrastructure must be connected to the high capacity, high speed, fibre optic submarine cables, which circumvent our world and which also provide regional connectivity between nations. It also means, that the country has to have Satellite links for Broadcast and Telephony purposes and also for back-up and restoration purposes, should those fibre links fail, due to cables being cut etc., which does happen from time to time. In some countries, Satellites are also used for domestic communications and broadcast purposes. It should be clearly understood that 'CyberSpace' is not somewhere above us, as the name implies, but actually in fact, the majority of the world's Internet (IP) traffic is carried on these submarine cables and 'Cyberspace for now is under the Oceans and Seas of our World'. Of course, with advancing technology, with the vulnerability of submarine cables to modern threats like Terrorism, the use of Satellites is being used more and more for Data and IP use, as well as their traditional Voice and TV transmission capability. In real terms, the internal development of a country's internal ICT network is very much linked to Politics, the development of policies and regulatory matters, with regards to ICT, availability of low cost financing or aid, availability of frequency spectrum etc. If we consider the development of a country in terms of the Human Capital, then we are faced with a wealth of other real issues, regarding provision of basic services, Education, or lack of it, Primary Health Care, Infant Mortality Rate, knowledge of English, IT awareness and Cultural issues. Until very recently, it was a statistic that 80% of the world, had not in fact heard dial tone and yet in some parts of the world, some developed countries have telephone penetrations which are completely diametrically opposed and are around 50-80% of the population. However, in developing or under-developed countries the penetration rate is still very low. The good news is that this is changing very fast and in some countries and in countries like China and India, phenomenal growth is being experienced in the provision of Mobile Cellular Phones and mobilephones are currently being added at the rate of 1Million new subscribers per month or more, in each country. This of course is wonderful news that more people are getting the ability to communicate and being connected, even in remote areas in some cases and this is a classic example of how a technology can skip legacy systems, like fixed wireline networks and provide services to rural areas. However, there is a big difference between people of the world talking to each other and being able to enjoy eLearning or TeleMedicine and that difference in simple

terms is called 'Bandwidth'. For those of us who have a PC and enjoy Broadband 'Always On' connectivity, we are literally a world apart from those who have no telephone. This really is the essence of the so called 'Digital Divide'. There are the 'haves' and 'have nots' and in whatever terms you equate it, whether it be in terms of basic services like Potable Water, Electricity, Sewerage, Education, Primary Health Care, ICT etc., it is very much stacked in favour of the 'Haves' and many argue that the 'Digital Divide' is widening. The modern developed world caters to an 'On line' generation who enjoy, expect and demand ubiquitous communications, where communication speed is of the essence and visionary and intelligent services are being delivered. Even when you get connected, if you come from a country which does not use English, you will still be disadvantaged as the majority of websites are in English and hosted in the developed world. This will change in time, particularly when PRC China develops further.

1.2 What is the Political Position?

Representatives of the Nations of the World have met at the World Summit on the Information Society (WSIS), held in Geneva in December 2003, to discuss this matter and other related issues and accords are in place. On the occasion of World Telecommunications Day 2004, an official United Nations Day held on May 14th, the United Nations (UN), Secretary General, Mr. Kofi A. Annan, made the following call to Member Nations:

"It was 160 years ago next week that Samuel Morse used a simple series of dots and dashes to send the first message by telegraph — ushering in the dawn of the telecommunications age. Within a decade, telegraphy had become a routine public service. Today, many people could not imagine daily life without the use of increasingly sophisticated Information and Communication Technologies (ICTs), from television and radio to the mobile telephone and the Internet. Yet for millions of people in the world's poorest countries, there remains a "digital divide" excluding them from the benefits of ICTs. The theme of this year's observance of World Telecommunication Day — ***ICTs: Leading the way to sustainable development*** — reminds us that ICTs serve as crucial tools for achieving economic progress. Affordable technologies, in the hands of local communities, can be effective engines of change, both social and material. Access to information and technological know-how is essential, if the world is to defeat hunger, protect the environment and achieve the other Millennium Development Goals agreed by Heads of State and Government at the United Nations Millennium Summit in 2000. But to harness this potential, we need to forge global partnerships for development between governments, the private sector, civil society and the United Nations system. Last December, at the first phase of the World Summit on the Information Society in Geneva, leaders set out a shared vision of how the world can eliminate the 'digital divide' in content and physical infrastructure. This was the first global gathering of its kind, and I was very much encouraged by the innovative initiatives that were put forward and by the strong commitment that was voiced towards overcoming the disadvantages faced by so many of the world's people. I urge Member States and all other stakeholders to sustain that commitment as we prepare for the Tunis phase of the Summit next year. On World Telecommunication Day, let us resolve to do all we can to lead the way to a truly open, inclusive and prosperous telecommunications age".

Kofi A. Annan
Secretary-General
United Nations

And similarly, the International Telecommunications Union (ITU), Secretary General, Mr.Yoshio Utsumi made a similar call as below:

"It is often said that if you don't like the way the world is, you should change it. Fortunately, many of the things we do not like about our world - poverty, ignorance, hunger - could all be changed through better communications. This belief was shared by the 11,000 delegates, including nearly 50 Heads of State and Government and 80 Ministers and Vice-Ministers who attended the first phase of the World Summit on the Information Society (WSIS) in Geneva last December. The Summit was organized by ITU to ensure that social and economic development, which is increasingly driven by Information and Communication Technologies (ICT), will result in a more just, prosperous and equitable world. It is this promise that lies at the heart of our Information Society and it is the reason we have chosen to celebrate the 139th anniversary of the founding of ITU with the theme ***ICTs: Leading the way to sustainable development***. Reliable and affordable communications can be used effectively as part of the toolbox for addressing global problems. ICTs alone may not feed the hungry, eradicate poverty or reduce child mortality, but they are an increasingly important catalyst that spurs economic growth and social equity. ICTs allow for more efficient agricultural production, diversity and distribution. They offer the possibility of delivering basic health services to those in dire need living in areas with little or no access to healthcare facilities. They can extend the reach of educators allowing them to bring knowledge to the most remote corners of our planet. Access to Information Technology can boost the creation of small companies and groupings of artisans in the poorest and most isolated areas of the world and help them join the mainstream of national and even global markets. Information Technology makes it possible to leapfrog poor infrastructures so that distance from markets is no longer a drawback and poor distribution channels a thing of the past. ICTs can also be extremely effective in improving governance. They give a voice to people who have been isolated, or have been invisible and silent, allowing them to speak out regardless of their gender and where they live. Given their enormous power to improve people's economic, social and cultural well-being, ICTs must be at the centre of any development strategy. The global commitment of world leaders at the Summit is no doubt a historical recognition of the importance of ICTs in addressing many of the major social, political and economical problems. But the successful outcome of the first phase of the Summit is only the start of a long process. We now need to transform the vision and plans adopted in Geneva into concrete action. And above all, we need to enlist the long-term commitment of all stakeholders to ensure that ICTs truly lead the way to sustainable development".

YoshioUTSUMI
Secretary-General
International Telecommunications Union

1.3 So What is the Solution?

The first part of the solution is purely Political. Individual countries have to take up the challenge and truly acknowledge the need to bridge the 'digital divide' in their countries and to what extent. This process has started. However, talking about it is easy. Doing something is the acid test. If the will is there, then the second part, is to find the way to do it and this is where ICTs, come into play. Assuming that the will is there, Broadband technologies are now available and emerging, which make it all possible, given the funding.

2. What is Broadband?

In ICT, there is no true, fixed, internationally accepted definition of Broadband. On the other hand, most of us understand what Narrowband is and can clearly define this. Some people simply define 'Broadband' as anything which is not 'Narrowband'. To understand this point, it is interesting to follow the leads of the Canadian and Australian Governments, who are the front runners in providing advanced Broadband services to remote areas of their countries. Broadband was originally an engineering term referring to the amount of information that could be carried between a sender and a receiver by a communications channel, using a wired or wireless telephone network, a Cable Television network, a Satellite network or any other kind of telecommunications network. This definition is generally understood and accepted by many. As the term implies, Broadband networks can carry a lot of information between senders and receivers. But how much is 'a lot'? Modern Telecommunication networks convert messages into combinations of 'ones and zeroes' or Binary Digits before sending them, using the same kinds of digital coding techniques as computers, CDs and DVDs. The resulting 'bits' of information are then transmitted from the sender to the receiver, where they are decoded and reconverted into their original form. To qualify as Broadband, international standards organisations consider that a communications network or service must be capable of transmitting at least 1.5 or 2 Million bits of information every second or Megabits per second (Mbps) i.e what engineers term an T1 or E1 respectively. However, a study of international Broadband initiatives will find that common usage of the term 'Broadband' is not this precise, and ranges from a low of 200 thousand bits per second (Kbps) to as high as 30 Mbps in other countries.

3. What is Fixed Wireless Broadband Access?

3.1 Definition

Fixed Wireless Broadband Access technology is a digital microwave radio technology, which allows radio waves to propagate from a Base Station in Line of Sight (LOS) or Non-Line of Sight (NLOS) to be received by a Customers Premises Equipment (CPE), which is located at the premises to be served e.g school, hospital, clinic, fire or police station, mosque, residential home etc., and therefrom distributed over a high bandwidth cable. It is a last mile solution and has to be back-hauled either by radio or fibre cable, back to the Point of Presence (POP), where connection to the Internet will be made. Frequencies used vary from manufacturer to manufacturer, Service Provider choice and Regulation and will largely depend upon the available frequency spectrum in the country, and whether it is licenced or unlicenced spectrum in the country where the system is being deployed. One problem often encountered in the region is illegal usage of frequencies or poor records of frequencies used and resulting interference, which may be caused. Again, dependant upon the frequency, the topology of the land, capacity and traffic requirements etc. distances in excess of 20 Km, from the Base Station to the CPE can be achieved, however in practice, it is more likely to be less. It is also likely in this part of the world, that frequencies lower than 10GHz will be used, due to an effect known as 'rain cut-off', which causes absorption of the radio signal and loss of signal. The area to be covered will need several Base Stations and a design hierarchy rather similar to mobilephone coverage is employed. Basically, anyone in the Base Station coverage area can be served provided you have the CPE. The system is normally designed using sectorised antennas, which allow the service provider to allocate

and direct bandwidth where it is required, so that more bandwidth can be allocated, to a particular CPE as required.

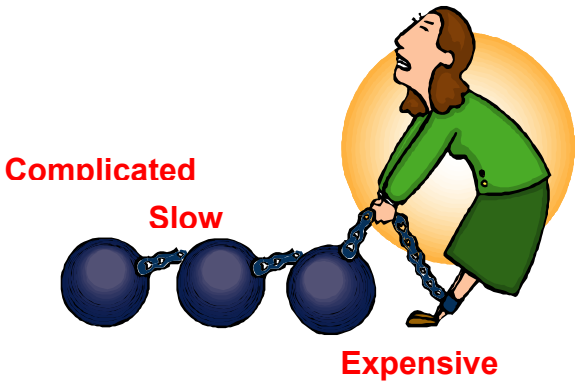
3.2 Fixed Wireless Broadband Access as the Transport Network for e-Services

Fixed Wireless Broadband Access technologies are coming of age. The technologies used inherently are not new, as some manufacturers are using patents which they have held for many years, but what is new, is that the price of the technology has broken through a critical barrier, particularly in the price of the CPE, that now it becomes economically viable to use the technology. The other factor, of course, is the capability to deliver the bandwidth and transmission speed, required for bandwidth hungry systems like eLearning and TeleMedicine. It is important to understand also that these applications often require symmetric, rather than asymmetric transmission capability. One other advantage also is that some Fixed Wireless Broadband Access technologies can delivery legacy services, like POTS, Facsimile, DSL, etc., as well as IP based services. Fixed Wireless Broadband Access technology provides bandwidth in the form of a Broadband 'pipe', which is scaleable according to the needs of the user. If for example the user e.g a School requires 2Mbps, this can be provisioned. If another requires 8Mbps, this can also be catered for. If a Clinic requires 8Mbps now and a new service in 2 years' time requires this to be increased to 34 Mbps, this can also be done. Most systems allow this to be done remotely and using software control, without a need to access the CPE. Once the CPE is installed, very little maintenance is required and service provisioning and network monitoring is done remotely.

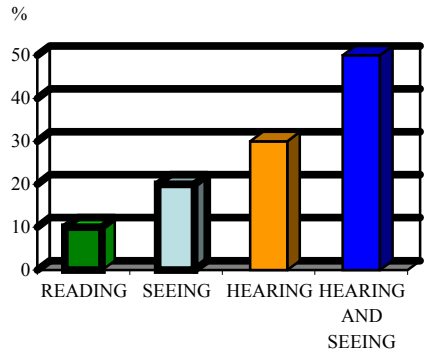
4. eLearning over Fixed Wireless Broadband Access

4.1 Possibilities

When discussing in detail about eLearning, one should understand the basic concepts of how people learn. eLearning is not new and has been around for many years in different flavours e.g Computer Based Training (CBT), Distance Learning, Multi-media Training, Video Learning etc. eLearning has received a lot of criticism and bad press, by users, as it can be boring, slow, dull, not user-friendly and also at a very basic level, normally only done in English. A lot of eLearning systems are no more than electronic books, substantiated by the fact that the companies selling such products, often have their roots in book publishing firms. Often too much emphasis has been put on the 'e' part of eLearning and not enough importance has been put on the 'learning' part of the word.



Let's look at some facts about knowledge retention:

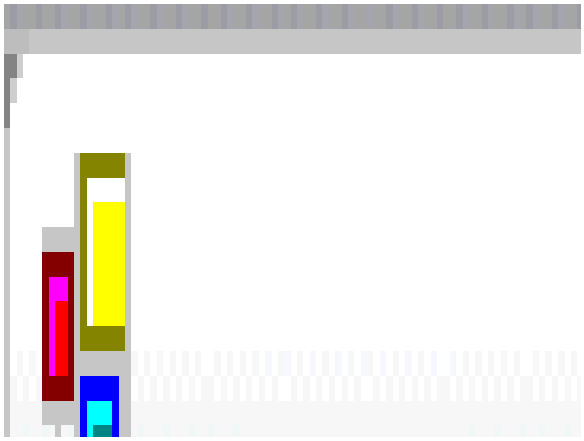


Human beings learn in different ways. Some people are Visual Learners, some are Auditory Learners and others are Kinetic Learners, or use a combination of learning styles. It follows, therefore, that if people are encouraged to use their senses or a combination of their senses, people absorb more of the knowledge being taught. This also touches on another topic, which some people fail to comprehend and that is what language does a person to think in. If you are a Thai, who speaks no other language but Thai, then you think in Thai. If you are a multi-lingual Thai and you also speak English, what language do you think in? Thai or English? Probably if you are talking Thai or learning a subject in Thai, then you think in Thai, but if you are learning a technical subject being taught in English, is it possible that you might be losing a lot of the essence of the information being taught? Do you think in Thai in this case or in English and translate in your head? So why not have an eLearning system which allows content to be taught in native tongues. If you ask yourself the question, why is Teacher training so successful? The answer is because the Teacher applies all the learning methodologies and gets the Learner to use a combination of his senses. So, if you are implementing an eLearning system in an under developed or developing country, it is important that the language of instruction should be in the local language and/or local language and English and content can also be standardised.

4.2 ePLATO

ePLATO is a pervasive, affordable, versatile, self-directed, self-paced learning tool, which facilities a feature rich learning experience and more importantly puts a human being back into the learning process. ePLATO has a powerful video and audio capability, which enables content to be delivered in any language or combination of languages.

A typical screen shot follows:

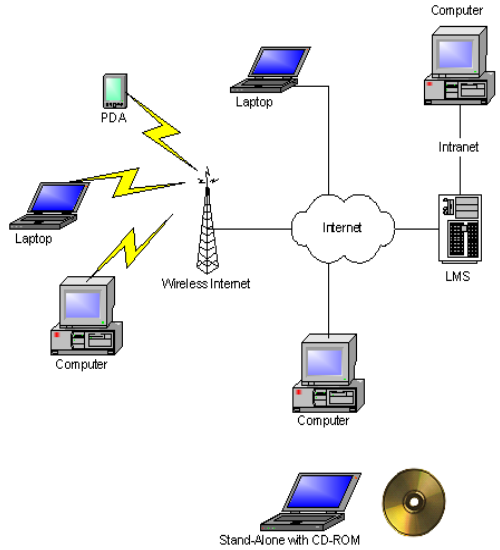


A screen shot example of multi-language capability follows:

4.3 ePLATO Learning Environment

ePLATO has been architected, to work in almost any environment i.e stand-alone with CD ROM content, Enterprise LAN with Learning Management Server (LMS) / Learning Content Management Server (LCMS) and can be linked to an HRMS. ePlato can be mounted on a URL or accessed through the Internet, by WiFi and even content delivery, can be on a PDA.

Typical scenarios follow:



ePLATO can also be used as a real-time delivery mechanism and enable eLearning, web-meetings, chat sessions etc., to be held in real time and as a delivery medium for eHealth to deliver TeleRobotic Surgery, Biometric Patient ID, Real Time distribution of High-Resolution video/photos and access to Electronic Medical Records, thus enabling Doctors, in remote clinics to seek second opinions, from Specialists in hospitals etc. All these features are possible if bandwidth is provided in the form of a Fixed Wireless Broadband network or in peri-rural or urban environments on a Fixed Cable network.

What the mind can conceive, ePLATO should be able to achieve.