Delivering eLearning through Fixed Wireless Broadband to the Rural Community and Disaster Stricken Areas - A Fantastic Opportunity to Bridge the 'Digital Divide' and Rebuild after the Horrors of the Tsunami Tragedy

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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, etc., to remote areas of countries and communities, economically, with high availability, resiliency, scalability and Quality of Service (QoS) and which also can be deployed rapidly in disaster situations .

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, but 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 and economically makes a lot of sense.

Recent tragedies like the recent Tsunami have highlighted the problems of communicating over a distance, reaching out to devastated remote communities and areas and for relief agencies to go into devastated areas and help the stricken communities.

Wireless Broadband is the answer and can be deployed quickly. Where schools have been demolished and teachers killed, eLearning is a fast way to restore teaching and to make sure that an education system is up and running quickly and effectively, through a medium i.e. Computers, which is readily understandable to the Community Generation (Generation –C).

Life can thus return to near normality, using advanced technologies.

This paper sets-out to discuss how eLearning can be delivered over a modern Fixed Wireless Broadband Access system, and 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 etc., can all be provided over a Fixed Wireless Broadband Access Network with the required level of security and 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 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 to describe 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 50-98% 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 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 1 Million 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 President of the US in his election campaign at a fund raising dinner, actually stated that there are the 'Haves' and 'Have Mores' and indeed in some countries, this is the case. The modern developed world caters to an 'On line' generation who enjoy, expect and demand ubiquitous, pervasive communications, where communication speed is of the essence and visionary and intelligent services are being delivered.

The reality in the developed world is that we have moved literally from the 'Digital Age' to the 'Connected Age'. 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, and is changing rapidly with PRC China developing rapidly.

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 have come up with an Action Plan and Declaration of Principles. On the occasion of World Telecommunications Day 2005, an official United Nations Day held on May 17th, the United Nations (UN), Secretary General, Mr. Kofi A. Annan, made the following call to Member Nations:

"We live in an age in which communication between people is essential to achieving our shared goals of development and peaceful coexistence. New innovations in information and communication technologies have increased exponentially our capacity to connect with each other. It is up to us to use to harness the potential of these technologies in our work to extend the benefits of education, health care, trade and environmental protection to all.

The theme of this year's World Telecommunication Day, "***Creating an Equitable Information Society: Time for Action***", calls on us to give shape to the vision adopted at the first phase of the World Summit on the Information Society in 2003. I urge Member States and all other stakeholders to reaffirm their commitment to that process, and to participate at the highest levels when the Summit reconvenes in Tunis in November of this year.

Efforts to build an equitable and accessible information society depend on the strength of partnerships between

Governments, civil society and businesses, underpinned by the support of international organizations such as the United Nations. On this World Telecommunication Day, which marks the 140th anniversary of the founding of the International Telecommunication Union, let us pledge to bridge technological differences and promote interconnectivity for all. Together, we can create a truly global information society that will benefit all the world's people".

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:

"Dear Friends,

Human communication has always been a combination of intellect and emotion — a characteristic that helps to define our shared humanity. Our information society has a way of reminding us of this reality, often in a dramatic fashion. A recent example is the Asian earthquake and tsunami disaster when information and communication technologies (ICT) brought the tragedy home to us in a manner unimaginable in the not-so-distant past and produced a surge of unprecedented global sympathy and humanitarian action.

From the birth of the telegraph, through radio and television broadcasting to satellite communications and the Internet, the work of ITU has been essential in harnessing the power of technology to fulfill a human basic need for communication. May 17th 2005 marks 140 years since ITU took on this important mission.

The year 2005 also marks another important anniversary for ITU. The release of the Maitland Report 20 years ago helped the world realize that it was not right that only a minority of the human race should enjoy the benefits of ICT while a majority lived in comparative isolation. The ITU report, prepared by the Maitland Commission, is a landmark in identifying the digital divide between information "haves" and "have nots" and in proposing concrete solutions to bridge it. Since its publication, ITU has been working in earnest to bring the benefits of ICT to all of humanity.

In 2003, ITU held the first-ever World Summit on the Information Society in Geneva. At the Summit, world leaders from 175 countries endorsed a Declaration of Principles and a Plan of Action that embraced the idea of universal, accessible and affordable access to ICTs. The Declaration of Principles has set the stage. The Plan of Action points the way forward. Discussions at the Summit also highlighted the fact that the digital divide is not only among countries, but also within countries. Access to ICT also varies greatly between urban and rural areas, between the rich and the poor, between the educated and the illiterate and between men and women. This multiplicity of divides is a major impediment to the emergence of an equitable and viable Information Society.

The second phase of the Summit, to be held this November in Tunis, will measure progress made in fulfilling the specific objectives set in Geneva and will call on all stakeholders to transform the political will expressed at the first phase into long-term commitments. To help focus the world's attention on the importance of this mission, ITU members selected as the theme for World Telecommunication Day 2005, ***Creating an Equitable Information Society: Time for Action***.

Looking ahead to Tunis, the true test of an equitable information society will be the extent to which today's powerful knowledge-based communication tools are able to connect different peoples across all geographic, economic and information divides. As the members of the Maitland's Commission stated 20 years ago "Neither in the name of common humanity nor on

grounds of common interests, is such a disparity acceptable". Clearly, the time for action is now!'

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 and as mentionde by the ITU Secretary **NOW** is the time for action. 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 in the form of IEEE 802.11 / ETSI, WiMax (IEEE 802.16 and 20)……. 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.

3.3 Role of Fixed Wireless Broadband Access in Disaster situations

When the recent Tsunami disaster struck, in most countries the installed telecommunications systems were initially knocked out, but were brought back into service relatively quickly, due to the incumbent Operators having Disaster Recovery Plans (DRPs) and also because of the widespread use of Cellular Mobile Technologies.

This, of course, was not the case in the rural areas, where there was no service before the disaster struck.

The fixed cable networks did not fare so well and to this day some remain damaged beyond economical repair.

Emergency aid and rescuers in the first 24-48 hours after the disaster were faced with mammoth problems of communicating, until the watching world reacted and the necessary aid and equipment was moved in.

Initially heavy reliance was placed on radio, use of alternative power sources like solar power, generators etc.

In some countries, schools were devastated beyond repair and teachers killed.

Now some months after the disaster, life is slowly returning to normal and part of this process has been to get the young back into school and the learning process continuing.

This is where Fixed Wireless Broadband Access Networks and eLearning can solve many of the problems being faced:

1. Properly designed and constructed telecommunications systems will survive disasters and this was shown with the rapid restoration of the Cellular Mobile Network where it existed, after the disaster struck
2. With schools devastated and in some countries, most of the teachers killed, there is an opportunity to make a positive outcome come out of a disaster and that is to use technology and eLearning, not to replace the teachers, but be used as a tool to get the process of learning moving again swiftly, using Fixed Wireless Broadband Access as the Transport mechanism.

In recent years, the world has been plagued by Sars and now the world community is being prepared for the outbreak of Avian (Bird) Flu, which will severely limit peoples mobility and contact, if it were ever to happen.

Again ePLATO is the answer.

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, eReading 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 and still is being put on the 'e' part of eLearning and not enough importance has been put on the 'learning' part of the word.

Human beings learn in different ways. Some people are Visual Learners, some are Auditory Learners and others are Kinesthetic 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 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, and someone speaks to you in Thai, 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.

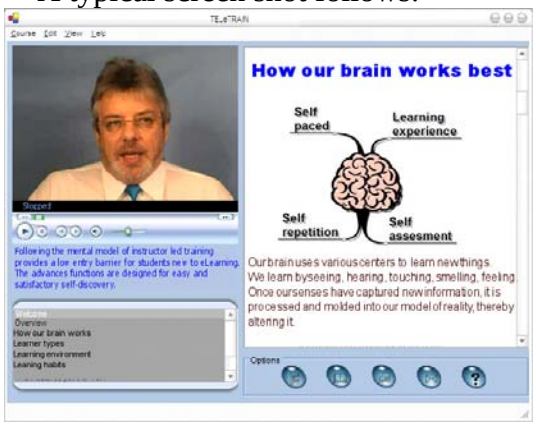
4.2 ePLATO

ePLATO is a pervasive, affordable, versatile, self-directed, self-paced learning

platform, which facilities a feature rich, Client 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. It features also advanced facilities, like Glossary, FAQs, Help, Assessment capability, print script, print content and has a Karaoke text facility, for hearing impaired users. The audio capability allows visually impaired users to participate in the learning experience.

ePlato has been developed in the Microsoft .NET 1.1 environment and uses Windows Media Player 9 / 10 and industry open standards.

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. It is truly pervasive.

ePlato can be mounted on a URL or Web-based accessed through the Internet, using a laptop, workstation or by WiFi connexion and content delivery, can even be on a PDA or a 3G phone.

ePLATO can also be used as a real-time delivery mechanism and enable Presentations, eLearning, Web-Meetings, chat sessions etc., to be held in real time and as it is a horizontal application it can be used 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.

Again in disaster situations, or times of restricted movement like pandemics e.g. Sars or Avian Flu outbreaks. All these features are possible if bandwidth is provided in the form of a Fixed Wireless Broadband Access network or in peri-urban or urban environments on a Fixed Cable network.

5. Awards Won

Teleconsult was the proud winner of the Brunei Darussalam InfoComm Technology Award (BICTA) 2004, for the ePLATO product, for the ‘eGovernment and Services’ Category.

Teleconsult went on to represent Brunei Darussalam at the Asia Pacific InfoComm Techniology Award (APICTA), held in SAR Hong Kong in December 2004 and garnered a ‘Special Mention Award for eGovernment and Services’.

ePLATO is featured in the latest edition of the Microsoft .NET applications handbook, recently published.

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