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The paper describes a real life story of ICT implementation, starting 1997, in a remote village in Bangladesh working with about 100 students who had never seen a computer before; how the program quickly spread to dozens of adjacent village schools and thousands of students; what obstacles it faced, what traditions it broke and what social changes it brought; how village kids learnt database, Visual Basic, Java, Multimedia, rural e-commerce and Wireless LAN and what they are doing with it now; who stood against them and who helped them; how they have become teachers, setup up cyber cafes and now repeating the process of cascading knowledge; how it was financed and how they are going about a pilot project with wireless network so that the network is able to fund education and education would in turn demand the network. The paper ends with a brief description of the pilot network, its rationale and how it is being designed to self propagate.

Background: How it started

One day in November 1997 I took a computer to a remote village school of Durgapasha, north eastern part of Bangladesh, nearly 350 km from capital city of Dhaka- perhaps one of the most conservative muslim areas of the subcontinent, where it is very normal for young girls to be clad in veil and married off by age 12 or 14 in exchange of dowries worth \$ 50 or less.

Many young boys and girls surrounded me as I disembarked from the car. Quite a few of them had not seen a TV, let alone a computer. Some village elders and school teachers curiously approached me and wanted to know who I was and what my business was. I told them I had come from the city and would like to teach computers to children after their normal school hours if it was acceptable for everyone and that I was going to do it free.

The headmaster and the village elders gladly accepted the proposal and wanted to know when I could start. I said right away. A class room was hurriedly made available, more benches were brought in and curious kids shuffled around in wild excitement thinking that some kind of entertainment was going to be staged. Entertainment it was, which changed many lives ever since. I remember it was a pleasant sunny day in November. I started at 10 in the morning and continued till dusk, well past normal closing time. I later found out that this never happened before because of strict rules that girls should reach home before dusk – a long established norm and custom was broken!

The experience in the class room was mind boggling! It was as if a Pandora's Box was opened. More than 100 children packed in 30 feet x 20 feet room, just one computer and silence and commotion playing out a peculiar crescendo. Village elders and some women veiled in burkas, stood and peeped from the veranda, looked amused at the proceedings. Paintbrush, Microsoft Encarta, Word, Excel, Powerpoint, songs, music, some recorded sports program and what the Internet was about were displayed and discussed. Between occasional breaks, I ran some games- the twinkling eyes, the intelligence; the awe and gaze were overwhelming.

Sadly the day had to end and it was time to leave and pack the computer back into the car because I was going to another village the next day. Boys and girls surrounded me and wanted to know when I was going to come again. I said every Friday when schools are normally closed.

For the next six months I travelled every weekend from Dhaka and went around the village schools morning to dusk every Friday spending about an hour or so in each school. Boys and girls walked miles, many came by country boats to attend the computer classes. Soon I realised that there were more than 1200 students at five different locations and I had just one computer which I had to carry it around from school to school. On average a child was just able to touch a computer for only a few minutes during the whole week. There was no way for providing hands on experience.

The child with the paper keyboard: ICT trained village students would play an important part in rural connectivity

One day an incident hit me. A boy of about 10 came over to me and handed me a dirty folded piece of paper. On it he had drawn the computer key board and wanted to know whether the placement of the individual keys had been drawn correctly. I was curious and wanted to know why he wanted me to do that, little realising that this dirty piece of paper was his only link to the computer and the Internet world.

He told me that he always kept the paper folded in his pocket and whenever he had time he would bring it out, spread it on the ground and practice on it! He would imagine that he was in the Internet and going from place to place, making friends and telling his story to the world. On my way back from the country that evening I was convinced that children would be a major force in bringing about rural connectivity.

Computer is now the most essential learning tool and the right to access and use in my mind is one of the most important factors in shaping a child's destiny because it is not just a learning tool, it is a professional tool and, most important, it is a communication tool with which a child can connect with others and have access to wealth of information and content

Computer is the perfect tool in bringing this vision into a reality. It is the all in one magic box: you don't need to persuade a child to learn computers. It comes naturally – a tremendous magic power. Introduced in the right way it would also be a great social and economic transformer.

Education is in dire state in rural Bangladesh despite widespread intervention by state agencies: children barely learn alphabets and numbers in primary schools, let alone science and math. Fully 40% of rural children still do not go to school. Out of the 60% who do, only 40% complete primary school education barely learning alphabets. Out of this only 7 % complete high school education. As a percentage of the total rural population only 0.5 (half) percent pass out of high schools! Apart from massive mismanagement and corruption, the single most important element that is lacking is that the child is not motivated to go to school. On any given day as you travel across rural Bangladesh, teachers' attendance in primary school would be 50% and children's about 30%!

Visit a school and you will find them buzzing around you but always keeping a distance. Try to call them to come near you and they would be frightened and move away at least a meter from you. Someone told me that the reason they stay away at least a meter is because the stick that the teachers carry is about that long! A smart and enthusiastic child is more likely to get the stick rather than praise. It is more fun to play in the paddy fields; go fishing; or row boats or drive rickshaws.

I realized that the first thing that we need to do is change our mindset: the child's need had to be viewed as a solution and a great opportunity for the world, rather than a problem. The magic box and the twinkling eyes, the burka clad mothers in the corridors watching, the dawn to dusk rules for girls broken- these were cataclysmic embryos of human actions in a microcosm, struggling to burst out and give birth to great social changes.

The second thing that was needed was that a very fundamental change in methodology has to be implanted – the existing rural education infrastructure is beyond repair and is simply not tailored for the modern interconnected world, indeed it stands on the way to empowering these children. The vested interest, the corruption, the administrative and bureaucratic setup is simply geared towards perpetuation of the status quo.

I decided early that whatever strategy or methodology is put in place to mitigate the condition of the 'paper keyboard' , the mechanism that would be put in place has to be comprehensive, holistic, self sustainable and based upon a long-term enduring partnership- the way one rears one's own children.

It was not going to be enough to just throw away real computers to replace the paper keyboards and teach rural children how to use MS Office, multimedia, advanced programming and networking. The use of computer as a productive tool must be tailored to the needs of the 'ecosystem'.

I persuaded some of my professional colleagues to take the week end trips to the north of the country and help me with the teaching. Some could not believe what I was doing and decided to come just for fun and break. Others were curious and were motivated to come along.

What worked and what didn't

Some practical do's and don't s were also discovered. Wherever we went and tried community participation involving the village elders, our plan failed, because of vested interest and interference. We involved the community with grand vision of the Internet and connectivity and signed prescriptions for disaster.

Only when we sought children's participation without community participation and confined our interactions with the kids we succeeded. We kept our vision short and just wanted to be in the class rooms teaching computers to kids. Nobody was interested and we were left alone and we worked the kids. The kids were backed by their mothers, particularly the girls. The mothers were our silent allies. They were determined to make sure that their daughters did not repeat their lives!

Strangely enough, rural teachers as a group were opposed to ICT education for students because it empowered the students with skills which were new to the teachers themselves and gave the students a sense of independence and freedom.

When courses were offered free it generally did not work because guardians were not bothered to supervise and students came and went as they pleased.

The processes we now implement are as follows:

Selection of an Ecosystem/Wireless GRID: Ecosystem characteristics are – it is a rural locality of about 14 km x 14km wide (250 sq km) with a population of about 180,000, comprising of 200 villages, 5000 shops, several markets, several secondary and primary schools.

A school is selected as a starting point for ICT implementation. The school provides a class room, LEARN delivers IT training and few computers. Local school teachers are strongly encouraged to attend ICT lectures. Once or twice a week (during week end holidays) lectures are provided free of cost at first. Later on a fee of \$2 per month is charged. This school is the future MCN (Micro Community Node) wireless connectivity centre.

Projection meeting/demonstrations are held in adjacent schools in the ecosystem explaining what knowledge revolution is about and how connectivity and Internet can change lives. School students from other adjacent schools are invited to attend the weekend course.

ICT Training starts, imparted by city based professionals whom we call Bulls. Bulls are ICT professionals working in the corporate sector most of whom live and work in Dhaka. They are highly motivated and competent professionals with specialised ICT skills ranging from software, networking, multimedia, business management, and wireless technologies. They travel from Dhaka on week ends. The bulls are persuaded to join in as stakeholders in the evolving model in the WLAN networks.

Commercial group courses are introduced – Education & Technology disseminates beyond schools and is now targeted for rural professional groups- graduate students, traders, small businessmen, teachers, journalists, pharmacists, rural bankers, NGO professionals, journalists, lawyers, grass root activists and rural unemployed.

Lecture contents and slides/presentations are displayed in English, the delivery and explanations are all in Bengali. LEARN's strategic goals in the context of wireless connectivity, engineering ecosystems and how they can participate in these initiatives after completion of the programs are also explained to the students.

ICT applied to ecosystem needs

Marketing and ecosystems engineering is introduced as a comprehensive Micro Community business objective to all students. Rural shop keepers and traders are explained about the benefits of connectivity and how they could become partners in the network and grid franchise.

Household survey is conducted – target population of ecosystems is segmented into various categories, Telemedicine, Education extension targets identified within the ecosystem, Physical space (clusters of Households) is divided and correlated with student locality for future CRM and marketing Market survey (shop clusters) is conducted. Market segmentation in terms of

- Products
- Suppliers
- Records/transactions/accounts/invoice/
- Distribution chains
- Identification of existing information systems
- Assessments of information needs are carried out by the students

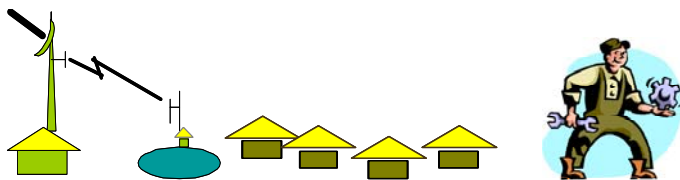
Senior students attain mid level ICT skills (3-4 years) and are now able to teach at junior school classes - thus extending the down lines. Graduating students are able to enter the ICT teaching workforce.

Wireless Network Installation & Management capabilities are honed and tested through formation of network teams at various rural clusters with expertise in routing, server administration, Linux, NT and 802.11 compliant architecture.

In-house capabilities in Micro Community Node management are developed: accounts, telemedicine, school management, Bandwidth management & radius authentication systems, project management systems, billing software systems are developed, tested and installed.

Web tracked office management; scheduling, daily activity routines are developed and strengthen for internal operations management systems.

Last Mile Dummy tests with 802.11b Wi-Fi devices are conducted to test Access Point links, wireless routing, and bandwidth allocations at service points.



Dummy service tests are conducted over the Wi-Fi links by simulating PCO (Public Call Office), CIC (Community Information Center) and HU (Home User) subscriber points. IP phone, VOIP, SMS, credit transfers, billing, OE (Operating Environment) systems are tested. Train network teams in LOS(Line of Sight) survey, using hand held GPS (Global Positioning System) device and FRESNEL zone calculations. Training on Link Budgets and building network teams for different grid areas.

Configuration of Base Units & Remote Bridge (RB) units: point to point and point to multipoint.



Story of a village girl: how ICT changed her life

One day an old man came up to me and asked that he no longer wanted his only girl, Nurulessa, to continue with the computer lessons because he could not afford to keep her any longer and wanted to marry her off. Nurulessa was about 17 and was learning programming and accounting. I learnt that Nurulessa was being married off to a landed farmer who already had 3 wives and wanted an 'extra hand' for harvesting. Nurulessa's father was a landless farmer who worked as a day labourer in other's land. On a good day he earned about \$2 in exchange of dawn to dusk hard labour.

I told the old man to give me 12 months more. After that Nurulessa would be contributing about \$10 a month for her food and that he would no longer have to pay for her higher education. If she did not then I would pay the old man from my own pocket.

The deal was kept. I remember the day Nurulessa got her first pay cheque (we call it honorarium) for some project that was delivered to a company in Dhaka. She was so excited she wanted to leave the center immediately to go home and pay the money to her parents.

Today Nurulessa is a college graduate and a computer programmer. She is a full time LEARN partner and handles the computerized accounts of the Foundation. She sends about \$40 to her family every month and has built a new tin roofed house for the family replacing the old mud house. She aspires to get married one day but to a software engineer and she plans to go for her masters degree.

Nurulessa is the only graduate from her village. People come to see her from far away places. Nurulessa's story has been featured in BBC's Asia Today, national television and news. She has become a role model for hundreds and thousands of other village girls. Nurulessa regularly browses the Internet and has an email address, regular and real, not imaginary on a dirty folded paper!

Her success and struggle is a moving human drama: of triumph of dignity and self reliance, of empowerment, of freedom. Her story is not just a beacon of hope for millions of other girls like her but stands poised as a potent instrument for social transformation of underserved communities of our world.

Nurulessa is one amongst many new generation of LEARN teachers and entrepreneurs who are now busy teaching the hundreds of younger children without the stick so that learning is fun. The use of computers and high quality content is a vital and necessary ingredient in this effort. Yet it is not sufficient.

What is achieved: A part success?

In areas where the LEARN Foundation operates –the districts of Sylhet and Sunamganj–there are 4.5million people encompassing 6200 square km and 6000 villages , 40% below the age of 14, which equals 1.8 million children, of that only about 20,000 will get past high school. Even then their knowledge of English, Math and Science would be extremely poor and none would possess any marketable skills.

Over the last six and half years we were able to impart computer training to only about 4000 students at a cost of more than \$300,000 which included hardware costs and setting up some communication

infrastructure. Many have become highly skilled programmers, hardware and network engineers. Many have gone into multimedia and video productions.

Some are working in Dhaka with software companies; some are working with Internet Service Providers in the cities. Many students have opened their own computer shops and cyber cafes and have small training facilities of their own. Many have gone into teaching in rural schools and working with LEARN as software, network and multimedia personnel. Some senior students have become LEARN partners and they now teach IT courses to new students in different LEARN centers. A senior girl student got married to a Dhaka based software engineer, a few to mid level government officials and businessmen. This is probably success up to a point.

The challenge: designing a self propagating model – the wireless network

Now try to extrapolate this over whole of Bangladesh, the theater space gets large, the ecosystem a massive bulk of humanity, 140 million people. Where does one get hundreds and thousands of Nurussas and millions of computers? Where does the money come from? Where will they get jobs?

The ecosystem where average earning is about \$2 a day containing more than 120 million inhabitants (globally 4 billion) it is difficult to imagine what use would computers come to, right? Many people I spoke to came up with the same question. They were wrong.

The answer lies with the same child with the dirty paper keyboard. Remember what he said he would do if he was given a computer? He wanted to connect! In every school I went a question was asked to the kids with an option to decide –

- a. A computer for each and every student in the class but no Internet
- b. Only one computer with an Internet

In every school surveyed over more than 1200 children the second option was chosen! The urge to connect with others is overwhelming!

The answer is in the heart of the ecosystem- the will to connect...remember millions of young boys and girls, the magic box, the learning device and the communication device, all in one...?? Here lies the key...

Education and connectivity are universal demands, even for people earning less than \$2 a day. It is difficult to imagine how to persuade a 10 year old boy (earning \$1 a day), driving a rickshaw to support his family, to leave his job and go to school. The family needs the \$1 and someone has to pay. Even if this money is found, it would still require an additional \$8 per month for 2 years to properly educate the child to a point where he is able to pay for higher education and start earning \$50 per month and not drive a rickshaw. For 1 billion of the poorest children in the world that is \$8 billion a month just for decent education! Is there a way how funding can be raised internally by the people themselves? The network provides the answer.

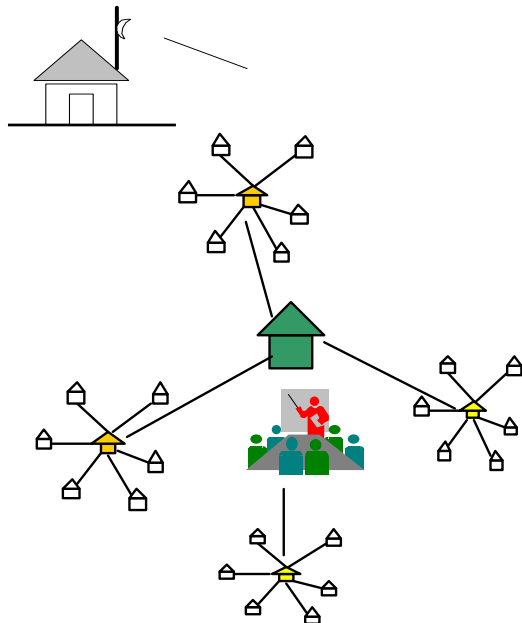
Connecting third world ecosystems with wireless broadband networks through multilateral partnerships involving universities, overseas volunteers, MNCs, NGOs, business and the target communities would stimulate education, commerce and development at the bottom of the economic pyramid and radically improve the lives of billions of people and help create more stable, less dangerous world. At the same time it would also provide significant strategic inroads into vast untapped markets for all.

Technology is easy, people are difficult

The technology is now available to build this network in a ground up viral manner, cheaply and quickly so that the network is paid for and driven by the information (and communication) needs of the third world communities. What is more important, it can be owned, managed, afforded and run profitably by these communities. The technology is Wireless LAN and it uses the unlicensed spectrum. It is packet switched, Internet protocol compliant, state of the art, massively broadband, supporting not just voice but data and video, and it is extremely cheap and plug and play!

It is based on the computer, not on legacy telecommunication technology, and it is fun and easily learnt by high school students! The cost of use is almost free – like air! Its viral unlicensed nature becomes a major force of human development, transforming everything from education to entertainment, hospitals to e-governance, trade, shopping, farming- everything!

Achieving this goal does not require anyone to spearhead new global social-development initiatives for charitable purposes. They need only act in their own self-interest. How?



Designing the virus.....the Wireless GRID



Imagine the landscape, the ecosystem– crowded villages scattered over densely populated landscapes spaced over much smaller distances, with next to zero telephone density, no Internet and no banking infrastructure! Billions of daily transactions, bad roads, creaky transportation

The space is populated with shopkeepers ...in every rural homestead cluster one will come across an almost equal number of shops selling almost everything- agricultural produce to consumer goods – fish, rice, vegetable, spices to textiles, cosmetics, jewelries, books, magazines, CDs and medicine.

Grid dynamics are short but intense (not via cars or bullet trains) but by bullock carts, rickshaws, creaky buses or simply by walking or by boating. Yet, money moves slow because of absence of modern banking systems. Goods, people, services and messages move slower over bad, narrow and over crowded roads, creaky vehicles, trucks, rails, boats and rickshaw ‘vans’. Invoices and bills travel the same routes.

Buying and selling transactions within ecosystems are intense like Brownian movement of gas particles inside close chambers - small, short, incremental dynamics of exchanges between massive humanity whose total population exceed 4 billion.

In each execution of these billions of daily transactions there is opportunity cost involved as it entails unnecessary travel and lost time which could have been saved if effective communication medium was available.

Add to those costs, the cost of inefficient market operations that result out of movements without prior information and this makes transactions unviable in most cases.

Samples:

- People can travel spending hours reaching destinations only to find that contacts are out of station,

- Traders reaching destinations to purchase goods which didn't arrive,
- On reaching destinations finding insufficient money at hand because prices have increased,
- Traders, shop keepers, farmers can find themselves stranded overnight only because boats or tempos (three wheelers) have left a little early or waiting for passengers in the wrong place at the wrong time.
- A fisherman can spend 20% of his daily income taking his catch just 15km away for marketing- spending more than an hour on transit.
- A rural shop keeper travels 3 times a week to his wholesaler just 5 km away (another village), each time paying \$ 0.5 on transporting goods worth less than \$20.

Wireless spectrum can provide the 'shot in the arm' to move things faster, save money and make money for the inhabitants of rural Bangladesh. For most parts, the terrain is flat, devoid of high man-made structures, thus enabling easy line of sight deployment for wireless applications.

Clusters of rural homesteads and markets are in proximity allowing close, dense and meshed last mile wireless solutions. Against these backdrops, juxtapose the viral nature of unlicensed inexpensive wireless broadband and you have a major force for human development.

The Indian experiment

A recent study¹ shows that \$1000 is all that is needed as capital cost per village to connect rural India and that it takes only a year to reach 10% user adoption and from thereon the ROI (rate of return on investment) is 100% annual both for the kiosk operators and network owners. However, it is no good to just wire up one village. Who will they interact with? We would need to connect a minimum critical mass of villages to jump start the network.

The figures are even better for Bangladesh because of dense population and proximity of the villages. It would require only \$100,000 for providing wireless broadband access (including a SCPC VSAT gateway) to 600 villages (approx \$ 200 per village) by 'seeding' direct connectivity to only 60 of these villages in year 1. Then on the network is set free to grow organically, funding itself, like a virus connecting all 600 villages in 5 years! The process is then repeated in the next ecosystem of villages and you get a viral propagation of universal connectivity.

The service would provide wireless broadband connectivity over rural shops, schools, homesteads, market clusters delivering applications ranging from voice mail, money transfer, IP phone, email, browsing, IRC, rural transportation links, e-purchase orders between retailers and wholesale merchants, e-auctions, affordable Wi-Fi video exchange between subscribers, market prices, e-education and e-health services and more- all in local language.

The network can fund education to produce future subscribers for the network; provide real time access to companies to their existing rural retail and distribution chains; and bring millions of students closer to universities which cannot reach them now.

Fully, 65% of the world's population earns less than \$2000 per year--that's 4 billion people. But despite the vastness of this market, it remains largely untapped

The reluctance to invest is based on outdated assumptions of the developing world. Although individual incomes may be low, the aggregate buying power of poor communities is actually quite

¹ This work was funded by Media Lab Asia and the Ministry of Information and Communications Technology, Government of India. The figures are based on wireless ICT infrastructure pilot projects in rural Tamil Nadu and Hariya

large, representing a substantial market in many countries for what some might consider luxury goods like satellite television and phone services. Since these markets are in the earliest stages of economic development, revenue growth for multinationals entering them can be extremely rapid.

Network grows and benefits everyone

Wireless Internet access to millions of underserved rural communities in exchange for bringing up bright school going children within a sustainable and scalable model is a viable proposition in the light of this revolutionary wireless technology.

The network is to be designed in a viral and organically scalable ground up manner so that connecting rural schools would intrinsically be an integral part of

a symbiotic process where the network pays for education and education in turn demands the network.

Framework for partnership

The framework stands on three components

- The network – triggered from a critical point from where it expands organically based on information and communication needs of the community
- Education and e-education-content creation and delivery- over the network so that it is paid for partly by
 - the community and partly by
 - the network as a part of its marketing strategy
- MNCs- building real time enterprises over the network to integrate their retail and supply chains for efficient marketing of low cost fast moving consumer good and for providing better customer experience

A test bed is to be designed and implemented to see if a holistic synergy can be triggered by the three components so that a sustainable growth path can be achieved.

Test bed

There are 540,000 people in 600 villages, 47% (253,000 people) below the age of 16, all demanding education, information and connectivity. There are more than 15,000 registered rural shops within the project ecosystem covering an area of only 42km x 42km (~ 750 sq km) with a combined annual turnover of approximately \$54 million. Most goods are fast moving consumer goods and agricultural products supplied from town based warehouses of national and multinational companies over almost non existent telephone and banking infrastructure. There is at least 15 % 'system loss' in the transaction due to 'information float' and lack of efficient money exchange between buyers and sellers which the network can help mitigate. Fifteen percent of \$54 million is \$ 8.16. If this is split between the sellers (MNCs), the buyers (rural shopkeepers), the consumers and the network owners there is potential annual savings or income of \$ 2.04 million for each.

According to the Indian experiment, per capita annual ICT (news, radio, telephone, message, letter etc) expenditure for a rural Indian is \$20. This translates to total annual ICT expenditure of \$11.05 million in the ecosystem. At least half of these services can be provided over the wireless broadband at less than 50 % of the prevailing costs with enormous savings in time. Now consider the 'trapped' potential revenue for the network which costs only \$100,000 – no wonder that ROI is more than 100% both for the kiosk operator and the network owners.

The framework provides a basis for global collaboration between all parties– the target communities; MNCs; universities; volunteer teachers; NGOs; content creators; advocacy groups; civil society;

philanthropists and the entrepreneurs. The network would internally generate the funds to sustain the collaboration.

The Pilot

LEARN Foundation is designing and implementing an organically scalable business model with WLAN and Wi-Fi radios over information and communication needs of remote rural communities in Sunamganj, northeast of Bangladesh. The project is

- A robust and financially viable broadband wireless network model to be erected in zero infrastructures when it is needed, where it is needed without any prior telecom systems being present.
- To be driven by rural information needs of farmers, fishermen, small traders, shopkeepers, schools, students and to be sustained by businesses these rural communities are engaged in, can understand, adapt and own - along with local businesses and ICT players who deliver the technology and training to these underserved communities.
- Modelled over relatively low capital cost per subscriber, easily maintainable, expandable through rural grid-franchise by small traders, community grassroots leaders and groups of ICT trained rural unemployed youths in order to provide subscriber services, and to be operable and partly owned by ICT trained rural students.
- The network is to symbiotically feed and to be fed by :
 - *Small rural businesses* - who move bricks and mortar, transacts, take up sizable ownership of the network as it propagates delivering value and cross fertilizing existing and new to the world value chains in the backdrop of wireless canvas in their market ecosystems. ICT knowledge transfer to communities is suitably packaged and delivered by trained rural students highlighting opportunities for businessmen and traders at grassroot levels.
 - *NETWORKING RURAL SCHOOLS*: The wireless network is to be designed in a way that connecting rural schools would intrinsically be an integral part of the business model. The access would-
 - Create equitable value both for the owners and users of the network
 - Finance training rural teachers for dissemination of ICT knowledge at primary schools
 - Make high quality educational content available to rural children
 - Encourage students to discover additional use and expand the network subscriptions in their communities in exchange of financial rewards and Scholarships
 - Facilitate long term training for the 'next generation' global market workforce

The project educates and provides high quality information access to rural children simply by extending the network. In other words, the additional value created through the expansion of the network must be enough to fund the education program, which would in turn create more demand for the use of the network. Wireless Internet access to rural communities in exchange for bringing up bright school going children within a scalable business model appears to be a viable option in the light of this revolutionary new wireless technology.

Technology

The service, compliant with local language desktop LEARN operating environment (**LOE**), runs over Linux OS fault-tolerant wide area DSSS/FHSS 2.4 GHz ISM free band wireless/WLAN backbone over distances of 20 kilometers LOS (Line of Sight) between Micro Community Nodes (MCN) in rural schools, 'sprinkling' the last with Wi-Fi 'clouds' over rural shops, schools, homesteads, market clusters delivering pre-paid billable and variable bandwidth (Subscriber controllable) at the customer premise .

The desktop LOE at the customer premise, seamlessly interoperates with dual boot Linux/Windows OS at customers' choice, delivers multi-layered applications ranging from voice mail, money transfer, IP phone, email, browsing, IRC, rural transportation links, e-purchase orders between retailers and wholesalers, e-auctions, affordable wi-fi video exchange between subscribers, market prices, e-education and e-health services and more.

The customer LOE runs on desktop PCs and is compatible with wi-fi compliant PDAs, SIMPUTER (the low cost Indian version), POS terminals and mobile IP phones moving between cloud to cloud over fixed IP address for each subscriber.

INNOVATING IN THE Wi-Fi CLOUD

The innovative features built in the LOE are:

1. Graphical & hierarchical Directory System of Connected Units

All business units/ subscriber information is located in the customer directory database accessible from all customer desktop LOE. The subscriber directory (e-yellow pages) of the system consists of cloud to cloud, grid to grid, node to node, village to village cross-linked navigation system in a map based easy to locate graphical interface.

Any user at any location can track out the online or offline customer information under the coverage and service area in a hierarchical fashion; choose the appropriate application, selecting target subscriber from the desktop LOE and clicking SEND or any appropriate trigger to initiate service.

2. Demographic Information of Covered Population

Along with the subscriber directory navigation system, the Operating Environment is also capable of storing vast amounts of family, household, social, financial and other relevant demographic and transactional information.

The back-end system of LOE is designed to perform statistical and analytical operations over the transactional/demographic database delivering secondary or organized information vectors for product marketing, advertising and determination of optimized future network propagation paths.

3. Electronic funds transfer

Creaky (or lack of) banking systems in rural areas is a major impediment for economic growth in the third world. The LOE incorporates major innovation in electronic money transfer in rural areas without the use of plastic cards or e-cash that requires third party bank mediation- proposition not feasible in most third world banking systems.

The 15 month pilot project aims to provide connectivity to 60 villages and 6 rural schools divided over 3 rural ecosystems in the district of Sylhet in Bangladesh to test these applications. The ICT trained rural students would install, manage and market the applications to their communities. Each ecosystem contains a wireless grid, 20 connected villages per grid. The schools would be the administrative centre of each grid. About 600 villages would avail the network services from information kiosks which would be owned by rural traders, businessmen and ICT trained students of LEARN Foundation even though only 60 villages are connected during the 15 months term of the project. The expectation is, over the next 5 years, the network would organically expand to all 600 villages.

Education holds the greatest promise of all.

Remember the technology? It is computer based and recall the number of people below the age of 16-253,000! Computers and children are analogous to honey and bees. Here lies the challenge and excitement for educators in harnessing this great human potential. The computer is first configured as a learning tool, and then as a communication tool and finally as a professional tool. The network, in the background, pays for it all. Why should the network pay? For its own growth- educated kids today are potential network subscribers of tomorrow.

The pilot project invites people of the highest creativity and expertise to come forward and execute ideas to make things happen so that these children are

- Given high quality access to information and knowledge
- Taught to be curious and to think analytically
- Able to form independent opinion and acquire globally marketable skills

The project would require entrepreneurs, people who can conduct courses in entrepreneurship and lateral thinkers to teach these students how to execute ideas, cross fertilise traditional value chains into value constellations over the wireless canvas and set up their own businesses in the grid ecosystems.

The pilot broadly aims to test -

- Network service adoption rates by the rural community and its potential for self propagation
- Education delivery systems over the network from remote universities and volunteer teachers
- Whether and to what extent rural students would pay for distance education
- Whether network would fund education as a part of its growth strategy and to what extent the newly educated community would demand the network
- Whether local and multinational companies are motivated to build real time links to their existing rural retail and distribution chains over the network
- Whether, how and to what extent the growth of the network provides employment opportunities and avenues for creative use by the newly educated community
- Whether multilateral partnerships can be structured over the model
- A set of best practices manual for replicating the model elsewhere

Specific goals of the pilot project

- Deliver wireless broadband Internet access to 6 rural schools, 60 villages and a central ICT and education training facility
- Provide rural wireless access nodes to ICT training centres and cyber cafés to be owned and managed by the trained students
- Test viability of student run/owned cyber cafés in grid areas
- Test the network user adoption and service adoption rates as per agreed benchmarks
- Test whether the income from the network would provide sufficient funds to provide ICT training for rural students
- Test at least one education cascade component– where parents are persuaded to run a kiosk in exchange of their children going to school, taking scholarships and training 10 younger children
- Test live delivery of lectures from the ICT centre over the network to 6 rural schools within the grids.
- Test integration of distributor, retail and supply chains for companies marketing consumer goods in the grid areas and involve at least one national and multinational company to participate in the project
- Test integration of invoice, fund transfer and goods delivery systems between rural shops and their wholesale agents in nearby towns
- Test cross fertilisation of traditional rural economic value chains to create new to world value constellation for better product and customer experience in rural retail shops
- Test rural audio/video access to village homes from UK based expatriate workers from Oxfordshire
- Design Grid Franchise models for network expansion
- Develop multilateral partnership for expanding the project

Conclusion

The new strategy requires a market approach, a business focus, towards closing the digital divide. It will need building strategic alliances between business, education and networks, because, in the ultimate analysis, it will be the drive for profit, and not humanity's collective sense of altruism, that will close the divide.

The role of business, ICT practitioners, and policy makers worldwide should be to look into this seriously, conduct a preliminary research to test the validity of the premise that WLAN networks can actually be built profitably from ground up providing viable ROI both for the network owners and kiosk operators, bench mark best practices and then present a case for all stakeholders.

First, to the communities by designing innovative methods of distance learning, entrepreneurship, and working out creative use of the network which would produce economic value for the communities, and then figuring out the best ways and means to deliver the content over the network so that the target communities would be willing to pay and educational institutions would make money. Second, to the prospective network owners by designing an economic model of the network which clearly shows that funding a part of the education program makes economic and marketing sense for the network owners. And finally, and perhaps most important, by building a case for the national and the MNCs in creating real time extended enterprises over the wireless canvas linking distribution, supply and retail chains in rural market space and cross fertilising existing value chains to create new to the world value constellations for millions of consumers. So the triangular synergy involves: education, network and MNCs.

Recommendation/prescription

Rural ICT implementation must start from the ecosystem brain center: the village school and the students. Computer is first configured as a learning tool and the students are attracted to the class rooms. Side by side, the rural markets and shops are surveyed to assess information needs: invoice, bills, orders, money transfers- distribution and supply chain integration of MNCs pushing fast moving consumer goods in the market ecosystem. The next step would be to design the optimal size of the WLAN grids and teach the students how to install and administer the network. Then hold focus group meetings with local business and traders to identify application needs. Deliver these over the network. Involve the MNCs to participate in building the network so that real time integration of their supply and distribution chains can be linked to the rural retail outlets. Design the information kiosks to deliver value constellations to the customers, not just VOIP, Internet browsing and email. Transfer part of the network ownership to the students, shop keepers and traders. Set the network free to grow organically like water lilies in a pond. Convince the network owners to link schools and contribute a part of the network income for ICT education as a marketing strategy. Once a critical mass is achieved try health services over WLAN.

“It is true that all successful learning networks are built from the ground upwards, just as we are experiencing in Sylhet. Its sustainability will require the developing electronic community to evolve quickly and then reach towards an originality of expression that will travel to all parts of Bangladesh. From these communications, a knowledge economy can grow and prosper from within Bangladesh and reach out to the world. In this way, we will hopefully all learn from each other, and how our different generations and our distinctive nations can co-operate in ways that will improve the world. It is the network that makes this possible, and that excitement drives us all.”