ICT R&D Grants Programme for Asia Pacific

Project Proposal

**Project Title:** Community Mesh Network for Mahavilachchiya, Sri Lanka

**Recipient Institution:** Information & Communication Technology Agency of Sri Lanka

**Project Leader:** Manju Haththotuwa, CEO/Managing Director

**Amount and Duration:** US$ 27,656 / 18 months

**Commencement Date:** December 2004

1. **Project Background & Justification**

1.1 **Introduction**

Internet access for the rural developing world is largely perceived as a way to reduce isolation, provide educational and economic opportunities, and ultimately improve the quality of life. Unfortunately, high capital and operating costs have limited rural access to a handful of heavily subsidized and supported demonstration projects. An innovative integrated strategy, based on existing technology and rural social structures, could address a variety of barriers and ultimately help get large numbers of rural communities on the internet. Here we propose the creation of a strategic demonstration and test bed in Mahavilachchiya, Sri Lanka.

1.2 **Background Information**

Mahavilachchiya is a rural town situated 40km from the Anuradhapura city, and is surrounded by the jungle in every side. Mahavilachchiya is a farming settlement better known for its large water reservoir, one of the biggest in Anuradhapura district.
Although the country is experiencing showers in the Central Western and Uva provinces, the Anuradhapura District has been dry with little rainfall through this monsoon season. This period of drought has caused many problems in the area especially in the agriculture sector.

The Horizon Lanka Institute of Technology and Creative Arts is a non profit organisation situated in Mahavilachchiya that provides education including English, Science, Mathematics, Computer Science and graphics to 200 village kids. In June 2004 a Transmission Tower was installed at the institute providing a 64kbps line to the community for the first time. This provided a good tool to the villagers especially the village youth to surpass the barriers imposed by the environment. The Horizon Lanka Foundation has provided the village with high computer density, currently reaching 30 PCs amongst households with electricity where children use it mainly for homework assignments. They have also donated computers to Dhamma schools, Public schools and the Police Station. Mahavilachchiya also has a high unemployment rate among the youth and the pace of it is not fast enough to redress the deep rooted poverty and other long standing grievances of the people. Education facilities in the area are so poor that there are records of a high rate of school leavers at the primary level. Poor infrastructure and geographical factors have sadly hindered foreign investment in the area. The area also lacks proper health care facilities and public transport.

Mahavilachchiya is a part of the rural sector of Sri Lanka that still remains largely unconnected to the Web. Even though there is a high density of computers in the village, they do not have internet access nor are they connected to each other. The villagers do not perceive how the information availability can make them more productive and demandable nor do they know how the same can improve their quality of life. For instance, in spite of the web carrying the weather report for four days ahead for a provincial town, random queries at surrounding villages reveal that no farmer uses this information in making decisions on his/her agricultural activities.

This situation is ironical, as the whole world has access to this information, while the very people to whom such information would have been most important, have been indirectly prevented from accessing the same. The most decisive bottleneck that prevents the rural penetration of Internet is financial. The following cost calculations were made not only to illustrate the high cost of Internet usage in general, but also to show the urban rural disparities. In addition, this estimation also points out the most critical components of the Internet usage.

1.3 The Internet usage charges constitute of five main components namely

1. Cost of hardware equipment and system software
2. Internet surfing charges (To be paid to the ISP separately)
3. Telecommunication charges (To be paid to the telecom service provider)
4. Cost of electricity
5. Value Added Taxes (VAT) applicable to the above services

The outcome of the calculations based on the above assumptions is shown in Graph (1). It shows the cost of Internet usage to an urban user and a rural user respectively for selected periods of monthly usage.

In spite of all the developments taken place during the past few decades, the rural banking sector in Sri Lanka still uses IT at the bare minimum level. Perhaps the state banks and some of the rural development banks use computers. However, they are not interconnected and work on a stand-alone mode mostly. Compared to the speedy and effective service received by their urban counterparts, as a result of automation, the rural population does not receive any financial services worthwhile mentioning.

Various technical elements are also addressed in the proposal, to reduce infrastructure and connectivity costs, and to lower the excessive amount of technical support currently needed to set up a communication network in a rural area.

2. Project Objectives

Our goal is to design and develop a low-cost wireless broadband architecture for providing high-speed Internet access services in Mahavilachchiya and to conduct a pilot program to identify key success factors for sustainable services. Our target is to connect 30 households together using the Mesh technology in eight phases.

2.1 Promoting use of computers in Schools and training

Children in most rural areas do not get the benefits of learning IT basics and the few schools that own computers do not have internet connections. Children mostly learn basic Microsoft Office tools and have no access to the Internet nor do they understand the knowledge they can gain from it. If children are able to use the Internet as a resource for information on their school work and projects, they would be able to reach a high standard and be on a similar standing as children in urban areas. Students will be able to communicate and chat with others in surrounding schools and teachers will be able to conduct forums. Homework help online will be possible and students will be able to share views and ideas and work collectively. Parents will be able to communicate with teachers regarding their child’s attendance in school or progress in class without traveling or interrupting school operations.

2.2 E-channelling and Hospital connection
Rural patients will be able to access information on doctor’s appointments and medicine recommendations without spending money to travel to the city. Clinics in the village will have the option of gaining access to other clinics and pharmacies will be able to stock on medications. Local doctors will have a means of communicating with doctors in the city for emergency operations, medication availability and advice.

University acceptance of students in all fields would also increase due to the new edge students will as a result of increased communication and information access through the Internet. Sri Lankans will have the necessary background to be engaged in ICT related industries and this will give rural job seekers an equal advantage when applying for jobs. Providing a communications network for rural students would definitely provide the boost, to take a leap into the new technological and globalized world.

### 2.3 Facilitating the search of employment opportunities

Unemployment within the Mahavilachchiya district, just like in other areas of the country, is one of the most important issues which can also be addressed. Although this project does not aim at directly creating employment opportunities, it intends to provide an easy channel for rural youth to find prospective employers. This objective is expected to be achieved by creating a means for which youth can access local job engines and interact via email to employers. It will also provide a means for local businesses to find employee by advertising and discussing in chat rooms.

### 2.4 Community Chat

In addition to browsing the web, making transactions and using e-government tools, villagers will be able to simply set up web-based email accounts, web pages, mailing lists, real-time chat sessions and message boards on topics of interest to them through a single portal. They will be able to post local community news stories and photos to an online community news forum and comment on the stories posted by others. For example a community entrepreneur working with local business people to develop a community revitalization plan could quickly develop a simple web site with a local service directory, background documents, calendar of upcoming events and discussion board.

### 2.5 Connectivity between institutions and people

Banks, financial institutions and other companies in the village will be able to access the network. This will open up a new avenue for them to communicate with the village. They will be able to get more customers, provide information to customers, employ people in the area, inform customers of transactions or critical information, and provide real time assistance to people that cannot afford a phone call. The institutions will also be able to communicate with other branches that have network capabilities
and this link with the Colombo branch will greatly reduce time lost in trying to reach people in different parts of the country or world. Customers will have access to bank/utilities information 24 hours without having to take time off work.

2.6 Dissemination of Health and Educationally important information

In crisis situations sometimes it becomes necessary to educate the population at short notice. (eg. To avoid an endemic of Dengue – a common disease - it might be necessary to educate the population on preventive measures on a contingency basis.) Currently this is done through the conventional media sources, but has been observed to be not so effective. The drawbacks of the conventional media (newspapers, government notices etc.) include their one way communication capability, delays in communication and the difficulty to address a large section of the population within a short period of time. The introduction of a district-wise information system will address this issue by effectively disseminating information to the public within a short period of time. However, in this case it is necessary to present all the information in Sinhala and Tamil, in a way easily understandable by the rural population.

2.7 Spreading information on how to face current environment conditions - drought

A severe drought is expected in Sri Lanka over the next few years, and Mahavilachchiya is an area that is affected more than others. Farmers especially need information on ways to prepare for these times and prevent their crops from being severely affected.

Areas where water is accessible and ways to overcome this time can be publicized over the internet. Ways to save water and electricity could be stated online so that people are more knowledgeable on saving methods and not ignorant.

2.8 Communication with the outside world

Parents who have children in universities will be able to communicate with them via email/chat and they will not have to depend on other expensive modes of communication for frequent contact. Villagers who have relatives in the Middle-East or other countries will be provided with low cost Net-to-phone facilities. Artisans in the area and surrounding villages will be able to market their handicrafts, music, etc., directly to customers via the internet. They will also be able to promote their products to the cities and even internationally.
2.9 IP Telephony

IP Telephony will open up another path for people to communicate within the village. Since most people in Mahavilachchiya are unable to afford a telephone line, this community voice system will allow villagers to chat and discuss their views. Villagers will no longer feel barred from communication but will be able to interact with each other whenever they want to.

3. Project Beneficiaries

In general, this project aims to bring benefits to the entire population of Mahavilachchiya. However, certain categories, given below, can be identified as some of the special beneficiaries within this large group:

- **Agriculture community:** This is the largest group, which will benefit from a project of this nature. Nearly 75% of the population of the district either directly or indirectly depends on agriculture and this project is expected to bring direct benefits to them. The exact ways and means this group benefits is described under project objectives.
- **Credit Societies:** This is a group that might benefit indirectly. Although the direct objective of the project is to address the financial requirements of the rural communities, the rural banks, co-operative banks, credit societies with their members will benefit from the programme as it enables them to expand their businesses and communicate with the villagers.
- **Employment seekers:** Although the ‘unemployment ratio’ within the district is low, many still opt for better opportunities as they feel they are currently under-employed. The establishment of an Information Network will provide them opportunities to find jobs outside the district, which will tally with their educational qualifications.
- **Wholesale Buyers:** At present the wholesale buyers face problems in finding their stock at the correct price. A buyer might have to visit several villages to find an adequate stock to buy. Sometimes he might not have offered the correct products or the correct quantity. The availability of product and price information solves this issue and guides them in finding the best locations to purchase farm products.
- **Children, Teachers, Parents:** All these parties benefit from the scheme, as the implementation of an information network creates communication between them and creates opportunities for students to advance in IT skills.
- **Food Processors/ Importers / Village level vegetable collectors:** These are specialized categories of purchasers. Naturally, they too will enjoy the benefits available to all purchasers.

4. Project Sustainability
After implementation of the network, the recurring costs are very low. This would mainly be the monthly charge to the Internet Service Provider (ISP). This cost can be recovered by charging the users a monthly nominal fee for usage.

5. Project Methodology

Implementation Strategies & Co-ordination Mechanisms

We plan to prototype and field test Mesh Network Nodes (MNN), a collection of which when installed at specific locations in Mahavilachchiya, will identify each other and form a wireless mesh network. It will also route IP (Internet Protocol) traffic for standard (IEEE 802.11b for this implementation) wireless clients (Personal Computers or Workstations) in the same neighborhood.

The following assumptions are made:

1. The client hardware and software assumed to be standard PC with wireless LAN adaptor and appropriate driver.
2. Zero or minimum configuration required for the client to join the community Network.

The project will be completed in 5 phases, each phase signifying a cluster of houses connected to a Mesh Node. Each phase will be tested for optimal transmission and connectivity between nodes in the Mesh.

The proposed mesh network leverages on the new open standard Ad hoc On-demand Distance Vector (AODV) routing protocol. All the mesh network nodes and client nodes are in the ad hoc mode. As per the IEEE 802.11 wireless physical layer standard, in this mode peer-to-peer communication can exist between any two nodes which are located with in the radio coverage range of each other. The system is commonly referred to as Independent Basic Service Set (IBSS). However, in the ad hoc mode a node cannot relay frames or packets to other node. That is communication between the nodes is point-to-point and no intermediate relay node can exist. This limits the geographical area of coverage to the extent of all nodes being located within the reach (by means of radio waves) of every other node.

Upon formation of the backhaul network any household can join the network by adding a wireless network adaptor and installing appropriate driver. In addition the AODV protocol stack can be installed on any client node and it become a mesh network node.

In addition to peer-to-peer communication, one of the network nodes can be connected to the Internet to provide connectivity.

6. Project Outputs
This pilot project will create a wireless Mesh Network where villagers will have access to information and this knowledge will stimulate economic growth by creating new products, increasing productivity and promoting new commercial and administrative methods. In addition to economic development, this connectivity would foster social development, cohesion and inclusion, through its applications in education, health and increased citizen participation in civil society and government.

The entire community will benefit from up-to-date information at their fingertips and will be able to grow towards developing an IT knowledgeable workforce.

7. Project Monitoring

- Project Leader based in Colombo will get daily reports from Technical Implementation staff at the site.
- Project meetings will be held once in two weeks via telephone conferencing.
- Site-visits will be made once in two months.
- Quarterly updates on project status will be sent to Officials at Asian Development Bank.
- Tests using the 2.4GHz frequency for evaluation will be conducted for measuring sound quality, call set-up delay time, effect of Internet usage to the telephony operation, digital transmission throughput with a small antenna (+8dB gain) at the roof top over the distance. Low-bandwidth videoconferencing abilities will also be tested using MS NetMeeting.
- These test results and developments will be published on the HorizonLanka website regularly.

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