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DAKNET: ARCHITECTURE AND CONNECTIVITY IN DEVELOPING NATIONS

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Abstract: DakNet provides extraordinarily low-cost digital communication, letting remote villages leapfrog past the expense of traditional connectivity solutions and begin development of a full coverage broadband wireless infrastructure. DakNet, an ad hoc network that uses wireless technology to provide asynchronous digital connectivity, is evidence that the marriage of wireless and asynchronous service may indeed be the beginning of a road to universal broadband connectivity. This paper briefly explains about what are DakNet, how wireless technology implemented with DakNet, its fundamental operations and its applications, and finally how to connect Indian villages with town city and global markets.

Keywords: Daknet, Information and Communication Technology, Wireless Communication

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INTRODUCTION

Now a day it is very easy to establish communication from one part of the world to other. Despite this even now in remote area villagers travel to talk to family members or to get forms which citizen's in-developed countries can call up on a computer in a matter of seconds. The government tries to give telephone connection in very village in the mistaken belief that ordinary telephone is the cheapest way to provide connectivity. But the recent advancements in wireless technology make running a copper wire to an analog telephone much more expensive than the broadband wireless Internet connectivity.

DakNet, an ad hoc network uses wireless technology to provide digital connectivity. DakNet takes advantages of the existing transportation and communication infrastructure to provide digital connectivity. Developed by MIT Media Lab researchers. DakNet whose name derives from the Hindi word "Dak" for postal combines a physical means of transportation with wireless data transfer to extend the internet connectivity that a uplink, a cyber cafe or post office provides. DakNet has been successfully deployed in remote parts of both India and Cambodia at a cost two orders of magnitude less than that of traditional landline solutions. 1.1 Purpose of Daknet

Real time communications need large capital investment and hence high level of user adoption to receiver costs. The average villager cannot even afford a personnel communications device such as a telephone or computer. To recover cost, users must share the communication infrastructure. Real time aspect of telephony can also be a disadvantage. Studies show that the current market for successful rural Information and Communication Technology (ICT) services does not appear to rely on real-time connectivity, but rather on affordability and basic interactivity. The poor not only need digital services, but they are willing and able to pay for them to offset the much higher costs of poor transportation, unfair pricing, and corruption.

It is useful to consider non-real-time infrastructures and applications such as voice mail, e-mail, and electronic bulletin boards. Technologies like store and forward or asynchronous modes of communication can be significantly lower in cost and do not necessarily sacrifice the functionality required to deliver valuable user services. In addition to non-real-time applications such as e-mail and voice messaging, providers can use asynchronous modes of communication to create local information repositories that community members can add to and query.

1.2 Applications of Daknet

AAfC supplements the government-mandated curriculum with additional teachers that teach English and computer classes to the most gifted students.

AAfC/JRF was FMSs first client to experiment with the innovative applications of the DakNet technology. The following applications and analysis of DakNet's potential social benefits reflect AAfC/JRF's experience. While Internet access has been reliable, each application must overcome specific challenges. Since applications complement the technology, these challenges directly affect demand for DakNet.

1.3 Features of Daknet

Since it avoids using phone lines or expensive equipment, DakNet provides one of the lowest-cost accessibility solutions in the world In addition to low cost the other feature of DakNet is its ability for upgrading the always-on broadband connectivity. As the village increases its economic means the villagers can use the same hardware, software and user interface to enjoy real-time information access.

Some benefits are,

• Real-time communications not required for public kiosks Communications tend to be asynchronous Villagers trade-off latency for affordability

• Leverages two major trends Cost of wireless broadband (WiFi) Cost of digital storage

• Easy to implement on widespread basis

• Lower uplink costs and maintenance requirements

• Bandwidth does not decrease with distance

• Seed infrastructure that is scalable with demand

• Reduced Regulatory Challenges 1.4 Daknet Package

DakNet offers an affordable and complete connectivity package, including:

Wireless hardware (wireless transceiver and antennas) Networking software

Server and cache software

Custom applications, including email, audio/video messaging, and asynchronous Internet searching and browsing

API enabling organizations to easily integrate DakNet with their existing applications

1. Daknet Architecture

DakNet is unique and proprietary network software that distributes bandwidth from Internet connection points as far as the road goes. Existing backbones become wireless uplinks for Mobile Access Points that are mounted on vehicles to provide broadband "drive-by WiFi" access as they pass through rural areas

The main parts of DakNet architecture are

Mobile Access Point

DakNet offers data to be transmitted over short point-to-point links. It combines physical and wireless data transport to enable high-bandwidth intranet hubs (places with reliable Internet connection).Data is transported by means of a mobile access point, which automatically and wirelessly collects and delivers data from/to each kiosk on the network. Low cost WIFI radio transceivers automatically transfer the data stored in the MAP at high bandwidth for each point- to- point connection. Mobile Access Point is mounted on and powered by a bus or motorcycle, or even a bicycle with a small generator. MAPs are installed on vehicles that normally pass by each village to provide store-and-forward connectivity.

MAP equipment used on the bus includes,

> A custom embedded PC running Linux with 802.11b wireless card and 512Mbytes of compact flash memory.

> A 100-mWamplifier, cabling, mounting equipment, and a 14-in Omni directional antenna.

> An uninterruptible power supply powered by the bus battery.

The total cost of the DakNet MAP equipment used on the bus is $580.A session occurs each time the bus comes within range of a kiosk and MAP transfers data. The speed of the connection between the access point and the kiosk or hub varies in each case. But on average, they can move about 21Mb or 42 Mb bidirectional per session.

The average good put or actual throughput for a session, during which the MAP and kiosk go in and out of connection because of mobility and obstructions, is 2.3Mbps. Omni directional antennas are uses on the bus and either directional or Omni directional antennas are located at

each of the kiosks or hubs. The actual throughput depends on gain of antenna and orientation of each kiosk with the road and internet connectivity among kiosks (public computers) .

It is a common connection point for devices in a network. It is used to connect segments of a LAN. It contains multiple ports. Packet at one port copied to all other ports-all segments see all packets. When the vehicle passes near an internet access point the hub-it synchronizes all the data from different kiosks using the internet.

Kiosk

Fig. 2.1 Mobile Access Point

Hub

It is a booth providing a computer related service such as ATM. In each village there is kiosk. It requires a user interface that can be used without training. It enable user to enter and display information on the same device. Either directional or Omni directional antennas are located at each of the kiosks or hubs. Amplifiers are used to boost the signal and range for higher.

In Daknet a wireless card i.e wifi card is mounted on a vehicle that travels around to remote villages and exchanges updated information with each kiosk it encounters through WiFi.

Advantages of using WiFi cards are :

- Increase mobility
- Cost for setting up a network is much less than running wires.

2.1 Implementation Of Daknet

A simple store-and-forward WiFi system, using a government bus as a central linkage. The bus contains a simple WiFi installation and server, and when in range of one of the outlying information kiosks it synchronizes data for later Processing.

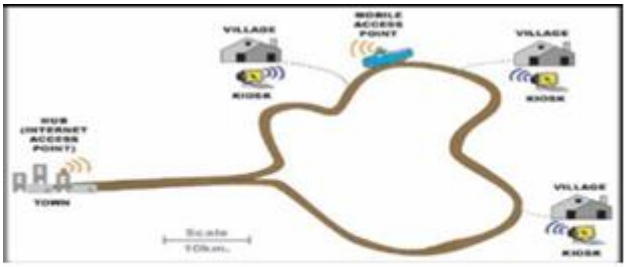

Fig.3.2 Implementation of daknet

DakNet is a patented wireless package that does away with base stations. DakNet a cost-effective network for data connectivity in regions lacking communications infrastructure. Instead of trying to relay data over long distances, which can be expensive, DakNet transmits data over short point-to point links between kiosks and portable storage devices called Mobile Access Points (MAP).

Mounted and powered on a bus or motorcycle with a small generator MAP physically transports data between public kiosks and private communications devices and between kiosks and a hub (for non real time internet access). Low-cost Wi-Fi radio transceivers transfer data stored in MAP at high bandwidth for each point-to-point connection.

The implementation process starts with configuring the Hub uplink and server, then to connecting real-time nodes directly or through repeaters, then to installing Mobile Access Points and store-and-forward nodes, and finally to network testing, troubleshooting and training. This process typically takes 2-3 days for the Hub, 1-2 days for each real-time node, and 5-1 day for each store-and-forward node. The FMS team typically implements the Hub and a first phase of nodes, and then the And the operation of the network can be described as follows.

1) The Map devices are mounted on specific transports that regularly pass through a series of villages

2) As the vehicle carrying the MAP comes within range of each village they automatically sense a wireless connection with a kiosk and deliver and collect data at relatively high bandwidth.

3) Whenever a MAP comes within range of another kiosk or a Hub, data is automatically uploaded to and downloaded from the intranet/Internet.

4) This cycle is repeated for every vehicle carrying a MAP unit, thereby creating a low cost wireless network and a seamless communication infrastructure. Even a single vehicle passing by a village once per day is sufficient to provide daily information services.

Although DakNet does not provide real time data transport, a significant amount of data can move at once-typically 20MB in one direction. Thus asynchronous broadband connectivity offers a stepping-stone to always on broadband infrastructure and end user applications

2.2 How Daknet works

Sender/receiver

DakNet service provider

Bus mounted wireless transceiver

Daknet Work

Operation performs in two steps:

• Asthe MAP equi pped vehicle comes within range of a village WiFi enabled kiosk, It automatically senses the wireless connection and then uploads and downloads tens of megabytes of data.

• When a MAP equipped vehicle comes within range of an internet access point(hub), it automatically synchronizes the data from all the rural kiosks, using the internet. The steps repeat for every vehicle carrying a MAP unit, thereby creating a low cost wireless network.

2.3 Daknet in action

Villagers in India and Cambodia are using DakNet with good results. Local entrepreneurs currently are using DakNet connections to make e-services like email and voice mail available to residents in rural villages. One of the DakNet's early deployments was as an affordable rural connectivity solution for the Bhoomi e governance project. DakNet is also implemented in a remote province of Cambodia for 15 solar- powered village schools, telemedicine clinics, and a governor's office. DakNet is currently in action in many places.

> Bhoomi initiative in Karnataka

An initiative to computerize land records is recognized as the first national e-governance initiative in India, pioneered by the state government of Karnataka. Bhoomi has been successfully implemented at district headquarters across the state to completely replace the physical land records. (Pentland, A et a/.2004) focus of the Government's universal service obligation funds from wireless village telephones to wireless ad-hoc networking. The shift will probably require formal assessment for user satisfaction, resulting economic growth and system reliability.

4. CONCLUSION

DakNet's low deployment cost and enthusiastic reception by rural users has motivated dozens of inquiries for further deployments. This provides millions of people their first possibility for digital connectivity. Increasing connectivity is the most reliable way to encourage economic growth. The larger goal is to shift the policy

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