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Daknet (The Village Area Network)

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Abstract- In today's world technology advancements have changed the way people communicate with each other. The massive growth of internet boosted up developing countries to adopt the new scenario. Like developed nations they also wanted to catch over the new pace and these nations were able to walk side by side .but still some loop holes remained like the ICT(Internet Communication Technology) advanced in urban areas of developing countries but the rural and remote areas were still lacking behind. In this paper an attempt has been made familiarize the network that proved to be a blessing to remote people giving them opportunity to use the world's biggest chain of networks Internet- called "THE DAKNET".

Keywords- Asynchronous - communication that does not occurs at the same time.
WiMax- (Worldwide Interoperability for Microwave Access) WiMax is a broadband wireless accesss network technology for Ethernet intended primarily as a alternative to wire technologies to provide broadband access to customer premises.
VoIP- It is an acronym for Voice over Internet protocol. It is said to be a phone service over the internet. It is a category of hardware ans software that enables people to use internet as the transmission maedium for telephone calls by sending voice data in the form of packets using IP rather than by traditional circuit transmission of Public Switched Telephone Network.
Bandwidth- It is defined as the amount of data that can be transmitted in a fixed amount of time. In digital devices the bandwidth is expressed in bits per second or bytes per second. in analog devices it is expressed in cycles per second.

I. INTRODUCTION

"Dak" is a Hindi word which means "Post" in English that used to be the traditional form of communicating messages. This traditional process suffered from delay and it was relatively unreliable and slow .Daknet as the name suggests "Dak over the network" which is a wireless network. It provides internet facility to rural areas at very low cost and in a simple manner. It was developed by **MIT** (Massachusetts Institute of Technology) by FirstMile Solutions co-founders Richard Fletcher and Amir Alexander Hasson. This technology, which United Villages calls DakNet essentially uses Wi-Fi boxes fitted in buses or on any other vehicle - such as two wheelers for places where roads won't accommodate four wheelers. These start from a big town or city and go into interior villages to provide "store and forward" connectivity in rural areas. It uses physical means of transportation like bus, car, motorbikes, bicycle and communication infrastructure like Routers, Hubs to provide Asynchronous digital connectivity. In other words, Daknet, which means exchange of information wirelessly, connects villages that are lacking a digital communication infrastructure through existing communication and transport infrastructure. Daknet is treated as an ad-hoc network which is not permanent. It provides excellent services to poor villagers who cannot afford their own personal computers and smart mobile phones . Real Time communication need large capital investment cost. So, Telecommunication companies used to avoid the extendability of their network in Rural areas.

II. WHY DAKNET

Daknet is an asynchronous communication methodology. The use of asynchronous communication infrastructure in developing countries. Based on the output of their cost calculator and other considerations such as power sources, scarce bandwidth, and unreliable infrastructure, they argue that asynchronous communication in general leads tothe most efficient use of scarce resources in developing countries. For example, since low access speeds and network congestion are common in developing countries, real- time services can be costly and ineffective. In these situations, asynchronous communication makes sense because it spreads out data transfers more evenly over time, using the communication medium more effectively. Besides being able to use resources effectively, pilot projects have shown that asynchronous communications can adequately meet the needs of individuals in the target market.

The other benefit of the technology is its cost. "DakNet is currently al least an order of magnitude lower in cost than available alternatives such as cellular, satellite, and WiMax," claims Hasson adding that DakNet's infrastructure cost per line is just about 1% compared to the cheapest alternative, the fixed line phone.

Over two billion people living in rural areas globally do not get access to even basic information and communications services just because telecommunication companies and governments have not been able to provide a

sustainable, cost-effective infrastructure. While the cost of connectivity rises dramatically with the distance from the backbone of the communications infrastructure, population density and income per capita decrease dramatically, and these two factors are the biggest reasons for the increasing global "digital divide," believes United Villages.

III. SOURCE OF POWER FOR DAKNET

Daknet uses only those computers for performing operations, that are charged by Solar Panels or by a Generator attached to a bicycle wheel. So it does not depends on Electricity as there are many Electricity issues in backward villages. Daknet is free from dependable power sources.

DakNet integrates inexpensive Customer Off-The-Shelf (COTS) hardware components, open-source software, and FMS's proprietary software to create an asynchronous Internet hub and spoke system. Computers at the hub are connected to the Internet in real time, while computers at the end of the spoke are connected asynchronously. Traditional transport mechanisms such as cars, motorbikes, buses, or even donkeys transport data between the hub and spoke.

IV. THE STRIKING IDEA

At the time, available technologies providing Internet access in rural areas were all either too expensive or too risky for telecommunication operators to implement. Traditional wireline infrastructures were too expensive to install and maintain and new technologies such as WIMAX- type systems were too risky to immediately launch on a wide scale. Richard Fletcher and Amir Alexander Hasson they believed That Daknet could overcome these deficiencies and provide a glimpse into the market opportunities that exist in serving people living in rural and remote areas. Fletcher and Hasson were inspired by the idea that profits could be made by catering to the poor as customers. This concept known as the bottom of the pyramid (BOP) business model. They believed that low-cost innovative solutions can profitably address the unique needs of the low- income market.

V. ARCHITECTURAL PARADIGM

The idea of Daknet is simple. First sneakernets were used. In that data used to travel slowly and it required a lot of manual intervention. Daknet used recent advances in cheap,high bandwidth and easy to use technology. Data was transmitted over wireless to e-postman which could be a motorbike.for sending messages via email it used to compose it in application programs like Ms Outlook and then send it. The mail used to get stored in e-postman until it gets within the range. The FAP(fixed access point) device connected to users machine automatically transmits it to MAP(Mobile access point).When e-postman approaches the internet hub then email transmitted from MAP to internet hub then to the internet. Then on the receiving side the email transmits from HAP to MAP of e-postman then to reciepients FAP and at last to user's mailbox.

The components of Daknet are:-

i. **Mobile Access Point:-** Daknet offers a moveable transceiver, which combines physical means of transportation with wireless data transfer to enable High-Bandwidth internet connectivity. Mobile Access Point device is installed on a vehicle. It may receive or transmit digitized information to and from kiosks. A vehicle mounted with MAP equipment moves in villages from kiosk to kiosk or from Hub to Kiosk. The transfer of data is done by point to point link.

Fig: MAP equipment to be secured or motorbike

ii. **Kiosk:-** A kiosk is an interactive computer terminal with specialized Hardware and Software that provides access to information. Kiosks are client computers where users can operate the computer according to their requirements. Kiosks are installed in villages. Using these well equipped kiosks, villagers easily transmit or receive information from mobile access point. Kiosk has another name **"Electronic Device"** and they are used under the supervision of a computer expert person. Kiosk work as central hub in village and consist of kiosk controller, a server providing network boot, a network file system, user management mechanism and network connectivity[. Users connect to kiosk either via a public terminal that boots over the internet or through their own devices like laptop and PDAs. Kiosk controller acts as a store-and-forward accessto Internet. Kiosk

controllers are connected to internet gateways using "ferries". Ferries can be any mechanical backhaul unit e.g. a bus, car, train etc. A ferry is also equipped with a communication system consisting of a battery powered computer with storage and WiFi card. Ferries can communicate with kiosk controllers and internet gateways. Gateways are located in areas where broadband connectivity to internet is present. Gateways receive message from the "ferries" and forward it to appropriate destination

iii. **Hub:-** Hub is the centre for devices , where they can connect to each other, for exchanging information. Basically, Hub is used to connect the different parts of LAN. Hub has multiple input/output ports and it works at the Data Link Layer of OSI Model. It makes available the coming message to all ports except the message generator port.The various types of hubs used are Repeater Hub, Multiport Hub, Ethernet Hub, Active Hub, Network Hub etc.Hubs were used for collision detection, forwarding a jam message to all ports etc. Hubs have low cost as compare to switches. So they are best suited for Daknet because Hubs contribute a lot to make Daknet cheapest technology.

VI. DAKNET IN OPERATION

- First of all, Mobile Access Points are installed on moving vehicles like Bus, Motorcycle, Bicycle and they are timely powered by generator or Solar Panels.
- Kiosks which are computer devices installed at public places with latest features and with interactive interface. Interactive interface of kiosks enables the users to efficiently utilize the facilities.
- Hubs are settled to connect more than one kiosks. When kiosks are connected to each other, the transfer of information from one computer to another is done effectively, without any interrupt.
- When all the components of Daknet are settled and ready to operate, then people or users come and using kiosks access the internet. But they can access internet only when MAP equipped vehicle is in the range of Hub. Mobile Access Point transfer or receive data from public kiosks or from hubs.
- Every time a new session begins, whenever MAP equipped vehicle comes under the range of Hub or kiosk.
- Most of the time, 2 minutes and 34 seconds is the length of a single session and in this session 20.9MB unidirectionally and twice of the same amount bidirectionally data can be transmitted.
- As the MAP-equipped vehicle comes within range of a village Wi-Fi- enabled kiosk, it automatically senses the wireless connection and then uploads and downloads tens of megabytes of data.
- MAP-equipped vehicle comes within range of an Internet access point (the 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 and seamless communications infrastructure.
- It works on "Store and Forward" networking. Kiosks are designed as they can also store information as well as transfer the information. Outbox and inbox facility is provided to users. Using this facility, they can send or record information.

VII. STRENGTHS

- Daknet is free from cabling system. So network expandability is easy.
- It uses unlicensed portion of Radio Spectrum. So it reduced the regulatory challenges and licensing fees.
- There are low maintenance requirements.
- No issue with bandwidth. Bandwidth is provided at constant rate. It does not decrease with increased distance.
- Daknet is easy to implement because of its seed infrastructure.
- Daknet uses mostly low coast equipments, so it is cost effective.
- Less interference problem
- It works on point to point connection. So loss of information is very less.

VIII. WEAKNESS

The major drawback of DakNet technology is that it provides asynchronous and not real- time Internet access. The speed of the network is dependent on the frequency of visits from the e- postman. Asynchronous communication has the following disadvantages:

- The network cannot support potentially important applications such as VoIP.
- The context- aware, customized web pages found on advanced web sites cannot be viewed optimally.
- It is difficult and cumbersome to make use of e- commerce web sites and fill out forms.
- As DakNet uses Asynchronous web surfing it is neither effective nor enjoyable.
- It consumes High power.
- Range of network is limited in Daknet.
- It uses Token Ring to handle collision. But if lower tier goes down all the process will shut down.
- Experts are needed to guide the users at villages. So they can operate kiosk by themselves.
- Limited storage capacity of kiosks.
- Sometimes, connection establishment problem arises between Hub and Mobile access point vehicle.

IX. REAL WORLD EXAMPLE

According to FirstMile Solutions the first major client was American Assistance for Cambodia/Japan Relief Fund (AAfC/JRF), an NGO based in Cambodia that has built over 250 schools. AAfC/JRF first approached First Mile Solutions in 2001 to connect its schools to the Internet. Many schools were already equipped with computers and printers powered by solar panels. However, only one school using a donated satellite, was connected to the Internet. Satellite technology was the only way to connect schools without telephone lines. Needless to say, it was too expensive to purchase a satellite for every school. AAfC/JRF was interested in FMS'technology as a much cheaper alternative. DakNet infrastructure was also more difficult to steal and vandalize than satellites and wireless base stations. If all fifteen schools had been connected to the Internet via satellite, it would have cost USD 260,376 for the first year. Using FMS only cost USD 39,979 (at that time, FMS did not charge for its software). FMS used the school that was already connected to the Internet as a central hub. The other fourteen schools were divided into five routes, each of them serviced by a " motorman." Motormen are the e-postmen hired locally that ride their motorbikes between the central hub and surrounding schools. Information from the schools would automatically be downloaded from the FAP to the MAP when the motorman passed by, and uploaded to the hub when the motorcycle returned. A hub operator trained by FMS managed the hub. Altogether, the DakNet solution was cost effective. Satellite First Mile Solutions Satellite $ 49,500 Satellite $ 3,300 Usage fee

Table1: Cost Effective nature of Daknet

Satellite		**First Mile Solutions**	
Satellite	$ 49,500	Satellite	$ 3,300
Usage fee	$ 54,000	Usage fee	$ 3,600
Electric Generator	$ 25,500	Electric Generator	$ 1,700
Gas	$ 77,376	Gas for Generator	$ 5,158
Hub Master	$ 54,000	Hub	$ 699
		Hub Master	$ 3,600
		MAP	$ 2,995
		FAP	$ 7,485
		Motor man	$ 6,000
		Antennas	$ 3,000
		Gas for Motorcycle	$ 2,418
		Motorcycle Maintenance	$ 24
Total Cost			
	$ 260,376		**$ 39,979**

As of December 2004, AAfC/JRF had purchased equipment for 3 HAPs, 7 MAP's ,and 33 FAP's. AAfC was so pleased with the results that they had already made plans to connect 10 schools in Robib, 9 schools in Koh Kong, and 10 schools in Preah Vihear in the near future. The introduction of basic telecommunications services in these places has been revolutionary, as many of these places did not even have a regular postman. The solution offered by FMS and AAfC/JRF is currently the only viable option for connecting to the Internet. This successful deployment of DakNet technology proved that it can function under difficult conditions, be it poor infrastructure, challenging climate conditions, or limited capacity of local staff. This proof-of- concept has paved the way to more opportunities. (example in website [1])

Bhoomi, 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 system. DakNet makes Bhoomi's land records database available to villages up to 40 km away from Bhoomi's district headquarters or "taluka," in Doddaballapur. In this deployment, of a public government bus with a DakNet MAP to transport land record requests from each village kiosk to the taluka server. The server processes requests and outputs land records. The bus then delivers the records to each village kiosk, where the kiosk manager prints them out and collects a payment of 15 rupees (US$0.32) per land record. The bus passes by the hub and stops at each village six times per day (three round-trips).A "session" occurs each time the bus comes within range of a kiosk and the MAP transfers data. The average length of a session is 2 minutes and 34 seconds, during which the MAP transfers an average of 20.9 Mbytes unidirectionally (kiosk to MAP or MAP to kiosk) and up to twice that amount bidirectionally (from kiosk to MAP and MAP to kiosk).

X. FUTURE SCOPE

Extending Internet connectivity to rural areas in the developing world involves a delicate cost-benefit balance. While affordable access must be provided (and in some cases strongly subsidized), the social and economic returns must be high enough to enable long-term sustainability. The costs and deployment models associated with wired access technologies have often proved inadequate to strike this balance. Current applications not only download explicitly requested web pages, but also the pages that are linked by the requested page.FMS is currently evaluating the possibility of caching a large number of Internet web pages at each remote location. Daknet is a great blessing for villagers, now

almost all villages are connected to big cities through internet. But Research & Development's are still going on to develop an interoperable and cross platform to streamline the deployment process and make the Daknet more and more cheaper and fast.

REFERENCES

[1] www.firstmilesolutions.com
[2] "Data communication and Networking" by Charanjeet Singh published by Kalyani Publishers
[3] "Computer Networks " by Andrew.S.Tanenbaum published byPearson Prentice Hall

