Experiences in Using CDMA2000 1x for Rural Connectivity in Malaysia

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Abstract
Socio-economic development in rural areas, particularly in the Asia Pacific region relies on information and communication access by its people. For affordability, the choice of technology to achieve this is a significant aspect. We have chosen CDMA2000 1x All IP Next Generation Network (NGN) System as a cost effective technology to provide rural connectivity in Kampung Lebir, Malaysia. This article presents our experiences in this project and discusses a few aspects in the use of CDMA2000 1x All IP NGN for rural connectivity. (Keywords: CDMA2000, Rural Connectivity)

1.0 INTRODUCTION

Digital divide is quite apparent in the ICT sector where there exists a gap between the information rich and the information poor among various groups in Malaysia. Coincidently, the pattern is that the former is located in urban areas whilst the latter in rural. The Malaysian government, through the Ministry of Water, Energy and Communications has embarked on numerous digital inclusion initiatives aimed at fulfilling the national objective of ensuring equitable provision of affordable ICT services over ubiquitous national infrastructure. However the infrastructure and technology meant for developed telecom economies is often expensive or less suitable for use in the rural areas. Thus despite the huge benefits enjoyed through the government initiatives by the people in urban Malaysia, penetration of such services in rural areas is still low or almost non-existing. The major reason for this is the low

paying capacity of the users there.
CDMA2000 1x All IP Next Generation Network (NGN) System is a promising technology to consider for providing telecommunication services to the remote places that were virtually impossible. It is an established, competitive cellular standard. The all IP traffic means low bandwidth utilization (important as transponder service comes with premium cost in a VSAT system). Also, it is a wireless technology. Thus, it eliminates the necessity for cable installation to potential subscribers.

We start by giving an overview of the CDMA2000 1x All IP Next Generation Network (NGN) technology. We then present the deployment of the technology in Kampung Lebir, Malaysia.

2.0 OVERVIEW OF CDMA2000 1x

The transition to 3G networks, still underway, began with a abundance of newly proposed standards. While some were designed to build on GSM infrastructures, others emerged directly from CDMA technology [1]. Ultimately the ITU took a position on the matter, defining an IMT2000 standard that encompassed five different radio interfaces including CDMA2000. All of the IMT-2000 protocols use spread-spectrum techniques, which has implications about network installation, operation and maintenance. The

ITU also defines a 3G network as one that delivers, among other capabilities, improved system capacity and spectrum efficiency as compared to 2G. Generally it supports data services at transmission rates of at least 144 Kbps in mobile (moving) environments and at least 2 Mbps in fixed (indoor) environments. The CDMA2000 architecture meets these objectives and includes several implementations that an operator can select to best serve a transition strategy based on competitive concerns, existing infrastructures, cost, and other variables. Among these implementations are CDMA2000 1X and CDMA2000 1xEV[1,2,3]:

CDMA2000 1X doubles the voice capacity of CDMAOne networks, delivering peak data rates of 307 Kbps per subscriber in a mobile environment [1].

CDMA2000 1xEV includes two variants, both backward compatible with CDMA2000 1X and CDMAOne technologies [1].

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CDMA2000 1xEV-DO (Data Only), capable of delivering data multimedia services such as MP3 transfers and videoconferencing at peak data rates of 2.4 Mbps per subscriber in a mobile environment;

CDMA2000 1xEV-DV (Data Voice), capable of delivering integrated voice and simultaneous data multimedia services at peak data rates of 3.09 Mbps per subscriber

[1]

The technical advantages of a CDMA-based network over other wireless technologies, including GSM, are well-documented. Based on a "spread-spectrum" technology, CDMA offers more voice and data capacity than other second-generation (2G) mobile technologies. An all-IP CDMA network basically utilizes an IP radio access network coupled with a soft switch packet core network, as opposed to the circuit-based mobile switching center (MSC) deployed in a traditional wireless network [1,2,2]. Some of the benefits of an all-IP network include enhanced coverage, lower infrastructure expenditure, lower operating expenses due to the distributed architecture of an all-IP network and, most importantly, increased network reliability.

3.0 DEPLOYMENT OF CDMA2000 IN KAMPUNG LEBIR

Kampung Lebir is a village located 60 kilometers from Gua Musang – a state in Kelantan, Malaysia. This village is accessible only through 8 kilometer of unpaved road via Kampung Paloh

Kampung Lebir is a remote area with population of more than 100. It does not have any telecommunication facility, especially mainstream telephony services, besides the USP network. Kampung Lebir is however supplied with electricity 24-hours a day.

3. The exact location of Kampung Lebir is shown in Figure 1. Kampung Lebir was selected as the site for the deployment of the technology on the following basis:

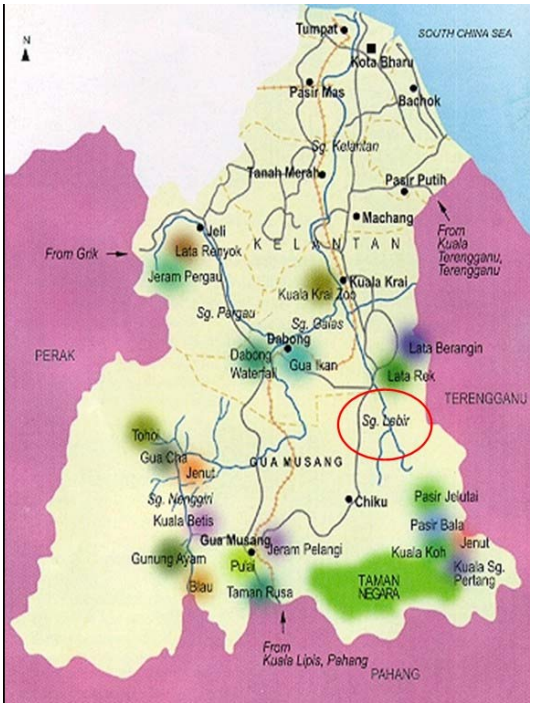

Figure 1: Location of Kampung Lebir.

In this project, the clinic in Kampung Lebir is equipped with one office telephone and two personal computers (for internet access) with the slim bandwidth VSAT system providing the

backhaul. Besides the office phone and the two PC's, two public telephones (installed outside the clinic compound) were also connected to the VSAT. These provide the means for the village people to communicate with people outside.

However, to utilize the telecommunication facility available at this site, the people in this village have to converge to the clinic. Nevertheless, the Internet access was only available during the clinic operation hours. This scenario was not unique to Kampung Lebir but is also prevalent to all the other sites. This represent under utilization and inefficient usage of the available resources. This has created the necessity to identify a suitable technology that would be able to expand the usability and the availability of the existing facility to the people in the village. Figure 2, illustrates a typical system network for a USP site.

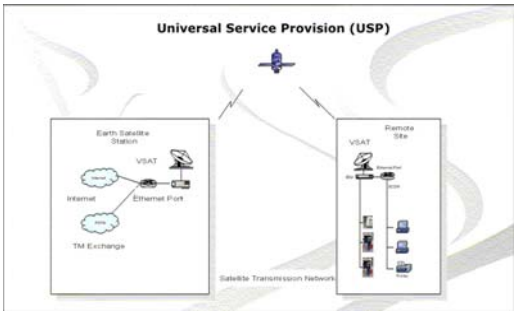

Figure 2: Typical System for USP Site

The Core Network with the Mobile Switching Center (MSC) that provides the calls processing, mobility and media control, is installed at Putrajaya Exchange, while the Base Station, comprising of the Base Transceiver System (BTS) and BSC, that provides the RF coverage to the Mobile Unit and controls the radio channel setup providing the connection between the mobile unit and the MovingMedia 2000 Core is installed at KESEDAR office in Kampung Lebir. The existing VSAT system currently installed at Kampung Lebir provides the link between the BTS and the MSC.

The MSC Server (a component of the Core Network) that is installed at the Putrajaya Wireless Exchange, functions as the next-generation soft switch for the All-IP CDMA2000 network system. While providing all the functions of the traditional circuit-based MSC, the MSC server provides the added benefits of an IP network to support mobile voice connections.

The BTS (a component of the Radio Access Network), installed at Kampung Lebir, provides the IP-based coverage for the CDMA2000 third-generation (3G) wireless network. Due to its ability to leverage IP network, the BTS is able to carry traffic over the slim bandwidth VSAT system.

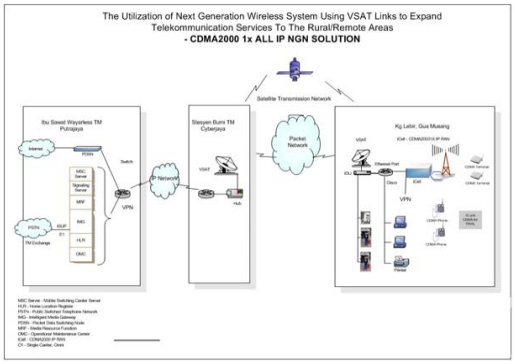

Figure 3: System Network Diagram for USP Site

The BTS is responsible for communicating with the terminals through the radio air interface. A BTS contains both the hardware and software performing the signal processing necessary to run the radio interface and to communicate with the servers and routers from the core network. It also contains all the radio components sending and receiving the RF signal to and from the terminals.

4.0 CHOICE OF TECHNOLOGY

The MovingMedia 2000 CDMA2000 1x All IP Next Generation Network (NGN) is proposed as the most suitable technology to meet this purpose. The reasons this technology was chosen were because;

The deployment of the CDMA2000 1x enables the transmission of both voice and data with a peak data rate of 153 kb/s in each direction. This is due to the fact that CDMA2000 1x is the core air interface standard of CDMA 2000 which uses a single pair of radio channels to transmit data at 1.25 MHz each for forward and reverse links [4].

It was able to use the VSAT as the backhaul, eliminating the need for microwave transmission, thus ensuring a enhanced coverage, lower infrastructure expenditure, lower operating expenses due to the distributed architecture of an all-IP network and, most importantly, increased network reliability. Also, the deployment of an

all IP traffic, means low bandwidth utilization (important as transponder service comes with premium cost in a VSAT system). It is a wireless technology. Thus, it eliminates the necessity for cable installation to potential subscribers.
Possibility for integration with TM's (Malaysia's Telephony Service Provider) existing CDMA network, thus eliminating redeveloping full billing and registration system. This will ensure that rural subscribers would enjoy economical fixed line tariff.

5.0 CDMA2000 1x and RURAL ONNECTIVITY

When it was announced that a telephone service would be provided to their village, the Kampung Lebir community came in droves to sign up as subscribers. Within one week more than 85 people are now the happy owners of a CDMA mobile phone. Their 20 years of waiting for the mainstream telephony service to come to their village has finally come to an end.

The deployment of this CDMA technology in Kampung Lebir has allowed the community there to enjoy affordable ICT services over ubiquitous national infrastructure. Furthermore, its integration with TM's (Malaysia's Telephony Service Provider) existing CDMA network has eliminated redeveloping efforts for full billing and registration system. This integration has resulted in ensuring that rural subscribers can now enjoy economical fixed line tariff.

CONCLUSION

Socio-economic development in rural areas, particularly in the Asia Pacific region relies on information and communication access by its people. In this paper, we have described our experiences in deploying CDMA2000 1x All IP Next Generation Network (NGN) in Kampung Lebir, Malaysia.

We have presented an overview of the CDMA2000 1x technology, highlighting its specifications. This leads us into believing that the technology is suitable as well as the economical for deployment in rural areas in Malaysia.

We have also presented the deployment of the infrastructure and the benefits that are being enjoyed by the rural community in Kampung Lebir.

In conclusion, we believe that the CDMA 2000 1x All IP Next Generation Network is feasible and promising technology to be deployed to bridge the digital divide between the information rich and the information poor among various groups in Malaysia, as well as to provide data services to the rural areas.

ACKNOWLEDGEMENTS

We would like to gracefully acknowledge the following organizations and individual for their endless support in making this project a success:

- The Ministry of Energy, Water and Communication of Malaysia
- The Malaysian Communication and Multimedia Commission
- TM Berhad
- Professor Dr. Abdul Rahman Bidin

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