

# **Telecom Egypt Case Study for CDMA**

# **Evolution of the Telephony Service for Egyptian Rural Areas and Villages**

*Telecom Egypt, Wireless Planning Department*

## **Abstract**

One of the most important demands in this century is providing the telephony service to the rural areas and villages. The biggest challenges for serving the rural areas and villages is to overcome their different topologies. In this report, the optimal ways for providing the telephony service are discussed and a case study for Egypt rural area is presented.

## **Introduction**

With the technological advances and rapid development of telephony system, a rapid growth of optical and wireless communication systems is being developed every day. The tremendous growth of users and application services must be taken into consideration.

From economical point of view, the operator has to choose the most suitable communication system for the areas to be served. Efficient deployment of appropriate communication system according to the terrestrial and terrain topography (Topology), enhances the services, provides higher rate, and increases revenue. The systems that may be used in providing telephony services to the rural areas and villages are outdoor optical fiber unit system, wireless system, and point-to-point wireless system.

## **Introduction to Access Network Topologies**

The Access Network (AN) is the physical connection between the core network and the subscriber terminals

### **Classification of Access Networks**

1. The wired line access method, utilizes copper wire cables , it is the conventional system. It is normally used for local networks at range of 5 Km maximum.
2. The optical cable access. The fiber cable is connected to a remote unit, this remote optical unit provides service to the subscribers through copper wire. This system is used when communities are located apart from each other and far from the host exchange.
3. The fixed wireless Access (FWA) method. the application of FWA for telephone service is generally called "Wireless Local Lop (WLL)", which applies radio systems in the distribution zone instead of wire lines. This system is used when low to medium subscribers density are located apart from each other, and deployment of primary or secondary local network is difficult.

Access networks can be based on **different technologies**

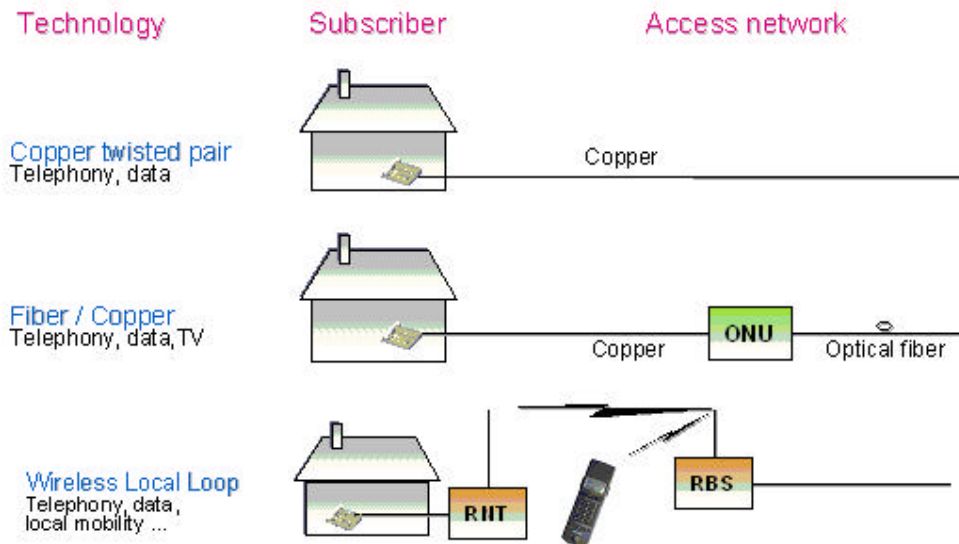


Figure 1, shows the different access network technologies.

## 1- Overview of the WLL project's target and objectives

### 1.a. Brief description of Egyptian Villages and Rural Areas and Villages

For Egypt, villages are either allocated in a scattered way within certain area or allocated cascaded along certain road or along the Nile River. They may be also connected with primary access network infra-structure or not connected . The terrain type (Desert, Rocky, Agricultural lands contains many obstacle as small rivers, highways, railways) and topography, also the subscribers density and near future users population must be provided for selecting the appropriate way for serving villages.

The climate is extremely hot and moist.

#### Example of Egyptian Rural Areas and their Classification

- **Elmenia governorate:** Many villages are located near each other, but on the opposite bank of the Nile river rather than the copper network, with low subscriber density. The best way to serve this area is using WLL, (Our case study)
- **Kafer El -Sheikh governorate:** Many Villages are located near each other, but in Agricultural land, **it is possibly having low capacity**

**copper local network**, and relatively high subscriber density. The best way to serve this area is using ONU.

### **1.b. Objective and implementation Details of the WLL project**

Telecom Egypt has decided to serve villages that represent suburban and rural areas all over Egypt regardless of the terrain type, topology, topography, and subscriber densities.

This project is one of the major telecommunication projects Egypt has ever seen in this century,.

The objective of this project is to provide the basic telephony services, community development, Internet services and small business support services.

Telecom Egypt has tendered the implementation of this project for different technology manufacturing companies, the best and more economic offers are chosen.

Huawei and ZTE have won this tender. These two Chinese companies have shared the implementation.

### **1.c. Financing and partnership aspects of the WLL project**

Telecom Egypt has provided the total cost for implementation of this WLL project.

Telecom Egypt didn't get either a partnership or any aid for WLL project.

## **2- Infrastructure and Regulatory Environment**

### **2.a. Infrastructure components**

In this project, the pre-existing telecommunication facilities are used as much as possible, the existing transmission media as fiber ring, and microwave links are used.

For economical purposes, most of the base transceiver stations (BTSs) are located and implemented above the existing local exchanges, these BTSs are powered from main existing AC power of the local exchanges and are connected to the Base station controller (BSC) through the existing fiber transmission ring. Of course the equipment located in the local exchanges are secured.

But for the coverage purpose, some BTSs are located apart from the local exchanges, with distances ranges from 20 to 100 Km, the places are chosen to fulfill the AC power requirement and security procedures. The links between these BTSs (located apart from the local exchanges) are new microwave links.

## **2.b. Regulatory components**

Telecom Egypt has to obey the universal service obligations and the standard Grade of Service (GoS), which is 1% for fixed and WLL networks.

Telecom Egypt has got a license from the **Telecommunication Regulatory Association (TRA)** for the radio propagation frequency band, the range of the radio frequency band is 824- 849 and 869- 894 MHZ

Telecom Egypt has got a license from the **TRA** for the separate frequencies used for the microwave links, these frequencies are in the range of 15& 18 GHz

The **TRA** has specified licenses conditions; that Telecom Egypt has accepted them; these licensing conditions can be summarized as follows

- Serving Villages in suburban and rural areas.
- Serving the Highways.
- Using the specified frequencies only.

## **2.c. The other factors influenced the project**

### **System Features and Standardization**

- UM interface complies with IS95A/B, CDMA2000-1X standards.
- NO.7 Signaling fully complies with the relevant technical specifications and has successfully passed tests.
- Full compliance with the national standards regarding CDMA mobile communications network.
- Full compliance with various CDMA technical standards and specifications.
- Core Network support ANSI41-E standards and compatible with ANSI41 standards series.
- Wireless Intelligent Network support IS-771, IS826 and the relevant national WIN standards.

### **3- Technical Description of WLL Project**

The WLL system is based on code division multiple access system (CDMA)

#### **3.a. System Architecture**

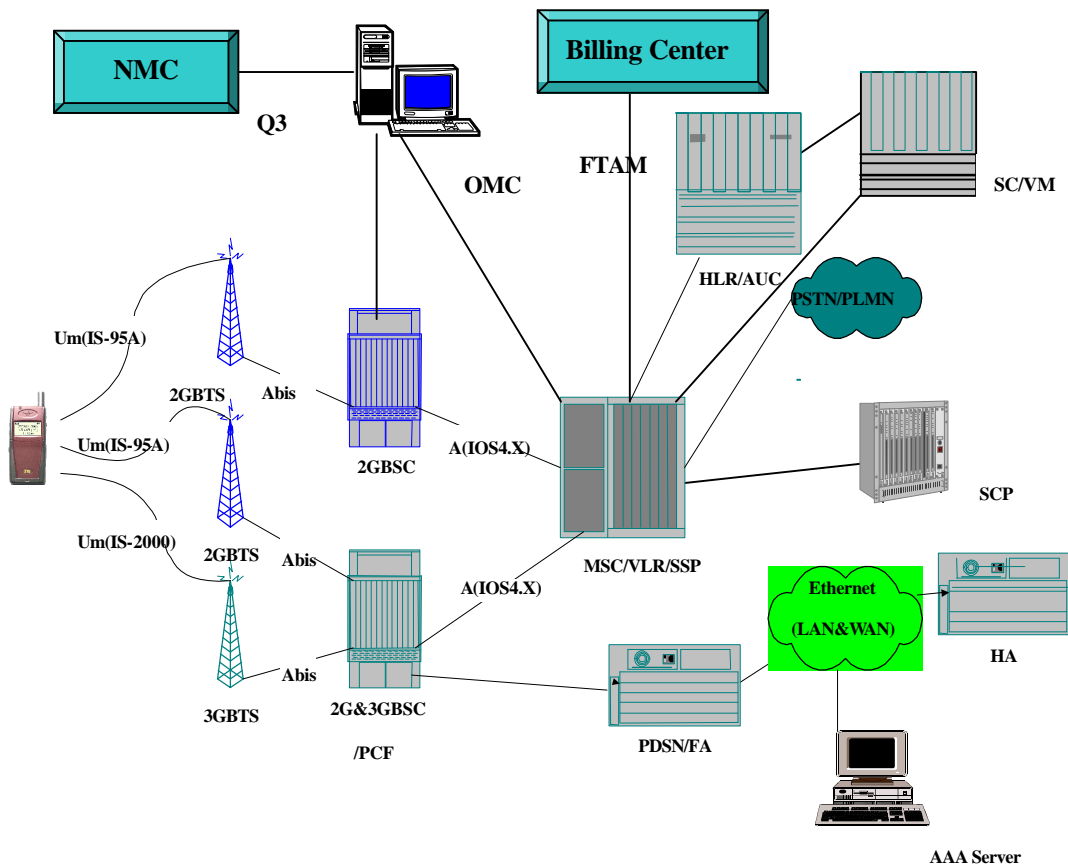


figure 2 shows the system architecture of the wireless network

## System Structure

The following diagram shows cellular mobile communications network structure.

### 1- Operation and Maintenance Center (OMC)

The OMC consists of the following network components:-

- OMC-S: Operation & Maintenance Center-Switching
- OMC-R: Operation & Maintenance Center-Radio

## **2- Network Switching Subsystem (NSS)**

The NSS consists of the following network components:-

- MSC/VLR/SSP: Mobile Switching Center/Visitor Location Register / Service Switching Point.
- HLR/AUC: Home Location Register/Authentication Center.
- SC/VM: Short Message Service Center/Voice Mailbox.
- SCP : Service Control Point.
- PDSN: Packet Data Serving Node.
- FA: Foreign Agent.
- HA: Home Agent.
- AAA: Authentication Accounting Authorization.

## **3- Base Station Subsystem (BSS)**

The BSS consists of the following network components:-

- 7BTS: Base Transceiver Station
- BSC : Base Station Controller
- PCF: Packet Control Function

## **CDMA System Products**

Hauwei & ZTE Corporation provide full series of CDMA products for total network solutions including CDMA Network Switching Subsystem (NSS), CDMA Base Station Subsystem(BSS) and CDMA Mobile Terminals.

The total capacity of the system is 100,000 lines , distributed on 65 BTSs

### **3.b. Installation and Deployment**

An Initial survey has been done to determine the areas to be served and a scanning for the existing infrastructure.

After the initial survey, the network planning phase had started. The restriction for the planning phase was the usage of the available existing networking (as Transmission Links).

Finally, The system has to be installed and deployed in a short time.

### **3.c. Interconnection to National Networks and Backbones**

The BTSs are connected to the different BSCs thorough E1s links, BSCs are connected in turn to one or more MSC.

The Interconnection to national networks and backbones are provided through the Mobile Switching Centers (MSCs), each MSC has a Gateway called GMSC to allow interconnection to PTSN, the other WLL systems (if available), and other PLMN(if available).

### **3.d. System Cost**

The main attraction of WLL is simple as it can provide an equivalent local loop connection to copper cable at a lower cost. It does not necessarily provide a better or different service, simply one that is less expensive, allowing the new operator using WLL to compete with price. The economics of fixed communication versus wireless communication are relatively simple to understand. The key points to note are that:

- The cost of installing wired systems is broadly dependent on the cost of labor (to dig up the roads), which tends to rise at a rate greater than inflation. The cost of wireless depends mainly on the cost of the subscriber units, which tends to fall off with increasing economies of scale.
- The cost of wired systems is critically dependent on the distance between houses and the penetration levels achieved, whereas the cost of wireless is widely independent of these factors.

The cost of wired systems is incurred prior to marketing to the users, whereas much of the cost of wireless is not incurred until the users subscribe to the network

The service is uniformly distributed and so, the line cost is approximately fixed, about 180 \$.

## **4- Technical Description of Provided Services**

### **4.a. Provided Services Quality**

Telecom Egypt provides both voice and data services, it also support the ISDN.

For voice service, TE guarantees an acceptable quality. The standard grade of services (GoS) of 1% is applied.

For data service, TE guarantees an acceptable bit error rate (BER), a PDSN in the wireless system is deployed in the system to guarantee acceptable BER and data rate of 153.6Kbps

#### **4.b. Fixed Wireless Terminal (FWT) Cost**

For the wireless communication, an end user terminal or a Mobile station is needed, but for Telecom Egypt WLL project, an Fixed wireless terminal (FWT) is used. The cost of FWT used for CDMA-WLL system is about 100\$.

## **5- Effectiveness and sustainability of the WLL project**

### **5-a) Effectiveness and benefits of the WLL project**

The benefits of the WLL project is to provide the basic telephony services, as well as Internet services to increase community development. The provision of rural telephony via wireless systems is one of the most-talked-about but least-acted-upon trends in the telecom sector in the last decade, the impact of wireless-local-loop (WLL) and rural telephony has been marginal when ranked alongside the two major developments that are defining communications in the twenty-first century - mobile communications and the Internet

Certainly, the liberalization of telecom markets and a sharp fall in manufacturing costs are giving rural telephony projects a major boost. On the other hand, there is evidence that WLL ventures may lose out to cellular communications because of an even-steeper fall in cellular network and handset costs.

#### **5-b) Profitability the WLL project**

- Increase community development.
- Support small business services.
- Emergency support
- Allow E-government and E- health. (In Future Plan)
- Allow E-education and E-entertainment. (In Future Plan)

#### **5-c) The Strategies Responsible for Responding the Socially Disadvantage Groups**

The voice nature differs from place to another and from age to another and Socio – economic level also differ according to gender, the parameters that affect this variation are:-

- Voice activation factor.
- Call duration affected by community development.
- Busy hour call attempt ( BHCA)

#### **5-d) The Aspects of the project to Enhance the Project Effectiveness and Sustainability**

To enhance effectiveness and sustainability of the system, the previous parameter that affect the system must be tuned according to the served area, Socio - economic level and the application. The parameter tuning may be as follows:-

- For women and youth, voice activation factor might be increased.
- A handicapped communication facilities must be available for handicapped persons.
- For developing communities, the decrease of call duration may be taken into consideration, while in high level socio – economic communities, call duration may be long and business services as well as educational and entertainment services are required.

## **6- Social and human development impacts**

### **6-a) Overview of Social and human development needs**

The goal of developmental social welfare is a human, peaceful, just and caring society which will uphold welfare rights, facilitate the meeting of basic human needs, release people's creative energies, help them achieve their aspirations, build human capacity and self-reliance, and participate fully in all spheres of social, economic and political life

To undertake human resource management, planning and development; to set guidelines for professional standards and accreditation systems for all personnel; to facilitate the representation of personnel in appropriate industrial relations structures

Since resources are limited, trade-offs must be made between investment in economic growth and human resources, and investment in a social safety net. Welfare expenditure will only be able to expand as higher economic growth rates are achieved.

The benefits of economic growth, however, should be equitably distributed through social development program, which in turn will increase the capacity of individuals and families to meet their own needs.

### **6-b) Role and Commitment of the WLL project in Addressing these Needs**

*The following priorities have been identified*

- ? Restructuring and the rationalization of the social welfare delivery system, towards a holistic approach, which will include social development, social functioning, social care, social welfare services and social security programmers
- ? Building consensus about a national social welfare policy framework
- Creating a single national welfare department as well as provincial welfare departments and exploring the potential role of local government in service delivery
- ? Developing representative governance structures to build up the partnership between Government, organizations in civil society, religious organizations and the private sector

- ? Human resource development and the re-orientation of personnel where this is necessary towards establishing a developmental social welfare framework

**6-c,d) Socio –Economic Benefits for community and disadvantages of marginalized and populations and Enhancement**

***The national goals of the proposed strategy are***

- ? To facilitate the provision of appropriate developmental social welfare services to all upper Egypt, especially those living in low socio-economic levels (poverty), these services should include rehabilitative, preventative, developmental and protective services and facilities, as well as social security, including social relief program, social care program and the enhancement of social functioning
- ? To promote and strengthen the partnership between Government, the community and organizations in civil society and in the private sector who are involved with the delivery of social services

## **7- Other Remarks**

**Unexpected Results and Lessons**

After the initial survey had been finished, and during the project execution, many other communities request the telephony service, and increase the number of required telephony lines. Fortunately the proposed plan was considering this increase in its near future prediction.



