

WiMAX Technology and Coverage in Kosovo

Vigan Raça¹, Betim Çiço²

¹Department of Computer Sciences, SEEU, CST, Tetovo, Macedonia
viganraca@gmail.com

²Department of Computer Engineering, FIT, UPT, Tirana, Albania
bcico@abcom.al

Abstract - Analysis of telecommunication systems of particular network generation, is a wide area that includes various mechanisms for research. Achieving coverage is one of the main objectives that affects network quality and directly the customer. The main reason of this analysis is to offer services for customers regardless their location. Coverage structure is organized by the cells that are created through the sectors that are located in the base stations (BTS). The different frequency bands enables the achievement of higher efficiency coverage. By increasing coverage various problems become present including monitoring and system maintenance. The WiMAX 3G system and combined services, voice and data, offers a good solution that is part of the future. As any system that requires financial justification, WiMAX has its own specific system unless services that offers it increase economic welfare. Finally part of this paper are obstacles faced through the phase of coverage; weaknesses that affect the system performance; opportunities and ideas for further development and advancement of mobile telecommunication technologies.

Keywords: Wireless, Coverage, Network, Systems.

1 Introduction

Communication and research on the internet is becoming the solution of most problems faced world-wide. Nowadays wireless communication system has become easy to implement. As part of wireless networks, WiMAX technology for which is analyzed on this paper, is a good opportunities toward achieving the success in the world of telecommunications. System is built in a way to offer subscribers satisfactory services like voice and internet regardless location [1]. Modulation technique (OFDMA)¹ that used WiMAX system allows many subscribers to connect in cell simultaneously. Urban areas are more complicated and pose a problem during designing the network coverage due to the great density of buildings and large numbers of subscribers. While rural areas are more simplified compared with urban. Further development is done by WiMAX forum and manufacturing companies of WiMAX devices.

¹ **Orthogonal frequency-division multiplexing (OFDM)** is a method of encoding digital data on multiple carrier frequencies

2 Basis concepts and characteristics of WiMAX

WiMAX Interoperability for Microwave Access is a technology whereby transmitted data can be voice (VoIP) or information data. It uses wireless channels on large distances along different paths based on Point-to-Point connections [2]. This is based on IEEE 802.16 Standard as we mentioned above, otherwise known as Wireless MAN. WiMAX technology enabled Internet users to surf on web via laptop or computer, without the need to physically connect to router, hub or switch. The WiMAX name was created by WiMAX Forum [7] that was established on January 2001. WiMAX mobility[3] is wireless broadband solution that provides coverage for both types of networks; mobile and fixed through radio waves propagation. It uses OFDMA and SOFDMA techniques, and is based on NLOS². The working principle of WiMAX technology is based on these elements[3]:

- Base Station BS is designed to operates on 3.5 GHz frequency band
- System Management and Monitoring of Network BWA which provides and configure normal functioning of system work.
- Call Session Controller CSC as software part of devices
- Session Border Control that provides security and QoS functionality
- Voice Gateways enables flexibility of PSTN migration to NGN network.

Table 1. Wimax Characteristics

| Technology | WiMAX (802.16a/revD) | WiMAX (802.16e) |
|-------------------|---------------------------------------|---------------------------------------|
| Bandwidth | <i>1.75, 3.5, 7, 14, 20 MHz</i> | <i>1.75, 2.5, 7, 14, 20 MHz</i> |
| Downlink Speed | <i>> 70 Mbit/s, 20 MHz channel</i> | <i>> 70 Mbit/s, 20 MHz channel</i> |
| Uplink Speed | <i>BTS Capacity – 4 Mbit/s</i> | <i>BTS Capacity – 4 Mbit/s</i> |
| Latency | <i>Not known, low</i> | <i>Not known, low</i> |
| Mobility | <i>Fixed</i> | <i>Limited mobility</i> |
| Speech | <i>VoIP</i> | <i>VoIP</i> |
| Availability | <i>Fall 2005</i> | <i>2007</i> |
| Cell Radius | <i>5 – 10 Km</i> | <i>2 – 5 Km</i> |
| Standard | <i>Ready</i> | <i>Fall 2005</i> |

3 WiMAX coverage in Kosovo

The current state of telecommunications infrastructure in Kosovo shows that this is ideal time to implement WiMAX technology. Based on the current situation of the population, around 70% of population lives in cities whereas around 30% lives in villages. The following table will reflect the state's residential population.

The houses in Kosova towns are built very near to each other. Also in the smaller villages the buildings typically form clusters of 5 to 10 houses. This makes it possible to share the WLL/BWA Customer Premises equipment between various households. Also, there houses are separated from other houses that CPE sharing is not feasible.

² **Non-line-of-sight (NLOS)** is radio transmission across a path that is partially obstructed

3.1 Rural Area

For rural areas we have made the following assumptions [8]:

- 8% of the households are separated houses
- 66% of households belong to clusters where one Customer Premises Equipment can be shared between five households
- 26% of household belongs to clusters where one Customer Premises Equipment can be shared between ten household

3.2 Country Town

For Country Town we have made the following assumptions [8]:

- 2% of the households are separated houses.
- 58% of households belong to clusters where one Customer Premises Equipment can be shared between five households.
- 40% of household belong to clusters where one Customer Premises Equipment can be shared between ten households.

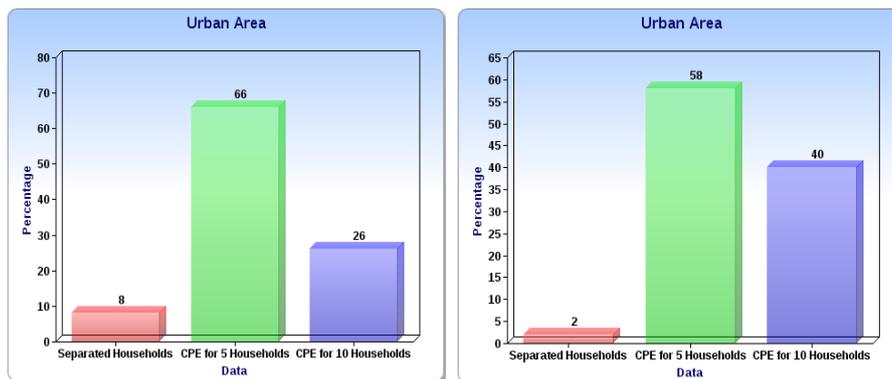


Fig1. Rural and Urban Area Households

4 Why WIMAX in Kosovo

Many responses argue WiMAX system implementation. The current technological infrastructure in Kosovo, is the main reason justifying WIMAX system implementation. Services that are offered today in Kosovo through telephone lines via DSL or cable technology (cable modem) or wireless through Wi-Fi access are not satisfying customers, both, financially and quality.

4.1 Coverage and Capacity Dimensioning

The radio network dimensioning methodology is based on desk-top studies on geographical maps, terrain profile analysis, benchmarking of existing GSM coverage and area surveys for verification of the desk-top studies.

- Coverage dimensioning
- Capacity dimensioning.

Radio network dimensioning takes the existing towers as the preferred location to place base stations to cover the desired areas. New towers for base stations are considered only as a secondary option. Based on the above subscriber profile assumptions and required capacities per subscriber, the capacity dimensioning for the radio network was performed as presented in the figure [2].

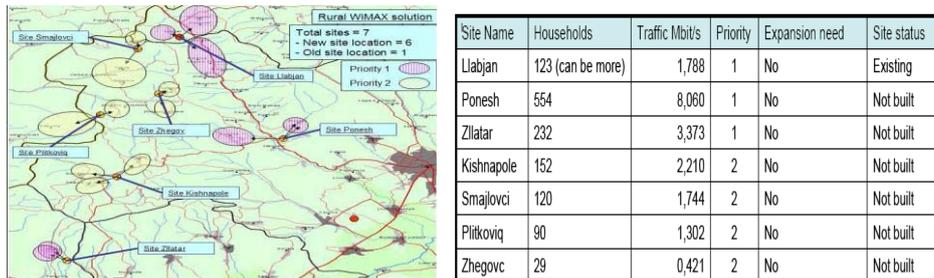


Fig. 2. The coverage and capacity dimensioning in certain areas

5 Conclusion

Based on given analysis on this paper we conclude that WiMAX system meets all possible criteria and requirements that today's human civilization needs for communication. Planning coverage including (base stations, cells capacity and dimensioning etc) and challenges during the coverage, remains a key objective in implementing of this technology. Achieving capacity was another position which should be fulfilled for more effective coverage. These analysis that is reported on this paper, provides a good solution for Kosovo, and their implementation will solve a problem that will be faced on the future.

References

1. Radha Krishna Rao G. Radhamani , "WiMAX A Wireless Technology Revolution, October 19, 2007
2. Maode Ma Editor, "Current Technology Developments of WiMax Systems, Januaray 30, 2009
3. Bachir Bellou1, Simon R. Saunders3 "Measurements and Comparison of WiMAX Radio Coverage " , 09, november 2007
4. Bharathi Upase, Sunil Vadgama "Radio Network Dimensioning and Planning for WiMAX, 7 May, 2007
5. Kai Dietze Ph.D, & Ted Hicks "WiMAX Uplink and Downlink Design Considerations", 8 May 2008
6. Anna Ha'c , "Mobile Telecommunication Networks for Data", 15 November 2002.
7. www.wimaxforum.org
8. Consultancy Services for Technical, Legal and Financial Support to Wireless Local Loop Project for Post and Telecommunication of Kosovo (PTK), 30 September 2005.