IPTV Over WiMAX : Possibilities And Challenges

Nassir Abuhamoud

Abstract—This paper is intended to be an introduction into the issues involved with delivering IPTV over WiMAX networks. The use of WiMAX Networks can provide service not only for fixed but also for mobile subscribers , However, there are still issues concerning bandwidth, codec selection, QoS and payload on WiMAX , where passing IPTV traffic relates to the addition payload, besides ,WiMAX technology adds its payload. This paper will address each of these issues and discuss the major players involved in deploying this new technology.

Index Terms— WiMAX, IPTV , Video, Audio,Payload, Network.

1 INTRODUCTION

INTERNET Protocol Television (IPTV) is becoming more popular, because it Enables to deliver content to users at a time when they want to. [1] The next step is to provide this content in any place - where users need. Traditional wired access networks can provide content only at fixed points. So , new technology is required that can deliver content to mobile subscribers. Technology Worldwide Interoperability for Microwave Access (WiMAX), based on the IEEE 802.16-2004 standard and 802.16e-2005, is designed to provide fixed and mobile wireless access to city data networks at speeds up to 70 Mbit / s, and it's able to cover a distance of over 30 km and provides secure content delivery.

2 ANALYSIS

The Link layer model WiMAX supports priority channel assignment in real time (rtPS - Real-Time Polling Service), which provides the required bandwidth and minimum delay for video service supporting the quality of service (QoS).

In WiMAX uses orthogonal frequency division multiplexing (OFDM) and technology OFDMA physical layer, that is resistant to attenuation. Technology OFDMA accepted as the preferred solution for the IEEE 802.16a wireless networking capabilities for broadband, allowing operators to offer a variety of voice services and data services. Furthermore, WiMAX uses adaptive modulation scheme and the error correction system pre-emption method (Forward Error Correction, FEC) to improve the quality of service [2].

Since the physical layer WiMAX supports different frame sizes and scalable bandwidth, the technology is ideal for applications IPTV. Basis on WiMAX can be built access network, moreover, It can be realized the principle of transparency to the core network. Thus, the base stations WiMAX, and mobile subscriber station ideally suitable for delivering IP- services (Triple Play): VoIP, IPTV, Internet multimedia over wireless city level. This makes the technology Wi.MAX better choice compared to conventional cable technology DSL and satellite solutions.

Access networks based on WiMAX allows us to offer ubiquitous delivery of content, in addition, the deployment WiMAX networks will provide a full range of services IPTV with high video and audio quality in rural and hard-wired technology areas.

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A functional block diagram of a service IPTV illustrated in Fig. 1.

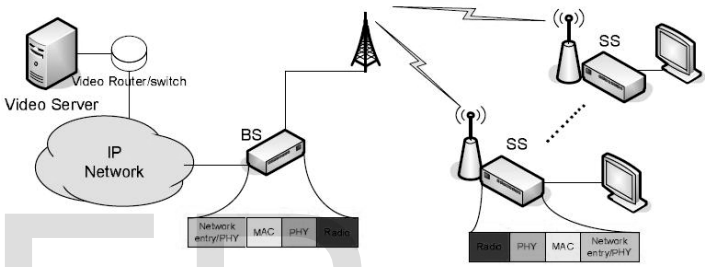

Fig. 1. Model of IPTV

Video servers store audio and video content consisting of compression coded and recorded programs. Video server may be located centrally or distributed over a data network [3]. On Fig. 2 shows a protocols stack for transmitting IPTV. Audio and video from a source formatted compressed (mainly with coding standard MPEG-2) and encapsulated using Protocol RTP. Datagrams are transported using UDP and TCP, and then become part of the IP-packets that are transmitted over a data network.

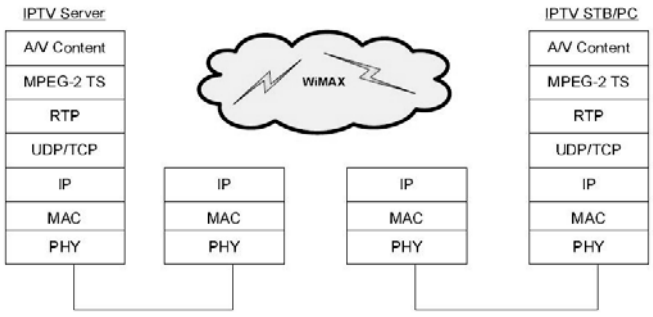

Fig. 2. The protocol stack for transmission IPTV

Base station WiMAX, located at the border of the network core, receives packets of 802.3 and on the link layer decapsulates the Ethernet header and encapsulates the IP-datagram slots 802.16 link layer protocol, and then the physical layer into frames. Physical layer prepare these frames for wireless transmission, performing modulation OFDM, feed forward error correction method, etc. Transceiver emits these signals via antenna to the user and to the mobile stations within the cell. Re-

verse the process through these levels delivers audio and video content to users' computers and consoles of service users. One of shortcomings of the packet - this payload emerging on each layer. As a result, the volume of the payload is considerably reduced [4].

Passing traffic IPTV leads to a significant increase in payload, and According to that posing a difficult problem in providing quality of service. Protocols UDP, TCP and IP with the corresponding payload are part of the payload WIMAX. In addition, the physical and data link layers protocol IEEE 802.16 add their payload. Thus, the need to find methods and make recommendations to reduce the above-mentioned payload.

Used for providing IPTV base station and the subscriber stations, the delivery system should provide point-to-multipoint applications for IPTV, which corresponds to the standards and certifications IEEE WiMAX. Then traffic IPTV can be transmitted both standard and high definition.

To provide streaming video used ports UDP and for the service "Video on demand» - TCP-ports. Also supported unicast, multicast and broadcast transmission. As a result, you may receive multiple packets from different sources, which must be delivered to specified users with different parameters of quality. This problem is solved at the data link level of base stations WiMAX through effective planning of services. For this reason, it is expected that it is the implementation of the plan at the link level will be a key factor among competing products.

Standard IEEE 802.16 link layer divides into three sub-layers: Convergence sub-layer (CS), the main sub-layer (CPS) and the sub-layer security (SS). On Convergence sub-layer of the upper-layer packets are received IPTV, which are then sorted according to its TCP / UPD port, source, recipient, IP-addresses, MAC addresses or anything else. On the main sub-layer packets are fragmented and packaged for efficient use of available bandwidth. Fragmentation also allows for automatic requests (ARQ), to minimize retransmission. At this sub-layer packages are designed to be transferred to the physical layer. Packages are divided on the basis of service layer agreements (SLA) and Quality of Service (QoS). Ultimately frames, in which will be transmitted IPTV packages are prepared on this sub-layer. On the security sub-layer packets are encoded to prevent unauthorized access to the service. At this layer also implemented key exchange between subscriber stations for secure authentication, transmission and use of cyclic redundancy check (CRC). The functions of the main sub-layer also include checking the radio wave quality, bandwidth and security settings using the control signal data link layer.

The link layer of the 802.16 standard is connection-oriented. The base station assigns the connection to the unique identifier for each downstream and upstream transmission stream. Convergence sub-layer classifier divides traffic flows according to different tasks. For various requirements of users usually use several schedulers. Obviously, this increases the load on the data link layer.

Fig. 3 shows the implementation of the proposed link-layer scheduler. The mechanism includes a QoS-planning and model the two-phase activation. Service QoS-planning mechanisms are processing data link layer supported by the scheduler. The unit of classifier will send the packet information from the packet's header to component connection control. Based on information from the header component connection control assigns connection identifier or service identifier flow (SFID) the appropriate package or flow. Each SFID will be connected with a set of parameters of QoS, which is stored in a component of QoS policies.

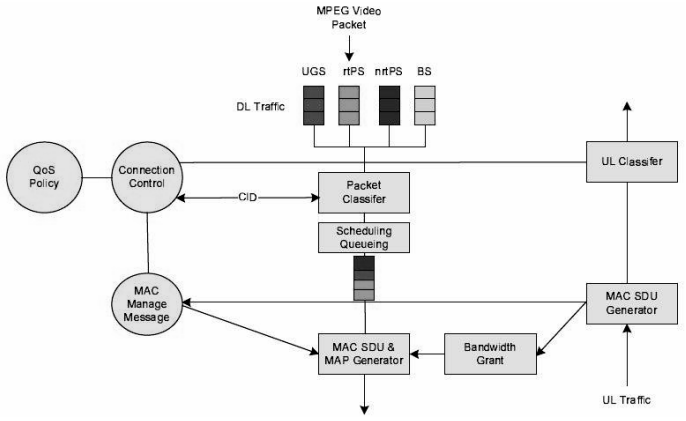

Fig. 3. The architecture of the data link layer

For IPTV services required QoS service flow parameters are: minimum guaranteed transfer speed, reserved for this service flow - it is the transmission rate of packets received on the data link layer to the overlying; the maximum steady-speed transmission – this is transmission speed of packets received on the data link layer to the overlying, which does not include the transfer of the MAC header and CRC, it is only the upper limit of the transmission rate, with no guarantee that the rate will be ensured. maximum delay relate to the minimum parameters as packet transmission between the sublayers and politics of transsmition and request.

For initiate creation of service flows may as a base station and the user. Component of control data link layer dynamically performs the functions to create or change a transaction, and dynamically change the parameters of QoS. A successful transaction for changing a service flow change the QoS parameters of the service flow, replacing the set of permissions and active parameters QoS.

The two-phase model performs functions including saving network resources to complete the connection, performs policy checks and control access to resources, as well as features to prevent unauthorized access to the service.

Based on the assigned QoS parameters and settings block scheduling and queues and generate controlling unit serve as backup resu rsov path data. Source packages IPTV plays an important role in the strategy of QoS for applications IPTV.

Broadcast packets IPTV often is a free service, while unicast packets transmitted within IPTV paid services, therefore delivery of unicast packets is more important than the delivery of broadcast packets that require different parameters QoS.

Physics at the layer must support modulation BPSK, QPSK, QAM16 and QAM64 with different coding rates, and the use of adaptive modulation and coding is necessary to provide high-quality video. For each type modulation requires its own optimal coding rate to use as possible lower throughput th ability, but without sacrificing quality.

Application of channel coding for video-content is necessary to protect the video-content from the channel errors and ofcourse guarantee the provision of high-quality packages IPTV. Unit Forward Error Correction (FEC) should consist of interconnected encoding using an outer code Reed - Solomon and inner convolutional coding. The coding is as follows: first, the data passes to the block format by encoder Reed - Solomon, and then they passed through the convolution encoder. All the encoded bits are interleaved block interleaving, and then the data bits are transmitted periodically in scheduler block and then - in an inverse Fourier transform (iFFT). After adding a header and cyclic prefix signal transmitted by radio waves via the radio interface physical layer. The receiving part of the physical layer includes operations such as channel estimation, equalization, phase-jitter compensation, decoding and synchronization. It is necessary to take into account that the availability of various specific receiver unit depends on a particular model or a particular vendor and are not specified any IEEE or any WiMAX Forum. Moreover, these algorithms are unique for each manufacturer, and hence these blocks are also unique for each product. In assessing the performance of the receiver algorithms as the criteria, we can use the signal / noise ratio, the presence of the vector error or bit error.

The main task of the air interface physical layer - control data transfer between the link layer parameters and a transmission medium. In addition, the link layer and configures programmable via this interface device and manages them.

As already mentioned, the packet has a significant number of payload, which increase from level to level. This reduces the effective payload. IPTV service which requires high performance is strongly influenced by this payload. Although UDP- and TCP-header, and IP-headers remain within the payload, and can not be accessed within the WiMAX, the overhead by WiMAX, can be significantly reduced by using the header suppression techniques (PHS) and header compression (ROHC). WiMAX systems require high performance radio transceiver. The main features of WiMAX transceivers are: high dynamic range, low phase noise, high stability, low noise and high linearity.

3 Conclusion and Recommendation

Designing transceivers with high performance is a challenging task, especially for applications IPTV. For example, IPTV applications require higher bandwidth compared to other multimedia applications such as voice and data, which creates additional problems. The main parameters of the transceivers to support IPTV -services - is a high dynamic range, low phase noise, high stability, low noise, high linearity and high bandwidth.

The devices, which are used as transceivers must have a high dynamic range, free of parasitics components, which is one of the most important parameters for IPTV. For example, the ADC(Analog-to-digital converter) and DAC typically provides 86 dBc and 78 dBc, respectively. In addition, the phase noise is another important characteristic of a radio transmitter which may affect the quality of services IPTV. Typical phase noise requirements for WiMAX transceivers smaller - 100 dBc / Hz at 100 kHz. To achieve this requirement, the transceiver circuit to use high clock drivers, along with dual synthesizer VCO / PLL, oscillators and must have a frequency tolerance of less than eight million more than ten, which provided standard.

Low noise is another important performance criteria to achieve a high quality of service IPTV. The components are used in systems designed for providing WiMAX, must have a high signal / noise ratio. Suppression of-band signals is an important parameter performance mobile radios, especially for services IPTV. This can be achieved by suppressing harmonics using the two-step conversion, as well as high-performance surface acoustic wave filters.

Thus, by making the best possible use of wireless technology to increase the efficiency of the service IPTV operator that will achieve greater competitiveness by providing services not only at a fixed point, but also in any place in the coverage area of the operator.

Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions. Authors are strongly encouraged not to call out multiple figures or tables in the conclusion—these should be referenced in the body of the paper.

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