A Review: IPTV over WiMAX Networks

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***Abstract*—Worldwide Interoperability for Microwave Access (WiMAX) technology is the wireless system capable of offering high QoS at high data rates for IP networks. Deployment of Video on Demand (VoD) over the next generation (WiMAX) has become one of the passionate subjects in the research these days, and is expected to be the most revenue generator in the coming years. The objective of this paper to provide a survey of IPTV services over WiMAX Networks, the key success factors of IPTV over WiMAX and to provide comparison of WiMAX networks over other networks like WiFi.**

Keywords: IPTV, QoS, VoD, WiFi, WiMAX

I. INTRODUCTION

WiMAX is basically a new shorthand term for IEEE Standard 802.16, which was designed to support the European standards. 802.16 predecessors (like 802.11a) were not very accommodative of the European standards. The IEEE wireless standard has a range of up to 30 miles, and can deliver broadband at around 75 megabits per second. This is theoretically, 20 times faster than a commercially available wireless broadband [1]. WiMAX can be used for wireless networking like the popular WiFi. WiMAX, a second-generation protocol, allows higher data rates over longer distances, efficient use of bandwidth, and avoids interference almost to a minimum. WiMAX can be termed partially a successor to the Wi-Fi protocol, which is measured in feet, and works, over shorter distances [1].

WiMAX have generated interest among researchers these years because of their potential usage in wide variety of applications [4]. WiMAX supports a variety of modulation and coding schemes and allows the scheme to change on a burst-by-burst basis per link, depending on channel conditions [6]. The bandwidth and range of WiMAX make it suitable for the following potential applications:

1. Providing portable mobile broadband connectivity across cities and countries through a variety of devices.
2. Providing a wireless alternative to cable and digital subscriber line (DSL) for "last mile" broadband access.
3. Providing data, telecommunications (VoIP) and IPTV services (triple play).
4. Providing a source of Internet connectivity as part of a business continuity plan.
5. Smart grids and metering.

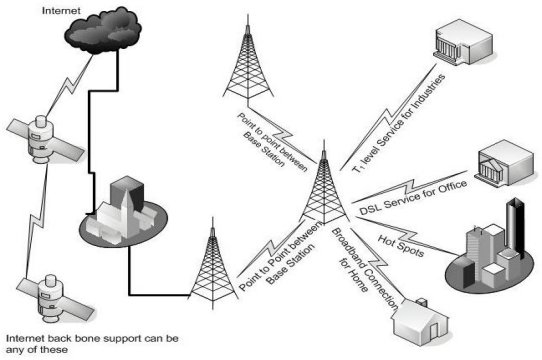

Fig. 1 WIMAX Network [8]

This paper is divided into five sections. The section II consists of IEEE 802.16 protocol architecture, section III is of IPTV, section IV explains IPTV services and WiMAX and section V concludes the paper with a conclusion.

II. IEEE 802.16 PROTOCOL ARCHITECTURE

The IEEE 802.16 protocol architecture is structured into two main layers: the Medium Access Control (MAC) layer and the Physical (PHY) layer. MAC layer consists of three sub-layers. The first sub-layer is the Service Specific Convergence Sub-layer (CS), which maps higher level data services to MAC layer service flow and connections. The second sub-layer is Common Part Sub-layer (CPS), which is the core of the standard and is tightly integrated with the security sub-layer. This layer defines the rules and mechanisms for system access, bandwidth allocation and connection management. The MAC protocol data units are constructed in this sub-layer. The last sub-layer of MAC layer is the Security Sub-layer which lies between the MAC CPS and the PHY layer, addressing the authentication, key establishment and exchange, encryption and decryption of data exchanged between MAC and PHY layers [2].

The PHY layer provides a two-way mapping between MAC protocol data units and the PHY layer frames received and transmitted through coding and modulation of radio frequency signals.

Comparisons and confusion between WiMAX and Wi-Fi are frequent because both are related to wireless connectivity and Internet access.

1. WiMAX is a long range system, covering many kilometres that uses licensed or unlicensed spectrum to deliver connection to a network, in most cases the Internet.

2. Wi-Fi uses unlicensed spectrum to provide access to a local network.
3. Wi-Fi is more popular in end user devices.
4. Wi-Fi runs on the Media Access Control's CSMA/CA protocol, which is connectionless and contention based, whereas WiMAX runs a connection-oriented MAC.
5. WiMAX and Wi-Fi have quite different quality of service (QoS) mechanisms:

5.1. WiMAX uses a QoS mechanism based on connections between the base station and the user device. Each connection is based on specific scheduling algorithms.

5.2. Wi-Fi uses contention access-all subscriber stations that wish to pass data through a wireless access point (AP) are competing for the AP's attention on a random interrupt basis. This can cause subscriber stations distant from the AP to be repeatedly interrupted by closer stations, greatly reducing their throughput.

6. Both 802.11 (which include Wi-Fi) and 802.16 (which include WiMAX) define Peer-to-Peer (P2P) and ad hoc networks, where an end user communicates to users or servers on another Local Area Network (LAN) using its access point or base station. However, 802.11 supports also direct ad ho or peer to peer networking between end user devices without an access point while 802.16 end user devices must be in range of the base station. [11]

III. INTERNET PROTOCOL TELEVISION (IPTV)

Internet Protocol Television (IPTV) has become popular as it promises to deliver the content to users whenever they want. IPTV is a set of multimedia services that are distributed throughout an IP network, where end of user receives video streams through a set-top-box (STB) connected to a broadband connection. IPTV is often combined with the services of VoD. VoD services contents are not live but pre-encoded contents available at any time from servers. These services must possess an adequate level of quality of service, security, interactivity, and reliability. [12] From the perspective of the provider, IPTV includes the video acquisition, video processed and video secure distribution on the IP network infrastructure. One official definition approved by the International Telecommunication Union focus group on IPTV (ITU-T FG IPTV) is:

"IPTV is defined as multimedia services such as television/video/audio/text/graphics/data delivered over IP based networks managed to provide the required level of quality of service and experience, security, interactivity and reliability".

Another more detailed definition of IPTV is the one given by Alliance for Telecommunications Industry Solutions (ATIS) IPTV Exploratory Group in 2005:

"IPTV is defined as the secure and reliable delivery to subscribers of entertainment video and related services. These services may include for example, Live TV, Video on Demand (VOD) and Interactive TV (iTV). These services are delivered across an access agnostic, packet switched network that employs the IP protocol to transport the audio, video and control signals [9]. In contrast to video over the public Internet, with IPTV deployments, network security and performance are tightly managed to ensure a superior entertainment experience, resulting in a compelling business environment for content providers, advertisers and customers alike."

IPTV services may be classified into three main groups:

1. Live television, with or without interactivity related to the current TV show.
2. Time-shifted television: catch-up TV (replays a TV show that was broadcast hours or days ago), start-over TV (replays the current TV show from its beginning).
3. Video on demand (VOD): browse a catalogue of videos, not related to TV programming.

IPTV is distinguished from Internet television by its on-going standardization process (e.g., European Telecommunications Standards Institute) and preferential deployment scenarios in subscriber-based telecommunications networks with high-speed access channels into end-user premises via set-top boxes or other customer-premises equipment.

IV. IPTV SERVICES & WIMAX

WiMAX technology is one of the access technologies that enable transmission of IPTV Services. Transmitting IPTV over WiMAX aims to make IPTV services available to users anywhere, anytime and on any device. The QoS for delivering IPTV services depends especially on network performance and bandwidth [7]. Scalable Video Coding (SVC) has achieved significant improvements in coding efficiency with an increased degree of supported scalability relative to the scalable profiles of prior video coding standards.[5] Transmitting SVC encoded videos over WiMAX networks is an effective solution which solves many of the video transmission problems over these networks.

In general, IPTV services can be classified by their type of content and services [13] [14]:

On-demand content: With pre-encoded and compressed content, a customer is allowed to browse an online movie catalogue, to watch trailers, and to select a movie of interest. Unlike the case of live video, a customer can request or stop the video content at anytime and is not bound by a particular TV schedule. The playout of the selected movie starts nearly instantaneously on the customer's TV or PC.

Live content: In this case, a customer is required to access a particular channel for the content at a specific time, similar to accessing a conventional TV channel. A customer cannot request to watch the content from the beginning if he or she joins the channel late. Similar to a live satellite broadcast, live content over IPTV can be a showing of a live event or a show encoded in real-time from a remote location, such as a soccer game.

Managed services: Video content can be offered by the phone companies who operate the IPTV business or obtained from syndicated content providers, in which the content is usually well-managed in terms of the coding and playout quality, as well as in the selection of video titles. Bandwidth for delivery and customer equipment are arranged carefully for serving the best play out performance and quality to the customers.

Unmanaged services: The technology of IPTV itself enables play out of any live or on demand video content from any third party over the Internet. Therefore, nothing stops a customer from accessing video content directly from any third party online such as YouTube (or Google Video), individuals, or an organization.

V. The Key Success Factors

A. Economy of Scale

Economy of scale characterizes a production process or service operation, in which an increase in the number of producing units may cause a decrease in the average fixed cost of each unit. By optimizing the economy of scale for operating IPTV services, one can minimize the risks and secure the early advent of ultimate success. This translates to the need of an access network technology that can support more subscribers and mobile TV for future requirements [14].

B. Scheduled Live Content and Quality Assurance

Quality of service and quality of experience for end users have been identified as critical requirements of IPTV services[10]. In the long run, watching IPTV content will be just like surfing different Web sites over the Internet. Watching unmanaged live or on-demand content offered by different service and media providers in the world would provide the true value of IPTV services to customers. However, an IPTV channel is still critical to ensure comparable TV quality and experiences similar to those of the conventional cable, satellite, or digital TV services. Offering managed and scheduled SDTV programs with a quality guarantee is required to secure a head start and the success of IPTV service [14].

VI. Conclusion and Future Work

This paper has provided us with information related to IPTV over WiMAX along with WiMAX characteristics, IPTV services and key success factors of IPTV with WiMAX. In this paper, we have discussed the major problems that are faced in delivering the good quality of service over WiMAX. This paper can act as a base for those who are new to this field. IPTV & WiMAX can be used jointly to provide better quality of on demand audio & video services over the network.

In WiMAX, nodes are free to move without disconnectivity with the network. So due to the movement of nodes there is possibility that misbehaviour nodes come across the network. So it is necessary to analyse the effect of misbehaviour nodes in WiMAX. In the near future, we will try to find the impact of IPTV over WiMAX with misbehaviour nodes so that quality of service of IPTV over WiMAX can be improved.

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