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ICN-WiMAX: An Application of Network coding based Centrality-measures caching over IEEE 802.16

Kumari Nidhi Lal*[a], Anoj Kumar[b]

[a]MNNIT Allahabad, Allahabad, 211004, India
[b]MNNIT Allahabad, Allahabad, 211004, India

Abstract

To provide broadband access services to customers, which resides residential and enterprise field, WiMAX worldwide interoperability for microwave access is one of the famous wireless technology nowadays. In the real world, the number of users making the request for access content item are high. Therefore, by exploiting the features of an Information-centric network (ICN) such as caching capability of content routers, can be used to reduce the bandwidth consumption using centrality measures with network coding. In this way, a user can access the content item using their neighboring content routers rather than the server. Also, It requires scheduling algorithm in the MAC layer of its protocol stack for allocation of the bandwidth. Therefore, to avoid starvation, to maintain fairness and to provide high data speed among users with continuous service there is a need of scheduling algorithm in the uplink layer of the WiMAX. One of the widely used scheduling algorithms is the earliest deadline first (EDF) but it contains certain performance limitations. In this paper, we propose a Heuristic earliest deadline first (H-EDF) uplink scheduler in the MAC layer of the ICN-WiMAX such that it can efficiently schedule user's request and provide a fairness in the ICN-WiMAX system. Further, we assess the performance of ICN-WiMAX using H-EDF scheme via simulations and provide a detailed analysis of its outcomes.

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Keywords: Information-centric network; Caching; WiMAX; Performance analysis.

1. Introduction

The WiMAX technology comes into account when there is need of a high data transfer rate in telecommunication networks. The wired infrastructure is very expensive to provide services to the high number of nodes with high speed

* Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000.
E-mail address: nidhi.2592@gmail.com

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and large coverage. Therefore to overcome these problems, a low cost wireless technology is introduced which does not contain wired network infrastructure and known as called WiMAX (worldwide interoperability for microwave access). The WiMAX communication system contains two basic components in its infrastructure: a WiMAX base station and WiMAX receiver [1]. In this paper, we proposed a new WiMAX communication system which supports the features of Information-centric networking (ICN). We named this new communication system as ICN-WiMAX. The exhaustion of IP address also leads to the requirement for changes from host-centric to content-centric architecture. In this way, Jacobson proposed a solution named as Information-centric networking(ICN) to overcome the issues of TCP/IP [2].

ICN uses two types of packet for establishing the communication: Interest packet and Data packet. The Interest packet is initiated by the user and it contains the information of a desired content item to be access [3]. the data packets is initiated by the server or a content router (CR) by imposing the desired content item in the data packet. There are three table used by a CR for establishment of content communication named as Content Store (CS), Pending Information Table (PIT) and the additional one is Forwarding Information Base (FIB).

Figure 1: ICN-WiMAX architecture

The users do not need to request for acquiring bandwidth from the base station in ICN-WiMAX for accessing of each content. In spite, they can easily get access to the desired content by using the neighboring CR (Figure 1). Each CR of ICN-WiMAX has caching capability so that they can easily cache the content and forwards to the requesting users. In this way, consumption of bandwidth can be reduce drastically and performance of the network system will be enhance. Our proposed ICN-WiMAX achieves very good results when requesting content is found in nearby CRs such that the bandwidth consumption is get reduced. While, if the content is not found in the CS of nearby CRs along the path then, the users need to acquire bandwidth for reach to the server. Therefore, our contribution can be summarized as follows:

• We developed an application of ICN over WiMAX using network coding based caching scheme. In this scheme, each CR of WiMAX has caching capabiliy. For selection of a CR for caching of content item, the proposed scheme is utilized.

• For eviction of a content in a CS, we used CCR content eviction strategy. This scheme selects a content for eviction based on the popularity.

• We simulated the proposed application using various multiple topologies and presented an average performance.

2. RELATED WORK

In [4], Delay Threshold Priority Queuing (DTPQ) has been proposed for usage when in cooperation real-time and non-real-time traffic in the chorus are contemporary. In this scheduling algorithm, a higher priority is given to real-time traffic but that event could harm the non-real time traffic. To overcome this issue a condition is defined. According to this condition, the real-time traffic is assigned to bandwidth only when the head-of-line (HOL) packet delay surpasses a specified delay threshold. In [5], Deficit Fair Priority Queuing (DFPQ) by way of using a counter has been introduced to balance and control of allocation maximum allowable bandwidth for each service class. The counter diminutions rendering to the size of the packets [6]. The scheduler vagaries to alternative class when the counter value condensed to zero. A scheme named Modified Largest Weighted Delay First (M-LWDF) has been proposed to offer the better