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Minimizing power for NOMA-enabled Traffic Offload with security allocation in cellular networks

R.Vijayarajeswari[1], K.S.Manojee[2]
[1,2]Assistant Professor, Department of Computer Science and Engineering, Mahendra Engineering College, Mahendhirapuri, Namakkal District, Mallasamudram, Tamilnadu, India.

Abstract

Non-Orthogonal Multiple Access (NOMA) has been proposed as an effective technique to cope with the enormous mobile traffic in wireless communication networks in a spectrum-efficient manner. Meanwhile, to further relieve the traffic pressure, 3GPP has proposed Dual-Connectivity (DC), through which each Mobile User (MU) can simultaneously communicate with the macro cell and small cell. In this paper, driven by the developing interest for greening cell frameworks, we examine the vitality proficient NOMA-empowered activity offloading through DC, which plans to limit the aggregate power utilization of the little and large scale cells, while fulfilling every MU's QoS-prerequisite. The ideal activity offloading compares to a two-sided control assignment issue which however is non raised. By misusing the element of DC, we equally change this power assignment issue into a raised rate-part issue which can be proficiently comprehended. Simulation analysis is carried out to show the performance of the proposed work compared to the existing schemes.

Keywords: Dual-Connectivity, Non-Orthogonal Multiple Access, traffic pressure, simulation analysis.

Introduction

The explosive growth of mobile traffic has heavily over-loaded the cellular networks. Offloading mobile traffic to small-cell networks is a promising way to relieve the traffic pressure of cellular networks. 3GPP has recently put forward a new technique Dual-Connectivity (DC), which can achieve efficient traffic offloading between macro cells and small cells. However, the increasingly congested spectrum is hard to support the dense deployment of small cells. Non-Orthogonal Multiple Access (NOMA) has been proposed as an effective approach to address it. Besides, due to the open access of small cells, Mobile Users (MUs) served by small cells often suffer security issue. Therefore, a careful radio resource management is desired for DC-based traffic offloading in NOMA systems with security provisioning.

Related works

The vitality effective NOMA-empowered activity offloading through DC plans to limit the aggregate power utilization of the little and full scale cells, while fulfilling every MU's QoS-requirement [1]. Efficient Authentication Technique [2] for improving the network efficiency and scalability. In this scheme, the Clusters are formed based on the distance and

the Cluster Heads (CHs) are selected by coverage and connectivity. The secret key is used to form the clusters securely. The CH initially checks the cluster members' secret key then formed the clusters. The Elliptical Curve Cryptography technique verifies the CH is authenticated or not. Hence, source sends the data to authenticated CH in the network.

Keeping in mind the end goal to enhance the otherworldly proficiency, non-orthogonal different access (NOMA) with superposition coding was utilized in a planned framework where downlink signs to clients close to base stations (BSs) and cell-edge clients are transmitted at the same time. To help a cell-edge client in a NOMA channel, two composed BSs utilize Alamouti code [3].

In Decentralized distributed Space Time Block Coding (Dis-STBC) system, the knowledge about the Channel State Information (CSI) is not available at the transmitter [4]. An Unobservable secure routing scheme offers complete unlinkability and content unobservability for all types of packets. This protocol is efficient as it uses a combination of group signature and ID based encryption for route discovery [5].

User favours low-entropy password in two-factor authentication protocols [6], which is selected from a small dictionary based on password and smartcard. The adversary performs the off-line procedure to guess user's password within polynomial time in the outcome. Therefore, two factor authentication systems cannot provide high security due to the off-line password guessing attack. Therefore 3 factor authentication mechanism is concentrated for providing highly confidential services.

A user authentication protocol for two-tire WSN [7] was introduced to overcome the hacking and vulnerabilities produced by the conventional scheme. Biometric-based three-factor user authentication protocol for WSNs was proposed which was in-secure against forgery attack and is vulnerable to information leakage attack and it is unable to preserve user anonymity and mutual authentication property.

Minimizing power for NOMA-enabled Traffic Offload with security allocation

Problem (TPM) is a nonconvex optimization problem. The idea to solve Problem (TPM) is to transform it into a rate-splitting problem which is convex. This section evaluates the proposed NOMA-enabled traffic offloading. We consider a scenario where the mBS is located at (0m; 0m), and the sAP is located at (250m; 0m). All MUs are uniformly distributed within a circle whose central is (220m; 0m) and radius is 20m (thus the MUs are closer to the sAP, which is a favorable condition for offloading). We use the similar path-loss model to set the channel power gain.

The advantage in saving power consumption by using the optimal NOMA-enabled offloading via DC is described. For comparison, we consider a TDMA-based offloading, in which all MUs equally share the time-slot, and the mBS and sAP use DC to provide traffic for each MU within its allocated scheduling-period. The top and middle subplots together show the advantage of the NOMA-enabled offloading which yields more offloaded traffic but consumes less power at the sAP. Such an advantage stems from that the NOMA reuses the channel for all MUs while properly cancelling the interference with SIC. Moreover, the middle-subplot verifies the importance of DC, namely, it becomes beneficial to invoke DC to properly schedule the MUs' traffic between the sAP and mBS when the MUs' traffic demand becomes large, which thus leads to the decrease in the ratio of offloaded traffic through the

sAP. The bottom-subplot shows that all the relative gains are positive, meaning that the NOMA-enabled offloading always outperforms the TDMA-based offloading.

Performance evaluation

The performance of the proposed scheme is analyzed by using the Network Simulator (NS2). The NS2 is an open source programming language written in C++ and OTCL (Object Oriented Tool Command Language). NS2 is a discrete event time driven simulator which is used to model the network protocols mainly. The nodes are distributed in the simulation environment.

The simulation of the proposed scheme has 50 nodes deployed in the simulation area 900×900. The nodes are communicated with each other by using the communication protocol User Datagram Protocol (UDP). The traffic is handled using the traffic model CBR. The radio waves are propagated by using the propagation model two ray ground. All the nodes receive the signal from all direction by using the Omni directional antenna. The performance of the proposed scheme is evaluated by the parameters packet delivery ratio, packet loss ratio, average delay, throughput, residual energy and lifetime.

Packet Delivery Rate

The Packet Delivery Rate (PDR) is the rate of the number of packets delivered to all receivers to the number of data packets sent by the source node. The PDR is calculated by equation (1).

$$PDR = \frac{\sum_0^n Packets\ Received}{\sum_0^n Packets\ Sent} \quad (1)$$

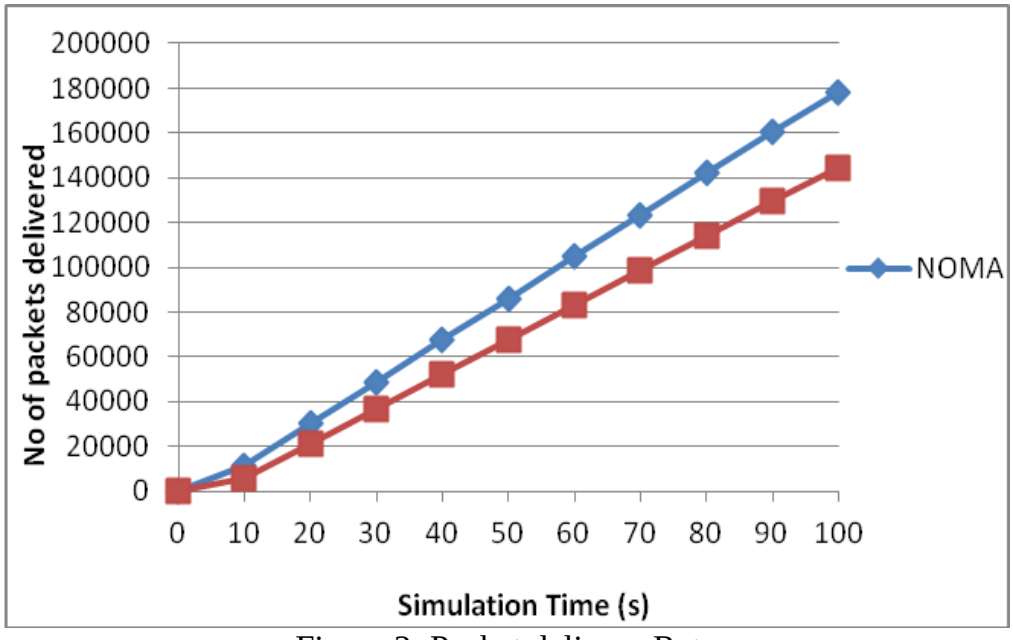

Figure 2: Packet delivery Rate

From Figure 2, the PDR of the proposed scheme is increased by 18% compared to the existing scheme VO-AODV. This is because of the QoS improved during the estimation of the connection density and residual energy parameters in the route selection process of the method proposed. The greater value of PDR means the better performance of the network protocol.

Average Delay

The average delay is defined as the time difference between the current packets received and the current packet sent. It is measured by equation (3).

$$Average\ Delay = \frac{1}{n}\left(\sum_{0}^{n} Pkt\ Recvd\ Time - Pkt\ Sent\ Time\right) \quad (3)$$

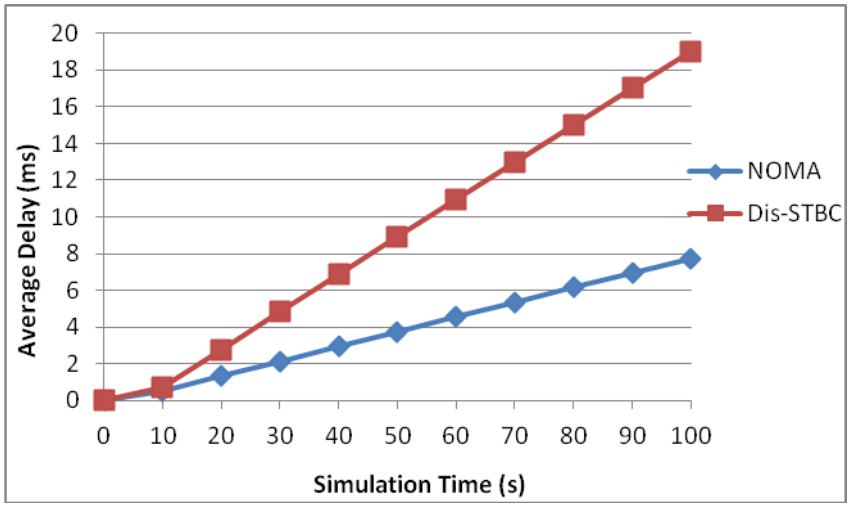

Figure 4: Average Delay

Figure 4 shows that the average delay is low by more than 23% for the proposed scheme RLMOR than the existing VO-AODV. The minimum value of delay means produces the higher value of the throughput in the network. This graph justifies the fact that the hindrances in the communication are lesser among the nodes in the network, which shows a significant average delay.

Conclusion

The vitality effective NOMA-empowered movement offloading through DC is proposed in this paper which intends to limit the aggregate power utilization of the little and large scale cells, while fulfilling every MU's QoS-prerequisite. The ideal movement offloading compares to a two-sided control designation issue which however is non curved. By misusing the element of DC, we identically change this power distribution issue into a raised rate-part issue which can be productively explained. Simulation analysis is show the performance of the proposed work compared to the existing schemes.

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