ANALYSIS OF THREE-NODE FRAMEWORK FOR ATOMIC UPLINK AND DOWNLINK FLOW

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ABSTRACT

Within this paper, we advise an arbitrary-access medium access control protocol using distributed power control to handle inter-client interference in wireless systems with full-duplex capable access points that provide half-duplex clients. Recent advances in signal processing have shown in-band full-duplex capacity at Wireless ranges. Additionally to synchronized two-way exchange between two nodes, full-duplex access points could possibly support synchronized uplink and downlink flows. However, the atomic three-node topology, which enables synchronized uplink and downlink, results in inter-client interference. Our key contributions are a couple of-folds. First, we find out the regimes by which power control provides sum throughput gains for that three-node atomic topology, with one uplink flow and something downlink flow. Second, we develop and benchmark a complete 802.11-based protocol that enables distributed choice of a 3-node topology. We transported out extensive simulations and software defined radio-based experiments to judge the performance from the suggested MAC protocol that is proven to attain a substantial improvement over its half-duplex counterpart when it comes to throughput performance. The suggested MAC protocol is proven to attain greater capacity when compared with a similar half-duplex counterpart, while keeping similar fairness characteristics in single contention domain systems.

Keywords: Full-duplex, power control, MAC protocol, wireless network.

1. INTRODUCTION

To benefit from full-duplex capacity inside a multi-node network, it is important to have new medium access control (MAC) protocols, because full-duplex results in new interference patterns when compared with current half-duplex communication systems. The important thing challenge for that full-duplex MAC would be to coordinate multiple synchronized transmissions that are thanks to the brand new in-band full-duplex capacity. Within this paper, we consider wireless systems by which an AP is capable of doing full-duplex communication and clients just use half-duplex transmissions. To beat the task of interfluent interference, we advise two concepts: distributed interference measurement to modulate access odds, and distributed power control to maximize the resulting throughput. First, we advise using a signal-strength-based back-off mechanism to supply a greater reception chance towards the client having a low inter-client interference. Second, to maximize the network throughput performance, we formulate an optimization problem for calculating the perfect transmits forces from the AP and client. By using this mechanism, the customer using the cheapest inter-client interference has got the tiniest contention window size and it is eventually selected to get a downlink transmission in the AP. The optimization issue is then solved included in the suggested MAC protocol, namely, power-controlled MAC (PoCMAC), to coordinate the uplink and downlink transmissions. By modifying the transmit forces from the AP and transmitter, the inter-client interference is minimized, and greater sum throughput of uplink and downlink transmissions is possible. PoCMAC uses additional short control frames for choosing a receiver as well as an acknowledgement frame for finishing full-duplex transmissions. To ensure the performance from the suggested MAC protocol, we evaluate the signal-to-interference-plus-noise ratio (SINR) of uplink and downlink transmissions with regards to the interfluent interference. Further, we compare the throughput and fairness performance from the suggested MAC protocol along with other schemes through extensive simulations. Among the key shortcomings from the aforementioned studies would be that the leveraging of full-duplex AP capacity isn't supported when all flows are half-duplex that is possible in practical wireless network environments supporting devices that don't have full-duplex ability. Regardless of the elevated overhead because of the control frames, the suggested MAC protocol is capable of a higher performance gain since the AP can furthermore transmit a lengthy data frame even though it is receiving an uplink transmission. However, within this paper, we think about a new MAC protocol design to offer the maximum performance grow in practical wireless systems when just the AP has full-duplex capacity. Several MAC protocols for full-duplex wireless communication happen to be studied. Inter-client interference among clients may considerably deteriorate the throughput performance of full-duplex wireless systems because two customers are permitted to deliver concurrently. Several researches have investigated the minimization from the inter-client interference problem.

2. PROPOSED SYSTEM:

Observe that the AP is definitely outfitted with elaborate antenna techniques and signal processing modules for self-interference cancellation while mobile clients with full-duplex capacity are now being incrementally deployed. Therefore, we think about a full-duplex wireless network in which the AP can concurrently transmit and receive signals and also the clients may either transmit or receive in a given instant over time. Within this paper, a transmitter (Texas) refers back to the client transmitting signals towards the AP, along with a receiver (RX) refers back to the client receiving signals in the AP. The machine model for any wireless network having a single full-duplex AP, one Texas, and something RX. Observe that the only AP is portrayed as two separate components for transmitting and receiving signals. The entire-duplex AP and Texas transmit the signals XAP and XTX, and also the RX and full-duplex AP gets the signals YRX and YAP, correspondingly. Gi,j may be the funnel profit from Client i to Client j. Just because a full-duplex AP transmits and gets to be a signal concurrently, the transmitted signal from the AP is given to the receiving RF chain from the AP, also it disrupts the signal reception in the AP. The funnel gains are modeled as complex Gaussian random variables with zero mean, and they're assumed to become constant within the time period of each transmission. Observe that the self-interference signal might be canceled by subtracting the canceling signal in the received signal. However, when the self-interference is extremely less space-consuming than the received signal from the AP, we'll contemplate it minimal and neglected. We define a because the suppression degree of self-interference cancellation, also it can be expressed. Even though this model inherently guarantees just the minimum rate, it's possible that greater SINR is going to be achievable in some instances, and therefore, greater rates may be used. We describe our power-controlled MAC protocol (PoCMAC) for in-band full-duplex wireless systems. Before supplying an in depth description of PoCMAC, we consider how you can boost the sum rate from the uplink and downlink transmissions in the AP inside a full-duplex wireless atmosphere. We advise an indication-strength-based back-off mechanism for choosing the RX to attain a minimal inter-client interference. Additionally, when the AP transmits signals while using maximum transmit power, the effectiveness of self-interference in the AP increases because of the strong signal transmitted in the AP itself. Consequently, the self-interference signal isn't sufficiently covered up, and also the AP cannot decode signals in the

Texas. When the Texas transmits signals while using maximum transmits power, the RX undergoes strong inter-client interference in the Texas and can't receive signals in the AP. The above mentioned conclusion is our motivation for adapting the transmit forces from the AP and Texas to maximize the sum capacity. PoCMAC performs the important thing functions: collecting info on the interfluent interference between your Texas and also the RX, figuring out the RX from one of the clients, and calculating and notifying the perfect transmit forces for that AP and Texas. Clients that are looking to deliver DATA frames towards the AP should first transmit an RTS frame towards the AP. To deliver the RTS frame, all of the clients have to carry out a back-off mechanism to prevent collisions before transmitting the RTS frame. If greater than two clients pick the same back-off number, RTS frame collisions will occur. Within this situation, the clients carry out the back-off mechanism again, and also the contention window dimensions are bending. This really is known as a binary exponential back-off mechanism, which is utilized in carrier sensing multiple access with collision avoidance. Entirely-duplex communication, we have to pick a receiver for that downlink transmission along with a transmitter for that uplink transmission. As described above, the performance of uplink and downlink transmissions during full-duplex communication is extremely determined by the RSS between your AP and also the RX which between your Texas and also the RX. We advise a received-signal strength-based (RSSB) contention mechanism for choosing the receiver for that downlink transmission. Observe that the contention mechanism for uplink transmissions is as being similar to IEEE 802.11 DCF with RTS/CTS handshake, as well as an advanced mechanism that adaptively adjusts the contention window size does apply for more performance enhancement. While using RSSB contention mechanism to look for the receiver, PoCMAC enables the candidate client that may maximize full-duplex capacity to possess a greater possibility of finding the downlink transmission in the AP. In this contention, collisions among candidate clients can happen if greater than two clients pick the same back-off number. Within this situation, PoCMAC fails to decide on the RX for downlink transmission, and also the Texas that effectively transmitted RTS to and received CTS in the AP performs the half-duplex uplink transmission. Following the RX is dependent upon the RSSB contention mechanism, the AP calculates the perfect transmit forces by itself and also the Texas while using details about the received forces in the Texas and RX, the inter-client interference in the Texas towards the RX, and also the self-interference within the AP [5]. This transmit power adjustment plan can help to eliminate the inter-client interference and stop collisions in the RX. The transmit power control that determines the transmit forces from the AP and Texas should 1) facilitate effective synchronized uplink and downlink transmissions, and a pair of) enable each transmission to offer the maximum SINR value. The optimization problem tries to increase the minimum SINR from the uplink and downlink transmissions while satisfying the SINR constraints. We've suggested the RSSB contention plan for receiver selection and also the transmit power adjustment plan to compute the perfect transmit forces from the AP and Texas. While using control frames and headers, the AP collects the inter-client interference information in the RX, calculates the transmit forces by itself and also the Texas in line with the collected information, after which informs the Texas from the transmit power for that uplink DATA transmission.

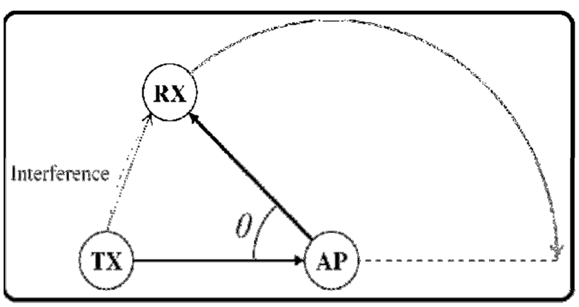


Fig.1.Network scenario

SIMULATION RESULTS:

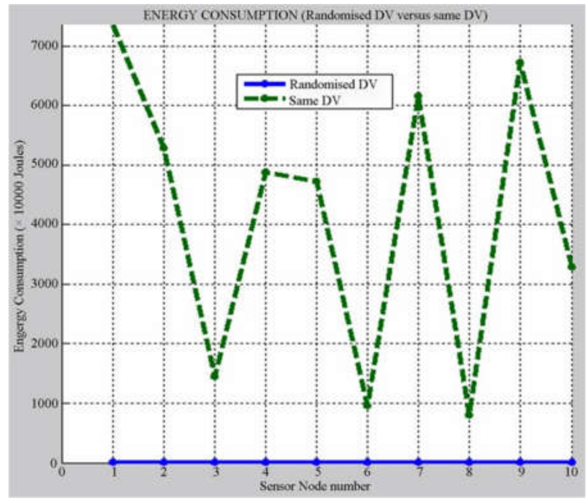
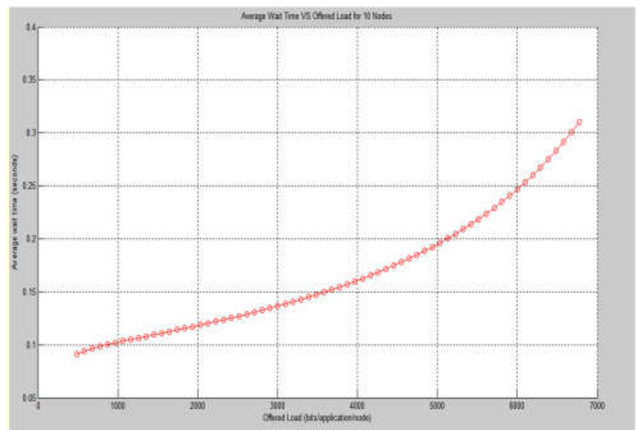
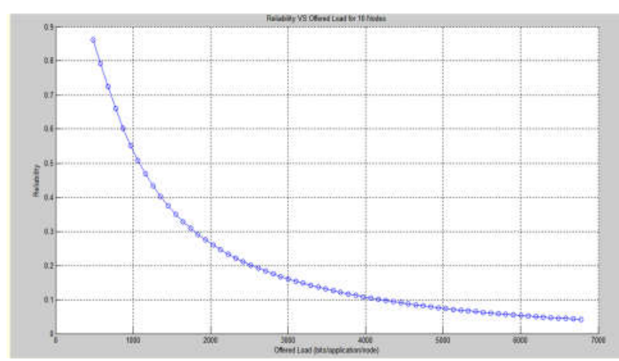
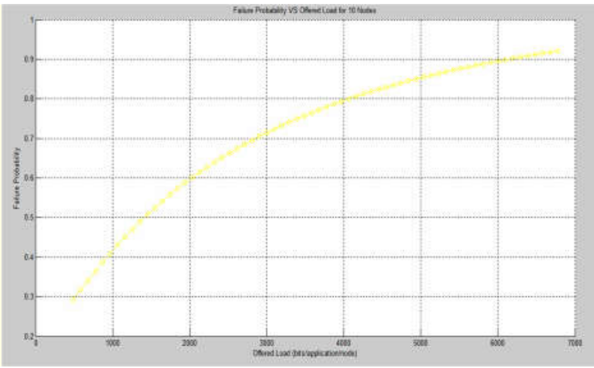


Fig: Energy consumption by sensor nodes— randomized DV and same DV.







In this paper, the Duration Value (DV) reported by the sender is 300 ms. The sender transmits 2000 bits, out of which 10% is assumed corrupted at the receiver and must be re-transmitted. The receiver has ten neighboring sensor nodes (i.e., n = 10). The proposed PDV-MAC protocol (using DV + random factor) and existing MAC protocol (with same DV). For the first scenario the DV of 300 ms becomes the basic sleep time. Ten random non-repeating integer values are generated in the range 1 - 100 ms, and used to obtain ten (10) randomized DV values. These randomized DVs (i.e. rDV_s) then form the sleep times for the neighboring nodes of the receiver. The consequent of this sleep schedule is that each node will wake up at different times; and normally at time when ongoing transmission would have completed. Moreover, since the focus of this work is on energy consumption by neighboring nodes of the receiver, it is expected that transmission of packets by the neighboring nodes of the receiver is not allowed. Hence, neighboring nodes can either be in sleep or idle mode.

3. CONCLUSION:

To maximize the uplink and downlink SINRs, an optimization problem was formulated, the perfect solution which determines the transmit power the AP and also the uplink client. We suggested a complete-duplex MAC protocol to supply greater reception possibilities to clients with low interference and also to lessen the interference between uplink and downlink transmissions in the AP. The performance of PoCMAC was evaluated under various simulation configurations regarding the SINR, throughput, and fairness. For any given uplink transmission from the client towards the AP, a customer that may achieve high SINR regardless of the synchronized uplink transmission could have a greater possibility of being selected because the downlink client underneath the suggested RSSB contention mechanism. We defined control frames and header structures to apply our protocol, PoCMAC.

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