Incentive Scheduler Algorithm for Cooperation and Coverage Extension in Wireless Networks

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ABSTRACT

The main purpose of the coverage extension area in wireless networks is to enhance the network connectivity without increasing the infrastructure. In wireless networks, this is one of the main applications in cooperative communications. So propose a new protocol based on an incentive approach and a scheduling algorithm to reward cooperative nodes. To increase the network connectivity, concentrate on the Quality of Service and energy consumption, which does not motivate some nodes to cooperate. In the existing system, use some of the algorithms such as Classical round robin, maximum signal-to-noise ratio (MaxSNR) and weighted fair opportunistic (WFO). But in these approaches there is no interest for a mobile to cooperate, increase in its mean packet delay, but reduces its potential throughput particularly in an overloaded context. So, introduce a new technique called coverage extension based on incentive scheduling (CEI). The scheduler, which is located in the central node such as the AP or the CH node, grants RUs to each mobile as a function of its channel state, its current cooperation ratio, its network confidence percentage, and its traffic backlog. In this method, significant priority is given to mobiles that help the network provide a low packet delay and a high personal throughput.

1. Introduction to wireless network

Wireless network refers to any type of computer network that utilizes some form of wireless network connection. It is a method by which homes, telecommunications networks and enterprise installations avoid the costly process of introducing cables in to a building as a connection between various equipmentlocations. Wireless telecommunications networks are generally implemented and administered using radio communication. This implementation takes place at the physical level of the OSI model network structure An access point AP connects wireless clients to the wired LAN. Client devices on a network do not typically communicate directly with each other communicate via an access point. In essence, an access point converts the data packets from the 802.11 frame encapsulation format in the air to the 802.3 Ethernet frame format on the wired Ethernet network**.** Wireless networks provide an inexpensive and easy way to share a single Internet connection among several computers. This means you only need one modem, and you can add additional computers to the network just by plugging in a wireless card and turning them on. The new machines are connected to the Internet immediately. A wireless network also lets you access files and printers from anywhere in your home. It allows you to synchronize files you have on your laptop with your home computer, and you can easily send files between computers as well. Using a wireless network to transfer files is faster than sending them via e-mail or burning them to a CD. Because printers connected to one of the computers on a network are shared by all the computers on that network, you can write documents anywhere in your 1home, press the ‘print' button, and collect the printed files from a printer that is connected to another computer.

2 .PROPOSED SYSTEM

In the proposed system, a new cooperative protocol based on an incentive approach that takes into account the QoS for mobile relayed nodes to extend the coverage area. This approach consists of increasing the priorities of the relayed nodes according to their cooperation rate. The idea is to reward the relayed nodes for their cooperation instead of penalizing them by increasing the cost of cooperation. Consequently, the nodes have no interest in selecting and acting selfishly by using their throughput only to transmit their own packets. Moreover, protocol guarantees that the nodes are free to cooperate because it chooses their percentage of cooperation. The proposed solution combines the QoS parameters and cooperation rate using the cross-layer approach with a scheduling algorithm. This solution is called coverage extension based on incentive scheduling (CEI). The CEI scheduling algorithm relies on weights that set the dynamic priorities to allocate the resources. These weights are built to satisfy two major objectives: To maximize the system throughput and to encourage the node cooperation.

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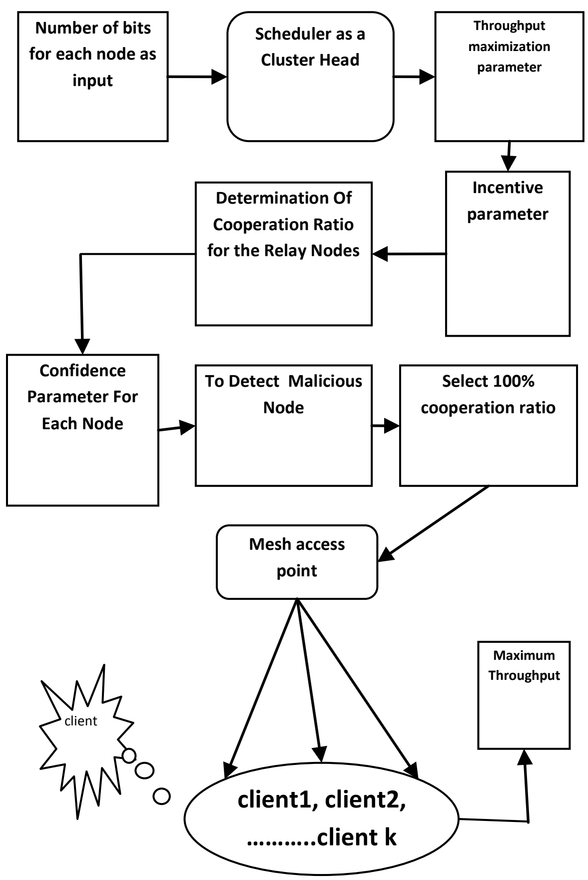
3. ARCHITECTURE DIAGRAM

The input to the each node is given in bits .Access point is located as a head for the wireless network. Throughput maximization parameter finds which nodes has highest throughput ,that is how many number of packets are transferred between two nodes within the given amount of time. Using high throughput and good cooperation ratio rely node is identified. Confidence parameter for each node is identified to detect malicious attack. After this determine the 100% cooperation ratio to find which is best rely node to transfer the packet from one node to another node. Using rely node coverage is extended between the nodes in access point.



3.1 NETWORK MODULE

An undirected graph G (V, E) where the set of vertices V represent the mobile nodes in the network and E represents set of edges in the graph which represents the physical or logical links between the mobile nodes. Sensor nodes are placed at a same level. Two nodes that can communicate directly with each other are connected by an edge in the graph. Let N denote a network of m mobile nodes, N1, N2...Nm and let D denote a collection of n data items d1; d2; . . . ; dn distributed in the network. For each pair of mobile nodes Ni and Nj, let tij denote the delay of transmitting a data item of unit-size between these two nodes.

3.2 INCENTIVE SCHEDULER ALGORITHM

The main element of the proposed protocol is its scheduling algorithm called CEI. The scheduler, which is located in the central node such as the AP or the CH node, grants RUs to each mobile as a function of its channel state, its current cooperation ratio, its network confidence percentage, and its traffic backlog. The channel state is supposed to be available at the receiver. The current channel attenuation on each subcarrier and for each mobile node is estimated by the access node based on the SNR of the signal sent by each mobile during the uplink contention sub frame. The CEI scheduling algorithm relies on weights that set the dynamic priorities to allocate the resources. These weights are built to satisfy two major objectives:

To maximize the system throughput and to encourage the node cooperation

3.2.1 SYSTEM THROUGHPUT MAXIMIZATION PARAMETER

The CEI scheduler maximizes the system throughput in a MAC/PHY opportunistic approach. Data integrity requirements of the mobiles are enforced to adapt the modulation scheme and the transmission power to the mobile specific channel state. At each scheduling period, the scheduler computes the maximum number of bits $m_{k,n}$ that can be transmitted in a time slot of subcarrier *n* if assigned to a mobile *k*, for all *k* and *n*. This number of bits is limited by two main factors: the data integrity requirement and the supported modulation orders.The transmission power $P_{k,n}$ of mobile *k* on subcarrier *n* is upper bounded to a value P_{max} which complies with the transmission power spectral density regulation,

$$P_{k,n} \leq P_{max} \qquad (3.1)$$

Given the channel gain $a_{k,n}$ experienced by mobile *k* on subcarrier *n*

$$P_r(\text{q,k}) \leq a_{k,n} P_{max} \qquad (3.2)$$

This bandwidth-allocation strategy maximizes the bandwidth-usage efficiency but do not encourage the node cooperation. To extend the coverage area while preserving the system throughput maximization, a new parameter is added on $m_{k,n}$ which modulates this pure opportunistic resource allocation.

3.2.2 INCENTIVE PARAMETER

The second major objective of CEI is to incite nodes to participate to frame relay to extend the network coverage zone. This is achieved by extending the aforementioned cross-layer design to other layers. A new "incentive parameter" IP_k is introduced based on the current estimation of the cooperation ratio, i.e.,

$$IP_k = \frac{R_k}{D_k} \qquad (3.3)$$

where R_k is the global amount of data transmitted by mobile *k*. It is the sum between D_k, which is the amount of data transmitted to mobile *k* for its own requirement, and $D_{k,i}$, which is the amount of data transmitted to mobile *k* for mobile *i* where R_k is the global amount of data transmitted by mobile k. It is the sum between D_k ,which is the amount of data transmitted to mobile k for its own requirement, and D_{ki} which is the amount of data transmitted to mobile k for mobile i .e

The cooperation ratio C_k as the number of packets that mobile *k* is ready to relay for other mobiles when it receives 100 packets for its own consumption.

i) When mobile *k* relays no traffic out of the cell, C_k is equal to 0%
ii) When it is ready to relay 50 packets out of the cell since it receives 100 packets for its own consumption, C_k is equal to 50%
iii) When the mobile relays as many packets out of the cell as its own received for its own consumption, C_k is equal to 10

Assuming that there are always packets to relay out of the cell, IP_k will be equal to 1, 1.5, and 2, respectively, for these three cases.

3.3 CONFIDENCE PARAMETER

The each mobile signals its R_k and D_k to the AP is assumed. Due to this information, the CEI scheduler will make adequate resource allocation rewarding the mobile according to its cooperation degree. However, to block malicious mobiles that could lie on this information, this introduced a last parameter called the confidence parameter. The confidence parameter T_k depends on the correspondence between the announced cooperative ratio and the observed forwarding ratio.

3.4 GLOBAL CEI ALGORITHM DESCRIPTION

In the allocation process of a given time slot, the priority of a mobile *k* for RU *n* is determined by the magnitude of its CEI parameter, i.e.,

$$CEI_{k,n} = m_{k,n} \times \frac{R_k}{D_k} \times T_k \qquad (3.4)$$

Based on $m_{k,n}$ and IP_k factors, $CEI_{k,n}$ directly takes into account the channel states and the mobile behavior. Like MaxSNR, the PHY information is used with $m_{k,n}$ to take advantage of the time, frequency, and multiuser diversity and maximize the system capacity. However, contrary to existing schedulers, cooperation information as cooperation ratio C_k is exploited in a weighted system with the IP_k parameter that introduces dynamic priorities between mobiles to ensure good rewards to mobiles that help extend the coverage zone. This results in an efficient scheme that guarantees a better network connectivity while avoiding tradeoff with the system capacity.

4. RESULTS AND DISCUSSION

THROUGHPUT

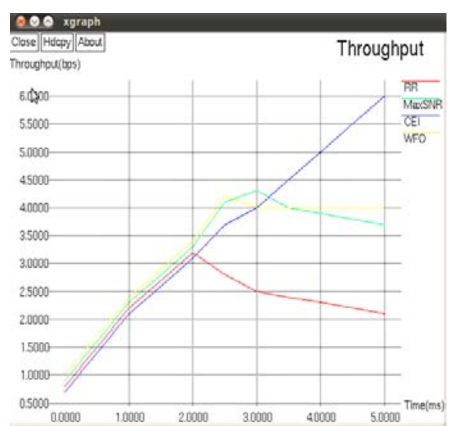


Fig 4.1 The throughput is shown in this graph. In the X-axis Time(ms) is taken. Y-axis Throughput is taken. This graph clearly shows the throughput is increases in CEI (coverage extension based on incentive scheduling) compared to the existing algorithms.

4.2 DELAY

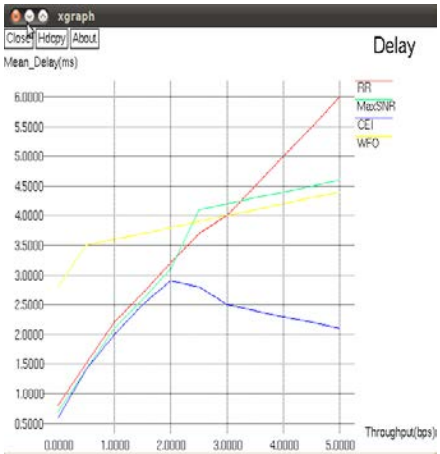


Fig 4.2 The delay is shown in this graph. In the X-axis Throughput is taken. Y-axis Mean delay is taken. This graph clearly shows the mean delay is decreases in CEI (coverage extension based on incentive scheduling) compared to the existing algorithms.

4.3 RELAY EFFICIENCY

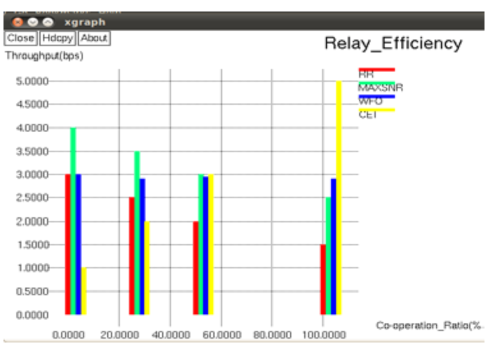


Fig 4.3 The Relay efficiency is shown in this graph. In the X-axis cooperation ratio is taken. Throughput is taken. This graph clearly shows the mean provided throughput is increases in CEI (coverage extension based on incentive scheduling) compared to the existing algorithms

5. CONCLUSION AND FUTURE WORK

Based on incentive approach and a scheduling algorithm a new protocol was used to reward cooperative nodes and extend the wireless area coverage. This incentive approach encourages nodes to relay neighbors' frames by escalating their priority to access resources' allocation. In addition, the cross-layer approach is used to optimize the QoS parameters. With this scheme, a mobile remains free to cooperate or not, but the proposed CEI scheduler sparingly rewards participating nodes so that it is more attractive for them to actively contribute to a high network coverage.

This results in a well-balanced resource allocation, which allows an increase in the network coverage area while never reducing the global system throughput. By using the CEI performance results show that a significant priority is given to mobiles that help the network provide a low packet delay and a high personal throughput.

For Further research, it is planned to use service differentiation in the coverage extension based on incentive scheduling approach.

Service differentiation is a method for specifying and controlling network traffic by class so that certain types of traffic get precedence - for example, voice traffic, which requires a relatively uninterrupted flow of data, might get precedence over other kinds of traffic. It provides dynamic prioritized access to users for service differentiation in a quantifiable manner.

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