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Achieving Certain Optimization Objectives in Broadband Wireless Networks Using Periodic Feedback Channels

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Abstract: MIMO, a form of advanced wireless technology requires several feedbacks to the base station from every mobile station (MS). Periodical feedbacks can consume a higher percentage of uplink bandwidth and this higher cost is seen as a major obstacle for the deployment of advanced closed-loop wireless technologies, such as MIMO. Thus, the aim of this paper is to propose a framework to promote the efficient allocation of periodical feedbacks to wireless network nodes. It will also present multiple optimization methods which are relevant to the study which are efficient to solve wireless technology problems. Lastly, a proper scheme for estimating when the BS should adopt an algorithm is proposed and shown through simulated results to show performance indicators well.

Key words: Base Station · CSI · Collision Free CSI allocation in an Empty tree

INTRODUCTION

Transmitters are needed to obtain high end achievements among wireless networks and to gain access to update information about the quality of the channel as observed by the receiver. To this end, advanced wireless standards require each mobile station (MS) to transmit information periodically from base station (BS) the Channel Quality Indicator (CQI). CQI is seen as a measure of downloadable link to mobile channels and is often utilized by the BS to modify itself to the modulated channel status coding parameters among different corresponding node. The above measurements have a huge role in the scheduling of the BS algorithm [1].

When Multiple Input Multiple Output (MIMO) technology becomes a part of 4G wireless networks, the amount of data transferred as feedback that must be transmitted drastically from MS to BS systems. Among closed- loop spatial multiplexing models of work, this kind of feedback involved the use of Rank Indicators, Channel Quality Matrixes (CQI) and Precoding Matrix Indicators (PMI) [2]. BS systems adopt PMI reports to estimate how precoding matrix should be configured for transmission. Indications from RI reports show the number of layers available in MIMO transmissions [3] according to the reports of MS. But this requires an expansive and costly uplink bandwidth because there is a periodical need to download channel links.

Our framework encompasses all common indicators, including RE, PMI and CQI. The last group, CQI [4] can either have wideband CQI feedbacks mechanisms where it is assessed for whole downlink channel bandwidth or sub-band CQO wherein every member of the CQI is measured over a sub-band. It is not required to differentiate between different indicators viewed collectively as the Channel Status Information channels or the CSI. This paper proposes a threefold contribution to knowledge systems. Firstly, it presents a formal framework under which CSI channels are periodically allocated. Secondly, it re-defines numerous problems which are relevant to the above framework and provides formulas to efficiently solve them. The third reason is that it encompasses a holistic scheme for solving problems. Thus, the proposed model this paper is to outline and define a profit/utility function for allocating CSI channels to every MS. Apart from providing generic algorithms to

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solve problems, the paper also addresses specific functions for which the Channel Quality Indicator (CQI) as well as Precoding Matrix Indicators (PMI) functions are used. PMI indicators are utilized by BS for determining how precoded matrixes are to be configured for the purpose of transmission. Indications from RI reports show how many layers are available to MIMI transmitters and this requires heavy expenses due to the periodical nature of their transmission as long as this exists within the downlink channel.

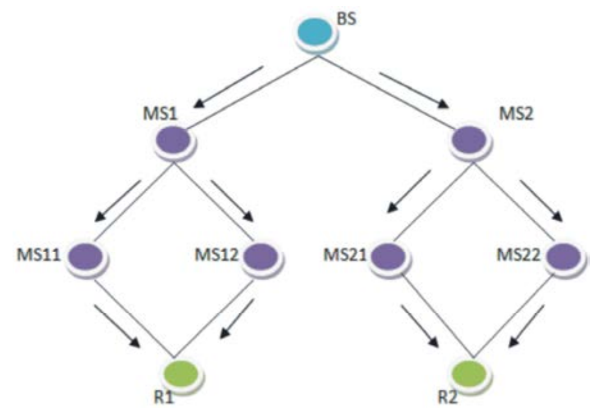
Preliminaries

CSI Channels: Sometimes CSI reports are not sent over due to specific decision-making schemes. The CSI bandwidths are segregated into many super-channels. A super-channel comprises one slot in each uplink frame. Therefore, the number of such super-channels is the same as the number of CSI slots in each frame. The aim of this study is to present super-channel division algorithms [5] which are separated into numerous CSI channels as well as positioned for either their allocation or deallocation. The allocation of a CSI channel involves the BS to forward control messages to the MS under the following guidelines:

- The first frame of the sequence number slots contains this channel.
- The amount of frames _ between each consecutive two slots.
- The estimated time period under which the CSI channel is allocated to a specific MS. It should be noted that the BS can also allocate a non-expiry timeline channel and then can immediately request it back.

Power of 2 Allocations: The allocation of CSI channels under the scheme of τ= 2i in every channel in which "I" is taken as the integer amongst the values 0 and C. In the case of such allocations it is useful to note that the above scheme can also prevent the situation of further collisions among two different CSI channel slots.

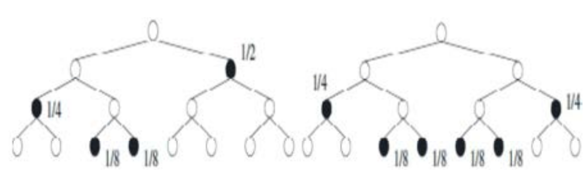
Definition 1: The collision of more than two CSI channels if they contain similar slot numbers. Therefore, collisions can take place amongst α_1/τ_1 *and* α_2/τ_2 if for some integers x > 0 and y > 0, $\alpha+\tau_1.x = \alpha_2+\tau_2.y$.



from which first C □□ 1 □□ 1 are same as of the node's parent while last digit is set at 0 for left child or at 1 for right child.

Lemma 1: Two of the allotted ndoes of CSI tree that are based on like root-to-leaf routes if and only they have corresponding slots which collide.

Proof: Considering the nodes v1 and v2 which are situated in levels l1 and 12 of the tree respectively. Without loss of generality, Letting level l1 > l2 in which there is no loss of generality. When we recall corresponding CSI slots of v1 and v2 as the equation d(r1)j2C□□l1 and d(r2)j2C□□l2 respectively, in which the values of r1 and r2 are the inverse labels of v1 and v2.



If the values of v1 and v2 have similar root-to-leaf pathways then the last C□□l1 digits of r1 and r2 are similar. Hence, there is an integer x such that d(r1) + 2C□□l1 _ x = d(r2), meaning that related CSI slots of v1 as well as v2 collide. If v1 as well as v2 are not on the same root-to-leaf path, the last C □□ l1 digits of r1 and r2 are distinct.

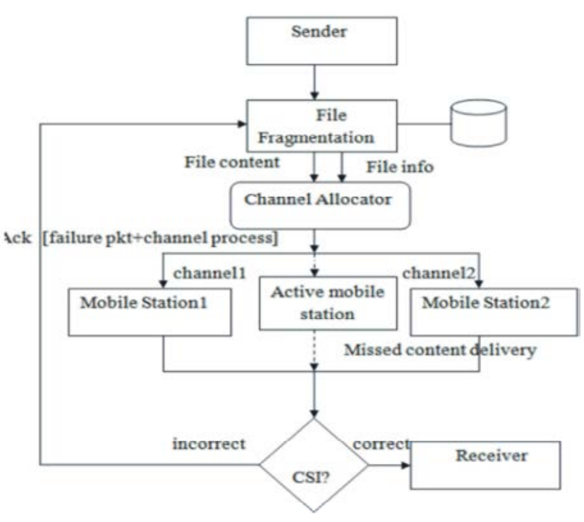
The Framework of CSI Allocations: Under the discussions made, the requirements of CSI Allocations are as follows. R1 situations, where collisions and fragmentations are not allowed among CSI channels. Thus the following situations need to be considered.

- Super-channels are divided into numerous SCI channels via the use of a complete binary tree;
- Every CSI channel contains at most one of the tree nodes, where the root is the subtree;
- Subtrees are allocated among different CSI channels which are mutually disjointed.

In other R2 situations where for every tree level 1 and MSj, the function for profit Pj9(1) can show the entire "profit of the system" under the allocated CSI channel to an MS system. Within the proposed framework, it is important to address every function Pj existent throughout the paper, via the following equation:

$$Pj(l) =(Ej.\ 2(lMAXj\ )\ \text{if}\ l > lMAXj\ Ej.\ 2(l)$$

With the help of the above function, the paper attempts to show how the above function can guarantee the equality between profits and the number of expected packets transmitted to the MSj with the help of a correct CSI value. The paper shows how the BS can determine profit functions for every MSj function, namely by how it can estimate the values of Ej and lMAXj. It first calculates the dynamicity of the downlink channel between the BS and MSj. The above estimations are translated into metric system wj in which average time windows among CSI values shifts. Thus, the BS can also study the average data packet [6] rate rj for every MSj value and can sets values for Ej wj _ rj. Also, consequently, Ej is taken as the average amount of packets which are to be transmitted to MSj via the help of a correct CSI value.



Modules

Base Station Configuring: Transmitters need to gain updated channel quality [7] information from the receiver in order to achieve high outputs throughput in wireless networks. For this, advanced wireless standards need all mobile stations (MS) to transmit information to base stations (BS) in a periodic manner. CQI or Channel Quality Indicator is described as the measure of down-link mobile channels which are used by BS systems to adjust coding parameters and modulations [8, 9] to corresponding nodal channel status.

For instance, within MIMO closed-loop spatial multiplexing mode feedback systems includes Precoding Matrix Indicators (PMI), Rank Indicator (RI) and Channel Quality Indicator (CQI) measures. BS systems utilize PMI reports to estimate how precoding matrixes are to be configured for transmission. Reports from the RI indicate how many numbers of layers in the MIMO transmission system are available to report to MS. The above indicators require extensive uplink bandwidth costs because they are required to periodically send transmissions on downlink channel.

File Fragmentation and Channel Allocator: The file has been split out into multi packets because of handling multiple channel bandwidth effectively. Following the above discussions which came into the scenario above, we now describe our requirements from a CSI allocation framework: Collisions as well as fragmentation of CSI channels are not permitted. Hence, 1) super-channels are split into several CSI channels through a complete binary tree; 2) all CSI channels comprise of maximum of one tree node, which is the root of a sub-tree; (c) sub-trees allotted to distinct CSI channels are mutually disjointed.

Frames Forwarding and Collusion Detection: Radio channels [10] are shared media. Collisions occur hwen two wireless waves of identical kind such as IR, DSSS or FHSS as well as frequency, that is on same channel intercept in mid-air. Colliding signals corrupt one another. Wireless networks are to handle potential collisions similar to how wired networks do. But the devices on wireless networks have no capacity for determining if collisions have actually occurred. Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) methods govern how radio channels may be utilized. Method also invoke arbitrary back-off timers when networks are in usage, for ensuring that all stations waiting for network access do it in an orderly manner.

CSI Tracker: Strategies for decision-making determine whether to transmit particular CSI reports. If channel conditions have not altered considerably, unutilized slots cannot be exploited as these slots are short for regular packets and MS is not able to depend on their availability.

The method in the current paper is different in that BS allots varying bandwidth to various CSI channels by each individual channel's profit functions.

Through the above method, CSI as portrayed by BS (i.e. the dedicated bandwidth for CSI channels) as a dynamic sharable resource allocated amongst MS values. The BS keeps adjusting the resource size according to the needs of MS. For example: when the BS realizes how they are a few dynamic MS features in a cell, then the BS decreases the total CSI bandwidth and utilizes it for alternative purposes. This bandwidth is segregated into numerous super- channels and one super-channel consists of one slot for every uplink frame, as seen in Figure 1a. Thus, the number of the above super-channels is the same as the number of CSI slots within every frame.

Metafile Based Missing Frame Forwarding: In this paper, we propose a meta file which contains information about sending a few numbers of packet with each packet size packet number etc., based on that split packets are combined altogether missed file will be retransmitted by sender provide alternate way by sending packet filer message with this failure act we enclose meta info. About missing or damaged packet which wants to resend.

CONCLUSION AND FUTURE WORK

A formal model for the allotment of periodic CSI channels. From the proposed pater, the allocated number of maintained bandwidth as observed from the allocation tree wherein each MS can be associated with a given profit function which shows the "profit of the system" from being allocated to a specific bandwidth CSI channel and a MS group. Through the above paper two optimization problems have been proposed and also an optimal polynomial-time algorithms for each of them. The simulated studies portray how proposed algorithms can be mixed into a unified scheme, to be utilized by BS systems when a new event can take place. An important aspect of the above proposed scheme is how the definition of profit function is optimized by the BS.

Thus, by the help of this paper, a function was proposed whose aim was to maximize amounts of packets transferred via the correct CSI value. Through this mechanism, other functions and parameters should also be studied and can be pursued in the future.

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